BHP Navajo Coal Company

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February 15, 2011

Ms. Brenda Steele, Navajo Mine Coordinator
Indian and Federal Programs Team
Office of Surface Mining/Western Regional Coordinating Center
P.O. Box 46667
Denver, Colorado 80201-6667

Re: Navajo Mine Permit Number NM-0003F; Rev 1105
Area IV North Mine Plan Resubmittal

Dear Ms. Steele:

Enclosed please find eight (8) copies of the Revised Area IV North mine plan material for your review and approval. The revised mine operation plan proposes development of approximately 800 acres of Area IV North to meet BHP Navajo Coal Company's (BNCC) contractual obligations through 2016.

On December 8 2004, BNCC requested approval of an operations plan to initiate development activities in Area IV North, on approximately 3,800 acres. The U.S. Office of Surface Mining Reclamation and Enforcement (OSM) approved this revision on October 7, 2005 (NM-0003-F-R-01), after completing an environmental assessment. On June 13, 2007, two non-governmental organizations (NGOs) challenged this approval in *Dine C.A.R.E v. Klein*. On October 28, 2010, Judge Kane of the U.S. District Court issued a decision vacating OSM's approval of the operations plan and remanded the matter back to the agency. Pursuant to OSM's instructions, BNCC immediately ceased all mine development activities in Area IV North.

BNCC has taken close look at our operational needs and, as a result, has determined that we need to develop approximately 800 acres of Area IV North to provide sufficient quantity and quality of coal supply through the current fuel contract with Four Corners Power Plant, which is due to expire on July 6, 2016.

As a result, BNCC requests that OSM place the permit revision application that was the subject of OSM's October 7, 2005 approval and subsequent remand by Judge Kane on hold, pending the disposition of the judicial appeal of Judge Kane's decision and OSM's consideration of the revision submitted by this communication.

This revision has two sets of permit text revision instructions. Table A contains replacement instructions for existing permit approved text with language specific to Area IV North redacted

(Strikeout). These pages will be replaced in the approved permit to ensure language that is not directly associated with Area IV North continues to be accurate and approved. These redacted pages will be temporary and will only remain in the permit until the current revision is approved. Table B contains replacement instructions for this new (1105) permit revision and will be incorporated into the permit upon approval.

All baseline information including any specific to Area IV North will remain intact and not redacted. This information will not change as a result of the reduced mine area within Area IV North. In addition, all facilities/structures within Area IV North where construction was either commenced or completed prior to October 28, 2010, have been included on applicable mine exhibits, text, tables and figures. A full list of these structures was sent to OSM on February 1, 2010. BNCC has included these structures on applicable mine exhibits to ensure proper monitoring and inspections are carried out and documented.

As of January 2008, BNCC has not received Coal Combustion Byproducts (CCB) from Four Corners Power Plant (FCPP) for placement in mined-out pits or ramps at Navajo Mine. BNCC does not intend to use CCB materials for reclamation within the Area IV North resource area subject to this application. Therefore, BNCC would request that OSM expressly not authorize the use or placement of CCB materials for reclamation or any other purpose in the portion of Area IV North to be permitted pursuant to this application.

BNCC is not submitting a permit fee pursuant to 30 CFR § 750.25(a) because Area IV North was permitted for mining in previous submittals.

Instructions for the replacement of updated permit contents follow:

Table A: Redaction of Area 4 North mining operations submittal (Strikeout).

Revisions	**Comments/Instructions**
Ch. 1 Vol 1, *Text*	**Remove and replace** pg. 1-10 (MSHA Numbers) with revised page.
Ch. 11 Vol. 12, *Text*	**Remove and replace** pg. 11-1 (Stream Buffer Zones) with revised page; **Remove and replace** pg 11-3 (Vegetation and Topdressing Removal) with revised page; **Remove and replace** pg. 11-18 (Permit Disturbance discussion) with revised page; **Remove and replace** pg. 11-46 (Coal Facilities) with revised page; **Remove and replace** pg. 11-102 (Dixon Haulroad) with revised page;

	Remove and replace pg. 11-201 through 11-202 (Pinabete/Chaco Tributaries) with revised pages; **Remove and replace** pg. 11-224 (Ephemeral Stream Diversion Designs) with revised page.
Ch. 11 Vol. 12, *Tables*	**Remove and replace** pg. 11-51 (Table 11-3 Topdressing Stockpile Approximate Volume) with revised page; **Remove and replace** pg. 11-192 (Table 11-22 Comparison of Pre- & Postmining Areas, Peak Flows, and Sediment Yields Cottonwood Wash, 10-Year, 6-Hour Precipitation Event) with revised page; **Remove and replace** pg. 11-202a (Table 11-30 Comparison of Pre- & Postmining Areas, Peak Flows and Sediment Yields Tributaries to the Chaco and Pinabete, 10-Year, 6-Hour Precipitation Event) with revised page.
Ch. 11 Vol.13A 2of3, *Appendices*	**Remove and replace** Appendix 11-Y (Cottonwood Arroyo Post-Mining Hydrology & Sedimentology) with revised appendix.
Ch. 11 Vol.13B, *Appendices*	**Remove and replace** Appendix 11-SS (Chaco and Pinabete Post-Mining Hydrology and Sedimentology) with revised appendix.
Ch. 11 Vol 18 1 of 2, *Exhibits*	**Remove and replace** Exhibit 11-77 (Lowe, Cottonwood, and Pinabete Arroyo Post-Mining Sedcad Drainage Subdivisions) with revised exhibit
Ch. 12 Vol 19, *Text*	**Remove and replace** pg. 12-41 (Determination of Bond) with revised page.
Ch. 12 Vol 19, *Tables*	**Remove and replace** pg. 12-6 (Table 12-2 Regrade Volume by Area) with revised page; **Remove and replace** pg. 12-9e (Table 12-8 Slope Distribution by Area for Pre- and Post-mining Topography) with revised page.
Ch. 12 Vol 19, *Figures*	**Remove and replace** pg. 12-9d (Figure 12.3-4 Area 4 North Slope Histogram) with revised page.

Table B: Area 4 North Mining and Reclamation Plan Submittal

Revisions	Comments/Instructions
Permit NM-0003F Table of Contents	**Remove and replace** pages 1-31 (Chapters 1-12 TOC)
Ch. 1 Vol 1, *Text*	**Remove and replace** pg. 1-1 (Identification of Interests); **Remove and replace** pg 1-10 (MSHA Numbers).
Ch. 1 Vol 1, *Appendix*	**Remove and replace** Appendix 1-A (BHP Ownership and Control) with updated Officers and Directors Lists and Verification of AVS Completeness; **Remove and replace** Figure 1-A (BHP Navajo Coal Company Corporate Organizational Structure) with revised figure.
Ch. 3 Vol 2, *Text*	**Remove and replace** Ch. 3 pages 3-1 to 3-7 with revised Ch. 3 pages 3-1 to 3-12.
Ch. 3 Vol 2, *Table*	**Remove and replace** Table 3-1 (Navajo Mine Archeological Clearance) with the revised table.
Ch. 4 Vol 2, *Table*	**Remove and replace** pg. 4-16 (Table 4-5 (Continued)) Air Monitor Siting Information with revised page.
Ch. 4 Vol 4, *Exhibits*	**Remove and replace** Exhibit 4-1 (Air Quality and Meteorological Monitoring Stations) with revised exhibit.
Ch. 6 Vol 7, *Text*	**Remove** pg. 6-1 (Aquifer Delineation) and replace with revised pgs. 6-1 and 6-1a (Aquifer Delineation).
Ch. 6 Vol 7, *Appendices*	**Add** new Appendix 6-G (Baseline Groundwater Update for Navajo Mine Area IV North)

Ch. 6 Vol 7, *Exhibits*	**Remove and replace** Exhibit 6-1 (Well Location Map) with the revised exhibit; **Remove and replace** Exhibit 6-2 (No. 8 Potentiometric Surface) with the revised exhibit; **Remove and replace** Exhibit 6-3 (No. 7 Potentiometric Surface) with the revised exhibit; **Remove and replace** Exhibit 6-4 (No. 4-6 Potentiometric Surface) with the revised exhibit; **Remove and replace** Exhibit 6-5 (No. 2-3 Potentiometric Surface) with the revised exhibit; **Remove and replace** Exhibit 6-6 (Location of Well/Piezometers Sites) with the revised exhibit.
Ch. 7 Vol 8, *Text*	**Remove and replace** pg. 7-33 (Pinabete Arroyo).
Ch. 7 Vol 8, *Exhibits*	**Remove and replace** Exhibit 7-4 (Lowe, Cottonwood and Pinabete Arroyo Pre-mining Sedcad Drainage Subdivisions) with the revised exhibit.
Ch. 7 Vol 8, *Appendices*	**Remove and replace** Appendix 7-H (Cottonwood Arroyo Pre-Mine Hydrology and Sedimentology Sedcad Files); **Remove and replace** Appendix 7-O (Chaco and Pinabete Tributaries Pre-Mining Hydrology and Sedimentology) with the revised appendix.
Ch. 8 Vol 10, *Exhibits*	**Remove and replace** Exhibit 8-1 Sheet 6 of 7 (Detailed Soils Map, Area I, II, III, & IV, Navajo Mine) with the revised exhibit.
Ch. 9 Vol 10, *Exhibits*	**Remove and replace** Exhibit 9-1a Sheet 1 of 6 (Navajo Mine Range Sites) with the revised exhibit; **Remove and replace** Exhibit 9-1b Sheet 2 of 6 (Navajo Mine Range Sites) with the revised exhibit; **Remove and replace** Exhibit 9-1c Sheet 3 of 6 (Navajo Mine Range Sites) with the revised exhibit; **Remove and replace** Exhibit 9-1d Sheet 4 of 6 (Navajo Mine Range Sites) with the revised exhibit; **Remove and replace** Exhibit 9-1e Sheet 5 of 6 (Navajo Mine Range Sites) with the revised exhibit; **Remove and replace** Exhibit 9-1f Sheet 6 of 6 (Navajo Mine Range Sites) with the revised exhibit.

Ch. 10 Vol 11, *Exhibits*	**Remove and replace** Exhibit 10-3 (Stock Watering Pond Sites On and Near the Permit Area) with the revised exhibit.
Ch. 11 Vol 12, *Text*	**Remove and replace** pg. 11-1 (Stream Buffer Zones) with the revised text; **Remove and replace** pg. 11-3 (Vegetation and Topdressing Removal) with the revised text; **Remove and replace** pg. 11-18 (Overburden Stripping Methods) with the revised text; **Remove and replace** pages 11-23 through 11-26 (coal combustion by-product disposal); **Remove and replace** pg. 11-45 (Electric Power Lines) with the revised text; **Remove and replace** pg. 11-46 (Coal Facilities) with the revised text; **Remove and replace** pg. 11-73 (Lowe/Dixon Diversion Channel Extension) with the revised text; **Remove and replace** pg. 11-99 (Existing Road Locations) with the revised text; **Remove and replace** pg. 11-102 (Dixon Haulroad) with the revised text; **Remove and replace** pg. 11-109 to 11-110 (Cottonwood Crossing) with the revised text; **Remove and replace** pg. 11-120 (Relocation or Use of Public Roads) with the revised text; **Remove and replace** pg. 11-160 (No. 4-6 Coal Seam) with the revised text; **Remove and replace** pg. 11-201 to 11-202 (Pinabete/Chaco Tirbutaries) with the revised text; **Remove and replace** pg. 11-224 (Ephemeral Stream Diversion Designs) with the revised text;

Ch. 11 Vol 12, *Tables*	**Remove and replace** pg. 11-19 (Table 11-25 Areas Mined by Year) with revised page; **Remove and replace** pg. 11-51 (Table 11-3 Topdressing Stockpile Capacities, Regolith Stockpile Inventories) with the revised page; **Remove and replace** pg. 11-56b (Table 11-5 Pond Cross Reference) with the revised page; **Remove and replace** pages 11-57s to 11-57y (Tables 11-5AM, 11-5AN, 11-5AP, 11-5AQ, 11-5AR, 11-5AS, 11-5AT, 11-5AU, 11-5AW, 11-5AX, 11-5AY, and 11-5AZ) with the revised pages; **Remove and replace** pg. 11-60 (Table 11-7 Highwall Impoundments and Impoundment Hazard Classification) with revised page; **Remove and replace** pg. 11-97 (Table 11-11 Primary Road Segments **Remove and replace** pg. 11-113b (Table 11-12a Primary Road Culvert) with revised page; **Remove and replace** pg. 11-192 (Table 11-22 Comparison of Pre- & Postmining Areas, Peak Flows and Sediment Yields Cottonwood Wash) with revised page;
Ch. 11 Vol 13 1of2, *Appendices*	**Resubmitting for OSM's administrative and technical review reference** Appendix 11-I pages 14 to 42 (structures are existing and pages are already included in the approved permit);
Ch. 11 Vol 13a 1of3, *Appendices*	**Remove and replace** Appendix 11-V Table of Contents page 1d (Area 4 North existing structures are currently included in the approved permit) with revised page (**Appendix 11-V Table of Contents pages 1-1c are included for administrative and technical review reference only**;
Ch. 11 Vol 13a 2of3, *Appendices*	**Remove and replace** Appendix 11-Y (Cottonwood Arroyo Post-Mining Hydrology and Sedimentology) with revised appendix;

Ch. 11 Vol 13a 3of3, *Appendices*	**Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Area 4 North Pond 3 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Area 4 North Pond 4 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 401 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 402 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 404 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 405 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 406 Design Sedcad Analysis (existing structure currently included in the approved permit); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 407 Design Sedcad Analysis (existing structure currently included in the approved permit); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 408 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 409 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011);

	Resubmitting for OSM's administrative and technical review reference Appendix 11-AA Pond 410 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 411 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 412 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011); **Resubmitting for OSM's administrative and technical review reference** Appendix 11-AA Pond 413 Design Sedcad Analysis (existing structure currently included in the approved permit, as-builts submitted 01 Feb 2011);
Ch. 11 Vol 13b, *Appendices*	**Resubmitting for OSM's administrative and technical review reference** Appendix 11-TT (Cottonwood Crossing Design by MHW Americas) (existing structure currently included in the approved permit, as-builts submitted 18 May 2009).
Ch. 11 Vol 14, *Exhibits*	**Add** Exhibit 11-01D (Area 4 North Pond 401 Design) following Exhibit 11-01 (Area 4 North Pond 401 As-built). The existing structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Add** Exhibit 11-02D (Area 4 North Pond 402 Design) following Exhibit 11-02 (Area 4 North Pond 402 As-built). The existing structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Remove** Exhibit 11-03 (Area 4 North Pond 403 Design); **Add** Exhibit 11-04D (Area 4 North Pond 404 Design) following Exhibit 11-04 (Area 4 North Pond 404 As-built). The existing structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Add** Exhibit 11-05D (Area 4 North Pond 405 Design) following Exhibit 11-05 (Area 4 North Pond 405 As-built). The existing structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Add** Exhibit 11-6D (Area 4 North Pond 413 Design) following Exhibit 11-6 (Area 4 North Pond 413 As-built). The existing

	structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Remove and replace** Exhibit 11-08 Sheet 1 of 2 (Blasting Area Location Map) with revised exhibit; **Remove and replace** Exhibit 11-08 Sheet 2 of 2 (Blasting Area Location Map) with revised exhibit; **Remove and replace** Exhibit 11-12E (Area III Culvert/Down Drainage Structure Locations and Watershed Areas) with revised exhibit; **Remove and replace** Exhibit 11-12F (Area 4N Culvert/Down Drainage Structure Locations and Watershed Areas) with revised exhibit; **Remove and replace** Exhibit 11-13F (Area 4N Impoundment and Pond Location/ Watershed Areas) with revised exhibit;
Ch. 11 Vol 17, *Exhibits*	**Remove** Exhibits 11-59, 11-59A, 11-59B, and 11-59C (Burnham Road Temporary Reroute #1 Design (Sheet 1 of 2), Burnham Road Temporary Reroute #1 Design (Sheet 2 of 2), Burnham Road Temporary Reroute #1 As-built (Sheet 1 of 2), Burnham Road Temporary Reroute #1 As-built (Sheet 2 of 2)); **Remove and replace** Exhibits 11-60, 11-60A, 11-60B, and 11-60C (Burnham Road Temporary Reroute #2 As-Builts) with revised exhibits;
Ch. 11 Vol 18 1of2, *Exhibits*	**Remove and replace** Exhibit 11-77 (Lowe, Cottonwood, and Pinabete Arroyo Post-mining Sedcad Drainage Subdivisions) with revised exhibit; **Remove and replace** Exhibit 11-83 (Area III Roads and Railroads Location Map) with revised exhibit; **Remove and replace** Exhibit 11-84 (Area-4N Roads and Railroads Location Map) with revised exhibit;
Ch. 11 Vol 18 2of2, *Exhibits*	**Remove and replace** Exhibit 11-94 (Sheets 1 through 3) (Area 4 North East & West Perimeter Road Design) with revised exhibits;

Ch. 11 Vol 18a 1of3, *Exhibits*	**Add** Exhibit 11-111D (Area 4 North Pond 412 Design) following Exhibit 1-111 (Area 4 North Pond 412 As-built). The existing structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Add** Exhibit 11-115D (Area 4 North Pond 3 Design) following Exhibit 1-115 (Area 4 North Pond 3 As-built). The existing structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Add** Exhibit 11-118D (Area 4 North Pond 4 Design) following Exhibit 11-118 (Area 4 North Pond 4 As-built). The existing structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Remove** Exhibit 11-120 (Area 4 North Pond 5 design) **Remove** Exhibit 11-121 (Area 4 North Pond 6 design);
Ch. 11 Vol 18a 3of3, *Exhibits*	**Remove and replace** Exhibit 11-143 (Area III South Dixon Pit Extension Burnham Road Reroute Location Map) with revised exhibit; **Add** Exhibit 11-156D (Area 4 North Pond 406 Design) following Exhibit 1-156 (Area 4 North Pond 406 As-built). The existing structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Add** Exhibit 11-157D (Area 4 North Pond 407 Design) following Exhibit 1-157 (Area 4 North Pond 407 As-built). The existing structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Add** Exhibit 11-158D (Area 4 North Pond 408 Design) following Exhibit 1-158 (Area 4 North Pond 408 As-built). The existing structure is currently included in approved permit, (As-built submitted 01 Feb 2011); **Add** Exhibit 11-159D (Area 4 North Pond 409 & 410 Design) following Exhibit 1-159 (Area 4 North Pond 409 & 410 As-built). The existing structure is currently included in approved permit, (as-built submitted 01 Feb 2011) **Add** Exhibit 11-161D (Area 4 North Pond 411 Design) following Exhibit 1-161 (Area 4 North Pond 411 As-built). The existing structure is currently included in approved permit, (as-built submitted 01 Feb 2011).

Ch. 12 Vol 19, *Text*	**Remove and replace** pages. 12-5 and 12-5a (Contemporaneous Reclamation) with revised pages. **Remove and replace** pg. 12-15 (Railroad reclamation and Surface Water Controls) with revised page. **Remove and replace** pg. 12-18b and 12-18c (Reclamation of Ash Disposal) with revised pages. **Remove and replace** pg. 12-41 (Determination of Bond) with revised page; **Remove and replace** pg. 12-42 (Reclamation Costs) with revised page; **Remove and replace** pages 12-47 and 12-48 (Area III) with revised pages.
Ch. 12 Vol 19, *Tables*	**Remove and replace** pg. 12-6 (Table 12-2 Regrade Volume by Year) with revised page; **Remove and replace** pg. 12-9e (Table 12-8 Slope Distribution by Area for Pre- and Post-mining Topography) with revised page; **Resubmitting for OSM's administrative and technical review reference** pg. 12-50 (Table 12-7 Reclamation Bond Summary); **Resubmitting for OSM's administrative and technical review reference** pg. 12-51 (Table 12-7A Reclamation Bond Adjustment Summary).
Ch. 12 Vol 19, *Figures*	**Remove and replace** pg. 12-6a (Figure 12.2-1 Reclamation Volume Available for Fill and Volume Regraded by Fiscal Year) with revised page; **Remove and replace** pg. 12-6b (Figure 12.2-2 Regrade Schedule by Year and Pit) with revised page; **Remove and replace** pg. 12-6c (Figure 12.2-3 Topsoil and Mitigation Schedule by Year and Pit) with revised page; **Remove and replace** pg. 12-6d (Figure 12.2-4 Revegetation by Year and Pit) with revised page; **Remove and replace** pg. 12-9d (Figure 12.3-4 Area 4 North Slope Histogram) with revised page.
Ch. 12 Vol 19, *Appendices*	**Resubmitting for OSM's administrative and technical review reference** Appendix 12-B (Bond Calculation Worksheets, Worse Case Bond Scenario 2009);

	Resubmitting for OSM's administrative and technical review reference Appendix 12-C pages 1-10 and 203-238 (Riprap Requirements for Bond Reclamation Topography Channel Stabilization Bond Scenario 2009); **Resubmitting for OSM's administrative and technical review reference** Appendix 12-D (Reclamation Bond Adjustment Worksheets).
Ch. 12 Vol 20, *Exhibits*	**Remove and replace** Exhibit 12-03 (Area III and A4N Permit Term Disturbance Schedules) with revised exhibit. Remove and replace Exhibit 12-6A (Area II Final Surface Configuration) with revised exhibit. Remove and replace Exhibit 12-6B (Area II Final Surface Configuration) with revised exhibit. Remove and replace Exhibit 12-7A (Area-4N Final Surface Configuration) with revised exhibit.
Ch. 12 Vol 21, *Exhibits*	**Resubmitting for OSM's administrative and technical review reference** Exhibit 12-30 (Area 4N Cut/Fill Contours Bond Scenario); **Resubmitting for OSM's administrative and technical review reference** Exhibit 12-30A (Area 4N Post-Mine Configuration Bond Scenario); **Resubmitting for OSM's administrative and technical review reference** Exhibit 12-30B (Area 4N Bond Surface Configuration Bond Scenario); **Resubmitting for OSM's administrative and technical review reference** Exhibit 12-30D (Area 4N Cut/Fill Contours Bond Scenario); **Resubmitting for OSM's administrative and technical review reference** Exhibit 12-30E (Area 4N Bond Spoil Mitigation Bond Scenario).

Should you have any comments, questions, or concerns, please contact Kent Applegate at (505) 598-3269. Thank you for your consideration.

Yours sincerely,

C. Kent Applegate
Superintendent Environmental Projects

Cc Jane Howe- Superintendent Environmental Permitting Technical Services

1.1.3 MSHA Numbers

The MSHA Identification number for Navajo Mine is 29-00097. Section numbers have been assigned to industrial areas, existing pit areas and proposed pit areas. They are:

Watson Pit Area	001-0
Bitsui Pit Area	001-0
Dodge Pit Area	002-0
Custer Pit Area	003-0
Bighan Pit Area	004-0
Pinto Pit Area	005-0
Doby Pit Area	006-0
Yazzie Pit Area	007-0
Hosteen Pit Area	008-0
Barber Pit Area	009-0
Mason Pit Area	010-0
Lowe Pit Area	011-0
Dixon Pit Area	012-0
~~Area 4 North Pit Area~~	~~013-0~~
Surface Area	090-0

1.1.4 Names and Addresses of Legal Owners of Record within Leased Area

The names and addresses of the legal or equitable owners of record (known to Applicant) of the surface and mineral property within the leased area are shown below. Tribal and Bureau of Indian Affairs (BIA) records are unavailable and cannot be verified by Applicant.

CHAPTER 11

OPERATION PLAN

11.1 LAND STATUS AND MARKERS

EXHIBITS 11-1 through 11-6 show the land status classifications of lands within the Navajo Mine leasehold. These lands are divided into Pre-Law, Interim, and Permanent Program land classifications.
Signs clearly identifying BHP Minerals and/or Navajo Mine, the permit identification number, and blast warning signs are posted at all points of public or permittee road access into the permit area. Signs are made of durable material and will be maintained until bond release.

11.1.1 Stream Buffer Zones

Stream Buffer Zone designations have been evaluated and identified for the permit areas and lands adjacent to the leasehold (see Section 11.6.4). A buffer zone was established in December 1995. The requirements under 30 CFR § 816.57 will be observed, and the zones marked as specified under Section 816.11. Identified Stream Buffer Zone designations and authorized stream crossings are delineated and shown on EXHIBITS 11-9 through 11-11.

The markers are spaced approximately 300 feet apart and are routinely checked and maintained. Any adjustments to the buffer zone boundary will be made as necessary.

Activities that necessitate travel into or through the designated crossings follow. Access to surface water samplers, access to groundwater wells, ~~access to Area IV North~~ for environmental data and resource gathering for future mine planning (i.e. surveys, core drilling), access for locals (public) use, and access for routine maintenance (i.e. powerlines, roads, Lowe Diversion outlet, etc.).

11.1.2 Incidental Boundary Revision (IBR)

The IBR appends an additional 106 acres contiguous with the permit boundary along the east boundary of the Lowe and Dixon pits in Area 3 as shown in Exhibit 1-2, Sheet 2 of 2. The IBR area will be used for power lines and access roads, and to facilitate activities ancillary to mining and reclamation. The IBR area will not be used for any new major facilities such as preparation plants or coal mine waste disposal areas. The IBR area will not increase the size of the area from which coal will be removed beyond the existing permit boundary in accordance with the current Resource Recovery and Protection Plan (R2P2).

denoted based upon their *in situ* location in the soil profile. The material found in the top 60 inches of the soil profile is called "topdressing", while the material found deeper than 60 inches in the soil profile is called "regolith".

Navajo Mine will salvage all suitable topdressing for use as topsoil substitute. The maximum extent of allowable disturbance in front of the pit is 1,800 feet beyond the extent of mining (i.e., highwall). Topdressing removal will precede pre-stripping activities where required or to facilitate mining activities where no pre-stripping is required, refer to section 11.2.3.2 Overburden Stripping Method. The extent of topdressing removal will fully consider and comply with the applicable hydrology performance standards.

The defined extent of topdressing removal will facilitate the ability to utilize opportunistic direct live haul of topdressing, which may result in increased reclamation success. In addition, the defined extent offers greater flexibility in mining and equipment operations.

Navajo Mine currently has no in situ reserves for Areas I and II. There is in-situ topdressing material remaining in Area III and IV North. This material will be direct hauled to active reclamation areas whenever possible. Topdressing removal activities are conducted in opportunistic blocks that maximize the direct haul and respread of the topdressing into active reclamation plots.

Suitable regolith may be salvaged for use in reclamation as either topsoil substitute or root-zone material, or it may be spoiled if deemed necessary by the operator. Regolith in each resource area (I, II, III ~~and IV~~) will be salvaged or spoiled depending on the need for topsoil or root-zone material in that specific resource area. Where practical and feasible, regolith that has been found

At the Navajo Mine, the pit names are also associated with area names such as; Area 1, Area 2 and Area 3. The progression of uncovered coal is in linear strips as shown on Exhibits 12-02 and 12-03. Pre-Stripping is done in the deeper parts of Area 3 and Area 2 to keep the total pit depth for the dragline under 200 feet. Pre-Stripping is accomplished using a fleet of end-dump haul trucks and a front-end loader. Pre-Strip material will be removed in front of the active mining strip and placed in final grading areas. Information compiled from Exhibits 12-02 and 12-03 is on Table 11-25 (Areas Mined by Year). This table summarizes pit locations, mining sequences, start and end dates of mining and approximate acres disturbed.

Refer to Exhibit 12-02 for Area 2. The current active pits in this area are Hosteen/Yazzie and Yazzie Overlook. Pre-Stripping with a truck and loader fleet will occur for the entire area. Exhibit 12-02 provides specific stripping sequence by permit term year. Upon finishing the Hosteen/Yazzie and Yazzie Overlook pits, coal-mining activities in Area 2 will be complete.

For Area 3, refer to Exhibit 12-03. The current active pits in Area 3 are Lowe and Dixon pit. Exhibit 12-03 provides specific stripping sequence by permit term year. Pre-Stripping with a truck and loader fleet in Area 3 will continue 4 strips ahead of the active mining strip. Lowe pit will be mined out ahead of Dixon pit. Upon finishing Dixon pit, coal-mining activities in Area 3 will be completed.

~~For Area 4N, refer to Exhibit 12-03. Area 4N will become active in Pit development in Year 1 and will begin mining in Year 2. Area 4N will remain active throughout the permit term. Upon finishing Area 4N pit, coal-mining activities in Area 4N will be complete.~~

There are explosives magazines at the north-end of Lowe Pit which was built in accordance with the Bureau of Alcohol, Tobacco, and Firearms Division regulations 26 CFR Parts 181.198 and 181.200. This area is used for storing primers, blasting cord, delays, and wet hole blasting product. See EXHIBIT 11-7 for locations of these stores.

11.5.2 Coal Facilities

11.5.2.1 Coal Storage

The Navajo Mine has four coal stockpiles. Three are field stockpiles located at railroad spurs, ~~one is a field stockpile in Area IVN for operational capacity,~~ and the last is an emergency coal stockpile located near the north area coal plant. The approximate maximum capacities and date of construction of these stockpiles are:

Name	Capacity (tons)	Construction Date
Barber	1,500,000	1973
Hosteen	800,000	1974
Emergency	80,000	1988
Lowe	2,700,000	1982
~~Proposed A4N~~	~~2,000,000~~	~~2009 (estimated)~~
Total	5,080,000~~7,080,000~~	

Barber Hosteen and Lowe field stockpiles are divided down the center by the railroad spur to facilitate blending. This division allows coal of varying qualities to be stacked on either side of the rail.

TABLE 11-3

TOPDRESSING STOCKPILE APPROXIMATE VOLUME

New Stockpile Name[1]	Old Stockpile Name	Approx. Volume (cyds)[3]
Airport_TS	Airport 1	9,919
DBR12_TS_E[2]	Doby 1	732,845
DBR13_TS_W	Doby R13	412,272
HSR1_TS_S	-	144,865
BBR3_TS_S		36,016
BBR5_TS_S	Barber 5	164,829
LWR1_TS_W[2]	Lowe 2	250,338
LWR2_TS_E	Lowe 4	17,162
LWR4_TS_N	-	716,713
LWR4_TS_E	Lowe/Dixon 1	118,668
LWR4_TS_S	-	0
DXR1_TS_N	-	0
DXR1_TS_S	-	372,164
DXR2_TS_W	-	413,515
DXR4_TS	-	899,820
~~TS-401~~	~~-~~	~~60,333~~
~~TS-402~~	~~-~~	~~71,444~~
~~TS-403~~	~~-~~	~~148,000~~
IBR_TS_N	-	136,200

Regolith Stockpiles Capacities

New Stockpile Name[1]	Old Stockpile Name	Approx. Volume (cyds)[3]
DXR1_RG_W	Dixon 3	475,100
LWR1_RG_N	Lowe 9	1,818,552
LWR4_RG_N	Lowe 10	468,633

[1]Topdressing stockpiles are shown on EXHIBITS 11-9, 11-10 & 11-11 (CHAPTER 11).
TS, Topdressing stockpiles. RG, Regolith stockpiles.
[2]Designates stockpiles that have snow fences installed.
[3] Volumes were calculated using aerial survey and/or loader count. Volumes do not include 10% rehandling loss so total volume will differ from 12-4 and 12-9.

Dixon Haulroad

The Dixon Haulroad begins at the south end of Dixon pit, bends to the west toward the spoils, and then follows the regraded area north to the Lowe Coal Stockpile. The road will be used for truck haulage for coal mining and reclamation, and as an access road to south Dixon ~~and eventually to Area IV North~~. The road is designed to Primary Road standards per Section 11.5.6. The road design and location can be found in Exhibit 11-137 and 11-83, respectively. The road information is included in TABLE 11-11, Section 11.5.6. Hydrology information for culvert design on CP-128 is located in Appendix 11-V, with the culvert location on Exhibit 11-12E also in this appendix. The road shall be constructed and maintained as outlined in Section 11.5.6.1.6 "Roads General Performance Standards".

Burn's Pass Road

The Burn's Pass Road begins at Turnout #2 (shown on EXHIBIT 11-81) and ends at the intersection with North Hosteen Ramp #1.

This road is primarily a maintenance access road to North Hosteen Ramp #1 and the main irrigation line. The road's sub-grade is mostly original ground that has been bladed. The road is in good condition.

Hosteen Haulroad

The Hosteen Haul Road serves Hosteen Pit Ramps #1 and #3. The haulroad is also the continuation of the Burn's Pass Road at the top of Ramp #1.

This road is used mainly for hauling the Hosteen Pit coal to the railroad stockpile. The majority of the road is built on reclaimed surface and is presently in good condition.

TABLE 11-22

COMPARISON OF PRE- & POSTMINING AREAS, PEAK FLOWS AND SEDIMENT YIELDS
COTTONWOOD WASH
10-YEAR, 6-HOUR PRECIPITATION EVENT

SEDCAD 4.0 WATERSHED DESIGNATION		Pre-Mine				Post-Mine				Difference From Pre-Mine			
Pre	Post	Area (acres)	Peak Flow (cfs)	Sediment (tons)	Yield (tons/acre)	Area (acres)	Peak Flow (cfs)	Sediment (tons)	Yield (tons/acre)	Area (acres)	Peak Flow (cfs)	Sediment (tons)	Yield (tons/acre)
S21	S21	13,492	1,561	13,076	1.0	13,332	1,527	13,029	1.0	-160	-34	-48	0.0
S34	S34	18,191	674	7,939	0.4	18,279	665	8,049	0.4	88	-9	110	0.0
S36 (lease line)	S36	49,221	2,890	30,538	0.6	49,104	2,880	30,409	0.6	-117	-10	-129	0.0
S37(Outlet)	S37	51,430	2,854	30,543	0.6	51,173	2,831	30,586	0.6	-257	-22	43	0.0

The post mine is redacted from permit

The Difference is redacted from permit

The comparison indicates there is no significant change between the pre and post-mine peak sediment and peak settleable concentrations. For the same storm event the total sediment yield in tons per acre declined for the post-mine condition.

~~11.6.3.11 Pinabete/Chaco Tributaries~~

~~Three tributaries to the Pinabete Arroyo will be disturbed by mining activities in Area 4 North. The tributaries are identified as Tributary A, B, and C on Exhibit 11-77. The Pinabete Arroyo drainage basin is about 59.1 square miles. A small portion, approximately 1.7 square miles or 2.9 percent of the drainage basin will be disturbed. The post-mining topography increases the Pinabete Arroyo drainage basin by 84 acres. This is primary due to the topography changes at the drainage divide between the Pinabete Arroyo and Cottonwood Arroyo.~~

~~A tributary to the Chaco Wash will also be disturbed by mining activities in Area 4 North. The tributary is identified as Tributary A to the Chaco on Exhibit 11-77. The Chaco Wash drainage basin is approximately 4,350 square miles. A very small portion, approximately 0.8 square miles will be disturbed. Due to the topography changes at the drainage divide between the Chaco Wash and Cottonwood Arroyo the drainage basin or affected tributary decreases by 53 acres.~~

~~Pre-mining drainage density within the Area 4 North disturbance area was estimated to be 2.64 mi./sq. mile. Post-mining drainage density for the area was estimated to be 2.67 mi./sq. mile. The pre and post-mine drainage density are approximately equal. This will achieve geomorphically stable conditions that are equivalent to pre-mine.~~

~~Final Surface Configuration designs were developed in CHAPTER 12 (see Section 12.3, EXHIBITS 12-7A). For design of the reclaimed channels, see Section 11.6.5.3.~~

~~Comparison of SEDCAD 4 predictions for pre- (see CHAPTER 7, APPENDIX 7-O) and postmining (see CHAPTER 11, APPENDIX 11-SS) flows and sedimentology are provided in~~

~~TABLE 11-30. The comparison of the peak flows and sediment yields from the 10 year-6 hour storm event indicates decreases in flow and sediment yield in the post-mine conditions from Tributary B and C to the Pinabete that are sufficient to offset the increases in sediment yield and flow from Tributary A to the Chaco and Tributary A to the Pinabete. The total sediment yield is predicted to decline from 468 tons pre-mine to 346 tons post-mine. The total flow leaving the permit area is predicted to decline from 238 cfs pre-mine to 180 cfs post-mine.~~

~~The runoff volume resulting from a 10 year-6 hour precipitation event in the post-mine condition is predicted to decline from a pre-mining estimate of 30 ac-ft to a post-mining estimate of 23 ac-ft for all the tributaries combined.~~

~~The SEDCAD 4.0 modeling for the 10 year-6 hour event indicates that the predicted peak sediment concentration for Tributary A to the Chaco and Tributary B to the Pinabete in the post-mining conditions are similar to pre-mine even though the predicted peak settleable solids concentration increased from 8 ml/l to 9 ml/l and 0 ml/l to 11 ml/l, respectively. The increase in peak settleable solids is attributable to replacement of premining badland areas (clay-rich) with a postmining sandy loam soil. The clay rich areas will increase the suspended solids concentration, while sandy loam areas will decrease the suspended solids concentration and increase the settable solids (sand) concentration.~~

~~The modeling also indicates a decrease in peak sediment concentration for Tributary C to the Pinabete in the post-mine condition that is sufficient to offset the increase peak sediment concentration for Tributary A to the Pinabete. The peak sediment concentration for Tributary C and A to the Pinabete are 41,628 mg/l pre-mine, 31,607 mg/l post-mine and 9,517 mg/l pre-mine, 15,224 mg/l post-mine, respectively. The overall sediment yield, all tributaries combined, is 0.4 tons/acre pre-mine and 0.2 tons/acre post-mine.~~

TABLE 11-30

COMPARISON OF PRE- & POSTMINING AREAS, PEAK FLOWS AND SEDIMENT YIELDS
TRIBUTARIES TO THE CHACO AND PINABETE
10-YEAR, 6-HOUR PRECIPITATION EVENT

SEDCAD 4.0 WATERSHED DESIGNATION			Pre-Mine					Post-Mine					Difference From Pre-Mine				
	Pre	Post	Area (acres)	Peak Flow (cfs)	Runoff (ac-ft)	Sediment (tons)	Yield (tons/acre)	Area (acres)	Peak Flow (cfs)	Runoff (ac-ft)	Sediment (tons)	Yield (tons/acre)	Area (acres)	Peak Flow (cfs)	Runoff (ac-ft)	Sediment (tons)	Yield (tons/acre)
Tributary A to Chaco	S1SW1	S1SW1	295	31	4	41	0.1	381	47	6	68	0.2	85	16	2	27	0.0
Tributary A to Pinabete	S1SW1	S1SW1	345	30	5	40	0.1	371	42	6	67	0.2	26	12	0	27	0.1
Tributary B to Pinabete	S1SW1	S1SW1	476	130	17	269	0.6	401	44	6	96	0.2	-75	-86	-10	-173	-0.3
Tributary C to Pinabete	S1SW1	S1SW1	142	47	4	118	0.8	314	46	5	114	0.4	172	-1	1	-4	-0.5
Total Sediment Yield and Flow off Permit area			1,258	238	30	468	0.4	1,467	180	23	346	0.2	209	-59	-7	-123	-0.1

The post mine is redacted from permit

The difference from pre-mine is redacted from permit

11.6.5.2 Ephemeral Stream Diversion Designs

All streams within the Navajo Mine Permit Area with the possible exception of Chinde Arroyo are hydrologically ephemeral streams. Nevertheless, OSM regulations classify all streams with drainage areas greater than one square mile as intermittent streams regardless of flow conditions. Therefore, this section provides information concerning design of permanent diversions for ephemeral streams and addresses low order stream segments with drainage areas less than one square mile. Reclamation structures will be designed in accordance with the Reclamation Surface Stabilization Handbook.

Design flows were developed using the SEDCAD+ computer model following the procedures and assumptions described in CHAPTER 7.

~~11.6.5.3 Area IV North Reclaimed Channels~~

~~All the drainage basins in post-mining topography are less than one square mile (640 acres). Per the Reclamation Surface Stabilization Handbook the channels for these drainage basins will not require detail designs. The detail designs will be developed during the final regrading and reclamation process~~.

11.6.5.4 Area I South Reclaimed Channels

There is one reclaimed channel in the Area I South FSC with a watershed larger than 640 acres, which requires detailed designs according to the Reclamation Surface Stabilization Handbook. The reclaimed channel is designated as the Doby North Channel. The alignment of the reclaimed channel is shown on EXHIBIT 11-85 and 12-5A.

In the vicinity of Doby Pit, the pre-mine surface sloped down towards the west with primarily sheet flow drainages and some small channels. The post-mine topography changed the pre-mine drainage pattern by diverting the westward drainages from the off lease undisturbed surface towards the south via a post-mine channel that runs north to south along the eastern lease

Cottonwood Arroyo Post-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is shown on Exhibit 11-77.

Revised October 2006

References to Area 4 North within this Appendix have been redacted.

AAY/LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted.

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.961	0.307	
Null	#2	==>	#3	0.068	0.331	
Null	#3	==>	#4	0.000	0.000	
Null	#4	==>	#9	0.718	0.281	
Null	#5	==>	#6	1.205	0.328	
Null	#6	==>	#7	0.189	0.304	
Null	#7	==>	#8	0.000	0.000	
Null	#8	==>	#10	0.989	0.300	
Null	#9	==>	#11	0.000	0.000	
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#21	0.495	0.453	
Null	#12	==>	#13	0.076	0.330	
Null	#13	==>	#14	3.790	0.314	
Null	#14	==>	#16	1.579	0.287	
Null	#15	==>	#16	1.579	0.287	
Null	#16	==>	#23	0.000	0.000	
Null	#17	==>	#19	0.000	0.000	
Null	#18	==>	#19	0.000	0.000	
Null	#19	==>	#20	0.915	0.252	
Null	#20	==>	#21	0.000	0.000	End of Middle Fork
Null	#21	==>	#22	0.000	0.000	End of South Fork
Null	#22	==>	#36	1.315	0.260	
Null	#23	==>	#20	0.593	0.281	
Null	#24	==>	#25	0.964	0.340	
Null	#25	==>	#27	1.454	0.333	
Null	#26	==>	#27	1.454	0.333	
Null	#27	==>	#29	0.800	0.323	
Null	#28	==>	#29	0.800	0.323	
Null	#29	==>	#32	0.479	0.298	
Null	#30	==>	#32	0.479	0.298	
Null	#31	==>	#33	0.000	0.000	
Null	#32	==>	#33	0.000	0.000	
Null	#33	==>	#34	1.348	0.294	Inlet to North Fork Diversion
Null	#34	==>	#36	0.825	0.261	End of North Fork
Null	#35	==>	#23	0.203	0.259	
Null	#36	==>	#37	3.388	0.246	
Null	#37	==>	End	0.000	0.000	

References to Area A North within this Appendix have been redacted.

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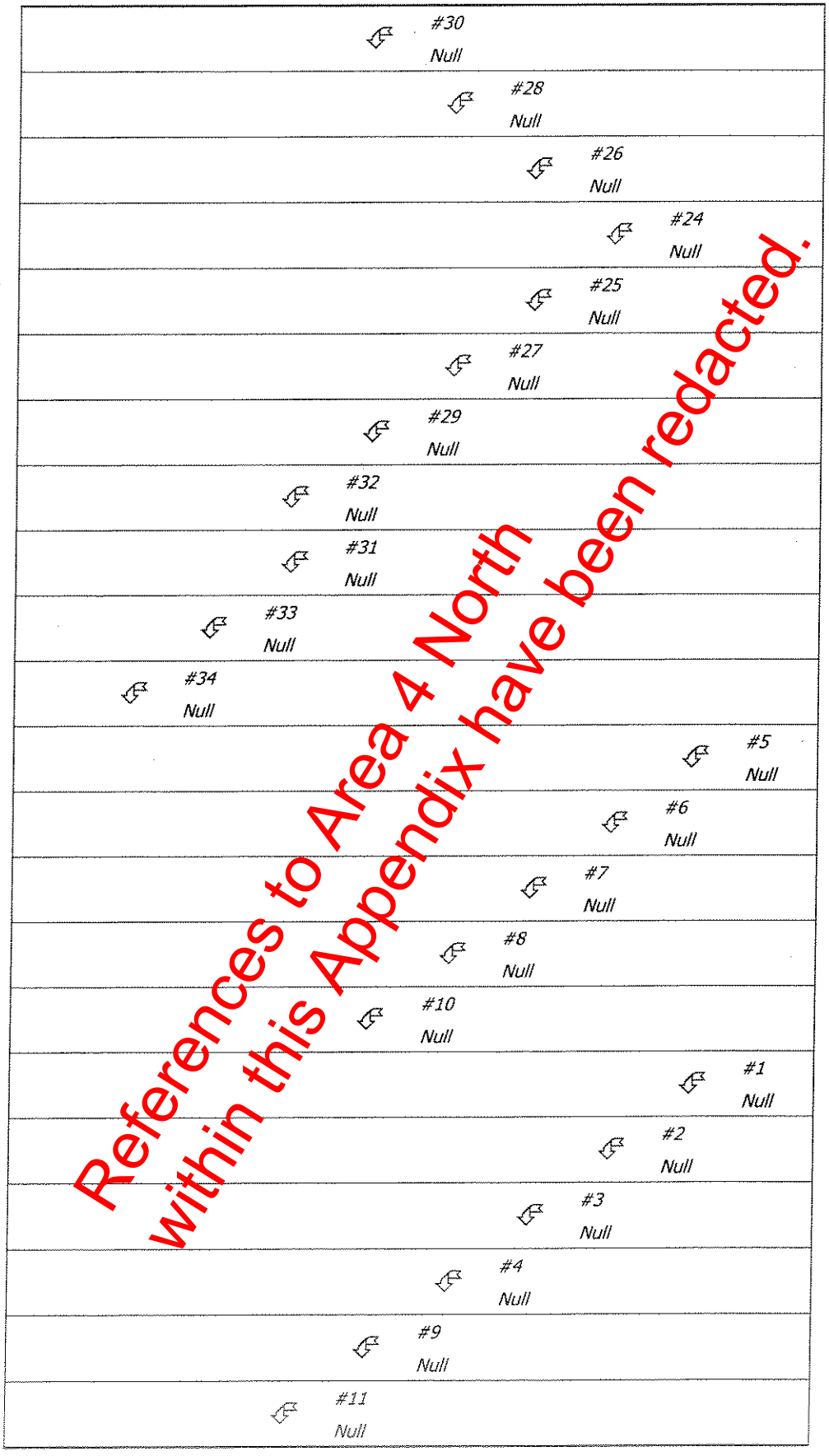
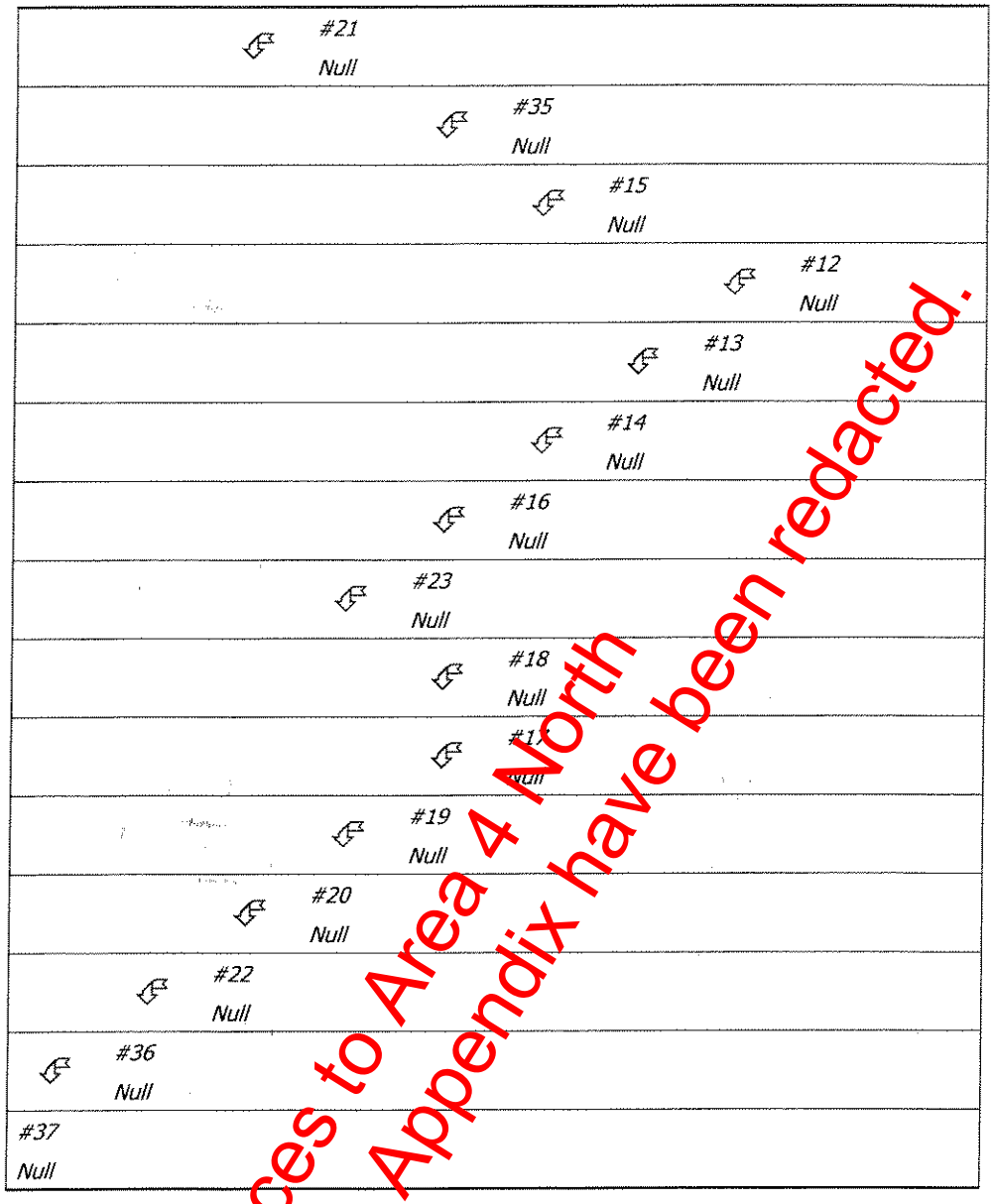


References to Area 4 North within this Appendix have been redacted.



References to Area 4 North within this Appendix have been redacted.

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	0.81	76.00	9,347.00	2.70	0.961
#1	**Muskingum K:**					**0.961**
#2	8. Large gullies, diversions, and low flowing streams	1.23	10.00	814.00	3.32	0.068
#2	**Muskingum K:**					**0.068**
#3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.53	30.00	5,637.00	2.18	0.718
#4	**Muskingum K:**					**0.718**
#5	8. Large gullies, diversions, and low flowing streams	1.17	165.00	14,065.00	3.24	1.205
#5	**Muskingum K:**					**1.205**
#6	8. Large gullies, diversions, and low flowing streams	0.78	14.00	1,799.25	2.64	0.189
#6	**Muskingum K:**					**0.189**
#8	8. Large gullies, diversions, and low flowing streams	0.72	65.00	9,046.00	2.54	0.989
#8	**Muskingum K:**					**0.989**
#11	8. Large gullies, diversions, and low flowing streams	30.00	8,801.00	29,336.66	16.43	0.495
#11	**Muskingum K:**					**0.495**
#12	8. Large gullies, diversions, and low flowing streams	1.21	11.00	906.00	3.30	0.076
#12	**Muskingum K:**					**0.076**
#13	8. Large gullies, diversions, and low flowing streams	0.92	363.00	39,301.00	2.88	3.790
#13	**Muskingum K:**					**3.790**
#14	8. Large gullies, diversions, and low flowing streams	0.59	77.00	13,075.22	2.30	1.579
#14	**Muskingum K:**					**1.579**
#15	8. Large gullies, diversions, and low flowing streams	0.59	77.00	13,075.00	2.30	1.579
#15	**Muskingum K:**					**1.579**
#16	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#16	**Muskingum K:**					**0.000**
#19	8. Large gullies, diversions, and low flowing streams	0.33	19.00	5,699.00	1.73	0.915
#19	**Muskingum K:**					**0.915**
#22	8. Large gullies, diversions, and low flowing streams	0.38	33.00	8,713.00	1.84	1.315
#22	**Muskingum K:**					**1.315**
#23	8. Large gullies, diversions, and low flowing streams	0.53	25.00	4,680.00	2.19	0.593
#23	**Muskingum K:**					**0.593**
#24	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,568.00	3.62	0.964
#24	**Muskingum K:**					**0.964**
#25	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.00	3.39	1.454
#25	**Muskingum K:**					**1.454**
#26	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.62	3.39	1.454

References to Area 4 North within this Appendix have been redacted.

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#26	**Muskingum K:**					**1.454**
#27	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#27	**Muskingum K:**					**0.800**
#28	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#28	**Muskingum K:**					**0.800**
#29	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#29	**Muskingum K:**					**0.479**
#30	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#30	**Muskingum K:**					**0.479**
#33	8. Large gullies, diversions, and low flowing streams	0.66	77.00	11,748.55	2.42	1.348
#33	**Muskingum K:**					**1.348**
#34	8. Large gullies, diversions, and low flowing streams	0.38	21.00	5,197.38	1.85	0.825
#34	**Muskingum K:**					**0.825**
#35	8. Large gullies, diversions, and low flowing streams	0.37	5.00	1,338.00	1.83	0.203
#35	**Muskingum K:**					**0.203**
#36	8. Large gullies, diversions, and low flowing streams	0.30	60.00	20,005.00	1.64	3.388
#36	**Muskingum K:**					**3.388**

References to Area 4 North within this Appendix have been redacted.

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	0.20	0.04	0.1	3,489	2.23	1.76
#28	1,217.900	1,217.900	127.50	21.24	835.0	55,232	0.00	0.00
#26	2,486.400	2,486.400	5.44	2.30	8.0	4,125	2.21	1.71
#24	8,061.800	8,061.800	6.64	4.91	10.9	2,959	1.50	0.83
#25	1,015.700	9,077.500	25.38	9.08	42.9	12,173	6.59	2.22
#27	1,783.700	13,347.600	51.42	18.56	137.5	15,285	7.87	3.16
#29	966.000	15,531.500	173.24	56.11	1,685.8	47,091	2.34	1.21
#32	293.700	16,301.600	178.81	63.51	1,820.6	49,624	0.00	0.00
#31	957.100	957.100	135.01	21.90	696.1	44,322	0.36	0.27
#33	0.000	17,258.700	243.60	85.41	2,516.7	45,965	0.10	0.06
#34	1,020.000	18,278.700	249.26	91.86	2,502.3	40,798	0.12	0.08
#5	2,023.000	2,023.000	171.21	25.48	525.7	36,251	4.57	2.35
#6	1,743.200	3,766.200	212.42	50.66	1,043.3	32,875	0.14	0.09
#7	2,395.300	6,161.500	387.09	107.77	3,278.7	43,897	0.02	0.01
#8	0.000	6,161.500	387.09	107.77	3,278.7	43,897	0.02	0.01
#10	1,053.200	7,214.700	408.06	127.09	3,317.5	40,841	0.02	0.01
#1	2,411.100	2,411.100	102.40	20.83	476.0	29,702	2.79	1.87
#2	1,497.000	3,908.100	165.97	52.28	878.5	25,017	0.11	0.07
#3	862.700	4,770.800	217.82	65.55	1,019.7	20,174	0.09	0.07
#4	0.000	4,770.800	217.82	65.55	1,019.7	20,174	0.09	0.07
#9	445.600	5,216.400	220.11	69.39	1,052.5	19,640	0.41	0.30
#11	0.000	12,431.100	561.70	196.48	4,369.9	34,091	0.18	0.12
#21	900.800	13,331.900	573.17	203.34	4,400.7	33,926	0.15	0.09
#35	160.400	160.400	24.45	4.02	28.0	8,923	0.00	0.00
#15	1,992.700	1,992.700	132.09	26.73	728.7	39,320	1.81	1.15
#12	3,494.500	3,494.500	29.47	7.70	70.0	11,169	5.66	4.05
#13	2,720.700	6,215.200	61.66	14.45	155.8	13,100	6.78	4.67
#14	5,096.800	11,312.000	166.07	70.54	1,409.1	70,149	0.51	0.14
#16	1,022.000	14,336.700	306.00	121.37	2,638.0	41,646	0.88	0.43
#23	0.000	14,487.100	310.83	125.39	2,666.0	40,274	0.84	0.41
#18	848.500	848.500	63.40	12.69	114.4	15,153	0.00	0.00
#17	182.200	182.200	46.10	4.57	42.5	12,532	0.29	0.20
#19	0.000	1,030.700	106.20	17.26	156.9	13,552	0.09	0.06
#20	271.100	15,788.900	330.16	146.74	2,850.1	34,761	0.69	0.36
#22	0.000	29,120.800	852.02	350.08	7,250.8	32,913	0.34	0.21
#36	1,704.400	49,103.900	1,049.74	446.16	9,790.4	32,845	0.35	0.22
#37	2,069.330	51,173.230	1,042.20	459.90	9,872.1	32,771	0.26	0.17

References to Area 4 North within this Appendix have been redacted

Particle Size Distribution(s) at Each Structure

Structure #30:

Size (mm)	In/Out
2.0000	100.000%
0.1000	42.445%
0.0500	24.052%
0.0020	15.563%
0.0010	0.000%

Structure #28:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #26:

Size (mm)	In/Out
2.0000	100.000%
0.1000	69.288%
0.0500	39.263%
0.0020	25.406%
0.0010	0.000%

Structure #24:

Size (mm)	In/Out
2.0000	100.000%
0.1000	76.595%
0.0500	43.404%
0.0020	28.085%

References to Area 4 North within this Appendix have been redacted.

Size (mm)	In/Out
0.0010	0.000%

Structure #25:

Size (mm)	In/Out
2.0000	100.000%
0.1000	67.534%
0.0500	38.270%
0.0020	24.763%
0.0010	0.000%

Structure #27:

Size (mm)	In/Out
2.0000	100.000%
0.1000	71.181%
0.0500	42.036%
0.0020	27.200%
0.0010	0.000%

Structure #29:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.910%
0.0500	95.289%
0.0020	93.701%
0.0010	0.000%

Structure #32:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #31:

References to Area 4 North within this Appendix have been redacted.

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.680%
0.0010	0.000%

Structure #33 (Inlet to North Fork Diversion):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.358%
0.0010	0.000%

Structure #34 (End of North Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.852%
0.0500	99.648%
0.0020	99.600%
0.0010	0.000%

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	92.799%
0.0500	86.859%
0.0020	80.969%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.782%

References to Area 4 North within this Appendix have been redacted.

Size (mm)	In/Out
0.0010	0.000%

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.884%
0.0010	0.000%

Structure #8:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.884%
0.0010	0.000%

Structure #10:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.861%
0.0010	0.000%

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	96.864%
0.0500	89.757%
0.0020	86.391%
0.0010	0.000%

Structure #2:

References to Area 4 North within this Appendix have been redacted.

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.739%
0.0010	0.000%

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.705%
0.0010	0.000%

Structure #4:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.705%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.241%
0.0500	97.919%
0.0020	96.748%
0.0010	0.000%

Structure #11:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.817%
0.0500	99.499%
0.0020	99.111%

References to Area 4 North within this Appendix have been redacted.

Size (mm)	In/Out
0.0010	0.000%

Structure #21 (End of South Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.882%
0.0500	99.688%
0.0020	99.163%
0.0010	0.000%

Structure #35:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #15:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	95.316%
0.0020	92.912%
0.0010	0.000%

Structure #12:

Size (mm)	In/Out
2.0000	100.000%
0.1000	76.847%
0.0500	43.547%
0.0020	28.177%
0.0010	0.000%

Structure #13:

References to Area 4 North within this Appendix have been redacted.

Size (mm)	In/Out
2.0000	100.000%
0.1000	73.953%
0.0500	41.907%
0.0020	27.116%
0.0010	0.000%

Structure #14:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.939%
0.0010	0.000%

Structure #16:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.723%
0.0020	95.648%
0.0010	0.000%

Structure #23:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.736%
0.0020	95.694%
0.0010	0.000%

Structure #18:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%

References to Area 4 North within this Appendix have been redacted.

Size (mm)	In/Out
0.0010	0.000%

Structure #17:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	93.383%
0.0010	0.000%

Structure #19:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.206%
0.0010	0.000%

Structure #20 (End of Middle Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.823%
0.0020	95.879%
0.0010	0.000%

Structure #22:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.348%
0.0020	97.872%
0.0010	0.000%

Structure #36:

References to Area 4 North within this Appendix have been redacted.

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.845%
0.0500	99.191%
0.0020	98.054%
0.0010	0.000%

Structure #37:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.718%
0.0500	99.257%
0.0020	98.663%
0.0010	0.000%

References to Area 4 North within this Appendix have been redacted.

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)
#30	1	476.400	1.131	0.000	0.000	73.100	M	0.20	0.043
	Σ	**476.400**						**0.20**	**0.043**
#28	1	772.300	0.657	0.523	0.334	90.400	M	106.00	13.472
	2	445.600	0.587	0.000	0.000	90.400	M	65.74	7.773
	Σ	**1,217.900**						**127.50**	**21.244**
#26	1	447.600	2.192	0.000	0.000	74.200	M	0.34	0.114
	2	2,038.800	3.000	0.000	0.000	77.000	M	5.10	2.186
	Σ	**2,486.400**						**5.44**	**2.300**
#24	1	2,607.500	5.367	2.377	0.305	75.200	M	2.02	1.246
	2	2,331.900	4.813	2.431	0.304	74.700	M	1.48	0.833
	3	1,758.500	2.231	1.788	0.297	76.200	M	3.66	1.366
	4	1,363.900	2.618	0.000	0.000	77.000	M	3.63	1.463
	Σ	**8,061.800**						**6.64**	**4.907**
#25	1	515.200	0.990	0.342	0.357	78.200	M	3.32	0.833
	2	130.500	0.787	0.342	0.357	78.100	M	0.89	0.204
	3	370.000	0.516	0.000	0.000	85.700	M	25.34	3.140
	Σ	**9,077.500**						**25.38**	**9.084**
#27	1	354.400	0.612	1.233	0.337	83.100	M	11.81	1.882
	2	305.200	0.529	1.054	0.328	84.000	M	14.02	1.922
	3	289.800	0.692	0.551	0.328	75.500	M	0.59	0.162
	4	253.000	0.361	0.551	0.328	79.400	M	3.26	0.579
	5	581.300	0.980	0.000	0.000	82.300	M	12.58	2.629
	Σ	**13,347.600**						**51.42**	**18.559**
#29	1	508.800	0.409	0.416	0.312	89.500	M	80.63	7.795
	2	233.200	0.521	0.291	0.312	91.600	M	44.78	4.818
	3	224.000	0.467	0.000	0.000	90.000	M	35.63	3.690
	Σ	**15,531.500**						**173.24**	**56.106**
#32	1	293.700	0.576	0.000	0.000	93.000	M	65.60	7.363
	Σ	**16,301.600**						**178.81**	**63.512**
#31	1	431.100	0.588	0.450	0.336	91.500	M	75.71	8.782
	2	325.800	0.432	0.149	0.327	93.000	M	85.40	8.167
	3	200.200	0.373	0.000	0.000	92.900	M	55.57	4.950
	Σ	**957.100**						**135.01**	**21.900**

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#33	**Σ**	**17,258.700**						**243.60**	**85.412**
#34	1	251.500	0.423	1.019	0.292	90.500	M	45.94	4.450
	2	219.100	0.611	0.267	0.322	80.000	M	3.12	0.587
	3	246.200	0.688	0.466	0.293	80.000	M	3.36	0.659
	4	303.200	0.370	0.000	0.000	79.700	M	4.27	0.752
	Σ	**18,278.700**						**249.26**	**91.861**
#5	1	503.600	0.618	0.000	0.000	87.600	M	44.56	5.802
	2	406.500	0.388	0.501	0.350	84.800	M	27.28	2.956
	3	439.600	0.342	0.681	0.347	87.800	M	57.48	5.224
	4	162.600	0.280	0.681	0.347	86.000	M	16.74	1.451
	5	294.100	0.375	1.021	0.348	92.000	M	71.65	6.423
	6	216.600	0.272	1.018	0.348	90.100	M	46.35	3.619
	Σ	**2,023.000**						**171.21**	**25.475**
#6	1	149.100	0.331	0.000	0.000	92.500	M	41.87	3.538
	2	245.000	0.529	0.192	0.328	88.100	M	26.07	3.048
	3	276.200	0.450	0.461	0.319	89.500	M	41.36	4.232
	4	158.400	0.380	1.385	0.185	93.000	M	44.23	3.971
	5	206.200	0.402	0.796	0.320	89.400	M	32.46	3.113
	6	414.000	0.430	1.066	0.323	87.200	M	42.38	4.482
	7	294.300	0.535	1.066	0.323	86.400	M	22.70	2.804
	Σ	**3,766.200**						**212.42**	**50.662**
#7	1	731.700	1.274	0.000	0.000	93.000	M	96.39	18.343
	2	445.800	1.043	0.000	0.000	93.000	M	67.76	11.176
	3	270.800	0.804	0.000	0.000	93.000	M	49.02	6.789
	4	78.900	0.267	1.037	0.328	93.000	M	25.53	1.978
	5	154.900	0.310	1.071	0.326	93.000	M	47.40	3.883
	6	101.400	0.288	1.264	0.328	92.900	M	31.46	2.507
	7	117.700	0.298	1.344	0.329	92.200	M	32.72	2.643
	8	494.100	0.518	1.344	0.329	91.300	M	90.89	9.788
	Σ	**6,161.500**						**387.09**	**107.768**
#8	1	0.000	0.000	0.000	0.000	1.000	0.00	0.000	
	Σ	**6,161.500**						**387.09**	**107.768**
#10	1	355.500	1.286	0.000	0.000	93.000	M	46.51	8.912
	2	307.100	1.282	0.668	0.305	83.200	M	7.05	1.663
	3	147.300	1.245	0.517	0.303	90.600	M	13.65	2.644
	4	126.400	0.585	0.517	0.303	93.000	M	27.97	3.169
	5	116.900	1.179	0.621	0.305	93.000	M	16.29	2.931
	Σ	**7,214.700**						**408.03**	**127.086**

References to Area 4 North within this Appendix have been redacted.

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	557.400	0.941	0.000	0.000	83.600	M	16.72	3.258
	2	169.600	1.616	0.677	0.333	93.000	M	18.75	4.252
	3	636.400	1.842	0.729	0.333	81.000	M	6.98	2.169
	4	223.400	0.846	1.005	0.336	84.100	M	7.97	1.433
	5	77.700	0.330	1.392	0.341	81.400	M	2.25	0.290
	6	746.600	0.678	1.392	0.341	88.200	M	39.45	9.430
	Σ	**2,411.100**						**102.40**	**20.831**
#2	1	257.000	0.423	0.000	0.000	93.000	M	68.09	6.443
	2	180.500	0.562	0.478	0.281	91.800	M	34.14	3.834
	3	200.700	0.687	0.574	0.283	93.000	M	40.21	5.031
	4	438.600	0.811	0.574	0.283	93.000	M	78.94	10.995
	5	420.200	1.247	0.801	0.293	88.000	M	25.21	5.148
	Σ	**3,908.100**						**165.97**	**52.283**
#3	1	172.600	0.443	0.000	0.000	93.000	M	44.66	4.327
	2	311.200	0.890	0.000	0.000	88.900	M	27.49	4.365
	3	378.900	0.632	0.209	0.314	87.000	M	34.90	4.572
	Σ	**4,770.800**						**217.82**	**65.547**
#4	**Σ**	**4,770.800**						**217.82**	**65.547**
#9	1	445.600	0.987	0.000	0.000	85.800	M	20.71	3.845
	Σ	**5,216.400**						**220.11**	**69.393**
#11	**Σ**	**12,431.100**						**561.70**	**196.479**
#21	1	249.600	0.657	0.000	0.000	84.100	M	10.27	1.601
	2	185.400	0.618	0.723	0.264	79.700	M	2.39	0.460
	3	181.100	0.289	0.077	0.256	91.300	M	44.96	3.588
	4	284.700	0.493	0.931	0.259	82.000	M	7.86	1.209
	Σ	**13,331.900**						**573.17**	**203.336**
#35	1	160.400	1.039	0.000	0.000	93.000	M	24.45	4.021
	Σ	**160.400**						**24.45**	**4.021**
#15	1	437.400	0.803	0.000	0.000	91.300	M	60.86	8.665
	2	549.000	0.637	0.654	0.327	91.300	M	88.81	10.876
	3	1,006.300	1.023	0.768	0.331	84.700	M	36.49	7.189
	Σ	**1,992.700**						**132.09**	**26.730**
#12	1	517.800	0.791	0.000	0.000	81.900	M	11.30	2.153
	2	229.000	0.571	0.043	0.418	80.100	M	3.43	0.629
	3	592.700	0.706	0.044	0.417	81.500	M	12.26	2.261
	4	1,806.900	1.542	0.487	0.362	76.700	M	5.34	1.726
	5	348.100	0.618	0.487	0.362	80.000	4.94	0.932	

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Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**3,494.500**						**29.47**	**7.702**
#13	1	411.600	0.725	0.000	0.000	79.700	M	5.01	1.021
	2	636.400	0.774	0.322	0.336	80.700	M	10.16	2.023
	3	319.000	0.575	0.685	0.318	85.500	M	19.58	2.617
	4	231.700	0.314	0.923	0.328	80.400	M	4.67	0.685
	5	1,122.000	1.308	0.923	0.328	74.700	M	1.29	0.401
	Σ	**6,215.200**						**61.66**	**14.448**
#14	1	405.900	0.384	0.000	0.000	90.800	M	81.84	7.494
	2	411.100	0.452	0.707	0.308	90.700	M	74.57	7.483
	3	787.400	0.658	0.975	0.307	91.400	M	126.78	15.818
	4	144.200	0.341	1.716	0.310	86.200	M	13.94	1.330
	5	343.800	0.289	1.970	0.312	86.500	M	38.50	3.329
	6	392.800	0.806	2.107	0.316	81.900	M	8.49	1.634
	7	528.200	0.518	2.544	0.316	87.200	M	48.43	5.718
	8	890.900	1.253	2.544	0.316	83.500	M	22.13	5.109
	9	741.400	1.076	3.047	0.316	84.800	M	26.61	5.391
	10	451.100	0.916	3.354	0.316	83.900	M	14.69	2.789
	Σ	**11,312.000**						**166.07**	**70.543**
#16	1	475.100	1.721	0.000	0.000	92.400	M	45.79	10.967
	2	348.400	0.542	0.951	0.281	92.500	M	74.85	8.154
	3	198.500	0.266	1.384	0.278	93.000	M	64.31	4.976
	Σ	**14,326.700**						**306.00**	**121.370**
#23	**Σ**	**14,487.100**						**310.83**	**125.391**
#18	1	301.700	0.652	0.000	0.000	93.000	M	62.47	7.563
	2	546.800	0.768	0.971	0.320	86.300	M	32.97	5.125
	Σ	**848.500**						**63.40**	**12.688**
#17	1	182.200	0.462	0.000	0.000	93.000	M	46.10	4.568
	Σ	**182.200**						**46.10**	**4.568**
#19	**Σ**	**1,030.700**						**106.20**	**17.256**
#20	1	271.100	0.978	0.000	0.000	89.400	M	24.47	4.093
	Σ	**15,788.900**						**330.16**	**146.739**
#22	**Σ**	**29,120.800**						**852.02**	**350.076**
#36	1	197.300	0.649	0.522	0.239	79.700	M	2.50	0.489
	2	374.100	0.583	0.934	0.232	79.700	M	4.93	0.928
	3	467.100	0.814	0.522	0.239	79.700	M	5.43	1.158
	4	322.400	0.644	0.149	0.377	79.700	M	4.10	0.799

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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	93.800	0.576	0.000	0.000	79.700	M	1.24	0.233
	6	249.700	0.708	0.000	0.000	79.700	M	3.07	0.619
	Σ	**49,103.900**						**1,049.74**	**446.163**
#37	1	744.000	1.756	0.000	0.000	84.800	M	19.52	5.410
	2	303.330	0.416	1.859	0.242	87.800	M	35.36	3.604
	3	242.400	0.330	1.649	0.246	84.200	M	15.61	1.583
	4	244.900	0.364	1.783	0.295	80.000	M	3.87	0.656
	5	139.500	0.828	2.381	0.251	80.500	M	2.04	0.423
	6	142.900	0.300	1.991	0.254	83.500	M	8.19	0.820
	7	252.300	0.561	1.487	0.252	82.700	M	7.93	1.238
	Σ	**51,173.230**						**1,042.20**	**459.897**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#30	1	0.095	200.00	3.80	0.3720	1.0000	2	0.1	3,489	2.23	1.76
	Σ							**0.1**	**3,489**	**2.23**	**1.76**
#28	1	0.187	100.00	10.10	0.3750	1.0000	3	555.9	52,723	0.00	0.00
	2	0.196	100.00	10.20	0.3950	1.0000	3	348.4	58,373	0.00	0.00
	Σ							**835.0**	**55,232**	**0.00**	**0.00**
#26	1	0.155	400.00	1.40	0.3480	1.0000	2	0.2	2,448	1.53	1.18
	2	0.155	300.00	2.40	0.3240	1.0000	2	7.8	4,238	2.26	1.74
	Σ							**8.0**	**4,125**	**2.21**	**1.71**
#24	1	0.128	300.00	2.30	0.3360	1.0000	2	2.7	2,661	1.33	1.00
	2	0.136	300.00	2.70	0.3440	1.0000	2	2.3	3,360	1.86	1.39
	3	0.107	300.00	2.30	0.3330	1.0000	2	3.3	2,811	1.56	1.23
	4	0.163	400.00	1.60	0.3210	1.0000	2	3.9	3,194	1.73	1.35
	Σ							**10.9**	**2,959**	**1.50**	**0.83**
#25	1	0.125	400.00	1.90	0.3440	1.0000	2	2.6	3,677	1.96	1.55
	2	0.124	300.00	2.60	0.3280	1.0000	2	0.7	3,754	2.08	1.63
	3	0.122	175.00	4.90	0.2660	1.0000	2	28.7	12,170	6.76	4.66
	Σ							**42.9**	**12,153**	**6.59**	**2.22**
#27	1	0.127	175.00	5.90	0.3160	1.0000	2	20.7	13,801	7.09	5.20
	2	0.122	150.00	7.50	0.2920	1.0000	2	23.8	15,793	8.49	6.12
	3	0.070	125.00	8.40	0.3270	1.0000	2	0.7	4,438	2.66	2.32

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.097	125.00	9.60	0.3170	1.0000	2	6.0	12,370	6.54	5.00
	5	0.126	125.00	8.90	0.3290	1.0000	2	35.7	16,624	7.78	5.85
	Σ							**137.5**	**15,235**	**7.87**	**3.16**
#29	1	0.190	125.00	9.80	0.3930	1.0000	3	387.3	64,968	0.38	0.26
	2	0.203	125.00	8.90	0.3940	1.0000	3	197.0	53,216	0.00	0.00
	3	0.193	125.00	8.40	0.3940	1.0000	3	129.6	47,0[illegible]	0.00	0.00
	Σ							**1,685.8**	**54,[illegible]**	**2.34**	**1.21**
#32	1	0.210	150.00	7.70	0.3990	1.0000	3	289.6	5[illegible],320	0.00	0.00
	Σ							**1,820.6**	**[illegible]9,624**	**0.00**	**0.00**
#31	1	0.204	125.00	8.70	0.3620	1.0000	3	329.8	48,526	0.00	0.00
	2	0.210	150.00	7.30	0.3990	1.0000	3	338.0	54,451	1.63	1.12
	3	0.210	175.00	4.50	0.3980	1.0000	3	130.3	37,227	1.56	1.06
	Σ							**696.1**	**44,322**	**0.36**	**0.27**
#33	**Σ**							**2,516.7**	**45,965**	**0.10**	**0.06**
#34	1	0.193	200.00	3.84	0.2460	1.0000	3	49.4	14,450	0.17	0.12
	2	0.214	200.00	3.66	0.3150	1.0000	1	4.8	9,950	5.38	4.05
	3	0.214	300.00	2.54	0.3150	1.0000	1	4.3	7,920	4.23	3.20
	4	0.242	200.00	3.50	0.3150	1.0000	1	7.1	11,319	6.28	4.82
	Σ							**2,502.3**	**40,798**	**0.12**	**0.08**
#5	1	0.149	75.00	12.50	0.3230	1.0000	3	165.7	37,263	0.00	0.00
	2	0.133	75.00	15.80	0.3190	1.0000	2	102.5	45,635	26.07	18.02
	3	0.103	100.00	11.00	0.2030	1.0000	3	78.2	20,017	0.17	0.12
	4	0.093	75.00	13.80	0.2130	1.0000	2	20.6	19,161	11.51	7.80
	5	0.123	100.00	11.00	0.1370	1.0000	3	80.0	16,445	0.58	0.40
	6	0.149	75.00	14.70	0.3290	1.0000	3	98.7	35,948	1.74	1.20
	Σ							**525.7**	**36,251**	**4.57**	**2.35**
#6	1	0.208	175.00	4.30	0.3980	1.0000	3	91.6	35,102	1.73	1.16
	2	0.183	175.00	5.10	0.3910	1.0000	3	69.3	29,853	0.00	0.00
	3	0.188	150.00	7.60	0.3900	1.0000	3	141.7	44,004	0.00	0.00
	4	0.210	150.00	6.30	0.3990	1.0000	3	135.6	42,816	1.77	1.28
	5	0.185	125.00	8.10	0.3860	1.0000	3	99.0	41,472	0.28	0.20
	6	0.104	100.00	11.30	0.2240	1.0000	3	69.9	20,288	0.00	0.00
	7	0.164	100.00	11.20	0.3740	1.0000	3	98.6	44,820	0.00	0.00
	Σ							**1,043.3**	**32,875**	**0.14**	**0.09**
#7	1	0.208	150.00	7.80	0.3780	1.0000	3	568.9	38,847	0.00	0.00
	2	0.209	100.00	10.20	0.3940	1.0000	3	464.2	52,246	0.00	0.00

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	3	0.210	150.00	6.70	0.3990	1.0000	3	205.7	38,872	0.00	0.00
	4	0.210	100.00	11.50	0.3990	1.0000	3	122.7	79,219	5.29	3.71
	5	0.210	150.00	7.10	0.3990	1.0000	3	156.1	51,819	2.96	2.08
	6	0.209	150.00	7.90	0.3990	1.0000	3	107.1	54,958	3.37	2.37
	7	0.206	75.00	15.50	0.3990	1.0000	3	201.7	96,052	5.25	3.72
	8	0.202	75.00	14.50	0.3980	1.0000	3	669.7	85,902	0.00	0.00
	Σ							**3,278.7**	**43,897**	**0.02**	**0.01**
#8	1	0.000	0.00	0.00	0.0000	1.0000	0	0.0	1	0.00	0.00
	Σ							**3,278.7**	**43,897**	**0.02**	**0.01**
#10	1	0.190	300.00	2.70	0.1930	1.0000	3	46.3	6,587	0.00	0.00
	2	0.153	200.00	3.50	0.3610	1.0000	2	10.6	7,825	3.48	2.62
	3	0.189	200.00	3.70	0.3190	1.0000	3	27.9	10,906	0.00	0.00
	4	0.190	300.00	2.10	0.1940	1.0000	3	15.6	6,459	0.00	0.00
	5	0.201	300.00	2.00	0.3030	1.0000	3	17.5	7,554	0.00	0.00
	Σ							**3,317.5**	**40,841**	**0.02**	**0.01**
#1	1	0.157	150.00	6.80	0.3830	1.0000	2	54.3	20,582	9.89	7.35
	2	0.210	150.00	6.60	0.3990	1.0000	3	91.1	26,615	0.00	0.00
	3	0.149	200.00	3.90	0.3870	1.0000	2	14.2	7,833	3.10	2.38
	4	0.169	175.00	4.70	0.3950	1.0000	2	19.1	16,624	8.23	6.06
	5	0.157	100.00	10.10	0.3940	1.0000	2	6.6	28,074	15.42	11.39
	6	0.175	75.00	12.60	0.2870	1.0000	3	290.9	39,015	0.00	0.00
	Σ							**476.0**	**29,702**	**2.79**	**1.87**
#2	1	0.190	150.00	7.90	0.1930	1.0000	3	123.1	25,644	0.82	0.56
	2	0.184	175.00	4.80	0.2010	1.0000	3	42.3	14,436	0.00	0.00
	3	0.202	200.00	3.90	0.3220	1.0000	3	68.3	17,482	0.00	0.00
	4	0.203	150.00	7.40	0.3220	1.0000	3	301.9	34,875	0.00	0.00
	5	0.181	175.00	5.10	0.3710	1.0000	3	81.0	19,571	0.00	0.00
	Σ							**878.5**	**25,017**	**0.11**	**0.07**
#3	1	0.190	175.00	5.80	0.1930	1.0000	3	56.3	17,538	0.48	0.33
	2	0.177	175.00	4.30	0.2560	1.0000	3	43.6	12,816	0.00	0.00
	3	0.166	175.00	4.30	0.2290	1.0000	3	43.8	12,524	0.00	0.00
	Σ							**1,019.7**	**20,174**	**0.09**	**0.07**
#4	**Σ**							**1,019.7**	**20,174**	**0.09**	**0.07**
#9	1	0.212	175.00	4.17	0.2490	1.0000	2	40.1	13,069	6.46	4.74
	Σ							**1,052.5**	**19,640**	**0.41**	**0.30**
#11	**Σ**							**4,369.9**	**34,091**	**0.18**	**0.12**

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#21	1	0.206	200.00	3.21	0.2760	1.0000	2	12.2	9,726	5.04	3.64
	2	0.241	200.00	3.26	0.3130	1.0000	1	3.6	9,500	5.16	3.93
	3	0.185	300.00	2.70	0.2180	1.0000	3	30.0	10,952	0.56	0.39
	4	0.220	200.00	3.24	0.2980	1.0000	1	10.5	10,761	5.96	4.39
	Σ							**4,400.7**	**33,926**	**0.15**	**0.09**
#35	1	0.194	200.00	3.42	0.2330	1.0000	3	28.0	8,923	0.00	0.00
	Σ							**28.0**	**8,923**	**0.00**	**0.00**
#15	1	0.201	125.00	8.20	0.3960	1.0000	3	284.0	41,954	0.00	0.00
	2	0.161	100.00	11.40	0.3060	1.0000	3	372.2	43,886	0.00	0.00
	3	0.118	100.00	10.20	0.2850	1.0000	2	104.7	18,046	8.67	6.42
	Σ							**728.7**	**39,320**	**1.81**	**1.15**
#12	1	0.124	150.00	6.30	0.3070	1.0000	3	28.4	11,661	5.67	4.23
	2	0.132	200.00	3.60	0.3500	1.0000	2	3.5	6,903	3.51	2.63
	3	0.136	175.00	5.00	0.3330	1.0000	2	22.6	12,336	6.09	4.54
	4	0.188	200.00	3.40	0.3570	1.0000	2	11.0	7,280	4.16	3.35
	5	0.228	175.00	4.10	0.3640	1.0000	2	12.6	16,394	8.29	6.26
	Σ							**70.0**	**11,169**	**5.66**	**4.05**
#13	1	0.128	150.00	6.90	0.3390	1.0000	2	10.6	12,556	6.27	4.76
	2	0.130	175.00	5.70	0.3300	1.0000	2	20.5	12,360	6.02	4.53
	3	0.191	175.00	6.00	0.2830	1.0000	2	46.2	22,620	12.32	8.80
	4	0.122	175.00	5.10	0.3460	1.0000	2	6.4	11,408	6.15	4.62
	5	0.137	175.00	4.20	0.3630	1.0000	2	2.2	6,078	3.78	3.16
	Σ							**155.8**	**13,100**	**6.78**	**4.67**
#14	1	0.196	100.00	10.20	0.3980	1.0000	3	390.8	70,290	1.68	1.13
	2	0.193	150.00	6.70	0.4020	1.0000	3	254.4	44,287	0.26	0.18
	3	0.169	75.00	13.80	0.3240	1.0000	3	675.2	54,052	0.00	0.00
	4	0.114	100.00	11.00	0.2980	1.0000	3	26.7	25,596	0.00	0.00
	5	0.078	100.00	10.10	0.1830	1.0000	3	29.3	11,302	0.14	0.10
	6	0.084	150.00	7.10	0.2700	1.0000	2	9.9	7,446	3.61	2.71
	7	0.087	100.00	10.00	0.1840	1.0000	3	48.3	10,687	0.00	0.00
	8	0.126	150.00	6.70	0.2740	1.0000	2	46.3	11,063	4.96	3.74
	9	0.117	150.00	7.30	0.2600	1.0000	2	50.6	11,548	5.49	4.11
	10	0.115	125.00	8.50	0.2610	1.0000	2	27.1	11,936	5.79	4.34
	Σ							**1,409.1**	**70,149**	**0.51**	**0.14**
#16	1	0.201	300.00	2.78	0.3030	1.0000	3	87.9	10,044	0.00	0.00
	2	0.204	150.00	6.00	0.3630	1.0000	3	229.8	36,204	0.07	0.05
	3	0.210	150.00	6.10	0.3990	1.0000	3	184.0	46,797	3.13	2.24

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**2,638.0**	**41,646**	**0.88**	**0.43**
#23	Σ							**2,666.0**	**40,274**	**0.84**	**0.41**
#18	1	0.193	300.00	2.80	0.2200	1.0000	3	59.6	10,362	0.00	0.00
	2	0.173	175.00	4.70	0.3880	1.0000	3	86.9	21,485	0.00	0.00
	Σ							**114.4**	**15,153**	**0.00**	**0.00**
#17	1	0.196	300.00	2.60	0.2600	1.0000	3	42.5	12,532	0.29	0.20
	Σ							**42.5**	**12,532**	**0.29**	**0.20**
#19	Σ							**156.9**	**13,552**	**0.09**	**0.06**
#20	1	0.192	200.00	3.19	0.2430	1.0000	3	27.4	8,570	0.00	0.00
	Σ							**2,850.1**	**34,761**	**0.69**	**0.36**
#22	Σ							**7,960.8**	**32,913**	**0.34**	**0.21**
#36	1	0.214	200.00	3.60	0.3120	1.0000		3.7	9,199	4.97	3.78
	2	0.222	200.00	3.62	0.3060	1.0000	1	8.0	10,313	5.63	4.30
	3	0.242	200.00	3.23	0.3150	1.0000	1	9.6	9,968	5.25	4.02
	4	0.242	200.00	3.80	0.3150	1.0000	1	7.8	11,798	6.38	4.83
	5	0.242	150.00	6.41	0.3150	1.0000	1	3.5	18,098	9.88	7.45
	6	0.214	175.00	4.45	0.3090	1.0000	1	6.6	12,909	6.91	5.24
	Σ							**9,790.4**	**32,845**	**0.35**	**0.22**
#37	1	0.196	200.00	3.80	0.3980	1.0000	2	55.5	12,520	5.18	3.91
	2	0.193	175.00	5.60	0.4020	1.0000	3	101.3	35,181	0.00	0.00
	3	0.189	150.00	6.87	0.2780	1.0000	2	30.8	24,312	14.07	10.27
	4	0.214	200.00	4.00	0.3150	1.0000	1	6.9	12,687	7.04	5.36
	5	0.196	175.00	5.22	0.3320	1.0000	2	4.8	13,663	6.59	5.08
	6	0.199	125.00	8.15	0.2690	1.0000	2	17.6	26,702	15.48	11.38
	7	0.214	175.00	4.83	0.3150	1.0000	2	18.2	18,206	9.42	6.98
	Σ							**9,872.1**	**32,771**	**0.26**	**0.17**

References to Area 4 North within this Appendix have been redacted.

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	3.65	50.00	1,369.00	1.910	0.199
		8. Large gullies, diversions, and low flowing streams	1.57	157.00	10,030.00	3.750	0.742
#1	**1**	**Time of Concentration:**					**0.941**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	5. Nearly bare and untilled, and alluvial valley fans	6.63	70.00	1,056.00	2.570	0.114
		5. Nearly bare and untilled, and alluvial valley fans	1.98	150.00	7,573.00	1.400	1.502
#1	**2**	**Time of Concentration:**					**1.616**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	1.65	117.00	7,070.00	1.280	1.534
		8. Large gullies, diversions, and low flowing streams	2.43	126.00	5,188.00	4.670	0.308
#1	**3**	**Time of Concentration:**					**1.842**
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.77	260.00	4,506.00	2.400	0.521
		8. Large gullies, diversions, and low flowing streams	2.84	168.00	5,924.00	5.050	0.325
#1	**4**	**Time of Concentration:**					**0.846**
#1	5	5. Nearly bare and untilled, and alluvial valley fans	19.93	180.00	903.00	4.460	0.056
		8. Large gullies, diversions, and low flowing streams	3.30	178.00	5,393.00	5.450	0.274
#1	**5**	**Time of Concentration:**					**0.330**
#1	6	5. Nearly bare and untilled, and alluvial valley fans	13.43	105.00	782.00	3.660	0.059
		8. Large gullies, diversions, and low flowing streams	2.62	283.00	10,822.00	4.850	0.619
#1	**6**	**Time of Concentration:**					**0.678**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.84	70.00	1,024.00	2.610	0.108
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,325.00	3.810	0.315
#2	**1**	**Time of Concentration:**					**0.423**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	5.56	45.00	810.00	2.350	0.095
		8. Large gullies, diversions, and low flowing streams	0.86	40.00	4,663.00	2.770	0.467
#2	**2**	**Time of Concentration:**					**0.562**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	5.89	50.00	849.00	2.420	0.097
		8. Large gullies, diversions, and low flowing streams	1.17	80.00	6,862.00	3.230	0.590
#2	**3**	**Time of Concentration:**					**0.687**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	12.63	95.00	752.00	3.550	0.058
		8. Large gullies, diversions, and low flowing streams	1.40	135.00	9,630.00	3.550	0.753
#2	**4**	**Time of Concentration:**					**0.811**
#2	5	5. Nearly bare and untilled, and alluvial valley fans	11.02	70.00	635.00	3.320	0.053
		8. Large gullies, diversions, and low flowing streams	0.46	40.00	8,732.00	2.030	1.194

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	**5**	**Time of Concentration:**					**1.247**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	10.00	805.00	1.110	0.201
		8. Large gullies, diversions, and low flowing streams	1.33	40.00	3,017.00	3.450	0.242
#3	**1**	**Time of Concentration:**					**0.443**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.68	10.00	1,478.00	0.820	0.500
		8. Large gullies, diversions, and low flowing streams	1.78	100.00	5,622.00	4.000	0.390
#3	**2**	**Time of Concentration:**					**0.890**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	4.66	70.00	1,501.00	2.150	0.193
		8. Large gullies, diversions, and low flowing streams	1.17	60.00	5,126.00	3.240	0.439
#3	**3**	**Time of Concentration:**					**0.632**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	19.06	285.00	1,495.00	4.360	0.095
		8. Large gullies, diversions, and low flowing streams	2.64	242.00	9,174.00	4.870	0.523
#5	**1**	**Time of Concentration:**					**0.618**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	14.27	105.00	736.00	3.770	0.054
		8. Large gullies, diversions, and low flowing streams	4.08	297.00	7,279.00	6.050	0.334
#5	**2**	**Time of Concentration:**					**0.388**
#5	3	5. Nearly bare and untilled, and alluvial valley fans	8.27	35.00	423.00	2.870	0.040
		8. Large gullies, diversions, and low flowing streams	3.44	208.00	6,049.00	5.560	0.302
#5	**3**	**Time of Concentration:**					**0.342**
#5	4	5. Nearly bare and untilled, and alluvial valley fans	14.58	85.00	583.00	3.810	0.042
		8. Large gullies, diversions, and low flowing streams	4.53	248.00	5,473.00	6.380	0.238
#5	**4**	**Time of Concentration:**					**0.280**
#5	5	5. Nearly bare and untilled, and alluvial valley fans	5.07	70.00	1,382.00	2.250	0.170
		8. Large gullies, diversions, and low flowing streams	3.89	170.00	4,375.00	5.910	0.205
#5	**5**	**Time of Concentration:**					**0.375**
#5	6	5. Nearly bare and untilled, and alluvial valley fans	12.48	90.00	721.00	3.530	0.056
		8. Large gullies, diversions, and low flowing streams	5.16	274.00	5,308.02	6.810	0.216
#5	**6**	**Time of Concentration:**					**0.272**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	5.36	75.00	1,399.00	2.310	0.168

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.41	66.00	2,742.00	4.650	0.163
#6	**1**	**Time of Concentration:**					**0.331**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.39	80.00	2,359.00	1.840	0.356
		8. Large gullies, diversions, and low flowing streams	2.63	80.00	3,039.00	4.860	0.173
#6	**2**	**Time of Concentration:**					**0.529**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	4.60	34.00	739.00	2.140	0.095
		8. Large gullies, diversions, and low flowing streams	2.33	136.00	5,845.00	4.570	0.355
#6	**3**	**Time of Concentration:**					**0.450**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	6.06	85.00	1,402.00	2.460	0.158
		8. Large gullies, diversions, and low flowing streams	2.52	96.00	3,810.00	4.760	0.222
#6	**4**	**Time of Concentration:**					**0.380**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	7.24	70.00	967.00	2.690	0.099
		8. Large gullies, diversions, and low flowing streams	2.34	117.00	5,003.00	4.580	0.303
#6	**5**	**Time of Concentration:**					**0.402**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	31.83	183.00	575.00	5.640	0.028
		8. Large gullies, diversions, and low flowing streams	3.38	270.00	7,990.00	5.510	0.402
#6	**6**	**Time of Concentration:**					**0.430**
#6	7	5. Nearly bare and untilled, and alluvial valley fans	23.08	325.00	1,408.00	4.800	0.081
		8. Large gullies, diversions, and low flowing streams	2.88	240.00	8,327.00	5.090	0.454
#6	**7**	**Time of Concentration:**					**0.535**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	11.42	90.00	788.00	3.370	0.064
		8. Large gullies, diversions, and low flowing streams	1.46	230.00	15,769.00	3.620	1.210
#7	**1**	**Time of Concentration:**					**1.274**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	10.97	60.00	547.00	3.310	0.045
		8. Large gullies, diversions, and low flowing streams	1.61	220.00	13,660.00	3.800	0.998
#7	**2**	**Time of Concentration:**					**1.043**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	938.00	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.72	171.00	9,931.00	3.930	0.701
#7	**3**	**Time of Concentration:**					**0.804**

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	4	5. Nearly bare and untilled, and alluvial valley fans	19.23	80.00	416.00	4.380	0.026
		8. Large gullies, diversions, and low flowing streams	2.45	100.00	4,083.00	4.690	0.241
#7	**4**	**Time of Concentration:**					**0.267**
#7	5	5. Nearly bare and untilled, and alluvial valley fans	6.09	67.00	1,101.00	2.460	0.124
		8. Large gullies, diversions, and low flowing streams	2.51	80.00	3,184.00	4.750	0.186
#7	**5**	**Time of Concentration:**					**0.310**
#7	6	5. Nearly bare and untilled, and alluvial valley fans	5.93	63.00	1,062.00	2.430	0.121
		8. Large gullies, diversions, and low flowing streams	2.74	82.00	2,99[illegible].00	4.960	0.167
#7	**6**	**Time of Concentration:**					**0.288**
#7	7	5. Nearly bare and untilled, and alluvial valley fans	7.97	65.00	[illegible]16.00	2.820	0.080
		8. Large gullies, diversions, and low flowing streams	3.48	153.00	4,400.00	5.590	0.218
#7	**7**	**Time of Concentration:**					**0.298**
#7	8	5. Nearly bare and untilled, and alluvial valley fans	6.60	[illegible]0.00	758.00	2.560	0.082
		8. Large gullies, diversions, and low flowing streams	4.66	[illegible]73.00	10,157.00	6.470	0.436
#7	**8**	**Time of Concentration:**					**0.518**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	3.01	55.00	1,829.00	1.730	0.293
		8. Large gullies, diversions, and low flowing streams	0.76	50.00	6,548.00	2.620	0.694
#9	**1**	**Time of Concentration:**					**0.987**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	41.00	3,317.00	1.110	0.830
		8. Large gullies, diversions, and low flowing streams	0.70	29.00	4,125.00	2.510	0.456
#10	**1**	**Time of Concentration:**					**1.286**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	2.25	125.00	5,554.00	1.500	1.028
		8. Large gullies, diversions, and low flowing streams	2.13	85.00	3,997.00	4.370	0.254
#10	**2**	**Time of Concentration:**					**1.282**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.39	68.00	4,904.00	1.170	1.164
		8. Large gullies, diversions, and low flowing streams	4.73	90.00	1,904.00	6.520	0.081
#10	**3**	**Time of Concentration:**					**1.245**
#10	4	5. Nearly bare and untilled, and alluvial valley fans	3.76	51.00	1,357.00	1.930	0.195
		8. Large gullies, diversions, and low flowing streams	0.65	22.00	3,385.00	2.410	0.390

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	**4**	**Time of Concentration:**					**0.585**
#10	5	5. Nearly bare and untilled, and alluvial valley fans	1.63	88.00	5,391.16	1.270	1.179
#10	**5**	**Time of Concentration:**					**1.179**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	4.50	75.00	1,667.00	2.120	0.218
		8. Large gullies, diversions, and low flowing streams	1.85	155.00	8,400.00	4.070	0.573
#12	**1**	**Time of Concentration:**					**0.791**
#12	2	5. Nearly bare and untilled, and alluvial valley fans	2.99	50.00	1,674.03	1.720	0.270
		8. Large gullies, diversions, and low flowing streams	1.67	70.00	4,201.17	3.870	0.301
#12	**2**	**Time of Concentration:**					**0.571**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	4.04	57.00	1,411.00	2.000	0.195
		8. Large gullies, diversions, and low flowing streams	1.55	107.00	6,884.00	3.740	0.511
#12	**3**	**Time of Concentration:**					**0.706**
#12	4	5. Nearly bare and untilled, and alluvial valley fans	2.23	84.00	3,771.04	1.490	0.703
		8. Large gullies, diversions, and low flowing streams	1.62	186.00	11,515.60	3.810	0.839
#12	**4**	**Time of Concentration:**					**1.542**
#12	5	5. Nearly bare and untilled, and alluvial valley fans	3.66	53.00	1,442.00	1.910	0.209
		8. Large gullies, diversions, and low flowing streams	1.93	120.00	6,155.00	4.180	0.409
#12	**5**	**Time of Concentration:**					**0.618**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	4.62	62.00	1,342.00	2.140	0.174
		8. Large gullies, diversions, and low flowing streams	1.91	157.00	8,225.00	4.140	0.551
#13	**1**	**Time of Concentration:**					**0.725**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	2.91	50.00	1,717.00	1.700	0.280
		8. Large gullies, diversions, and low flowing streams	2.28	183.00	8,039.00	4.520	0.494
#13	**2**	**Time of Concentration:**					**0.774**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	6.18	95.00	1,537.00	2.480	0.172
		8. Large gullies, diversions, and low flowing streams	2.13	135.00	6,347.00	4.370	0.403
#13	**3**	**Time of Concentration:**					**0.575**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.17	10.00	315.00	1.780	0.049
		8. Large gullies, diversions, and low flowing streams	2.30	100.00	4,344.00	4.550	0.265
#13	**4**	**Time of Concentration:**					**0.314**

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	5	5. Nearly bare and untilled, and alluvial valley fans	3.10	70.00	2,255.00	1.760	0.355
		8. Large gullies, diversions, and low flowing streams	1.23	140.00	11,392.00	3.320	0.953
#13	**5**	**Time of Concentration:**					**1.308**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	10.59	63.00	595.00	3.250	0.050
		8. Large gullies, diversions, and low flowing streams	2.60	151.00	5,808.00	4.830	0.334
#14	**1**	**Time of Concentration:**					**0.384**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	7.28	67.00	920.00	2.690	0.095
		8. Large gullies, diversions, and low flowing streams	2.17	123.00	5,[illegible]00	4.410	0.357
#14	**2**	**Time of Concentration:**					**0.452**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	21.46	150.00	699.00	4.630	0.041
		8. Large gullies, diversions, and low flowing streams	3.10	364.00	11,728.00	5.280	0.617
#14	**3**	**Time of Concentration:**					**0.658**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	3.39	35.00	1,032.00	1.840	0.155
		8. Large gullies, diversions, and low flowing streams	2.97	103.00	3,470.00	5.160	0.186
#14	**4**	**Time of Concentration:**					**0.341**
#14	5	5. Nearly bare and untilled, and alluvial valley fans	28.13	125.00	444.00	5.300	0.023
		8. Large gullies, diversions, and low flowing streams	4.18	246.00	5,886.00	6.130	0.266
#14	**5**	**Time of Concentration:**					**0.289**
#14	6	5. Nearly bare and untilled, and alluvial valley fans	3.18	40.00	1,257.00	1.780	0.196
		8. Large gullies, diversions, and low flowing streams	2.29	228.00	9,963.00	4.530	0.610
#14	**6**	**Time of Concentration:**					**0.806**
#14	7	5. Nearly bare and untilled, and alluvial valley fans	16.72	100.00	598.00	4.080	0.040
		8. Large gullies, diversions, and low flowing streams	2.81	243.00	8,649.00	5.020	0.478
#14	**7**	**Time of Concentration:**					**0.518**
#14	8	5. Nearly bare and untilled, and alluvial valley fans	1.70	47.00	2,765.00	1.300	0.590
		8. Large gullies, diversions, and low flowing streams	2.44	274.00	11,208.00	4.690	0.663
#14	**8**	**Time of Concentration:**					**1.253**
#14	9	5. Nearly bare and untilled, and alluvial valley fans	2.87	105.00	3,657.00	1.690	0.601
		8. Large gullies, diversions, and low flowing streams	2.43	194.00	7,991.00	4.670	0.475

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	**9**	**Time of Concentration:**					**1.076**
#14	10	5. Nearly bare and untilled, and alluvial valley fans	2.75	80.00	2,907.00	1.650	0.489
		8. Large gullies, diversions, and low flowing streams	2.41	172.00	7,149.00	4.650	0.427
#14	**10**	**Time of Concentration:**					**0.916**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	12.80	54.00	422.00	3.370	0.032
		8. Large gullies, diversions, and low flowing streams	1.68	181.00	10,781.00	3.880	0.771
#15	**1**	**Time of Concentration:**					**0.803**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	44.22	260.00	588.00	6.640	0.024
		8. Large gullies, diversions, and low flowing streams	2.45	254.00	10,351.24	4.690	0.613
#15	**2**	**Time of Concentration:**					**0.637**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	10.04	85.00	847.00	3.160	0.074
		8. Large gullies, diversions, and low flowing streams	2.34	366.00	15,663.00	4.580	0.949
#15	**3**	**Time of Concentration:**					**1.023**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	2.26	117.00	5,179.00	1.500	0.959
		8. Large gullies, diversions, and low flowing streams	0.46	26.00	5,601.00	2.040	0.762
#16	**1**	**Time of Concentration:**					**1.721**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	8.70	62.00	713.00	2.940	0.067
		8. Large gullies, diversions, and low flowing streams	1.99	144.00	7,241.00	4.230	0.475
#16	**2**	**Time of Concentration:**					**0.542**
#16	3	5. Nearly bare and untilled, and alluvial valley fans	6.88	32.00	465.00	2.620	0.049
		8. Large gullies, diversions, and low flowing streams	2.29	81.00	3,543.00	4.530	0.217
#16	**3**	**Time of Concentration:**					**0.266**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	9.37	65.00	694.00	3.060	0.062
		8. Large gullies, diversions, and low flowing streams	1.19	56.00	4,712.00	3.270	0.400
#17	**1**	**Time of Concentration:**					**0.462**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	9.00	60.00	667.00	2.990	0.061
		8. Large gullies, diversions, and low flowing streams	0.97	61.00	6,287.00	2.950	0.591
#18	**1**	**Time of Concentration:**					**0.652**
#18	2	5. Nearly bare and untilled, and alluvial valley fans	2.47	33.00	1,336.00	1.570	0.236

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.01	164.00	8,154.00	4.250	0.532
#18	**2**	**Time of Concentration:**					**0.768**
#20	1	5. Nearly bare and untilled, and alluvial valley fans	2.64	47.00	1,783.00	1.620	0.305
		8. Large gullies, diversions, and low flowing streams	0.56	30.00	5,405.00	2.230	0.673
#20	**1**	**Time of Concentration:**					**0.978**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	1.39	15.00	1,076.00	1.180	0.253
		8. Large gullies, diversions, and low flowing streams	2.00	123.00	6,165.00	4.230	0.404
#21	**1**	**Time of Concentration:**					**0.657**
#21	2	5. Nearly bare and untilled, and alluvial valley fans	0.92	15.00	1,635.00	0.950	0.479
		8. Large gullies, diversions, and low flowing streams	3.61	103.00	2,856.00	5.690	0.139
#21	**2**	**Time of Concentration:**					**0.618**
#21	3	5. Nearly bare and untilled, and alluvial valley fans	1.70	15.00	881.00	1.300	0.188
		9. Small streams flowing bankfull	1.49	60.00	4,014.00	11.000	0.101
#21	**3**	**Time of Concentration:**					**0.289**
#21	4	5. Nearly bare and untilled, and alluvial valley fans	2.07	15.00	724.00	1.430	0.140
		8. Large gullies, diversions, and low flowing streams	1.91	100.00	5,249.00	4.140	0.352
#21	**4**	**Time of Concentration:**					**0.492**
#24	1	5. Nearly bare and untilled, and alluvial valley fans	1.71	430.00	25,118.00	1.300	5.367
#24	**1**	**Time of Concentration:**					**5.367**
#24	2	5. Nearly bare and untilled, and alluvial valley fans	1.84	430.00	23,393.00	1.350	4.813
#24	**2**	**Time of Concentration:**					**4.813**
#24	3	5. Nearly bare and untilled, and alluvial valley fans	1.82	155.00	8,498.00	1.350	1.748
		8. Large gullies, diversions, and low flowing streams	0.84	40.00	4,771.00	2.740	0.483
#24	**3**	**Time of Concentration:**					**2.231**
#24	4	5. Nearly bare and untilled, and alluvial valley fans	1.24	50.00	4,042.00	1.110	1.011
		8. Large gullies, diversions, and low flowing streams	0.49	60.00	12,150.00	2.100	1.607
#24	**4**	**Time of Concentration:**					**2.618**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	0.51	10.00	1,950.00	0.710	0.762
		8. Large gullies, diversions, and low flowing streams	1.81	60.00	3,322.00	4.030	0.228
#25	**1**	**Time of Concentration:**					**0.990**

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#25	2	5. Nearly bare and untilled, and alluvial valley fans	1.11	25.00	2,254.00	1.050	0.596
		8. Large gullies, diversions, and low flowing streams	2.36	75.00	3,178.00	4.600	0.191
#25	**2**	**Time of Concentration:**					**0.787**
#25	3	5. Nearly bare and untilled, and alluvial valley fans	3.23	30.00	929.00	1.790	0.144
		8. Large gullies, diversions, and low flowing streams	2.45	154.00	6,297.00	4.690	0.372
#25	**3**	**Time of Concentration:**					**0.516**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	1.20	103.00	8,602.00	1.090	2.192
#26	**1**	**Time of Concentration:**					**2.192**
#26	2	5. Nearly bare and untilled, and alluvial valley fans	1.23	120.00	9,780.00	1.100	2.469
		8. Large gullies, diversions, and low flowing streams	2.18	184.00	8,454.00	4.420	0.531
#26	**2**	**Time of Concentration:**					**3.000**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.32	50.00	1,158.02	2.070	0.155
		8. Large gullies, diversions, and low flowing streams	2.53	198.00	7,838.16	4.760	0.457
#27	**1**	**Time of Concentration:**					**0.612**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	5.26	30.00	570.00	2.290	0.069
		8. Large gullies, diversions, and low flowing streams	3.15	278.00	8,822.00	5.320	0.460
#27	**2**	**Time of Concentration:**					**0.529**
#27	3	5. Nearly bare and untilled, and alluvial valley fans	16.33	80.00	490.00	4.040	0.033
		8. Large gullies, diversions, and low flowing streams	2.15	225.00	10,443.00	4.400	0.659
#27	**3**	**Time of Concentration:**					**0.692**
#27	4	5. Nearly bare and untilled, and alluvial valley fans	12.43	65.00	523.00	3.520	0.041
		8. Large gullies, diversions, and low flowing streams	3.49	225.00	6,454.00	5.600	0.320
#27	**4**	**Time of Concentration:**					**0.361**
#27	5	5. Nearly bare and untilled, and alluvial valley fans	9.40	25.00	266.00	3.060	0.024
		8. Large gullies, diversions, and low flowing streams	2.32	364.00	15,700.00	4.560	0.956
#27	**5**	**Time of Concentration:**					**0.980**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	40.00	762.00	2.290	0.092
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	1	**Time of Concentration:**					**0.657**

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	2	5. Nearly bare and untilled, and alluvial valley fans	25.86	105.00	406.00	5.080	0.022
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**2**	**Time of Concentration:**					**0.587**
#29	1	5. Nearly bare and untilled, and alluvial valley fans	11.58	30.00	259.00	3.400	0.021
		8. Large gullies, diversions, and low flowing streams	3.61	288.00	7,976.00	5.700	0.388
#29	**1**	**Time of Concentration:**					**0.409**
#29	2	5. Nearly bare and untilled, and alluvial valley fans	8.06	40.00	496.00	2.830	0.048
		8. Large gullies, diversions, and low flowing streams	2.90	252.00	8,696.55	5.100	0.473
#29	**2**	**Time of Concentration:**					**0.521**
#29	3	5. Nearly bare and untilled, and alluvial valley fans	7.25	25.00	345.00	2.690	0.035
		8. Large gullies, diversions, and low flowing streams	2.26	158.00	7,001.00	4.500	0.432
#29	**3**	**Time of Concentration:**					**0.467**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	35.00	710.00	2.220	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	243.00	14,540.00	3.870	1.043
#30	**1**	**Time of Concentration:**					**1.131**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.91	15.00	515.00	1.700	0.084
		8. Large gullies, diversions, and low flowing streams	2.74	247.00	9,006.00	4.960	0.504
#31	**1**	**Time of Concentration:**					**0.588**
#31	2	5. Nearly bare and untilled, and alluvial valley fans	7.46	25.00	335.00	2.730	0.034
		8. Large gullies, diversions, and low flowing streams	2.18	138.00	6,335.00	4.420	0.398
#31	**2**	**Time of Concentration:**					**0.432**
#31	3	5. Nearly bare and untilled, and alluvial valley fans	3.84	20.00	521.00	1.950	0.074
		8. Large gullies, diversions, and low flowing streams	2.24	108.00	4,826.00	4.480	0.299
#31	**3**	**Time of Concentration:**					**0.373**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	22.00	632.00	1.860	0.094
		8. Large gullies, diversions, and low flowing streams	1.56	101.00	6,494.00	3.740	0.482
#32	**1**	**Time of Concentration:**					**0.576**
#34	1	5. Nearly bare and untilled, and alluvial valley fans	2.28	35.00	1,538.00	1.500	0.284
		8. Large gullies, diversions, and low flowing streams	2.89	74.00	2,560.00	5.100	0.139

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#34	**1**	**Time of Concentration:**					**0.423**
#34	2	5. Nearly bare and untilled, and alluvial valley fans	2.69	38.00	1,415.00	1.630	0.241
		8. Large gullies, diversions, and low flowing streams	1.60	81.00	5,052.00	3.790	0.370
#34	**2**	**Time of Concentration:**					**0.611**
#34	3	5. Nearly bare and untilled, and alluvial valley fans	3.80	56.00	1,474.00	1.940	0.211
		8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,293.00	2.500	0.477
#34	**3**	**Time of Concentration:**					**0.688**
#34	4	5. Nearly bare and untilled, and alluvial valley fans	4.17	35.00	840.00	2.040	0.114
		8. Large gullies, diversions, and low flowing streams	1.89	72.00	3,807.00	4.120	0.256
#34	**4**	**Time of Concentration:**					**0.370**
#35	1	5. Nearly bare and untilled, and alluvial valley fans	2.34	113.00	4,831.12	1.520	0.882
		8. Large gullies, diversions, and low flowing streams	1.11	20.00	1,794.00	3.160	0.157
#35	**1**	**Time of Concentration:**					**1.039**
#36	1	5. Nearly bare and untilled, and alluvial valley fans	2.84	85.00	2,213.02	1.950	0.315
		8. Large gullies, diversions, and low flowing streams	1.00	36.00	3,602.16	2.990	0.334
#36	**1**	**Time of Concentration:**					**0.649**
#36	2	5. Nearly bare and untilled, and alluvial valley fans	3.39	23.00	678.00	1.840	0.102
		8. Large gullies, diversions, and low flowing streams	1.42	88.00	6,185.00	3.570	0.481
#36	**2**	**Time of Concentration:**					**0.583**
#36	3	5. Nearly bare and untilled, and alluvial valley fans	1.23	15.00	1,219.00	1.100	0.307
		8. Large gullies, diversions, and low flowing streams	1.82	135.00	7,399.00	4.050	0.507
#36	**3**	**Time of Concentration:**					**0.814**
#36	4	5. Nearly bare and untilled, and alluvial valley fans	1.17	15.00	1,286.00	1.070	0.333
		8. Large gullies, diversions, and low flowing streams	1.65	71.00	4,313.00	3.840	0.311
#36	**4**	**Time of Concentration:**					**0.644**
#36	5	5. Nearly bare and untilled, and alluvial valley fans	4.54	80.00	1,762.00	2.130	0.229
		5. Nearly bare and untilled, and alluvial valley fans	3.45	80.00	2,316.00	1.850	0.347
#36	**5**	**Time of Concentration:**					**0.576**
#36	6	5. Nearly bare and untilled, and alluvial valley fans	3.19	85.00	2,668.00	1.780	0.416

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.41	53.00	3,753.00	3.560	0.292
#36	**6**	**Time of Concentration:**					**0.708**
#37	1	5. Nearly bare and untilled, and alluvial valley fans	4.68	129.00	2,754.05	2.160	0.354
		8. Large gullies, diversions, and low flowing streams	0.16	10.00	6,108.73	1.210	1.402
#37	**1**	**Time of Concentration:**					**1.756**
#37	2	5. Nearly bare and untilled, and alluvial valley fans	5.17	45.00	870.00	2.270	0.106
		8. Large gullies, diversions, and low flowing streams	2.01	95.00	4,737.00	4.240	0.310
#37	**2**	**Time of Concentration:**					**0.416**
#37	3	5. Nearly bare and untilled, and alluvial valley fans	5.08	55.00	1,083.00	2.250	0.133
		8. Large gullies, diversions, and low flowing streams	3.68	150.00	4,080.00	5.750	0.197
#37	**3**	**Time of Concentration:**					**0.330**
#37	4	5. Nearly bare and untilled, and alluvial valley fans	3.18	35.00	1,099.00	1.780	0.171
		8. Large gullies, diversions, and low flowing streams	1.49	38.00	2,544.00	3.660	0.193
#37	**4**	**Time of Concentration:**					**0.364**
#37	5	5. Nearly bare and untilled, and alluvial valley fans	3.76	86.00	2,285.00	1.940	0.327
		8. Large gullies, diversions, and low flowing streams	0.35	11.00	3,175.00	1.760	0.501
#37	**5**	**Time of Concentration:**					**0.828**
#37	6	5. Nearly bare and untilled, and alluvial valley fans	1.70	15.00	883.00	1.300	0.188
		8. Large gullies, diversions, and low flowing streams	5.60	160.00	2,859.00	7.090	0.112
#37	**6**	**Time of Concentration:**					**0.300**
#37	7	5. Nearly bare and untilled, and alluvial valley fans	7.23	80.00	1,106.00	2.680	0.114
		8. Large gullies, diversions, and low flowing streams	1.05	52.00	4,950.00	3.070	0.447
#37	**7**	**Time of Concentration:**					**0.561**

References to Area 4 North within this Appendix have been redacted.

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	1.29	107.00	8,294.00	3.400	0.677
#1	**2**	**Muskingum K:**					**0.677**
#1	3	8. Large gullies, diversions, and low flowing streams	1.27	113.00	8,880.00	3.380	0.729

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**3**	**Muskingum K:**					**0.729**
#1	4	8. Large gullies, diversions, and low flowing streams	1.35	171.00	12,634.00	3.490	1.005
#1	**4**	**Muskingum K:**					**1.005**
#1	5	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**5**	**Muskingum K:**					**1.392**
#1	6	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**6**	**Muskingum K:**					**1.392**
#2	2	8. Large gullies, diversions, and low flowing streams	0.53	20.00	3,756.00	2.180	0.478
#2	**2**	**Muskingum K:**					**0.478**
#2	3	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**3**	**Muskingum K:**					**0.574**
#2	4	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**4**	**Muskingum K:**					**0.574**
#2	5	8. Large gullies, diversions, and low flowing streams	0.65	45.00	6,955.00	2.410	0.801
#2	**5**	**Muskingum K:**					**0.801**
#3	3	8. Large gullies, diversions, and low flowing streams	0.92	20.00	2,168.00	2.880	0.209
#3	**3**	**Muskingum K:**					**0.209**
#5	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#5	**1**	**Muskingum K:**					**0.000**
#5	2	8. Large gullies, diversions, and low flowing streams	1.75	125.00	7,149.00	3.960	0.501
#5	**2**	**Muskingum K:**					**0.501**
#5	3	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**3**	**Muskingum K:**					**0.681**
#5	4	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**4**	**Muskingum K:**					**0.681**
#5	5	8. Large gullies, diversions, and low flowing streams	1.67	239.00	14,273.00	3.880	1.021
#5	**5**	**Muskingum K:**					**1.021**
#5	6	8. Large gullies, diversions, and low flowing streams	1.68	239.00	14,223.00	3.880	1.018
#5	**6**	**Muskingum K:**					**1.018**
#7	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**1**	**Muskingum K:**					**0.000**
#7	2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	**2**	**Muskingum K:**					**0.000**
#7	4	8. Large gullies, diversions, and low flowing streams	1.16	140.00	12,037.00	3.230	1.035
#7	**4**	**Muskingum K:**					**1.035**
#7	5	8. Large gullies, diversions, and low flowing streams	1.14	140.00	12,307.69	3.190	1.071
#7	**5**	**Muskingum K:**					**1.071**
#7	6	8. Large gullies, diversions, and low flowing streams	1.17	158.00	13,546.00	3.230	1.164
#7	**6**	**Muskingum K:**					**1.164**
#7	7	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**7**	**Muskingum K:**					**1.344**
#7	8	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**8**	**Muskingum K:**					**1.344**
#10	3	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**3**	**Muskingum K:**					**0.517**
#10	4	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**4**	**Muskingum K:**					**0.517**
#10	5	8. Large gullies, diversions, and low flowing streams	0.79	47.00	5,956.00	2.660	0.621
#10	**5**	**Muskingum K:**					**0.621**
#12	2	8. Large gullies, diversions, and low flowing streams	8.24	111.00	1,347.00	8.610	0.043
#12	**2**	**Muskingum K:**					**0.043**
#12	3	8. Large gullies, diversions, and low flowing streams	8.01	109.00	1,360.00	8.490	0.044
#12	**3**	**Muskingum K:**					**0.044**
#12	4	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**4**	**Muskingum K:**					**0.487**
#12	5	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**5**	**Muskingum K:**					**0.487**
#13	2	8. Large gullies, diversions, and low flowing streams	1.34	54.00	4,025.00	3.470	0.322
#13	**2**	**Muskingum K:**					**0.322**
#13	3	8. Large gullies, diversions, and low flowing streams	0.98	72.00	7,333.00	2.970	0.685
#13	**3**	**Muskingum K:**					**0.685**
#13	4	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**4**	**Muskingum K:**					**0.923**
#13	5	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	**5**	**Muskingum K:**					**0.923**
#14	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#14	**1**	**Muskingum K:**					**0.000**
#14	2	8. Large gullies, diversions, and low flowing streams	0.83	58.00	6,957.00	2.730	0.707
#14	**2**	**Muskingum K:**					**0.707**
#14	3	8. Large gullies, diversions, and low flowing streams	0.81	77.00	9,480.00	2.700	0.975
#14	**3**	**Muskingum K:**					**0.975**
#14	4	8. Large gullies, diversions, and low flowing streams	0.86	147.00	17,117.00	2.770	1.716
#14	**4**	**Muskingum K:**					**1.716**
#14	5	8. Large gullies, diversions, and low flowing streams	0.88	175.00	19,934.00	2.810	1.970
#14	**5**	**Muskingum K:**					**1.970**
#14	6	8. Large gullies, diversions, and low flowing streams	0.95	211.00	22,155.00	2.920	2.107
#14	**6**	**Muskingum K:**					**2.107**
#14	7	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**7**	**Muskingum K:**					**2.544**
#14	8	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**8**	**Muskingum K:**					**2.544**
#14	9	8. Large gullies, diversions, and low flowing streams	0.95	307.00	32,146.59	2.930	3.047
#14	**9**	**Muskingum K:**					**3.047**
#14	10	8. Large gullies, diversions, and low flowing streams	0.96	339.00	35,382.00	2.930	3.354
#14	**10**	**Muskingum K:**					**3.354**
#15	2	8. Large gullies, diversions, and low flowing streams	1.14	86.00	7,535.26	3.200	0.654
#15	**2**	**Muskingum K:**					**0.654**
#15	3	8. Large gullies, diversions, and low flowing streams	1.25	115.00	9,236.00	3.340	0.768
#15	**3**	**Muskingum K:**					**0.768**
#16	2	8. Large gullies, diversions, and low flowing streams	0.55	42.00	7,608.00	2.220	0.951
#16	**2**	**Muskingum K:**					**0.951**
#16	3	8. Large gullies, diversions, and low flowing streams	0.51	54.00	10,615.00	2.130	1.384
#16	**3**	**Muskingum K:**					**1.384**
#17	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#17	**1**	**Muskingum K:**					**0.000**
#18	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#18	**1**	**Muskingum K:**					**0.000**
#18	2	8. Large gullies, diversions, and low flowing streams	1.02	62.00	6,103.00	3.020	0.561
#18	**2**	**Muskingum K:**					**0.561**
#21	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#21	**1**	**Muskingum K:**					**0.000**
#21	2	8. Large gullies, diversions, and low flowing streams	0.40	20.00	4,946.00	.900	0.723
#21	**2**	**Muskingum K:**					**0.723**
#21	3	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,626.00	1.780	0.877
#21	**3**	**Muskingum K:**					**0.877**
#21	4	8. Large gullies, diversions, and low flowing streams	0.37	23.00	6,135.00	1.830	0.931
#21	**4**	**Muskingum K:**					**0.931**
#24	1	8. Large gullies, diversions, and low flowing streams	0.79	180.00	22,769.00	2.660	2.377
#24	**1**	**Muskingum K:**					**2.377**
#24	2	8. Large gullies, diversions, and low flowing streams	0.78	180.00	23,111.00	2.640	2.431
#24	**2**	**Muskingum K:**					**2.431**
#24	4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#24	**4**	**Muskingum K:**					**0.000**
#25	1	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**1**	**Muskingum K:**					**0.342**
#25	2	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**2**	**Muskingum K:**					**0.342**
#25	3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#25	**3**	**Muskingum K:**					**0.000**
#27	1	8. Large gullies, diversions, and low flowing streams	1.38	216.00	15,629.00	3.520	1.233
#27	**1**	**Muskingum K:**					**1.233**
#27	2	8. Large gullies, diversions, and low flowing streams	1.17	144.00	12,301.00	3.240	1.054
#27	**2**	**Muskingum K:**					**1.054**
#27	3	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**3**	**Muskingum K:**					**0.551**
#27	4	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**4**	**Muskingum K:**					**0.551**
#28	1	8. Large gullies, diversions, and low flowing streams	1.30	84.00	6,445.17	3.420	0.523

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	**1**	**Muskingum K:**					**0.523**
#29	1	8. Large gullies, diversions, and low flowing streams	0.88	37.00	4,210.00	2.810	0.416
#29	**1**	**Muskingum K:**					**0.416**
#29	2	8. Large gullies, diversions, and low flowing streams	0.88	26.00	2,949.00	2.810	0.291
#29	**2**	**Muskingum K:**					**0.291**
#31	1	8. Large gullies, diversions, and low flowing streams	1.35	76.00	5,639.00	3.480	0.450
#31	**1**	**Muskingum K:**					**0.450**
#31	2	8. Large gullies, diversions, and low flowing streams	1.15	20.00	1,734.00	3.220	0.149
#31	**2**	**Muskingum K:**					**0.149**
#34	1	8. Large gullies, diversions, and low flowing streams	0.64	56.00	8,773.00	2.390	1.019
#34	**1**	**Muskingum K:**					**1.019**
#34	2	8. Large gullies, diversions, and low flowing streams	1.05	31.00	2,957.00	3.070	0.267
#34	**2**	**Muskingum K:**					**0.267**
#34	3	8. Large gullies, diversions, and low flowing streams	0.64	26.00	4,031.00	2.400	0.466
#34	**3**	**Muskingum K:**					**0.466**
#36	1	8. Large gullies, diversions, and low flowing streams	0.27	8.00	2,933.62	1.560	0.522
#36	**1**	**Muskingum K:**					**0.522**
#36	2	8. Large gullies, diversions, and low flowing streams	0.24	12.00	4,944.37	1.470	0.934
#36	**2**	**Muskingum K:**					**0.934**
#36	3	8. Large gullies, diversions, and low flowing streams	0.27	8.00	2,933.00	1.560	0.522
#36	**3**	**Muskingum K:**					**0.522**
#36	4	8. Large gullies, diversions, and low flowing streams	3.03	85.00	2,803.15	5.220	0.149
#36	**4**	**Muskingum K:**					**0.149**
#37	2	8. Large gullies, diversions, and low flowing streams	0.28	30.00	10,641.00	1.590	1.859
#37	**2**	**Muskingum K:**					**1.859**
#37	3	8. Large gullies, diversions, and low flowing streams	0.31	30.00	9,800.71	1.650	1.649
#37	**3**	**Muskingum K:**					**1.649**
#37	4	8. Large gullies, diversions, and low flowing streams	0.66	104.00	15,664.00	2.440	1.783
#37	**4**	**Muskingum K:**					**1.783**
#37	5	8. Large gullies, diversions, and low flowing streams	0.33	48.00	14,659.00	1.710	2.381
#37	**5**	**Muskingum K:**					**2.381**
#37	6	8. Large gullies, diversions, and low flowing streams	0.34	43.00	12,547.00	1.750	1.991

References to Area 4 North within this Appendix have been redacted.

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#37	**6**	**Muskingum K:**					**1.991**
#37	7	8. Large gullies, diversions, and low flowing streams	0.33	31.00	9,266.00	1.730	1.487
#37	**7**	**Muskingum K:**					**1.487**

References to Area 4 North within this Appendix have been redacted.

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	14.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area A North within this Appendix have been redacted.

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	12.85	2.98	14.2	5,823	2.63	1.99
#28	1,217.900	1,217.900	348.89	55.85	2,523.5	62,288	0.15	0.11
#26	2,486.400	2,486.400	65.87	26.07	120.8	5,583	1.83	1.40
#24	8,061.800	8,061.800	94.58	74.22	230.2	4,450	0.94	0.63
#25	1,015.700	9,077.500	103.41	93.53	318.0	14,973	4.39	0.98
#27	1,783.700	13,347.600	236.67	153.83	991.6	20,940	9.20	2.46
#29	966.000	15,531.500	535.73	253.00	5,701.3	62,577	5.53	1.88
#32	293.700	16,301.600	553.89	272.97	6,197.3	56,019	2.91	1.09
#31	957.100	957.100	333.75	52.17	1,885.7	48,387	1.13	0.87
#33	0.000	17,258.700	646.50	325.16	8,083.0	50,209	2.27	1.07
#34	1,020.000	18,278.700	664.99	349.04	8,049.1	46,073	1.39	0.67
#5	2,023.000	2,023.000	506.93	74.88	1,835.9	42,293	7.10	3.81
#6	1,743.200	3,766.200	630.69	145.20	3,523.1	37,902	0.66	0.41
#7	2,395.300	6,161.500	1,047.30	279.30	9,564.4	49,059	0.35	0.24
#8	0.000	6,161.500	1,047.30	279.30	9,564.4	49,059	0.35	0.24
#10	1,053.200	7,214.700	1,090.41	327.89	9,682.3	45,852	0.08	0.05
#1	2,411.100	2,411.100	379.94	69.75	1,801.7	33,350	5.15	3.43
#2	1,497.000	3,908.100	424.36	146.48	2,640.6	27,235	0.18	0.12
#3	862.700	4,770.800	559.86	182.72	3,083.2	21,895	0.16	0.12
#4	0.000	4,770.800	559.86	182.72	3,083.2	21,895	0.16	0.12
#9	445.600	5,216.400	573.82	196.01	3,183.6	20,911	0.60	0.45
#11	0.000	12,431.100	1,505.28	523.90	12,865.9	38,001	0.32	0.20
#21	900.800	13,331.900	1,526.57	547.84	13,028.5	38,285	0.42	0.25
#35	160.400	160.400	58.34	9.28	72.9	10,039	0.00	0.00
#15	1,992.700	1,992.700	386.36	75.98	2,270.9	44,345	3.76	2.31
#12	3,494.500	3,494.500	193.05	50.42	599.6	16,055	7.95	5.41
#13	2,720.700	6,215.200	371.99	90.19	1,206.7	16,565	8.59	5.98
#14	5,096.800	11,312.000	509.48	261.94	4,722.7	77,966	2.13	0.45
#16	1,022.000	16,326.700	833.40	394.77	8,306.9	47,954	2.16	0.87
#23	0.000	14,487.100	843.93	404.06	8,379.8	46,619	2.08	0.85
#18	848.500	848.500	169.02	34.58	389.3	20,552	0.10	0.06
#17	182.200	182.200	108.99	10.55	110.0	13,892	0.66	0.46
#19	0.000	1,030.700	255.08	45.13	499.3	18,671	0.27	0.18
#20	271.100	15,788.900	889.57	460.53	8,967.5	40,778	1.73	0.77
#22	0.000	29,120.800	2,302.10	1,008.37	21,996.0	37,199	0.88	0.49
#36	1,704.400	49,103.900	2,880.10	1,384.01	30,408.8	37,032	1.18	0.68
#37	2,069.330	51,173.230	2,831.28	1,436.45	30,585.6	36,245	0.87	0.49

References to Area 4 North within this Appendix have been redacted.

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area A North within this Appendix have been redacted.

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	30.89	6.52	36.1	6,848	3.20	2.38
#28	1,217.900	1,217.900	503.94	79.78	3,785.9	64,830	0.47	0.33
#26	2,486.400	2,486.400	129.71	49.77	252.2	6,132	2.13	1.63
#24	8,061.800	8,061.800	187.84	146.37	496.8	4,961	1.10	0.72
#25	1,015.700	9,077.500	192.60	178.46	630.7	15,775	4.34	0.96
#27	1,783.700	13,347.600	390.94	285.23	1,879.5	22,553	9.85	2.51
#29	966.000	15,531.500	811.81	427.10	8,961.2	57,027	7.06	2.14
#32	293.700	16,301.600	841.49	456.97	9,765.4	58,352	4.76	1.61
#31	957.100	957.100	468.62	72.36	2,769.5	49,912	1.43	1.11
#33	0.000	17,258.700	933.80	529.38	12,534	52,484	3.67	1.56
#34	1,020.000	18,278.700	961.80	561.25	12,404.6	48,074	2.42	1.06
#5	2,023.000	2,023.000	759.22	110.62	2,992.3	44,396	8.02	4.36
#6	1,743.200	3,766.200	937.84	218.01	5,461.3	39,588	0.96	0.60
#7	2,395.300	6,161.500	1,511.91	398.19	14,212.4	50,892	0.57	0.38
#8	0.000	6,161.500	1,511.91	398.19	14,212.4	50,892	0.57	0.38
#10	1,053.200	7,214.700	1,570.09	466.38	14,398.1	47,738	0.30	0.18
#1	2,411.100	2,411.100	519.70	107.13	2,889.3	34,591	5.99	4.00
#2	1,497.000	3,908.100	639.70	214.44	4,165.5	27,962	0.19	0.13
#3	862.700	4,770.800	796.58	266.87	4,723.0	22,166	0.06	0.04
#4	0.000	4,770.800	796.58	266.87	4,723.0	22,166	0.06	0.04
#9	445.600	5,216.400	819.53	287.32	4,883.4	21,101	0.67	0.51
#11	0.000	12,431.100	2,170.49	754.30	19,281.5	39,490	0.50	0.31
#21	900.800	13,331.900	2,263.87	791.55	19,468.5	39,504	0.50	0.30
#35	160.400	160.400	80.69	12.75	104.4	10,453	0.00	0.00
#15	1,992.700	1,992.700	573.85	111.38	3,464.8	46,177	4.79	2.91
#12	3,494.500	3,494.500	342.58	89.19	1,127.7	17,435	8.75	5.92
#13	2,720.700	6,215.200	652.52	158.89	2,263.5	17,685	9.32	6.50
#14	5,096.800	11,312.000	855.51	416.05	7,583.6	80,737	4.22	0.86
#16	1,022.000	14,336.700	1,207.11	606.03	12,934.5	50,061	3.26	1.25
#23	0.000	14,487.100	1,221.18	618.79	13,038.9	48,744	3.15	1.23
#18	848.500	848.500	254.46	50.10	629.1	22,480	0.17	0.11
#17	182.200	182.200	150.01	14.49	157.1	14,384	0.80	0.55
#19	0.000	1,030.700	355.05	64.59	786.2	20,520	0.35	0.23
#20	271.100	15,788.900	1,283.67	699.84	13,960.4	42,886	2.63	1.12
#22	0.000	29,120.800	3,329.40	1,491.39	33,428.9	38,582	1.27	0.69
#36	1,704.400	49,103.900	4,195.63	2,105.05	46,628.6	38,370	1.76	0.97
#37	2,069.330	51,173.230	4,118.04	2,187.96	46,904.2	37,624	1.33	0.72

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	14.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted.

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	65.84	12.83	80.6	7,897	3.88	2.84
#28	1,217.900	1,217.900	724.22	113.81	5,661.4	67,335	0.79	0.57
#26	2,486.400	2,486.400	239.85	89.42	491.1	6,676	2.47	1.87
#24	8,061.800	8,061.800	347.67	268.91	989.6	5,44[illegible]	1.32	0.85
#25	1,015.700	9,077.500	355.36	321.00	1,205.4	[illegible]	4.43	0.99
#27	1,783.700	13,347.600	632.57	503.04	3,430.7	[illegible]	10.45	2.60
#29	966.000	15,531.500	1,224.41	705.70	14,034.2	[illegible]	8.70	2.38
#32	293.700	16,301.600	1,271.84	750.71	15,388.5	60,689	6.75	2.11
#31	957.100	957.100	658.11	100.59	4,029.6	51,481	1.68	1.31
#33	0.000	17,258.700	1,380.10	851.30	19,418	54,967	5.21	2.04
#34	1,020.000	18,278.700	1,392.62	910.60	19,[illegible]2.6	50,672	3.58	1.42
#5	2,023.000	2,023.000	1,134.33	162.68	4,633.8	46,042	9.29	5.15
#6	1,743.200	3,766.200	1,388.71	321.34	9,463.0	41,364	1.61	1.00
#7	2,395.300	6,161.500	2,178.26	567.73	21,139.2	52,813	0.89	0.60
#8	0.000	6,161.500	2,178.26	567.73	21,139.2	52,813	0.89	0.60
#10	1,053.200	7,214.700	2,258.71	665.29	21,434.0	49,680	0.62	0.39
#1	2,411.100	2,411.100	873.47	119.06	4,586.2	35,752	6.80	4.55
#2	1,497.000	3,908.100	957.23	313.42	6,458.5	28,518	0.20	0.13
#3	862.700	4,770.800	1,132.66	389.11	7,079.3	22,325	0.06	0.05
#4	0.000	4,770.800	1,132.66	389.11	7,079.3	22,325	0.06	0.05
#9	445.600	5,216.400	1,170.08	420.23	7,338.2	21,194	0.74	0.57
#11	0.000	12,431.180	3,131.48	1,085.51	28,772.2	40,930	0.74	0.46
#21	900.800	13,331.900	3,279.46	1,142.87	29,095.9	40,611	0.77	0.46
#35	160.400	160.400	111.85	17.57	150.0	10,899	0.00	0.00
#15	1,992.700	1,992.700	849.14	162.79	5,262.2	48,014	5.90	3.57
#12	3,494.500	3,494.500	584.36	151.76	2,044.5	18,768	9.60	6.47
#13	2,720.700	6,215.200	1,103.87	269.77	4,088.5	18,975	10.18	7.04
#14	5,096.800	11,312.000	1,402.27	652.61	12,213.4	83,135	7.75	1.54
#16	1,022.000	14,326.700	1,744.40	924.36	20,186.6	52,101	4.96	1.85
#23	0.000	14,487.100	1,763.29	941.93	20,336.5	50,748	4.80	1.81
#18	848.500	848.500	380.92	72.50	1,005.9	24,282	0.23	0.15
#17	182.200	182.200	206.29	19.96	224.8	14,878	0.93	0.64
#19	0.000	1,030.700	494.85	92.45	1,230.7	22,297	0.42	0.27
#20	271.100	15,788.900	1,850.79	1,058.19	21,773.0	44,854	4.01	1.65
#22	0.000	29,120.800	4,810.80	2,201.06	50,869.0	39,885	1.96	1.06
#36	1,704.400	49,103.900	6,106.15	3,189.88	71,387.4	39,567	2.56	1.37
#37	2,069.330	51,173.230	5,987.72	3,318.99	71,844.5	38,780	2.07	1.09

References to Area 4 North within this Appendix have been redacted.

APPENDIX 11-SS

CHACO AND PINABETE TRIBUTARIES
POST-MINING HYDROLOGY AND SEDIMENTOLOGY
(2 YR-6 HR, 10 YR-6 HR, 25 YR-6 HR, & 100 YR-6 HR STORM EVENTS)

References to Area 4 North within this Appendix have been redacted

NOV 2004

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Civil Software Design

Tributary A to the Chaco Wash Post-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is presented on Exhibit 11-77.

References to Area 4 North within this Appendix have been redacted

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

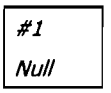
Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	23.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Tributary A to Chaco



References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	380.500	380.500	5.07	0.94	7.0	9,043	4.95	3.72

References to Area 4 North within this Appendix have been redacted

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	66.047%
0.0500	34.893%
0.0020	27.416%
0.0010	0.000%

References to Area 4 North within this Appendix have been redacted

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	380.500	0.559	0.000	0.000	79.700	M	5.07	0.944
	Σ	**380.500**						**5.07**	**0.944**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.242	300.00	2.35	0.3150	1.0000	1	7.0	9,043	4.95	3.72
	Σ							**7.0**	**9,043**	**4.95**	**3.72**

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	2.46	47.00	1,908.00	1.560	0.339
		8. Large gullies, diversions and low flowing streams	1.60	48.00	3,006.01	3.790	0.220
#1	**1**	**Time of Concentration:**					**0.559**

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	33.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	380.500	380.500	46.88	5.94	67.9	15,154	8.84	6.13

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	20.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	380.500	380.500	86.92	10.37	131.1	16,805	10.04	6.93

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	23.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	380.500	380.500	153.21	17.45	241.0	18,391	11.20	7.72

References to Area 4 North within this Appendix have been redacted

Tributary A to the Pinabete Wash Post-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is presented on Exhibit 11-77.

References to Area 4 North within this Appendix have been redacted

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

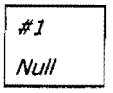
Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Tributary A to Pinabete



References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	370.850	370.850	4.75	0.92	7.1	9,367	5.07	3.83

References to Area 4 North within this Appendix have been redacted

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	67.521%
0.0500	35.672%
0.0020	28.028%
0.0010	0.000%

References to Area 4 North within this Appendix have been redacted

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	370.850	0.631	0.000	0.000	79.700	M	4.75	0.920
	Σ	**370.850**						**4.75**	**0.920**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.242	300.00	2.52	0.3150	1.0000	1	7.1	9,367	5.07	3.83
	Σ							**7.1**	**9,367**	**5.07**	**3.83**

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	2.09	25.00	1,230.01	1.420	0.240
		8. Large gullies, diversions, and low flowing streams	1.21	56.00	4,636.14	3.290	0.391
#1	**1**	**Time of Concentration:**					**0.631**

References to Area A North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	17.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	370.850	370.850	42.35	5.79	67.3	15,224	8.74	6.14

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	19.000%	23.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	370.850	370.850	78.68	10.10	130.1	16,945	9.97	6.96

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	370.850	370.850	138.28	17.01	238.9	18,505	11.12	7.75

References to Area 4 North within this Appendix have been redacted

Tributary B to the Pinabete Wash Post-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is presented on Exhibit 11-77.

References to Area 4 North within this Appendix have been redacted

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

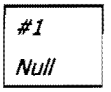
Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Tributary B to Pinabete



References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	401.600	401.600	5.05	1.00	10.2	12,385	6.68	5.05

References to Area 4 North within this Appendix have been redacted

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	68.214%
0.0500	36.038%
0.0020	28.315%
0.0010	0.000%

References to Area 4 North within this Appendix have been redacted

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	401.600	0.664	0.000	0.000	79.700	M	5.05	0.996
	Σ	**401.600**						**5.05**	**0.996**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.242	200.00	3.92	0.3150	1.0000	1	10.2	12,385	6.68	5.05
	Σ							**10.2**	**12,385**	**6.68**	**5.05**

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	1.21	15.00	1,238.13	1.100	0.312
		8. Large gullies, diversions, and low flowing streams	2.03	110.00	5,424.06	4.270	0.352
#1	**1**	**Time of Concentration:**					**0.664**

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North have been redacted within this Appendix

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	401.600	401.600	44.44	6.27	96.1	19,906	11.34	8.01

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	401.600	401.600	82.60	10.94	185.9	22,177	12.97	9.10

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	31.000%	93.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	401.600	401.600	144.97	18.42	340.9	24,191	14.44	10.11

References to Area 4 North within this Appendix have been redacted

Tributary C to the Pinabete Wash Post-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is presented on Exhibit 11-77.

References to Area 4 North within this Appendix have been redacted

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

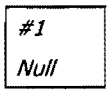
Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Tributary C to Pinabete



References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	314.200	314.200	4.41	0.78	10.9	16,905	9.38	7.13

References to Area 4 North within this Appendix have been redacted

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	64.162%
0.0500	33.897%
0.0020	26.633%
0.0010	0.000%

References to Area 4 North within this Appendix have been redacted

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	314.200	0.417	0.000	0.000	79.700	M	4.41	0.779
	Σ	**314.200**						**4.41**	**0.779**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.242	175.00	4.61	0.3150	1.0000	1	10.9	16,905	9.38	7.13
	Σ							**10.9**	**16,905**	**9.38**	**7.13**

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	1.5	15.00	943.00	1.260	0.207
		8. Large gullies, diversions, and low flowing streams	2.86	110.00	3,850.00	5.070	0.210
#1	**1**	**Time of Concentration:**					**0.417**

References to Area 4 North within this Appendix have been redacted

2005 Schedule C Cost Summary (With Allocations)

	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05	Budget 05
6122061602 (N160) Primary Grading													
6122061601 (160D) Primary Grading - Draglines	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061603 (N160Z) Primary Grading - Dozers	$ 42,942	$ 42,783	$ 69,584	$ 21,841	$ 48,388	$ 42,685	$ 42,942	$ -	$ 17,830	$ -	$ 15,101	$ -	$ 344,096
6122061602 (N160L) Primary Grading - Truck / Loader	$ 289,562	$ 430	$ 8,588	$ 178,889	$ 124,114	$ 208,117	$ 192,780	$ 389,843	$ 432,529	$ 338,975	$ 371,638	$ 388,912	$ 2,924,376
6122061602 (N160P) Primary Grading - Scrapers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061610 (N161) Secondary Land Features	$ 743	$ 740	$ 738	$ 741	$ 741	$ 739	$ 743	$ 738	$ 739	$ 743	$ 739	$ 741	$ 8,886
6122061632 (N163) Spoil Mitigation													
6122061630 (N163A) Spoil Sampling & Analysis	$ 42,757	$ -	$ -	$ 18,706	$ -	$ -	$ 24,051	$ -	$ -	$ 48,102	$ -	$ -	$ 133,615
6122061631 (N163C) Spoil Mitigation-Coal Haulers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061632 (N163L) Spoil Mitigation-Truck / Loader	$ -	$ 115,203	$ 30,246	$ 48,758	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061632 (N163P) Spoil Mitigation-Scrapers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 99,254	$ -	$ -	$ 293,461
6122061642 (N164) Revegetation													
6122061641 (N164A) Seedbed Preparation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061642 (N164B) Mulching	$ 10,528	$ 4,791	$ 9,582	$ 11,978	$ 11,978	$ 2,396	$ 2,396	$ 2,396	$ 23,088	$ 23,088	$ 23,088	$ 23,088	$ 148,397
6122061643 (N164C) Soil Amendments	$ 96	$ 958	$ 1,917	$ 2,396	$ 2,396	$ 479	$ 479	$ 479	$ 96	$ 96	$ 96	$ 96	$ 9,585
6122061644 (N164D) Seeding	$ 24,695	$ 27,913	$ 7,151	$ 8,939	$ 8,939	$ 1,788	$ 1,788	$ 1,788	$ 13,191	$ 13,191	$ 13,191	$ 358	$ 122,930
6122061645 (N164R) Revegetation Research	$ 187	$ 187	$ 374	$ 374	$ 374	$ 374	$ 374	$ 374	$ 374	$ 374	$ 187	$ 187	$ 3,743
6122061646 (N164U) Revegetation Supervision	$ 8,196	$ 8,196	$ 8,196	$ 8,196	$ 8,196	$ 8,196	$ 8,196	$ 8,196	$ 8,196	$ 8,196	$ 8,196	$ 8,196	$ 98,352
6122061662 (N166) Fencing	$ -	$ 1,164	$ 2,278	$ 1,726	$ 1,174	$ 1,174	$ 3,905	$ 3,905	$ 1,174	$ 1,174	$ -	$ -	$ 17,613
6122061672 (N167) Surface Water Control - Terrace Building	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061672 (Other) Surface Water Control & Terrace Shaping	$ 19,728	$ 16,978	$ 347,038	$ 38,174	$ 117,133	$ 140,603	$ 19,728	$ 16,978	$ 221,553	$ 19,853	$ 19,728	$ 16,978	$ 994,469
6122061681 (N168) Irrigation													
6122061681 (N168A) Irrigation Main Line	$ 21,845	$ 11,771	$ 11,771	$ 21,845	$ 11,771	$ 11,771	$ 11,771	$ 175,071	$ 195,219	$ 31,919	$ 31,919	$ 11,771	$ 548,443
6122061682 (N168B) Irrigation Plot	$ -	$ 4,847	$ 6,298	$ 26,058	$ 23,149	$ 23,149	$ 23,033	$ 22,859	$ 22,859	$ 20,920	$ 1,238	$ -	$ 174,413
N16A Reclamation Administration	$ 6,416	$ 6,416	$ 6,416	$ 6,416	$ 6,416	$ 6,416	$ 6,416	$ 6,416	$ 6,416	$ 6,416	$ 6,416	$ 6,416	$ 76,992
6122061696 (N16U) Reclamation Planning & Supervision	$ 31,498	$ 31,498	$ 31,498	$ 31,498	$ 31,498	$ 31,498	$ 31,498	$ 31,498	$ 31,498	$ 31,498	$ 31,498	$ 31,498	$ 377,978
6122061695 (N16G) Reclamation Planning & Engineering	$ 17,540	$ 18,640	$ 20,840	$ 17,540	$ 20,840	$ 18,640	$ 17,540	$ 18,640	$ 17,540	$ 23,040	$ 23,040	$ 18,640	$ 232,479
6122061722 (N171) Topsoiling													
6122061721 (N172C) Topsoil Remove>Spread-Coal Haulers	$ -	$ -	$ -	$ -	$ -	$ 31,004	$ -	$ -	$ 40,392	$ 246,015	$ -	$ -	$ 427,411
6122061722 (N172E) Topsoil Remove>Spread-Truck \ Loader	$ 17,691	$ 50,365	$ 135,609	$ 2,391	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 441,656
6122061722 (N172P) Topsoil Remove>Spread-Scrapers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061731 (N173C) Topsoil Remove>Stockpile-Coal Haulers	$ -	$ -	$ 341,087	$ -	$ -	$ 6,350	$ -	$ -	$ 33,362	$ 9,576	$ -	$ -	$ 390,375
6122061732 (N173E) Topsoil Remove>Stockpile-Truck \ Loader	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061731 (N173P) Topsoil Remove>Stockpile-Scrapers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061741 (N174C) Topsoil Stockpile>Spread-Coal Haulers	$ -	$ -	$ 1,927	$ -	$ 94,373	$ 19,938	$ -	$ -	$ -	$ -	$ -	$ -	$ 244,239
6122061742 (N174E) Topsoil Stockpile>Spread-Truck \ Loader	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061742 (N174P) Topsoil Stockpile>Spread-Scrapers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061751 (N175C) Topsoil Stockpile>Stockpile-Coal Haulers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061752 (N175E) Topsoil Stockpile>Stockpile-Truck \ Loader	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061751 (N175P) Topsoil Stockpile>Stockpile-Scrapers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061760 (N176C) Topsoil Road Maint.-Coal Haulers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061760 (N176E) Topsoil Road Maint.-Truck \ Loader	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122061760 (N176P) Topsoil Road Maint.-Scrapers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal Reclamation Costs	$ 534,425	$ 342,822	$ 1,[illegible],140	$ 682,066	$ 511,480	$ 665,317	$ 387,639	$ 679,180	$ 1,066,055	$ 922,429	$ 546,074	$ 506,880	$ 8,013,506
6122061800 (N180) Supervision, Salary - Administration	$ [illegible]	$ [illegible]	$ [illegible]	$ 35,918	$ 35,918	$ 35,918	$ 35,918	$ 35,918	$ 35,918	$ 35,918	$ 35,918	$ 35,918	$ 431,014
6122061821 (N182) Monitor and Control													
6122061821 (N182A) Air Quality - Monitoring & Control	$ 22,650	$ 22,650	$ 22,650	$ 22,650	$ 22,650	$ 3,136	$ 3,136	$ 3,136	$ 3,136	$ 3,136	$ 3,136	$ 3,136	$ 135,207
6122061822 (N182F) Flora & Fauna - Monitoring & Control	$ 6,502	$ 6,522	$ 4,245	$ 4,245	$ 9,585	$ 29,525	$ 28,352	$ 28,352	$ 9,801	$ 29,601	$ 29,138	$ 24,971	$ 210,856
6122061823 (N182G) Grazing Program - Monitoring & Control	$ 1,574	$ 1,574	$ 1,574	$ 1,574	$ 1,574	$ 1,574	$ 1,574	$ 1,574	$ 1,574	$ 1,574	$ 1,574	$ 1,574	$ 18,884
6122061824 (N182H) Hydrology - Monitoring & Control	$ 4,480	$ 4,480	$ 5,025	$ 4,480	$ 4,480	$ 4,480	$ 4,480	$ 4,480	$ 5,025	$ 4,480	$ 4,480	$ 4,480	$ 54,846
6122061825 (N182S) Soils - Monitoring & Control	$ -	$ -	$ -	$ 21,755	$ -	$ -	$ 26,106	$ -	$ -	$ 26,106	$ 13,053	$ -	$ 87,020
6122061854 (N185) Regulations & Compliance													
6122061851 (N185A) Permitting	$ 34,615	$ 29,782	$ 31,157	$ 35,990	$ 31,157	$ 31,157	$ 34,615	$ 29,782	$ 29,782	$ 34,615	$ 29,782	$ 29,782	$ 382,219
6122061854 (N185B) Compliance	$ 143,553	$ 18,153	$ 50,243	$ 164,123	$ 37,898	$ 37,898	$ 195,388	$ 70,813	$ 69,988	$ 50,243	$ 18,153	$ 18,153	$ 1,051,840
6122061882 (N188) Waste Management	$ 41,878	$ 41,878	$ 72,909	$ 41,878	$ 41,878	$ 41,878	$ 41,878	$ 41,878	$ 72,909	$ 41,878	$ 41,878	$ 41,878	$ 564,598
Subtotal Environmental Quality Costs	$ 291,189	$ 160,956	$ 223,721	$ 332,612	$ 185,139	$ 185,565	$ 371,447	$ 215,933	$ 228,133	$ 372,696	$ 209,202	$ 159,891	$ 2,936,484
Total Reclamation Cost w/ Allocations	$ 825,612	$ 503,778	$ 1,392,861	$ 1,014,677	$ 696,619	$ 850,882	$ 759,085	$ 895,113	$ 1,294,189	$ 1,295,125	$ 755,276	$ 666,771	$ 10,949,989
6122298140 (N814) Ash Leveling/Covering/Plating 7 Feet	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6122298170 (N817) Ash Regulatory	$ 1,136	$ 1,136	$ 3,436	$ 1,136	$ 1,136	$ 1,136	$ 1,136	$ 1,136	$ 3,436	$ 1,136	$ 1,136	$ 1,136	$ 18,229
6122298195 (N81G) Ash Regulatory Planning & Engineering	$ 2,019	$ 2,019	$ 2,019	$ 2,019	$ 2,019	$ 2,019	$ 2,019	$ 2,019	$ 2,019	$ 2,019	$ 2,019	$ 2,019	$ 24,227
Total Ash Regulatory Costs	$ 3,155	$ 3,155	$ 5,455	$ 3,155	$ 3,155	$ 3,155	$ 3,155	$ 3,155	$ 5,455	$ 3,155	$ 3,155	$ 3,155	$ 42,456

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	314.200	314.200	46.23	4.90	114.3	31,607	19.09	12.82

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	314.200	314.200	86.02	8.56	221.0	35,047	21.61	14.49

References to Area 4 North within this Appendix have been redacted

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badland	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

References to Area 4 North within this Appendix have been redacted

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	314.200	314.200	150.51	14.41	404.7	37,973	23.80	16.01

References to Area 4 North within this Appendix have been redacted

APPENDIX 11-Y

COTTONWOOD ARROYO POST-MINING HYDROLOGY & SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, 25 YR-6 HR, & 100 YR-6 HR STORM EVENTS)

References to Area 4 North within this Appendix have been redacted.

OCTOBER 2006

Post-mining watersheds within Area 4 North have been redacted.

SOUTH PERMIT BOUNDARY

Surface Use Permit Boundary

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 6300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 / 5422.45 HORIZ. & VERT. CONTROL
- L-30 LEASE CORNER
- PERMIT BOUNDARY

2000 0 2000 4000

CONTOUR INTERVAL: 10'

Original Certified signed exhibits are maintained at the Mine Site and OSM

REV No	DATE	DRAFT BY	REVISION DESCRIPTION	ENGR	E.S.	P.E.
				APPROVALS		
TR-4	7-12-06	PJF	REVISED TBR PARTRIDGE OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW	Signed Seals	YB	KAB
AT-4	10-31-07	PJF	SUBMITTED FOR AJN DEVELOPMENT TO OSM FOR REVIEW AND APPROVAL	LR	YB	LR
E	10-17-06	PJF	REVISED TO REFLECT FSC REVISIONS AND SUBMITTED TO OSM FOR APPROVAL	LR	KJ	LR
D	10-17-05	PJF	REVISED TO REFLECT FSC REVISIONS AND SUBMITTED TO OSM FOR REVIEW	LR	MC	LR
C	11-15-04	PJF	REVISED TO INCLUDE 4-4 NORTH AND SUBMITTED TO OSM FOR REVIEW	LR	MC	LR
B	3-17-03	PJF	REVISED TO REFLECT AOC REVISIONS AND SUBMITTED TO OSM FOR REVIEW	LR	MC	LR
A	5-10-01	PJF	UPDATE PERMIT EXHIBIT AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL	LR	MC	LR

EXHIBIT 11-77

BHP NAVAJO COAL COMPANY

NAVAJO MINE

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

LOWE, COTTONWOOD AND PINABETE ARROYO POST-MINING SEDCAD DRAINAGE SUBDIVISIONS

PREPARED BY	AAY/LR	DRAWN BY	PJFOSTER
SCALE	1" = 2000'		
APPROVED BY	AAY/LR	DATE	MAY 3, 2001

CERTIFICATION STATEMENT

I, KEVIN A. BAHE, HEREBY CERTIFY THAT THE INFORMATION DISPLAYED ON THIS DRAWING IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

KEVIN A. BAHE NEW MEXICO 17850 LICENSED PROFESSIONAL ENGINEER

D:\SEDCAD\DATA\SUBDIVISIONS\PREDEVELOPMENT\EXHIBIT11-77\EXHIBIT11-77-A_4N_WS_LOWE-PB-SEDCAD.DWG 5/3/2001 10:17:11 PJFOSTER 1:24000 Plot Scale: 0.5000 ' / Inch

D:\SEDCAD4\SUBDIVISIONS\PREDEVELOPMENT\EXHIBIT11-77\EXHIBIT11-77-A_4N_WS_LOWE-PB-SEDCAD4.DWG 5/3/2001 10:17:11 PJFOSTER 1:24000 Plot Scale: 0.5000 ' / Inch

Table 12-2

Regrade Volume by Area

Volume Moved (Bank Cyds)	Location		
Year	Area 2	Area 3	Area 4
2010	6,113,331	4,602,065	
2011	5,583,134	4,826,890	
2012	4,249,955	5,770,431	
2013	4,942,521	5,463,651	
2014	5,452,429	4,064,407	
2015	6,063,844	4,378,689	~~248,000~~
2016	3,759,176	6,781,872	~~1,140,000~~
2017	2,500,000	8,308,488	~~2,330,000~~
2018	2,500,000	7,354,127	~~3,320,000~~
2019	2,500,000	10,775,504	
2020	5,500,964	4,599,732	~~2,660,000~~
2021	2,192,310	5,052,194	~~5,930,000~~
2022			~~4,571,000~~

Estimated volume (cubic yard) of spoil material moved each fiscal year for cut and/or fill requirements to meet Final Surface Configuration (FSC)

Figure 12.3-4
Area 4 North Slope Histogram

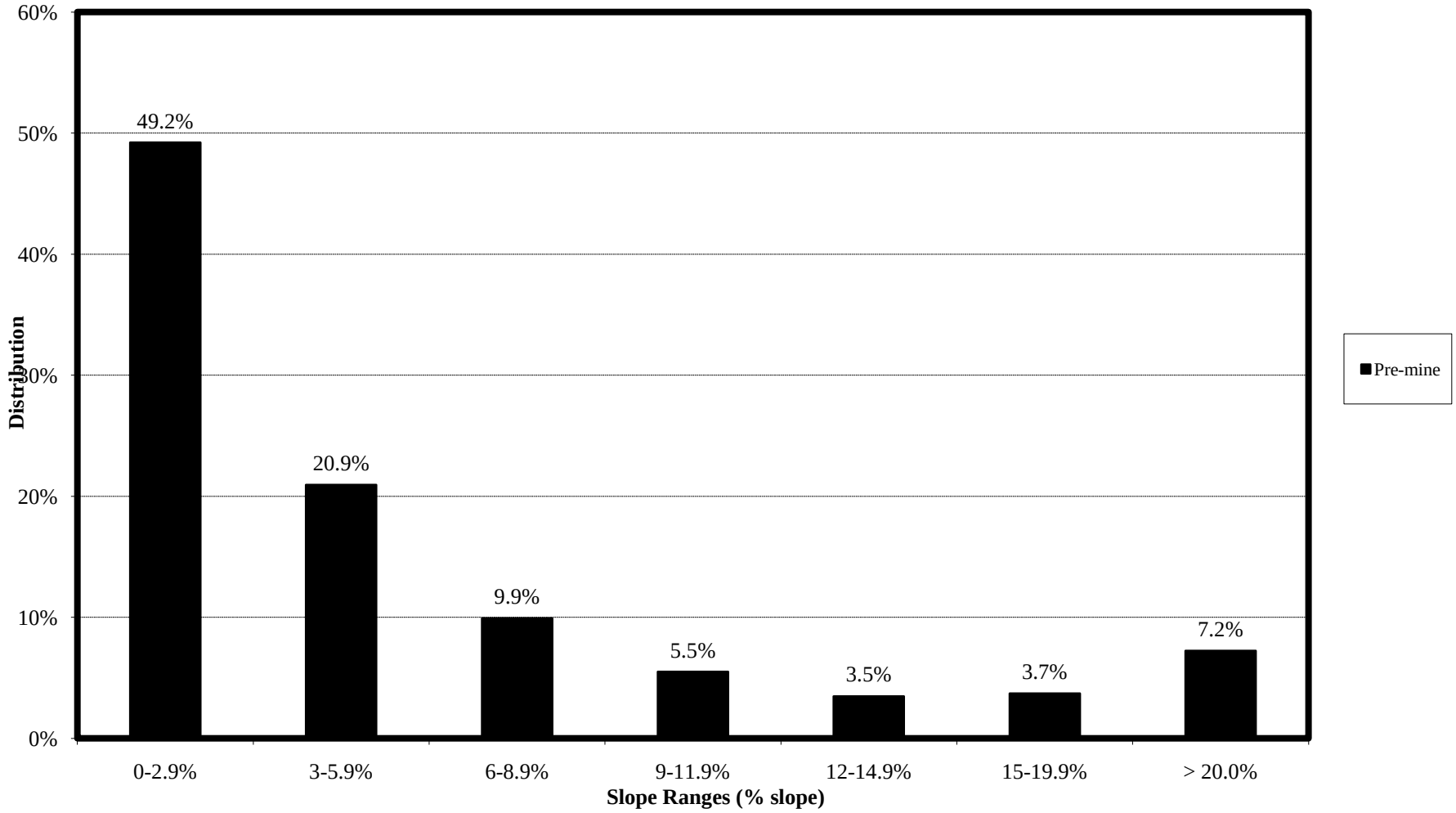


Table 12 - 8

Slope Distribution by Area for Pre- and Post-mining Topography

Percent

	Area 1			Area 2			Area 3			Area 4 North		
	AOC	PRE	**Variance**	AOC	PRE	**Variance**	AOC	PRE	**Variance**	AOC	PRE	**Variance**
0-2.9%	47.2%	62.0%	**-14.8%**	26.9%	34.9%	**-8.0%**	50.1%	57.4%	**-7.3%**		49.2%	**-49.2%**
3-5.9%	25.9%	23.4%	**2.6%**	28.3%	27.6%	**0.7%**	25.6%	18.7%	**6.9%**		20.9%	**-20.9%**
6-8.9%	12.7%	7.9%	**4.7%**	20.4%	14.3%	**6.1%**	11.7%	9.0%	**2.7%**		9.9%	**-9.9%**
9-11.9%	6.4%	3.3%	**3.1%**	11.6%	8.4%	**3.2%**	6.2%	4.8%	**1.4%**		5.5%	**-5.5%**
12-14.9%	3.7%	1.6%	**2.1%**	6.6%	5.1%	**1.5%**	3.1%	2.8%	**0.3%**		3.5%	**-3.5%**
15-19.9%	2.5%	1.1%	**1.5%**	4.1%	4.3%	**-0.2%**	2.1%	2.8%	**-0.7%**		3.7%	**-3.7%**
> 20.0%	1.6%	0.7%	**0.8%**	2.2%	5.5%	**-3.3%**	1.2%	4.6%	**-3.4%**		7.2%	**-7.2%**
Total	100%	100%		100%	100%		100%	100%			100%	

Acres

	Area 1			Area 2			Area 3			Area 4 North		
	AOC	PRE	**Variance**	AOC	PRE	**Variance**	AOC	PRE	**Variance**	AOC	PRE	**Variance**
0-2.9%	1,035	1,360	**(325)**	1,579	2,047	**(467.6)**	2,060	2,359	**(298.9)**		1,866	**(1,866.4)**
3-5.9%	568	512	**56**	1,660	1,622	**38.5**	1,052	768	**283.6**		794	**(793.7)**
6-8.9%	278	174	**104**	1,198	838	**360.0**	481	369	**111.8**		376	**(376.1)**
9-11.9%	140	72	**68**	679	493	**186.0**	255	196	**59.3**		208	**(208.4)**
12-14.9%	81	35	**46**	387	297	**89.5**	129	115	**14.3**		132	**(132.0)**
15-19.9%	56	23	**33**	240	251	**(11.3)**	85	116	**(30.7)**		141	**(140.8)**
> 20.0%	34	16	**19**	126	321	**(195.2)**	50	189	**(139.3)**		274	**(274.3)**
Total	2,193	2,193		5,870	5,870		4,113	4,113			3,792	

12.9 DETERMINATION OF BOND

The determination of the bond is an estimation of the maximum reclamation cost that the Regulatory Authority would incur in the event of bond forfeiture by Navajo Mine during the permit term ending in 2014. Areas bonded include those areas which will be disturbed in the process of recovering coal from the permit area and those facilities that support the mine. The following costs and procedures apply only for determining the bond dollar figure at year 2014 and are not necessarily meant to represent current or future operational practices. Direct costs are calculated in Worksheets 2 through 15 and are totaled in Worksheet 16 in APPENDIX 12-B. Indirect costs are applied as percentages of the direct cost in Worksheet 16 to achieve a total bond cost.

12.9.1 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.

For the purposes of this calculation, the disturbed areas have been updated with aerial flight topography and merged with the bond post mining configuration. BNCC will evaluate, and adjust if neccasry, the bond amount based on significant permit revisions, mid-term renewals, and permit renewal periods.

The amount of disturbance taking place during the permit term is primarily controlled by strip progression, which is shown on EXHIBITS 12-2 and 12-3.

Mining activities will continue in Dixon, Lowe, Barber, Hosteen and Yazzie pits. ~~Additionally, a box-cut and strip progression will commence in Area IV as seen in EXHIBIT 12-03~~. Pinto pit will be reclaimed during the permit term. Consequently Areas II and III are the primary areas for reclamation during this permit term.

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ADJUDICATION
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1.2 VIOLATION INFORMATION
1.3 RIGHT OF ENTRY INFORMATION
1.4 STATUS OF UNSUITABILITY CLAIMS
1.5 PERMIT TERM
1.6 INSURANCE
1.7 NEWSPAPER ADVERTISEMENT AND PROOF OF PUBLICATION
1.8 PUBLIC OFFICE AND LOCATION FOR FILING APPLICATION - ADDRESS OF PUBLIC LOCATIONS
1.9 FACILITIES OR STRUCTURES USED IN COMMON

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1-A BHP Ownership and Control.
1-B Notice of Violations
1-B-A Navajo Mine, San Juan County, NM
1-B-B San Juan Mine, San Juan County, NM
1-B-C La Plata Mine, San Juan County, NM
1-B-D Black Diamond Mine Violations
1-C Legal description of the original Mining Lease and Amendments 2, 3, 4, and 4-A.
1-D Grants of Easement for Right of Way
1-E Certificate of Liability Insurance.
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1-1 Information for Entities with Ownership and Control Interest in Navajo Mine
1-2 Other Permits maintained by Navajo Mine, Navajo Coal Company
1-3 Other Permits maintained by San Juan Mine, San Juan Coal Company
1-4 Other Permits maintained by La Plata Mine, San Juan Coal Company

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1-A BHP New Mexico Coal Operations Corporate Organizational Structure

LIST OF EXHIBITS

1-1 Surface and Minerals Ownership Coal Leasehold Interest (Sheets 1 and 2)
1-2 Customary Use Area (Sheets 1 and 2)
1-3 Rights-of-Way and Easements (Sheets 1 and 2)
1-4 Area I Permit Areas Pre-Law, Interim, Permanent Program (Sheet 1)

LIST OF EXHIBITS (Continued)

	Area II Permit Areas Pre-Law, Interim, Permanent Program (Sheets 2 through 4)
	Area III Permit Areas Pre-Law, Interim, Permanent Program (Sheets 5 and 6)
1-5	OPEN
1-6	Navajo Mine Lease Base Map (Sheets 1 through 9)

CHAPTER 2
LAND USE
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2.2 POSTMINING LAND USE
2.3 SOCIOECONOMIC IMPACT ASSESSMENT
2.4 REFERENCES

LIST OF APPENDICES

2-A Land Use Correspondence:
IOC, A. King to A.F. Geiger. "Ref. Contract No. 14-20-603-2505 Mining Lease - Tribal Indian Lands". April 5, 1971.
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1.1 IDENTIFICATION OF INTERESTS

1.1.1 Ownership and Control Information

BHP Navajo Coal Company (referred to in this permit application package as "BNCC", "BHP", "BHP Billiton", "BHP Minerals International") is the applicant, owner, and operator of Navajo Mine.

1.1.1.1 Applicant Identification

Legal Structure:

( ) Single proprietorship

( ) Partnership

(X) Corporation - Date Inc. **July 14,1994**

State: **Delaware**

( ) Association

( ) Other Business_____

Name **BHP Navajo Coal Company**

Address **300 West Arrington, Suite 200**

City **Farmington** State **NM** ZIP **87401**

Telephone **(505) 598-4350**

Employer Identification No. **Federal I.D. No. 85-0436672**

The applicant assumes responsibility for mail delivered to this address and must notify the Office of Surface Mining Reclamation and Enforcement (OSMRE) by submittal of a permit revision of any change of this address until the time of final bond release.

1.1.1.2 Resident Agent Identification

Name **CT. Corporation System**

Address **123 East Marcy Street, Suite 201**

City **Santa Fe** State **NM** ZIP **87501**

Telephone **(505) 983-9122**

Employer Identification No. **Federal I.D. No. 51-0006522**

1.1.3 MSHA Numbers

The MSHA Identification number for Navajo Mine is 29-00097. Section numbers have been assigned to industrial areas, existing pit areas and proposed pit areas. They are:

Watson Pit Area	001-0
Bitsui Pit Area	001-0
Dodge Pit Area	002-0
Custer Pit Area	003-0
Bighan Pit Area	004-0
Pinto Pit Area	005-0
Doby Pit Area	006-0
Yazzie Pit Area	007-0
Hosteen Pit Area	008-0
Barber Pit Area	009-0
Mason Pit Area	010-0
Lowe Pit Area	011-0
Dixon Pit Area	012-0
Area 4 North Pit Area	013-0
Surface Area	090-0

1.1.4 Names and Addresses of Legal Owners of Record within Leased Area

The names and addresses of the legal or equitable owners of record (known to Applicant) of the surface and mineral property within the leased area are shown below. Tribal and Bureau of Indian Affairs (BIA) records are unavailable and cannot be verified by Applicant.

BHP Navajo Coal Company
Corporate Organizational Structure

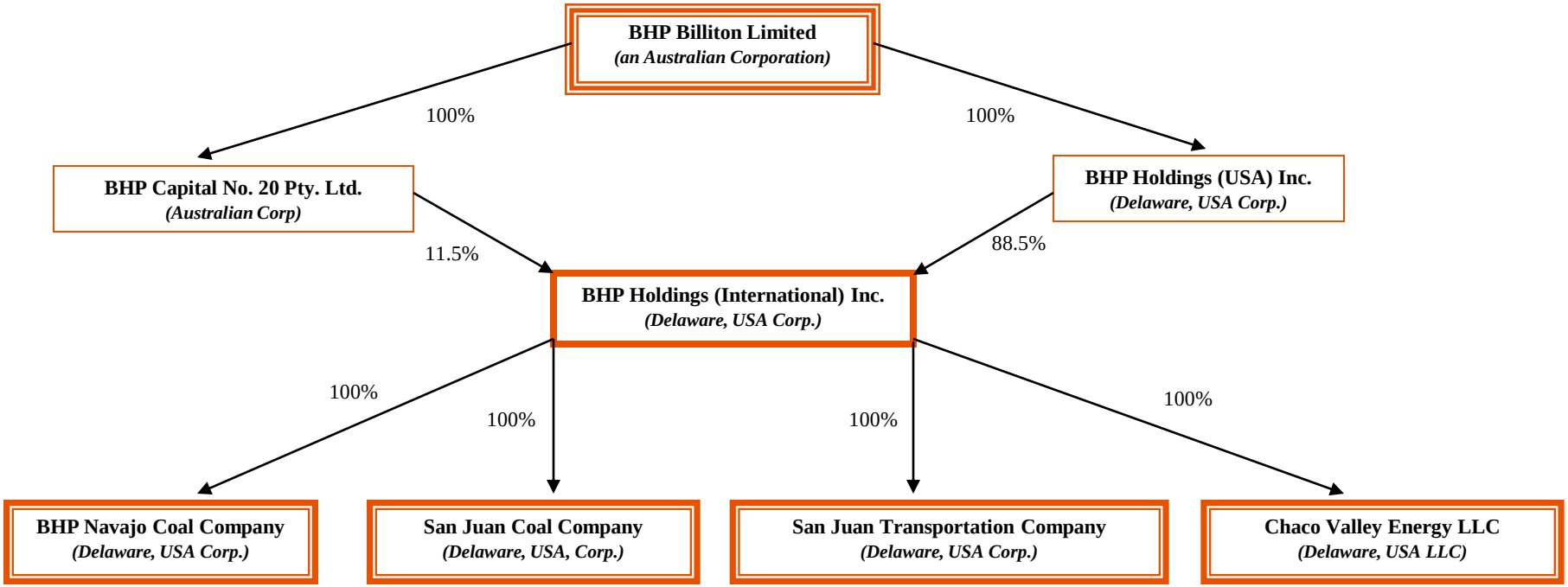

Figure 1-A

VERIFICATION OF OWNERSHIP AND CONTROL

BHP NAVAJO COAL COMPANY
NAVAJO MINE PERMIT RENEWAL APPLICATION
SAN JUAN COUNTY, NEW MEXICO

I swear and affirm, under oath and in writing that the AVS information submitted to update the ownership and control information in the Navajo Mine PAP is accurate and complete in accordance with Federal regulations under 30 CFR 778.9.

The following changes have occurred:

- Updates to the Officers and Directors listing:
  - The most current listing for Officers and Directors is included in this package

Alfred Francis
General Manager
BHP Navajo Coal Company

STATE OF NEW MEXCIO §

COUNTY OF SAN JUAN §

SUBSCRIBED AN SWORN to before me, in my presence, this 4 day of February, 2011, a Notary Public in and for the State of New Mexico.

Notary Public

My Commission Expires: 08/14/13

JANIS NOTARY PUBLIC STATE OF NEW MEXICO

Updated through January 26, 2011

BHP BILLITON LIMITED
ACTIVE OFFICERS

Name	Title	Date Elected
Crawford, David Alexander	Director	5/1/94
Schubert, John Michael	Director	6/1/00
Buchanan, John Gordon St. Clair	Director	2/1/03
Codeiro, Carlos Antonio Souza	Director	8/26/05
Kloppers, Marius Jacques	Director	1/1/06
Nasser, Jacques	Director	6/6/06
McAloon, Jane	Secretary	10/25/06
Smith, Fiona Catherine Davis	Secretary	6/28/07
Rumble, Keith Christopher	Director	9/1/08
Boeckmann, Alan Lee	Director	9/1/08
Murdy, Wayne William	Director	6/18/09
Broomhead, Malcolm William	Director	3/31/10
Hewson, Carolyn Judith	Director	3/31/10
Vadera, Shriti	**Director**	**1/1/11**

BHP BILLITON LIMITED
RESIGNED OFFICERS

Name	Title	Date Elected	Date Resigned
Taylor, Roger Vernon	Assistant Secretary	4/26/85	3/4/05
Codeiro, Carlos Antonio Souza	Director	2/3/05	4/3/05
Chaney, Michael Alfred	Director	5/24/95	11/25/05
Lord Renwich of Clifton (Robin)	Director	6/29/01	11/25/05
Salamon, Miklos	Director	2/24/03	10/26/06
Wood, Karen Joy	Secretary	6/1/01	7/12/07
Lynch, Christopher James	Director	1/1/06	6/30/07
Mallet, Ross Edwin	Secretary	3/21/05	9/28/07
Brink, David C.	Director	6/29/01	11/28/07
Goodyear, Charles Waterhouse	Director	11/30/01	9/30/07
Mallett, Ross Edwin	Secretary	3/21/05	9/28/07
Butcher, Samuel Andrew	Secretary	3/19/04	7/16/08
Morgan, David Raymond	Director	1/1/08	11/24 09
Jenkins, David Anthony Lawson	Director	3/1/00	11/26/09
Anderson, Paul Milton	Director	6/6/06	1/31/10
de Planque, Eileen Gail	Director	10/19/05	1/31/10
Argus, Donald Robert	Director	11/30/96	3/30/10

Names in Bold indicate new changes since last report

BHP CAPITAL NO. 20 PTY LIMITED
ACTIVE OFFICERS

Name	Title	Date Elected
Chadwick, Nigel	Director	8/23/02
Merlo, Anthony Joseph	Director	10/29/08
Gayfer, Angeli	Secretary	9/1/08
Rix, Brett Andrew	Director	9/3/09
Rowntree, Ian	Director	1/1/10

BHP CAPITAL NO. 20 PTY LIMITED
RESIGNED OFFICERS

Name	Title	Date Elected	Date Resigned
Taylor, Roger V.	Secretary	5/17/89	3/4/05
Butcher, Samuel Andrew	Secretary	6/3/04	10/5/06
Mallett, Ross Edwin	Secretary	5/3/05	9/28/07
Edney, Ian C.	Director	4/7/95	1/16/09
Austin, Anthony Harold	Director	6/3/04	12/16/08
McKaig, Natalie Ellen	Secretary	10/5/07	9/1/08
Wong, Susie	Secretary	10/5/07	9/1/08
Williams, Mark Lindsay	Director	10/29/08	12/31/09

Names in Bold indicate new changes since last report

(dba: BHP Capital No. 20 Pty Ltd)

BHP HOLDINGS (USA) INC.
ACTIVE OFFICERS

Name	Title	Date Elected
Moore, Earl Kenneth	President & Director	3/1/00
Teel, Paul Lawrence	Director & Vice President	12/20/05
White, Catriona	Treasurer	1/28/09
McGrath, Gail	Secretary	1/28/09
Gayfer, Angeli	Assistant Secretary	6/17/09
Jr., David T. Grand	Assistant Secretary	6/17/09

BHP HOLDINGS (USA) INC.
RESIGNED OFFICERS

Name	Title	Date Elected	Date Resigned
Huisman, Brian	Vice President – Tax	11/30/04	11/1/05
Koach, John J.	Director	12/6/04	1/13/06
Rhodes, Malinda Ruth	Secretary	2/28/03	7/1/07
Theron, Ian David	Treasurer	1/1/04	7/1/08
Tlachac, Kelly D.	Secretary	7/1/07	9/1/08
Bowden, Jon M.	Assistant Secretary	2/28/03	9/11/08

Names in Bold indicate new changes since last report

BHP HOLDINGS (INTERNATIONAL) INC.
ACTIVE OFFICERS

Name	Title	Date Elected
Moore, Earl Kenneth	President & Director	3/1/00
Teel, Paul Lawrence	Director & Vice President	12/20/05
White, Catriona	Treasurer	1/28/09
McGrath, Gail	Secretary	1/28/09
Gayfer, Angeli	Assistant Secretary	6/17/09
Jr., David T. Grand	Assistant Secretary	6/17/09

BHP HOLDINGS (INTERNATIONAL) INC.
RESIGNED OFFICERS

Name	Title	Date Elected	Date Resigned
Huisman, Brian	Vice President – Tax	11/30/04	11/1/05
Koach, John J.	Director	12/6/04	1/13/06
Rhodes, M. Ruth	Secretary	6/16/03	7/1/07
Theron, Ian David	Treasurer	1/1/04	7/1/08
Tlachac, Kelly D.	Secretary	7/1/07	9/1/08
Bowden, Jon M.	Assistant Secretary	6/16/03	9/11/08

Names in Bold indicate new changes since last report

BHP NAVAJO COAL COMPANY
ACTIVE OFFICERS

Name	Title	Date Elected
Moore, Earl Kenneth	Vice President & Director	1/17/00
Jones, Evan Y.	Director & Vice President	3/1/01
Clarke, Steve C.	Assistant Treasurer	10/30/01
Francis, Alfred	Vice President	7/14/04
Teel, Paul Lawrence	Vice President	6/1/05
Groves, Darrell	Treasurer	7/1/08
Fourie, Jacobus Gerhardus	Director, President & COO	4/1/10
Jr., David T. Grand	Assistant Secretary	12/22/09
Roybal, Charles E.	Secretary	3/3/09

BHP NAVAJO COAL COMPANY
RESIGNED OFFICERS

Name	Title	Date Elected	Date Resigned
Grubb, J. W.	President & Director	8/22/00	7/1/05
Huisman, Brian J.	Vice President	11/30/04	11/1/05
Isaacs, Lewis Wayne	President	7/1/05	3/14/07
Isaacs, Lewis Wayne	Director	7/1/05	4/23/07
Rhodes, M. Ruth	Secretary	8/30/03	7/1/07
Theron, Ian David	Treasurer	3/18/04	7/1/08
Tlachac, Kelly D.	Secretary	7/1/07	9/1/08
Neumann, Michael J.	Assistant Secretary	8/30/03	3/3/09
Pettigrew, Ed A.	Vice President	8/28/07	12/31/09
Kellow, Glenn Leslie	President & COO	3/14/07	4/1/10
Kellow, Glenn Leslie	Director	4/24/07	4/1/10
Roybal, Charles E.	Assistant Secretary	8/1/02	3/3/09

Names in Bold indicate new changes since last report

SAN JUAN COAL COMPANY
ACTIVE OFFICERS

Name	Title	Date Elected
Moore, Earl Kenneth	Vice President & Director	1/17/00
Jones, Evan Y.	Vice President & Director	3/1/01
Clarke, Steve C.	Assistant Treasurer	10/30/01
Teel, Paul Lawrence	Vice President	6/1/05
Jones, James Scott	Vice President	8/11/08
Groves, Darrell	Treasurer	7/1/08
Fourie, Jacobus Gerhardus	Director, President & COO	4/1/10
Jr., David T. Grand	Assistant Secretary	**3/3/09**
Roybal, Charles E.	Secretary	3/3/09

SAN JUAN COAL COMPANY
RESIGNED OFFICERS

Name	Title	Date Elected	Date Resigned
Grubb, John W.	President & Director	8/22/00	7/1/05
Huisman, Brian J.	Vice President - Tax	4/30/05	11/1/05
Lansdale, Gary	Vice President	3/1/01	3/28/06
Isaacs, Lewis Wayne	President	7/1/05	3/14/07
Isaacs, Lewis Wayne	Director	7/1/05	4/23/07
Rhodes, M. Ruth	Secretary	2/28/03	7/1/07
Tlachac, Kelly D.	Secretary	7/1/07	9/1/08
Theron, Ian David	Treasurer	3/18/04	7/1/08
Langley, Scott B.	Vice President	3/28/06	8/11/08
Neumann, Michael J.	Assistant Secretary	2/28/03	3/3/09
Pettigrew, Ed A.	Vice President	8/28/07	12/31/09
Kellow, Glenn Leslie	President & COO	3/14/07	4/1/10
Kellow, Glenn Leslie	Director	4/24/07	4/1/10
Roybal, Charles E.	Assistant Secretary	8/1/02	3/3/09

Names in Bold or **dates** indicate new changes since last report

SAN JUAN TRANSPORTATION COMPANY
ACTIVE OFFICERS

Name	Title	Date Elected
Moore, Earl Kenneth	Vice President & Director	1/17/00
Jones, Evan Y.	Vice President & Director	3/1/01
Clarke, Steve C.	Assistant Treasurer	10/30/01
Teel, Paul Lawrence	Vice President	6/1/05
Jones, James Scott	Vice President	8/11/08
Groves, Darrell	Treasurer	7/1/08
Fourie, Jacobus Gerhardus	Director, President & COO	4/1/10
Jr., David T. Grand	Assistant Secretary	12/22/09
Roybal, Charles E.	Secretary	3/3/09

SAN JUAN TRANSPORTATION COMPANY
RESIGNED OFFICERS

Name	Title	Date Elected	Date Resigned
Grubb, J. W.	President & Director	8/22/00	7/1/05
Huisman, Brian J.	Vice President - Taxes	12/1/04	11/1/05
Lansdale, Gary	Vice President	3/1/01	3/28/06
Isaacs, Lewis Wayne	President	7/1/05	3/14/07
Isaacs, Lewis Wayne	Director	7/1/05	4/23/07
Rhodes, M. Ruth	Secretary	2/28/03	7/1/07
Theron, Ian David	Treasurer	3/18/04	7/1/08
Langley, Scott B.	Vice President	3/28/06	8/11/08
Tlachac, Kelly D.	Secretary	7/1/07	9/1/08
Neumann, Michael J.	Assistant Secretary	2/28/03	3/3/09
Kellow, Glenn Leslie	President & COO	3/14/07	4/1/10
Kellow, Glenn Leslie	Director	4/24/07	4/1/10
Roybal, Charles E.	Assistant Secretary	8/1/02	3/3/09

Names in Bold indicate new changes since last report

CHACO VALLEY ENERGY LLC
ACTIVE OFFICERS

Name	Title	Date Elected
Jones, Evan Y.	Vice President	3/19/04
Moore, Earl Kenneth	Vice President	3/19/04
Clarke, Steve C.	Assistant Treasurer	3/19/04
Teel, Paul Lawrence	Vice President	6/1/05
Groves, Darrell	Treasurer	7/1/08
Fourie, Jacobus Gerhardus	President & COO	4/1/10
Jr., David T. Grand	Assistant Secretary	12/22/09
Roybal, Charles E.	Secretary	3/3/09

CHACO VALLEY ENERGY LLC
RESIGNED OFFICERS

Name	Title	Date Elected	
Grubb, John W.	President	3/19/04	7/1/05
Huissman, Brian J.	Vice President	11/30/04	11/1/05
Rhodes, M. Ruth	Secretary	3/19/04	7/1/07
Isaacs, Lewis Wayne	President	7/1/05	3/14/07
Theron, Ian David	Treasurer	3/19/04	7/1/08
Tlachac, Kelly D.	Secretary	7/1/07	9/1/08
Neumann, Michael J.	Assistant Secretary	3/19/04	3/3/09
Pettigrew, Ed A.	Vice President	3/19/04	12/31/09
Kellow, Glenn Leslie	President	3/14/07	4/1/10
Roybal, Charles E.	Assistant Secretary	8/1/02	3/3/09

Names in Bold indicate new changes since last report

CHAPTER 3
CULTURAL RESOURCES

3.1 INTRODUCTION

The cultural resources information in this chapter covers Areas I, II, III, and IV North, industrial sites, and right-of-ways associated with BHP Navajo Coal Company's (BNCC) mining lease (see EXHIBIT 3-1). Information concerning the nature and location of cultural, historic, and archaeological resources and properties, including survey and study reports submitted as part of this permit application package are understood to be confidential under applicable law.

Archaeological actions on the Navajo Mine leasehold have taken place in phases corresponding to the sequence of mining activities. Permitting activities on BNCC's mining lease have been and will be conducted in compliance with all applicable federal laws, including without limitation: National Historic Preservation Act (NHPA) of 1966 (Public Law 98-655), the Archaeological Resources Protection Act (ARPA) of 1979 (Public Law 96-96), and the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990. (Appendix 3-1). In addition, BNCC intends to comply with the appropriate, applicable Navajo Nation policies, statutes and guidelines to the extent they are not inconsistent with applicable federal law**.**

3.2 CULTURAL/HISTORICAL BACKGROUND

At the onset of mining activities on the mining lease, BNCC (formerly BHP, Utah Construction & Mining Co., and Utah International Inc. (UII)) and Arizona Public Service Company (APS) obtained the services of the Museum of New Mexico's Laboratory of Anthropology to conduct an archaeological survey of the Area I and Area II prior to any land disturbances associated with the start of the Four Corners Power Plant and Navajo Mine. The northern portion of this area was cleared (reflecting approval) in June 1961 and the report from this initial survey was completed in 1962 (Greminger and Sciscenti, 1962). Area II was subsequently cleared on August 25, 1969.

An archaeological survey (Reher, 1977) was conducted for Areas III, IV North, IV South and V from September 1973 to December 1974. In this survey, 718 archaeological sites were identified; 153 of those sites were determined eligible for listing on the National Register of Historic Places (NHRP).

The archaeological compliance actions taken by BNCC and its consultants from 1961 to 2008 have resulted in the completion of BNCC's obligations under its permits and in the completion of OSM's (and other federal agency) obligations under applicable cultural resources management statutes and regulations within BNCC's mining lease lands from Area I to Area IV North. TABLE 3-1 summarizes the archaeological actions with compliance completion dates, the principle agency involved, area clearance granted, and principle consultant involved in the major mitigation projects.

Artifacts and records from these mitigation and research activities that have not been returned to the Navajo Nation are maintained at the Museum of New Mexico, University of New Mexico in Albuquerque, New Mexico, or at the San Juan County Museum in Bloomfield, New Mexico.

In 2004, BNCC contracted with San Juan County Museum Association's Division of Conservation Archaeology (DCA) to perform an updated inventory/evaluation of archaeological sites and historic properties within the Area IV North portion of the Navajo Mine lease area. DCA reviewed the literature and conducted field inventories to re-locate and characterize 57 sites previously identified within this area (Hofan and Winter, 1983: Reher, 1977). As part of its work, DCA identified 16 new sites of varying potential significance. A total of 73 archaeological or cultural resources sites were located and/or identified during the evaluation project (Meininger and Wharton, 2004).

TABLE 3-1

NAVAJO MINE ARCHEOLOGICAL CLEARANCE

	Clearance Area	Acres	Clearance Approval	Clearance Date	Project Documentation[1]
1.	Mining Area I[2] and Industrial Complex.	5307.60	Museum of New Mexico (MNM)[3]	06/61	Report: "Archaeology of the 4 Corners Power Project", Greminger & Sciscenti, 1962.
2.	Mining Area II.	3391.10	MNM	08/25/69	Recommendation from MNM to NPS after survey finds no arch. sites.
3.	The "Neck", North of Area III.	160.00	National Park Service (NPS).	12/16/76	Report: "Archaeological Survey of the 160 ac. part of Area III of the Navajo Mine Leasehold known as "the Neck"", conducted for UII, Cultural Resources Management Prog., New Mexico State Univ.
4.	NW Corner of Area III.	661.80	NPS.	06/26/81	Report: "Human Adaptations in a Marginal Environment, The Mitigation Project, 1980, Office of Contact Archaeology (OCA), UNM.
5.	SW Corner of Area III.	1583.74	NPS.	12/10/79	11/27/79 letter from OCA to NPS recommending clearance.
6.	Eastern Side of Area III.	2709.70	NPS.	09/25/81	08/27/81 letter from UII to NPS requesting clearance based on CGP survey.
7.	106 acres on Eastern Side of Area III plus most of the Southern part of Area IV North.	4247.20	Office of Surface Mining (OSM).	12/12/84	Report: "Economy and Interaction Along the Lower Chaco River", OCA, May 1983.

[1]All documentation, correspondences, reports, etc., have been submitted to OSM/WSC and are maintained as confidential.
[2]Acres reflecting Mining Area I only.
[3]The Museum of New Mexico in 1961 certified the "clearance" since no clearances were required at that time.

TABLE 3-1 Continued

NAVAJO MINE ARCHEOLOGICAL CLEARANCE

	Clearance Area	Acres	Clearance Approval	Clearance Date	Project Documentation[1]
8.	27 EQ Areas.	842.00	OSM.	12/07/88	Report: "Archaic, Puebloan, and Navajo Land Use and Occupation Along the Middle Chaco River", Southwest Archaeological Consultants Inc. (SAR).
9.	Block "B".	820.00	OSM.	02/10/92	Approval letter from OSM/WSC to BHP. OSM in receipt of 2/5/92 submittal of the Navajo Nation Historic Preservation Officer & the State Historic Preservation Officers, 1/7/92 concurrence with DCA's 8/5/91 report "Archaeological Testing & Evaluation Report" for site NM-H-21-162.
10.	Block "D".	19.50	OSM.	10/12/93	Approval letter from OSM/WSC to BHP, based upon review of "Preliminary Data Recovery Report for Site LA 88815", DCA, August 1993.
11.	Block “A”	210.8	NNHPD	06/18/96	Approval by NNHPD for sites in Block A via OSM with effects/Conditions of Compliance to include a testing plan and a data recovery plan in consultation with NNHPD.

[1]All documentation, correspondences, reports, etc., have been submitted to OSM/WSC and are maintained as confidential.
[2]Acres reflecting Mining Area I only.
[3]The Museum of New Mexico in 1961 certified the "clearance" since no clearances were required at that time.

TABLE 3-1 Continued

NAVAJO MINE ARCHEOLOGICAL CLEARANCE

	Clearance Area	Acres	Clearance Approval	Clearance Date	Project Documentation[1]
12.	Area 3 Lowe Pit	111.41	BIA 11/02/99	11/2/99	Approval by NNHPD for A Cultural Resources Inventory of a Proposed Surface Addition to the Navajo Mine Area III Lowe Pit with No historic properties affected Cultural Resources Compliance Form signed and issued by BIA
13.	Area 4 North	4500	, BIA 06/08/05	06/08/05	NNHPD HPD-04-1252 Cultural Resources Compliance Form signed and issued by NNHPD via BIA. Effect/Conditions of Compliance to test 33 sites and mitigate 19 sites including ethnographic study completion prior to mining activities within the project area. The Eligibility evaluation of Cultural Resources for A4N submitted in 2004, Data Recovery and Treatment plan for 44 Sites submitted in 2006. Data Recovery and Treatment plan for 47 Sites submitted in 2006. NRHP Eligibility testing report for 33 sites submitted in 2007, Ethnography *Each Place Brings Stories* submitted in 2007, Preliminary Report on Excavation of 19 Sites in Area 4N completed in 2008. All material submitted to NNHPD.
14.	Burnham Road Realignment	188	BIA 12/27/07	03/07/08	NNHPD HPD-06-843 Revised Cultural Resource Survey of 188 Acres for a Proposed Realignment of Burnham Road, within and outside the Navajo Mine Lease Area. Cultural Resource Survey submitted to NNHPD in 2006.
	TOTAL:	25594.85			

[1]All documentation, correspondences, reports, etc., have been submitted to OSM/WSC and are maintained as confidential.
[2]Acres reflecting Mining Area I only.
[3]The Museum of New Mexico in 1961 certified the "clearance" since no clearances were required at that time.

Based on the review of the DCA report, and in coordination with OSM, the Navajo Nation Historic Preservation Department (NNHPD) issued a Cultural Resources Compliance Form that outlined the Effects and Conditions of Compliance of the proposed project to conduct mining and related operations throughout Area IV North of the Navajo Mine lease. Of the total 73 cultural resources located in the proposed mine area, OSM, in coordination with NNHPD, determined that 21 were not eligible for listing on the National Register of Historic Places (NRHP) and 52 were NRHP eligible. In addition to the cultural resource or archaeological sites, one Traditional Cultural Property (TCP), also determined not eligible for the National Register, 4 burial locations, and 2 In-use sites were identified. OSM, in coordination with NNHPD, determined that a thorough ethnographic study, a data recovery plan, and additional testing were required to mitigate the adverse effects of the proposed mining impact.

In 2005, BNCC contracted Ecosystem Management, Inc (EMI) to draft a data recovery and treatment plan to conduct a thorough ethnographic study for Area IV North, to survey the proposed Burnham Road realignment, and to conduct additional eligibility testing in that area . The data recovery plan provided a framework for the mitigation and testing of 47 previously recorded archaeological sites located within Area IV North (Burelson, Phippen, and Yost 2006). This plan provided methodology for formal data recovery at 12 sites and testing at 35 sites to determine whether or not additional data recovery was warranted.

EMI subcontracted the prescribed ethnographic study to Dinetahdoo CRM. A plan was made for gathering ethnographic information, based on the review of the local literature, field visits to Navajo archaeological sites in Area IV North, and preliminary contacts with members of the families using the project area. This plan was submitted to and approved by OSM, in coordination with NNHPD, in 2006. Officials of the chapters that encompass the project area were consulted: Nenahnezad, Burnham, San Juan, Upper Fruitland, Sanostee, and Newcomb chapters. Individuals were identified for ethnographic interview by using data from the chapter contacts, historical users of the area, and individuals identified in previous ethnographic interviews. All together 36 people within six chapters were contacted. Nineteen individuals were taken on field visits to old family sites and or camps, and portions of interviews were conducted on those site visits. The results of the

ethnographic study were presented in the publication "Each Place Brings Stories" that was submitted to NNHPD in 2007 (Kelley et al 2007).

EMI also conducted a cultural resources Class III survey of the proposed Burnham Road realignment, including on and off lease segments of the realignment. In the survey area, four cultural resource sites were located (Burelson 2006). Based on the review of EMI's report, OSM, in coordination with NNHPD, issued a Cultural Resources Compliance Form that outlined the Effects of the project and the Conditions of Compliance. All four sites were determined to be eligible for inclusion to the NRHP; three of the sites could be avoided by rerouting and one required mitigation. Mitigation work for the one site was completed in 2007 (Honeycutt 2008).

During the spring of 2007, EMI conducted evaluative investigations at 33 sites in Area IV North. Subsurface testing was conducted at 19 sites and detailed mapping and artifact analysis was conducted at the remaining 14 sites. The results of the testing indicated that 7 sites should be further mitigated according to the data recovery plan. In addition, it was recommended that the sites dating to the Navajo period should be considered as part of an eligible historic landscape (Johnson et al, 2007).

A Programmatic Agreement (PA) for Area IV North was developed, approved, and executed by OSM, NNHPD, and BNCC. The PA details the steps and methods to be followed when taking into account effects of cultural properties by a federal undertaking in association with Section 106 of the National Historic Preservation Act of 1966. In this case, the PA is an agreement between the proponent (BNCC), the federal agency (OSM), and the Navajo Nation Historic Preservation Office (NNHPD). The Advisory Council on Historic Preservation chose not to participate in the PA. Various tribes were consulted during the process of developing the PA. In addition to procedures for mitigation and reporting, the PA included a plan for treatment of unanticipated discoveries of archaeological resources.

In 2007, BNCC contracted Ecosphere Environmental Services to mitigate 6 of the 12 sites initially identified for data recovery. Under subcontract, Woods Canyon Archaeological Consultants, Inc. (Woods Canyon) completed the mitigation work at these sites. The mitigation of this work was

conducted under the approval of an ARPA permit issued by the Bureau of Indian Affairs and a Navajo Nation Class C permit. As the fieldwork on this project was nearing completion, the results of EMI's testing were finalized. Based on the results of the testing, the contract for mitigation was expanded by 13 more sites; to include the 7 additional sites and the remaining 6 sites. Mitigation work was completed in May of 2008 and a preliminary report on the findings was submitted in October of 2008 to NNHPD (Honeycutt 2008). The technical report is in draft form and has been submitted to NNHPD.

In addition to the mitigation work, Woods Canyon was tasked to investigate the location of historic human burials in Area IV North. As a result of the ethnographic study, the locations of 10 human burials were claimed to exist. Investigations include surface inspection of locations, metal detector investigations, hand test units in the potential areas of the burial, and in the case of two locations mechanical testing. The investigations located probable evidence of burials (2) at one location in Area IV North. In accordance with Navajo Nation Jishchaa' Policy, the closest lineal descendants were interviewed and it was their desire to leave the graves were they are located. A fence has been built around the location of the burials and proposed mining activities will avoid the location. A confidential report on the investigations was written and filed with NNHPD.

In July of 2007, a meeting was held with representatives from NNHPD, BNCC, Woods Canyon, and EMI to discuss mitigation plans associated with the proposed historic landscape. It was decided to produce a web-based product that presents the results of the survey, excavation, and ethnographic data. In addition, a cultural landscape study was written as part of the technical report submitted to NNHPD.

DCA and the Ethnographic Study identified a Traditional Cultural Property (TCP), TCP1, within the Area IV North lease area. Ethnographic interviews were conducted with the individuals and their families familiar with the TCPs.

BNCC has and will comply with the American Indian Religious Freedom Act (AIRFA), the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), and the adopted 1996 Navajo Nation Policy for the Protection of Jishchaa': Gravesites, Human Remains, and Funerary

Items, to the extent it is consistent with NAGPRA. A copy of policy is located in Permit NM-0003F, Chapter 3, Appendix 3-1. A confidential exhibit of possible human burial locations within and adjacent to Navajo Mine Permit Area is kept on file at Navajo Mine and the Office of Surface Mining/Western Regional Coordinating Center (OSM/WRCC).

3.3 PROTECTION OF PUBLIC PARKS AND HISTORIC PLACES

No existing public parks will require measures to be taken at Navajo Mine to minimize or prevent impacts due to mining and reclamation operations.

3.4 REFERENCES

Burleson, Richard. 2006. Cultural Resource Survey of 188 Acres (76 hectares) for a Proposed Realignment of Burnham Road, Within the Navajo Mine Lease Area, Located in the Nenahnezad Chapter, Shiprock Agency, San Juan County, New Mexico. EMI Report 685a. Ecosystem Management Inc. (EMI). Albuquerque.

Burleson, Richard, Robert Phippen, and Stephen W. Yost. 2006. Data Recovery and Treatment Plan for 47 Sites Located on Lease Area IV North, BHP-Billiton Navajo Coal Company's Navajo Mine, Navajo Reservation, Nenahnezad Chapter, Shiprock Agency, San Juan County, New Mexico. EMI Report 685. Ecosystem Management Inc. (EMI). Albuquerque.

Greminger, H.C. and J.V. Sciscenti. 1962. Archeology of the Four Corners Power Project Museum of New Mexico Press, Number 5. Museum of New Mexico Papers in Anthropology, Santa Fe NM. 130 pp.

Honeycutt, Linda, Compiler. 2008. Preliminary Report on Excavations at 19 Sites, Lease Area IV North, BHP-Billiton Navajo Coal Company's Navajo Mine, Navajo Reservation, Nenahnezad Chapter, Shiprock Agency, San Juan County, New Mexico. Woods Canyon Archaeological Consultants, Inc., Yellow Jacket, Colorado

Johnson, Jalesa, Nina Harris, Stephen Yost, Thomas F. Messerli, and Thomas Shine. 2007. NRHP Eligibility Testing at 33 Sites Located Within Lease Area IV North, BHP-Billiton Navajo Coal Company's Navajo Mine, Navajo Reservation, Nenahnezad Chapter, Shiprock Agency, San Juan County, New Mexico. Ecosystem Managment, Inc. Albuquerque.

Kelly, Klara, Harris Francis, Rena Martin, John Torres-Nez, and Mary Bernard. 2007. Each Place Brings Stories: Navajo Mine, Area IV North Cultural Resources Intensive Data Recovery Project: Navajo Ethnology Sub-Project. Dine'tahdoo CRM, Farmington, New Mexico.

Meininger, J. and L. Wharton. 2004. Division of Conservation Archaeology. The Eligibility Evaluation of Cultural Resources Located Within Lease Area IV North of BHP Billiton Navajo Coal Company's Navajo Mine, Navajo Indian Reservation, Nenahnezad Chapter, Shiprock Agency, San Juan County, New Mexico. San Juan County Archaeological Research Center and Library, DCA Technical Report No. 04-DCA-114. 224 pp.

Reher, Charles A. 1977. Settlement and Subsistence Along the Lower Chaco River: The CGP Survey. The University of New Mexico Press, Albuquerque NM. 164 pp.

Table 4-5 (Continued)				
Monitor	**Land Status**	**Siting Criteria**	**Rationale**	**Access**
NM07	Permanent	1. W of Area IVN mining area. 2. Outside of 5 year mine plan. 3. Location is in the vicinity of a local residence.	1. Location will provide background data. 2. Long term monitoring data collection. 3. Assess the effectiveness of Navajo Mine Fugitive Dust Control Plan in the future Area IVN pit area.	Two track dirt road and walk in.

"NOTE"
ADDITIONAL MINE STRUCTURES, INCLUDING ROADS RAILROAD, PONDS, IMPOUNDMENTS AND CULVERTS, ALTHOUGH PRESENT ON THIS EXHIBIT AS PART OF THE AERIAL BASE MAPPING, ARE NOT INTENDED TO BE CURRENT OR ACCURATE ON THIS EXHIBIT. PLEASE REFER TO THE APPROPRIATE P.A.P TEXT SECTION FOR A MINE STRUCTURE EXHIBIT REFERENCE.

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.S.	ENG.
				APPROVALS			
11-A	FEB-2011	PJF	Removed Air Monitoring Station NM04B, added NM04C on the east side of Burnham Twp. Remove road and submitted to OSM for Review.	Shawn Smith	N. Briggs		
09-C	7-12-09	PJF	ADDED IBR EASTSIDE OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB		
09-B	5-07-09	PJF	REVISED NM07 AIR MONITORING STATION LOCATION IN A4N AND SUBMITTED TO OSM FOR REVIEW.	D. VAUGHN	YB		
09-A	3-18-09	PJF	ADDED NM07 AIR MONITORING STATION IN A4N AND SUBMITTED TO OSM FOR REVIEW.	WS	YB		
07-A	10-31-07	PJF	RESUBMITTED FOR THE A4N DEVELOPMENT TO OSM FOR REVIEW AND APPROVAL.	WS	YB		
E	1-23-07	PJF	ADDED A4N WET 3 STA (SOUTH OF COTTONWOOD WASH AND WESTSIDE OF BURNHAM ACCESS ROAD, AND SUBMITTED TO OSM FOR REVIEW.	WS	MC	WB	
D	4-19-01	PJF	REMOVED NA02A, CHANGE NM04A TO NM04B AND SUBMITTED TO OSM FOR PERMIT UPDATE.	MC	MC	WB	
C	12-21-00	PJF	CHANGE NM-03 TO NM-03-1,REMOVED NM-02B AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	MC	MC	WB	
B	9-11-98	PJF	CHANGE NM-04 TO NM-04A AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	JL	MC	WB	
A	5-26-98	PJF	MID-TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL	GW	PNS	WB	

EXHIBIT 4–1

bhpbilliton

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AIR QUALITY AND METEOROLOGICAL MONITORING STATIONS

PREPARED BY PJF	DRAWN BY PJF	SCALE 1" = 2000'
APPROVED BY	DATE April 14, 1998	

Path: G:\Gs\Permit F\Ch 4\Exhibit 4-001\NM_PAP EXH\OSM Subm FEB-2011\EXH_4-1.pro
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CHAPTER 6

GROUNDWATER HYDROLOGY

6.1 AQUIFER DELINEATION

The Navajo Mine is located on the western flank of the San Juan Structural Basin in northwestern San Juan County approximately 15 miles west of Farmington, New Mexico. The geologic formation dips gently to the east toward the center of the basin at an angle of one to two degrees and steepens toward the outcrop areas where a fairly abrupt monocline (Hogback) can be observed. A more thorough description of the regional and localized geology of Navajo Mine is provided in CHAPTER 5.

The mine and adjacent areas are underlain by the Pictured Cliffs Sandstone Formation, Fruitland-Kirtland Formation, and unconsolidated alluvial deposits in the valleys of the San Juan River, Chaco River, and the Chinde and Cottonwood Arroyos. A number of ground water monitoring wells have been completed (EXHIBIT 6-1) in the geologic formations on and near the permit area. These monitoring wells are described in the Billings & Associates (1989) report found in APPENDIX 6E. Permit NM-0003C, CHAPTER 12, APPENDIX 12-D. Additional baseline data were also obtained from monitoring wells and vibrating wire piezometers (VWPs) installed in the Fruitland coals and in the underlying Pictured Cliffs Sandstone Formation for baseline hydrogeology characterization of Area IV and Area V of the BHP Navajo Coal Company (BNCC) coal lease. The data from these wells and VWPs are provided in Appendix 6.G along with a charaacterization of the groundwater aquifers within the Area 4 North resource area of the BNCC lease area. This Appendix also provides the baseline data that are used to support the development and calibration of multilayer, numerical, groundwater flow model of the hydrogeologic system of Areas IV and V of the BNCC lease.

To obtain hydrologic information, a piezometer installation program was conducted throughout the mine area to estimate the water-bearing potential of the above geologic formations.

Information on the water-bearing zones within these formations was obtained during drilling by monitoring fluid return, air injection pressure, and lithology.

Aquifers were delineated using two different methods. The first approach treated the individual coal seams in the Fruitland Formation as separate aquifers. This resulted in the potentiometric surface maps for the major coal seams (EXHIBITS 6-2 through 6-5). Since the coal seams are discontinuous through the formation, an alternate approach for delineation was considered which utilized United States Geological Survey (USGS) data and treated the coal seams and interbedded lithologic units of the Fruitland Formation as a single aquifer. The single aquifer approach was previously evaluated (Billings, 1987) A copy of the Billings (1987) report

Appendix 6.G

Baseline Groundwater Update for Navajo Mine Area IV North

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6.G-1 Introduction

This Appendix has been prepared to summarize and interpret the additional baseline data obtained from monitoring wells and vibrating wire piezometers (VWPs) that were installed in the Fruitland coals and in the underlying Pictured Cliffs Sandstone (PCS) for baseline hydrogeology characterization of Area IV and Area V of the BHP Navajo Coal Company (BNCC) coal lease. Completion diagrams and lithologic logs for these monitoring wells and VWPs are provided in Attachment 6.G-1. The data from these wells and VWPs locations provide additional information on groundwater levels, aquifer characteristics, and groundwater quality within and adjacent to the Navajo Mine permit area. Geologic information as well as data from monitoring wells installed in Area III of the BNCC lease are also included in this Appendix to support the hydrogeologic interpretations. This Appendix also provides the baseline data that are used to support the development and calibration of multilayer, numerical, groundwater flow model of the hydrogeologic system of Areas IV and V of the BNCC coal lease.

The hydrogeologic units within and adjacent to Navajo Mine Area IV North include:

- The alluvial groundwater of the Chaco River, Pinabete Arroyo, and Cottonwood arroyo
- The coal seams of the Fruitland Formation
- The Pictured Cliffs Sandstone (PCS), located below the Fruitland Formation

The location of baseline monitoring wells and VWPs completed within or adjacent to Areas III, IV and V of the BNCC coal lease are shown in Exhibit 6.G-1. This exhibit also provides hydrogeologic sections, depicting the various coal seams of the Fruitland Formation and the top of the PCS. Water level elevations measured in the monitored coal units and in the underlying PCS are plotted in the hydrogeologic sections in Exhibit 6.G-5 to depict both horizontal and vertical gradients.

6.G-2 Alluvial Groundwater

Alluvial fill deposits occur in the valley bottom of Cottonwood Arroyo within the permit area and along the Chaco River and Pinabete Arroyo, to the west and south of the permit area. However, these deposits are not considered Alluvial Valley Floors (AVF). Refer to of Chapter 6.5 for information on the negative determination for AVF within and adjacent to the permit area. The Chaco River alluvium is saturated and provides limited stock water supply at several dug wells. Likewise, portions of the alluvium of Cottonwood and Pinabete Arroyos are saturated and will yield water to wells, as evidenced by the dug wells completed in the alluvium of both Cottonwood and Pinabete Arroyos

Baseline monitoring of the alluvium of Cottonwood Arroyo was conducted at four alluvial well monitoring locations shown on Exhibit 6.G-1. Baseline water quality information obtained prior to year 1983 from the monitoring wells GM-17 and QACQ-2 (GM-18) are included in Appendix 6-C. Well GM-17 is completed

in the alluvium of North Fork of Cottonwood Arroyo. A dug well, GM-18, completed in the alluvium of Cottonwood Arroyo west of the permit area, was converted for use as a monitoring well and is designated as QACW-2 in Exhibit 6.G-1. This well was included in the Navajo Mine quarterly monitoring program. However, the well is usually dry and relatively few samples have been obtained during baseline monitoring. Water quality samples could not be obtained from alluvial monitoring well QACW-1 because it was dry during baseline monitoring from 1989 through 1998. The well was subsequently removed by the advance of mining operations in Area III. BNCC has also performed baseline monitoring of well QACW–2B completed in the alluvium of Cottonwood Arroyo west of the permit area as shown in Exhibit 6.G-1. This well is a dug well that has been used for stock water supply and is not owned by BNCC.

The baseline water quality monitoring results for these Cottonwood alluvial wells are summarized in Table 6.G-1. These results show the water quality of the alluvium of Cottonwood Arroyo to be a sodium-sulfate type with variable TDS concentrations. Water within the Cottonwood alluvium is unsuitable for drinking water use because of TDS, sulfate, fluoride, iron, and manganese exceedances of the criteria listed Table 6.G-2. The water in the alluvium of the mainstem of Cottonwood is marginally suitable for its current stock watering use, although the TDS, sulfate, and fluoride concentrations often exceed the Navajo Nation water quality criteria for livestock (Table 6.G-2). Also, the alluvium is variably saturated and often will not yield sufficient water for sampling.

Two alluvial monitoring wells, PA-1 and PA-2, were installed in 1998 within the alluvium of Pinabete Arroyo at the locations shown in Exhibit 6.G-1. Table 6.G-3 summarizes the baseline water level readings and aquifer test results are summarized in Table 6.G-4. The estimated hydraulic conductivities for the Pinabete Arroyo alluvium of 51.3 ft per day (ft/day) (1.8×10^{-2} cm per second (cm/sec)) and 10.7 ft/day (3.8×10^{-3} cm/sec) are within the range expected for clean sand and are considerably higher than the bedrock values in the area. Well yields from the alluvium, however, are limited by a very low saturated thickness of about 5 ft or less.

Water quality analytical results from the baseline sampling of alluvial wells PA-1 and PA-2 are provided in Table 6.G-5 and Table 6.G-6, respectively. These results show the water quality to be a sodium-sulfate type with TDS concentrations ranging from 1,500 to 4,310 mg/L. Water within the alluvium is unsuitable for drinking water use due to TDS, sulfate, fluoride, iron, and manganese concentrations above drinking water criteria. The water is marginally suitable for its current use for stock watering, although the TDS, sulfate, and fluoride concentrations usually exceed the Navajo Nation water quality criteria for livestock and wildlife use and selenium concentrations exceed the Navajo Nation water quality criteria for wildlife use.

Some information on the baseline water quality in the Chaco River Alluvium is provided in the well inventory included in Appendix 6E –Addendum 12-D-A of the PAP. The available water quality information from this well inventory show TDS concentrations ranging from 1,950 mg/l to 3,110 mg/l and sulfate concentrations ranging from 1,100 to 1,790 mg/l at wells located west of Areas II, III and IV at the Navajo Mine. Limited groundwater quality baseline data are also provided by Thorn (1993) for the Chaco River alluvium. The results show considerable variability in the alluvial water quality with TDS concentrations ranging from 742 to 11,900 mg/L, sulfate concentrations from 350 to 6,600 mg/L, and fluoride concentrations ranging from 0.4 to 1.7 mg/L.

6.G-3 Fruitland Coal Seams

Groundwater is also found in the coal units of the Fruitland Formation and in the PCS, which underlies the Fruitland Formation at the Navajo Mine site. The geologic strata within the permit and adjacent area dip gently to the east toward the center of the San Juan Basin at an angle of 1 to 2 degrees as depicted in the cross sections provided in Exhibit 6.G-1. Based on both regional and site-specific information, the Fruitland Formation and associated coal units, and the PCS are unsaturated or partially saturated near the outcrop of these units on the western side of the Navajo Mine permit area but become saturated to the east and down dip of the outcrop. The pre-mine groundwater in the Fruitland Formation throughout most of the BNCC coal lease will not support beneficial use because of the very low well yields and poor water quality. There are no known water supply wells completed in the Fruitland Formation within or adjacent to the BNCC coal lease.

Based on baseline information obtained from water level elevations measured in the wells and piezometers, the general groundwater flow directions in the Fruitland Formation within Areas III, IV and V of the BNCC coal lease are vertically downward through the interbedded shale and coal units of the Fruitland Formation and into the PCS and laterally within individual coal seams toward the north-northeast with some localized flow toward the topographic lows along Cottonwood and Pinabete Arroyos. Direct recharge rates measured by chloride mass balance methods on undisturbed areas at the Navajo Mine ranged from 0.002 to 0.09 in/yr (Stone 1987). The highest recharge rate of 0.09 in/yr was for valley terraces while the lowest recharge rate of 0.002 in/yr was for badland areas. Recharge from upland flats averaged 0.03 in/yr. Recharge is expected to be higher from saturated alluvium and surface impoundments. Although Stone's research (1986 and 1987) did not include recharge estimates for surface impoundments, it does provide an estimate of an average recharge rate of 0.16 in/yr from depressions within reclaimed mine areas at the Navajo Mine.

Based on the previous mining experience at the Navajo Mine, the coals, the overburden, and the interburden in the Fruitland Formation are not expected to yield much water during mining. The mine pit has remained dry except on rare occasions when surface flows are captured. Groundwater seeps are rarely

observed along the highwall as any groundwater in the Fruitland overburden and coals is consumed by evaporation along the highwall. The few seeps that have been observed during mining were at locations within Area I where the highwall was near Navajo Agricultural Products Industry (NAPI) irrigation plots. NAPI irrigation plots do not occur within the drainages associated with proposed Area IV mining, although Cottonwood Arroyo does receive direct discharges of water from irrigation canals. The direct discharges occur when an over supply of water in the canal is released directly to the stream channel. Direct discharge is highly variable, occurs quickly, and can last up to 12 hours. However, usually there is no flow in Cottonwood Arroyo and it retains the characteristics of an ephemeral stream

One conceptualization of the hydrogeology of the Navajo Mine site is to consider the Fruitland Formation as a single hydrogeologic unit. The single hydrogeologic unit approach was previously proposed by Billings and Associates (Appendix 6.D) for modeling groundwater at the Navajo Mine because of the complexity of the individual coal seams, which often split or pinch out. This conceptualization has been used for predicting steady-state post mining flow in the Fruitland Formation from the Navajo Mine to the discharge locations along the subcrop with the San Juan River alluvium. This conceptualization may be best for regional modeling and is the appropriate conceptualization when baseline hydrogeologic information does not exist to calibrate a more complex hydrogeologic model.

However, given the extensive baseline hydrogologic information that was available within areas IV and V of the BNCC lease, a conceptual hydrogeologic model and the numerical groundwater model that delineates the coal beds as distinct hydrogeologic units was developed to assess the baseline hydrogeologic conditions and to simulate the effects of mining within Area IV North. This conceptualization supports the calibration of a numerical model because the potentiometric information is developed from monitoring wells and piezometers completed in specific coal units. This conceptualization is also better for evaluating local influences and the potential changes in vertical and horizontal groundwater flows that may occur as a result of mining and reclamation.

The potentiometric elevations in the specific coal units decline with depth within Areas III, IV and V of the BNCC lease as shown in Exhibit 6.G-1, indicating a vertical downward component of flow through the Fruitland Formation. One of the primary hydrogeologic changes to occur as a result of mining is the removal of the coals, interbedded shales, and sandstone strata, thus resulting in more homogeneous and isotropic conditions within the mine backfill. This change is expected to result in a steady-state post-mining water table that is lower than pre-mining but steady-state potentiometric elevations at the base of the mine backfill that are higher than the potentiometric elevations that occurred in the lowest coal seam prior to mining. The result of this change would be an increase in vertical flow from the mine backfill into the PCS under steady-state post-mining conditions relative to the vertical flow from the Fruitland Formation to the PCS prior to mining.

However, these changes would not be expected within Area I. The pre-mine vertical downward gradient may not have occurred in the Fruitland Formation within Area I because of its closer proximity to the San Juan River, a location for regional groundwater discharge where upward gradients would be expected. Also, Morgan Lake has increased potentiometric elevations in the PCS, which further limits the potential for downward flow into the PCS from the Fruitland Formation.

The PCS, the first hydrogeologic unit below the Fruitland Formation, has been included in the groundwater flow model. The top of the Lewis Shale, the first hydrogeologic unit below the PCS, has been included as the base of the model domain. The delineation of these hydrogeologic units within the model domain was created from the extensive geologic and groundwater information developed for Areas IV and V. Information was also obtained from a variety of sources to help delineate the hydrogeologic units and define groundwater conditions for the portions of the model domain that are beyond the limits of Areas IV and V. The hydrogeologic model and simulations generated to support the probable hydrologic consequences assessment are provided in Appendix 11-UU.

Baseline potentiometric elevations measured in the wells and in the VWPs completed in specific coal seams within Areas IV and V are summarized in Table 6.G-7. The potentiometric surface for the No. 3 coal seam is provided in Exhibit 6.G-2. This potentiometric surface was constructed from the baseline potentiometric elevations for the No. 3 coal seam presented in Table 6.G-7 and the July 1989 baseline potentiometric elevations measured in the No. 3 coal wells located within Area III. The modeled baseline potentiometric surface for the No. 3 coal in Figure 6.G-2 was also used to estimate the potentiometric contours beyond the limits of the monitoring data. The potentiometric gradient in the No. 3 coal indicates groundwater flow components toward the north-northeast with local gradients toward Pinabete Arroyo and Cottonwood Arroyo. The lower coal seams pinch out and do not extend north of Area III. The groundwater moving along the potentiometric gradients to the northeast flows through the undifferentiated Fruitland Formation into either the upper coal units or into the underlying PCS.

Potentiometric gradients in the other coal seams within Areas III, IV, and V of the BNCC coal lease are expected to be generally toward the northeast, similar to the gradients shown for No. 3 coal. However, the upper coal seams (No. 6, No. 7, and No. 8) outcrop to a greater extent within the valleys of Pinabete Arroyo, No Name Arroyo, and Cottonwood Arroyo within the BNCC coal lease. The groundwater associated with these upper coal seams is expected to show greater local influence from the topographic lower elevations along the arroyos. The baseline hydrogeologic model generated to support the probable hydrologic consequences assessment simulated local potentiometric gradients toward the topographic lows along Pinabete Arroyo, No Name Arroyo, and Cottonwood Arroyo in all of the Fruitland coal units. The local influence of topography on potentiometric gradients was greatest for the shallowest coal, the No. 8 seam (see Appendix 11-UU). Field observations of salt deposits and enhanced vegetation production also

indicate that local discharge may occur from the No. 8 coal at the coal outcrop along Pinabete Arroyo. Baseline groundwater model simulations in Figure 6.G-3 and potentiometric elevations at wells KF-2007-01, KF84-22A, and KF83-10A were used to prepare the potentiometric surface of the No. 8 coal seam that is provided in Exhibit 6.G-3.

A displacement (slug) test was performed at well KF-98-02 and bailed recovery tests were conducted at wells KF-98-03 and KF-98-04 to determine transmissivity and hydraulic conductivity in the No. 3 coal seam within Area IV South. Test results in Table 6.G-8 show very low hydraulic conductivity values for the No. 3 coal consistent with the low hydraulic conductivity values reported in Table 6-1 for the No. 2, No. 3, and No. 4-6 coal seam wells located within Area IV North. A pumping test of the No. 8 coal seam well KF2007-01 was also performed and interpreted using the Papadopulos-Cooper method as shown in Table 6.G-8. The higher hydraulic conductivity for the No. 8 coal seam relative to the No. 3 seam is consistent with the results in Table 6-1, which show higher hydraulic conductivities for the No. 7 and No. 8 coal units relative to the lower coal units.

In a separate set of tests, the transmissivity and hydraulic conductivity values calculated from the observation well response during a pumping test of the No. 8 coal seam well, G-20, located at the San Juan Mine were 0.017 ft^2/day and 0.001 ft/day (3.5×10^{-7} cm/sec), respectively (San Juan Coal Company, 2009). These results for the hydraulic conductivity from G-20 are lower than the values from well tests at Navajo Mine. However, the observation well response from well G-20 pumping test is useful because it provides a reliable estimate for the storage coefficient (4.2×10^{-4}) associated with the No. 8 coal seam.

Water quality monitoring data from Fruitland Formation coal wells at the Navajo Mine and BNCC coal lease monitoring locations show that baseline groundwater in the coals is very saline. Table 6.G-9 provides a summary of the baseline water quality obtained from coal wells located within Areas II, III, and IV at the BNCC coal lease. This table provides median baseline concentrations measured at the coal wells along with the number of baseline analyses obtained for each constituent at each well. Given the variability in some of the analytical results, the median provides a good representation of baseline water quality at each well location. The median, unlike the mean, is not biased by an anomalous value resulting from analytical or transcription errors or by a sample that may not be representative due to sampling method or impact by drilling fluids or annular grout seal.

The TDS concentrations in Table 6.G-9 for the coal water at the Navajo Mine monitoring locations exceed the Navajo Nation and EPA Water Quality criteria for both drinking water and livestock use The chloride concentrations also exceed the Navajo Nation Water Quality criteria for both drinking water and livestock use in most of the wells. Fluoride concentrations are quite variable but the median values in several of the wells exceed the Navajo Nation Water Quality criteria for both drinking water and livestock. Sulfate is

also quite variable among coal wells with concentrations above the Navajo Nation Water Quality criteria for both drinking water and livestock in the shallow coal wells near the outcrop but very low sulfate concentrations in the coal water in the deeper coal units and down dip of the outcrop. The low sulfate in these deeper coals is due to apparent sulfate reduction in the groundwater.

Groundwater monitoring results in Table 6.G-9 show that sodium is the dominant cation in the coal water and that bicarbonate-chloride are typically the dominant anions except for the relatively high sulfate in the shallow coals near the outcrop. The TDS concentrations in the coal units at the Navajo Mine typically increase from south to north and from shallow to deep. Furthermore, baseline TDS concentrations in excess of 40,000 mg/L have been reported in Table 6-2 of Navajo Mine Permit Application for the Fruitland coal monitoring wells SJKF84#2 and SJKF84#3 installed in the No. 8 coal northeast of the Navajo Mine as shown in Exhibit 6-6 of the Navajo Mine Permit Application.

Groundwater chemistry can change or evolve along its flow path from the recharge area to the discharge area. Precipitation is low in TDS, is naturally weakly acidic, and contains bicarbonate due to the solution of carbon dioxide in the air. In this portion of the San Juan Basin, the precipitation reaching the ground is immediately neutralized and acquires sodium, sulfate, and other ions. Water that has only a short residence time in the ground is still typically high in TDS concentrations, with sodium, sulfate, and bicarbonate the dominant ions as indicated by both the surface water and alluvial groundwater samples. Calcium is also present due to dissolution of calcium carbonate, but at concentrations that are considerably lower than sodium. Chloride concentrations in precipitation are low. Chloride concentrations in groundwater increase due to evapotranspiration and are typically lower in groundwater in the alluvium and in shallow bedrock near recharge areas. As groundwater migrates through the saturated zones it is no longer in contact with atmospheric carbon dioxide and its capacity to dissolve carbonates diminishes. The chemistry of the groundwater continues to evolve as other soluble minerals dissolve and cation exchange processes reduce the proportion of calcium and increase the proportion of sodium in solution. Sulfate reduction also occurs when groundwater transitions from oxidizing to reducing conditions, particularly within the coal units.

6.G-4 Pictured Cliffs Sandstone

The PCS is a well-cemented, low-permeability, marine sand and is the first water-bearing unit below the Fruitland Formation. Based on the geologic information presented in Section 5 of the Navajo Mine Permit, the PCS is approximately 110 to 120 ft thick and follows the structure of the Fruitland Formation, dipping to the east at approximately 2 degrees, although the structure varies locally. The PCS conformably overlies the Lewis Shale, with the contact marked by a zone of interbedded sandstones and mudstones in the lower part of the PCS (Stone et al. 1983). It outcrops just west of the mine lease and east of the Chaco River. The PCS is a marginal water resource due to low permeabilities, poor water quality, gas production, and low yields (Stone et al. 1983). The PCS is also a natural gas reservoir in the San Juan Basin. Stone et al.

(1983) state that the PCS cannot be considered a major aquifer and it is important only because it is the water-bearing horizon immediately underlying the coals in the Fruitland Formation.

Well KPC-98-01 was installed in 1998 near the PCS outcrop at the location shown in Exhibit 6.G-1. In 2007, wells KPC2007-01, KPC2007-02, and KPC2007-03 were completed in the PCS at locations around the perimeter of Area IV South (Exhibit 6.G-1). VWPs were installed in the PCS at four of the five VWP locations as shown on Exhibit 6.G-1. A VWP was not installed in the PCS at the VWP2007-03 location because monitoring well KPC2007-02 was installed in the PCS at this location. Potentiometric elevations measured at the PCS wells and the VWPs are summarized in Table 6.G-10.

The water levels measured in the PCS well KPC2007-01 at the VWP2007-01 location show elevations in the PCS monitoring well that are consistently about 6 feet lower than the potentiometric elevation measured in the PCS at the VWP. The VWP in the PCS at this location is installed at the top of the PCS, while the well screen and filter pack extends through about 75 ft of the PCS. The difference between the two measurements suggests that hydrostatic heads are higher at the top of the PCS at this location and decline with depth. Thus, downward gradients are believed to continue through the PCS at this location.

Historical water level data are also available for six PCS wells that were completed within or adjacent to BNCC lease Areas IV and V during the mid-1970s. Data from these well are included in a report by Science Application, Inc. (1979) that was prepared for a proposed coal gasification project. These PCS monitoring wells are designated as the GM wells with water elevations shown on Exhibit 6.G-4. These PCS monitoring wells and piezometers were plugged and abandoned in 1994.

The modeled baseline potentiometric surface for the PCS in Figure 6.G-1 together with the baseline potentiometric elevations from the PCS wells and VWPs were used to prepare the PCS potentiometric surface provided in Exhibit 6.G-4. The measurements of the baseline potentiometric elevations for the abandoned GM wells were obtained in June 1989. The potentiometric surface for the PCS shows overall gradients to the north. The highest potentiometric elevations for the PCS shown in Exhibit 6.G-4 correspond with a structural high in the PCS located within the southeast portion of Area V of the BNCC coal lease. There are also local gradients toward the topographic lows along No Name Arroyo, Pinabete Arroyo and Cottonwood Arroyo.

Water yields are quite low from these PCS monitoring wells completed around BNCC lease Area IV South. Two of the PCS wells were quickly pumped or bailed dry during conventional sampling. The yield from one of the PCS wells was sufficient to sustain a rate of about 0.4 gallons per minute (gpm) during a constant rate pumping test. The fourth PCS monitoring well was pumped dry after about 140 minutes during a constant-rate pumping test at a rate of about 1 gpm.

An aquifer test was also conducted in 1975 at well T4-1 installed in the PCS near the western side of the Navajo Mine lease boundary as shown in Exhibit 6.G-4. The drawdown and recovery measurements were recorded at the pumped well and at observation well GM30A, located 55.8 ft from the pumping well, and at observation well T4-2 located 12.5 ft from the pumping well (Science Application Inc. 1979). The results of this aquifer test and those performed at the PCS monitoring wells installed within or adjacent to Area IV South are summarized on Table 6.G-11.

Water quality analytical results from the baseline sampling of KPC-98-01 are provided in Table 6.G-12. The initial sample collected from this well in 1998 showed some influence from drilling fluids based on elevated pH and nitrate in the well sample results (Table 6.G-12). It is suspected that the well was not fully developed due to low permeability and limited saturation. Sampling results starting in 2007 are more consistent and representative of baseline conditions within the PCS at this location. Based on the recent samples, the PCS groundwater at this location is a sodium-sulfate type with TDS concentrations slightly above 6,000 mg/L.

The baseline water quality results from PCS well KPC2007-01 are summarized in Table 6.G-13. The PCS groundwater at this location is similar to the groundwater at well KPC-98-01 with TDS concentrations slightly below 6,000 mg/l. Baseline water quality information was also collected during the mid-1970s from PCS wells GM-19, GM-20, GM-30A and GM21 located within or in close proximity to the BNCC coal lease as shown in Exhibit 6.G-1. Water quality data from these wells are summarized in Tables 6.G-14 through 6.G-17. Baseline water quality data for these PCS monitoring wells indicate a sodium-sulfate type with TDS concentrations between 5,000 and 9,000 mg/l. The water quality results are consistent with the results from wells KPC-98-01 and KPC2007-01, although the initial well samples from a number of the PCS wells is suspect due to either poor ion balance or insufficient well development.

In summary, groundwater quality data from monitoring wells located within and adjacent to the Navajo Mine indicate that the groundwater in the PCS has high TDS concentrations, ranging from 5,000 mg/L to over 9,000 mg/L. Sulfate is the dominant anion, although the concentrations of chloride and bicarbonate are also relatively high. Sodium is the dominant cation. Magnesium and calcium concentrations are quite low and are typically less than the potassium concentrations. Generally, water quality changes are observed in the first few samples obtained from PCS monitoring wells, apparently due to the difficulty in developing these low-yield wells. Thus, samples obtained after the initial two samples are believed to provide a better representation of baseline conditions.

The groundwater in the PCS groundwater within Areas IV and V of the BNCC coal lease is unsuitable for either domestic or livestock use. The concentrations of TDS, sulfate, chloride, and boron in the PCS wells are considerably higher than the domestic use criteria provided in Table 6.G-2. The TDS and sulfate

concentrations in the PCS are also considerably higher than the livestock use criteria provided in Table 6.G-2. The low permeability and low yield of the PCS also limits the potential for groundwater use from the PCS. There are no known water supply wells completed in the PCS within or adjacent to Navajo Mine Permit Area.

6.G-5 Hydrologic Model

Conceptual and numerical groundwater models are useful to support the interpretation of baseline hydrogeologic information. Furthermore, conceptual or numerical groundwater models are required for the predictive evaluations needed to prepare a probable hydrologic consequence (PHC) assessment of proposed mining and reclamation activities. Groundwater models used for a PHC assessment can range from conceptual depictions, to simple empirical equations, to complex numerical computer simulations of groundwater flow and chemistry.

Site-specific data or data representative of the site conditions are needed to apply groundwater models. Numerical groundwater flow models can help develop a better understanding of the hydrogeologic system, including the groundwater flow relationships between hydrogeologic units and between surface water and groundwater. Extrapolation of data from adjacent or nearby areas or using typical values for parameters from similar hydrogeologic environments is often used in developing numerical flow models. Model calibration can also serve to revise the conceptual model of the groundwater system and provide a better assessment of the properties of hydrogeologic units on a regional scale that cannot be obtained solely from local pumping testing results.

The first step in developing a groundwater model is to establish the objectives of the study. There are three primary objectives for the development of a groundwater model for Area IV North mine permit revision application:

- To provide a better understanding of the baseline groundwater flow systems within and adjacent to the proposed mine area.
- To predict the steady state groundwater flow system that is expected to occur long after mining and reclamation activities have been completed in the area. In particular, this evaluation will need to estimate the expected level of saturation within the mine backfill and the groundwater flow rates and directions into and from the mine backfill.
- To predict the transient groundwater changes that are expected during and after mining. In particular, these evaluations will assess the extent of drawdown in the Fruitland coals and the PCS, and the approximate time frames for recovery to steady state conditions following mining.

Potentiometric elevations in the monitored coal units and in the underlying PCS are plotted in the hydrogeologic sections in Exhibit 6.G-1, to depict vertical gradients. Quarterly monitoring performed on

many of these wells and VWPs show no seasonal changes but occasional fluctuation in some wells due to slow recovery following bailing, purging and sampling. Results show downward potentiometric gradients through the Fruitland formation. Generally the gradients are downward from the Fruitland to the PCS except at locations VWP2007-02 and VWP2007-05. The slightly higher potentiometric elevation in the PCS at these locations indicates a slight upward gradient from the PCS to the No. 2 and 3 coal units of the Fruitland Formation.

6.G-6 Numerical Groundwater Model

A multilayer, numerical, groundwater flow model has been developed to model the groundwater flow systems within and adjacent to Navajo Mine Area IV. A detailed presentation of the numerical groundwater flow model is included in as Appendix 11-UU. This numerical model is based on the conceptual model of the hydrogeology of the Fruitland coals, the PCS and the alluvial groundwater systems within and adjacent to Navajo Mine Area IV. A conceptual groundwater model is a complex hypothesis of the characteristics and functions of a hydrogeologic system, including recharge and discharge relationships, groundwater flow within and between hydrogeologic units, and the expected properties of these hydrogeologic units. An essential part of the both the conceptual and numerical models is a graphical representation of the horizontal and vertical boundaries of the hydrogeologic system (the model domain) and the delineation of the hydrogeologic units within the model domain that are believed to have the primary controlling influence on groundwater flows. Another element of the conceptual model is to define, to the extent possible, the properties of these hydrogeologic units, including the thickness, hydraulic conductivities, and storage characteristics across the model domain. The conceptual model also includes the hydrogeologist's understanding of spatial relationships between and approximate rates of recharge and discharge, including the groundwater inflows and outflows from the model domain.

The delineation of the hydrogeologic units within and adjacent to Navajo Mine Area IV was based on the extensive geologic and groundwater information obtained from a variety of sources, including the baseline information presented in this Appendix. The multilayer groundwater model was calibrated to obtain a good match with potentiometric surfaces and water levels established from the baseline groundwater information while maintaining consistency with the site-specific recharge estimates from Stone (1986) and the range of hydraulic conductivities associated with each hydrogeologic unit. During model calibration, hydraulic conductivities were applied only for the entire hydrogeologic unit and not spatially within a unit. Without a consistent geologic basis, spatial adjustments in hydrologic conductivities would lead to over-parameterization of the model to match modeled potentiometric levels with observed values. Although some of the differences between the modeled and observed potentiometric levels may be associated with spatial variation in hydrogeologic properties within a hydrogeologic unit, the chosen method for model calibration allows for the overall groundwater flow within each hydrogeologic unit and between units to be represented by the calibrated groundwater model.

Generally, a shale zone such as the Lewis Shale would be considered as an impermeable boundary. However, given the low recharge rates at the Navajo Mine site, the overall low permeability of the Fruitland Formation shales and coals, and the relatively low permeability of the PCS, the flow conditions at the boundary between the PCS and Lewis Shale were found to be significant for calibrating the groundwater flow model. Providing for downward flow from the PCS into the Lewis Shale was required in order to reach an adequate calibration with recharge rates consistent with the measurements from Stone (1987). Downward flow and downward gradients are also indicated by hydrogeologic studies and tests of the Lewis Shale and the PCS immediately west of Area V of the Navajo Mine lease (Science Application, Inc. 1979). Also, as discussed in Section 6.G-4, the water levels measured in the PCS well KPC2007-01 and in the PCS VWP at the same location show that downward gradients continue through the PCS at this location.

Table 6.G-18 shows the relationship between the modeled recharge rates and the measurements by Stone (1987). Outside of the alluvial valleys, recharge rates were adjusted by slope within the range of estimates from Stone (1987) for badland areas and for upland flats. The modeled potentiometric surface for the PCS, the No. 3 coal seam, and the No. 8 coal seam are provided in Figure 6.G-1, Figure 6.G-2, and Figure 6.G-3, respectively. These results are consistent with the baseline potentiometric elevations obtained from monitoring wells completed in these hydrogeologic units. However, the modeled potentiometric surfaces extend beyond the limits that could be depicted from well measurements. These potentiometric surfaces and flow patterns are consistent with the conceptual model and all the geologic and hydrogeologic information and the specified boundary conditions.

The results in Figure 6.G-1 show a component of groundwater flow from the PCS to the topographic lows along the west side of the model domain in the valleys of Brimhall Wash, No Name Arroyo, Pinabete Arroyo, and Cottonwood Arroyo. The results for the No. 3 coal seam in Figure 6.G-2 also show a component of groundwater flow to the topographic lows along the west side of the model domain in the valleys of No Name Arroyo, Pinabete Arroyo, and Cottonwood Arroyo. The No. 3 coal seam is not present over a portion of the Brimhall Wash drainage or along the western portion of the model domain. Also, the No 3 coal seam is unsaturated in areas along the western outcrop and remains unsaturated in the modeled potentiometric surface as indicated in Figure 6.G-2. A similar pattern is observed in Figure 6.G-3 for the No. 8 coal seam, although this coal is not present over a large portion of the Brimhall drainage or within a large portion of the No Name, Pinabete, and Cottonwood valleys within the BNCC coal lease. In addition to the flow toward the topographic lows, there is a component of flow down dip to the northeast. Portions of the No. 8 coal seam near the western outcrop are unsaturated. Not shown in these figures for individual hydrogeologic units are the overall downward gradients and downward flow between units. In fact, the model predicts perched groundwater conditions in the shallower coals along the western portion of the lease area as depicted by the north-south section in Figure 6.G-4.

Figure 6.G-1. Modeled Potentiometric Surface for the PCS

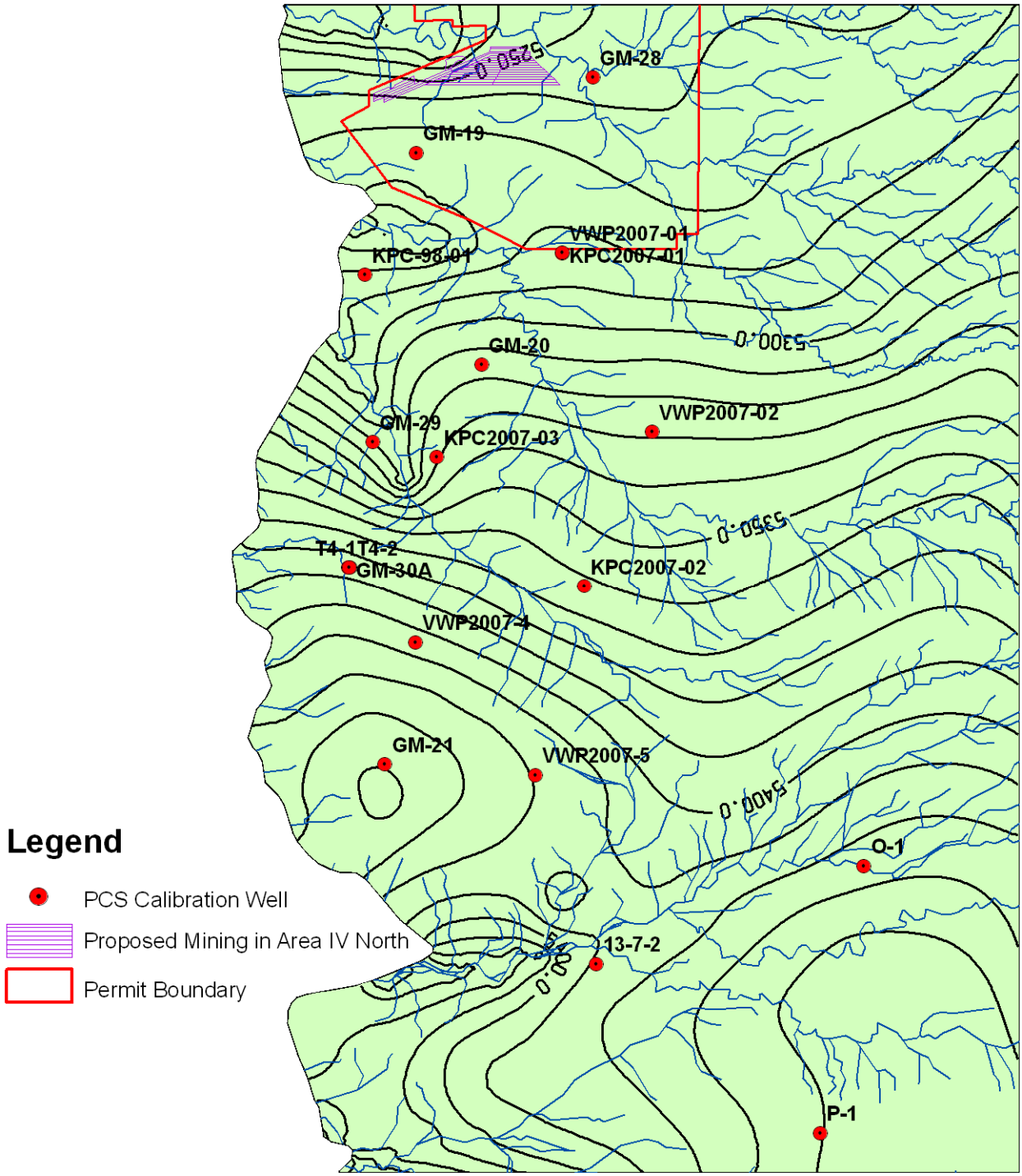


Figure 6.G-2. Modeled Potentiometric Surface for the No.3 Coal

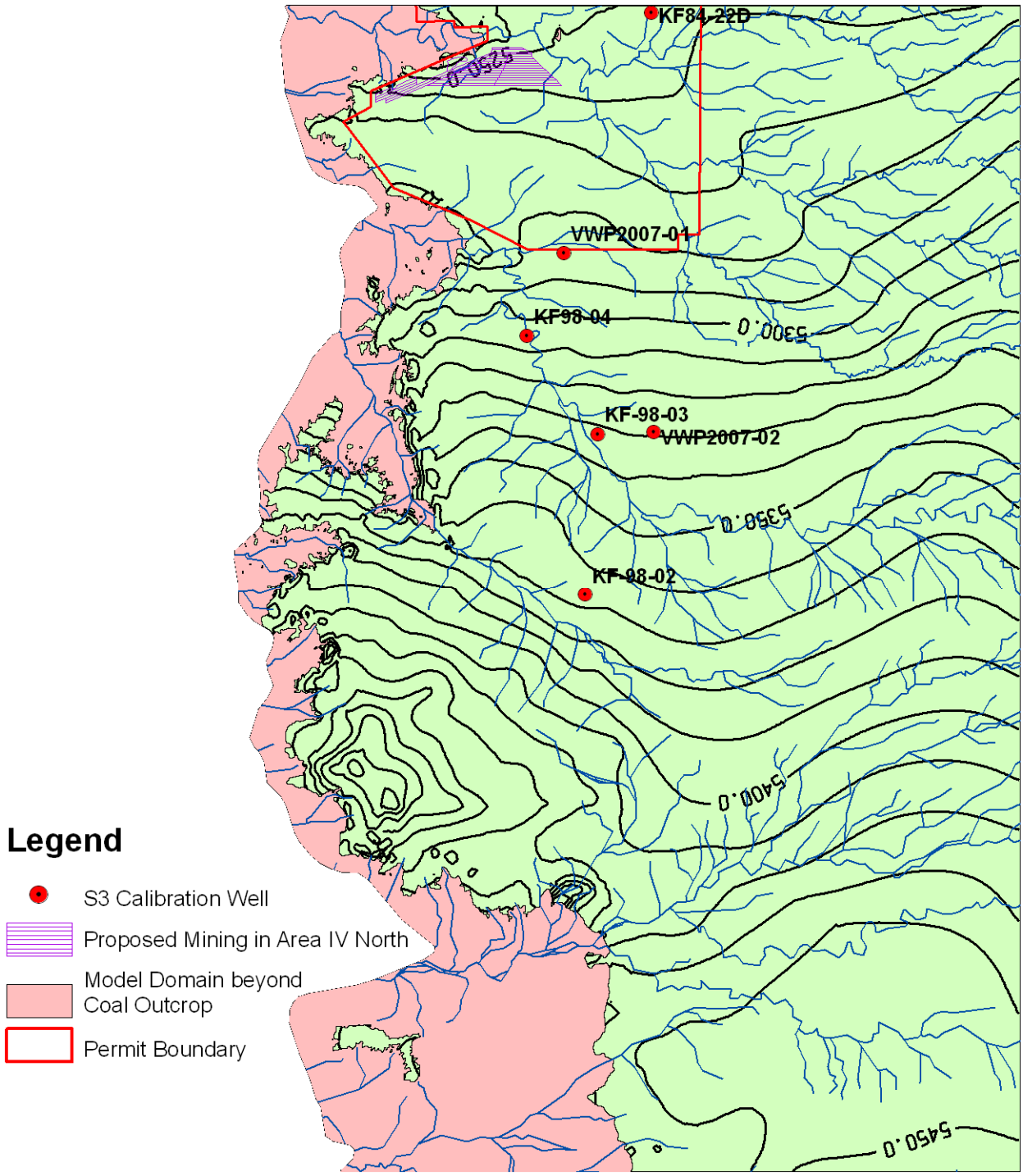


Figure 6.G-3. Modeled Potentiometric Surface for the No. 8 Coal

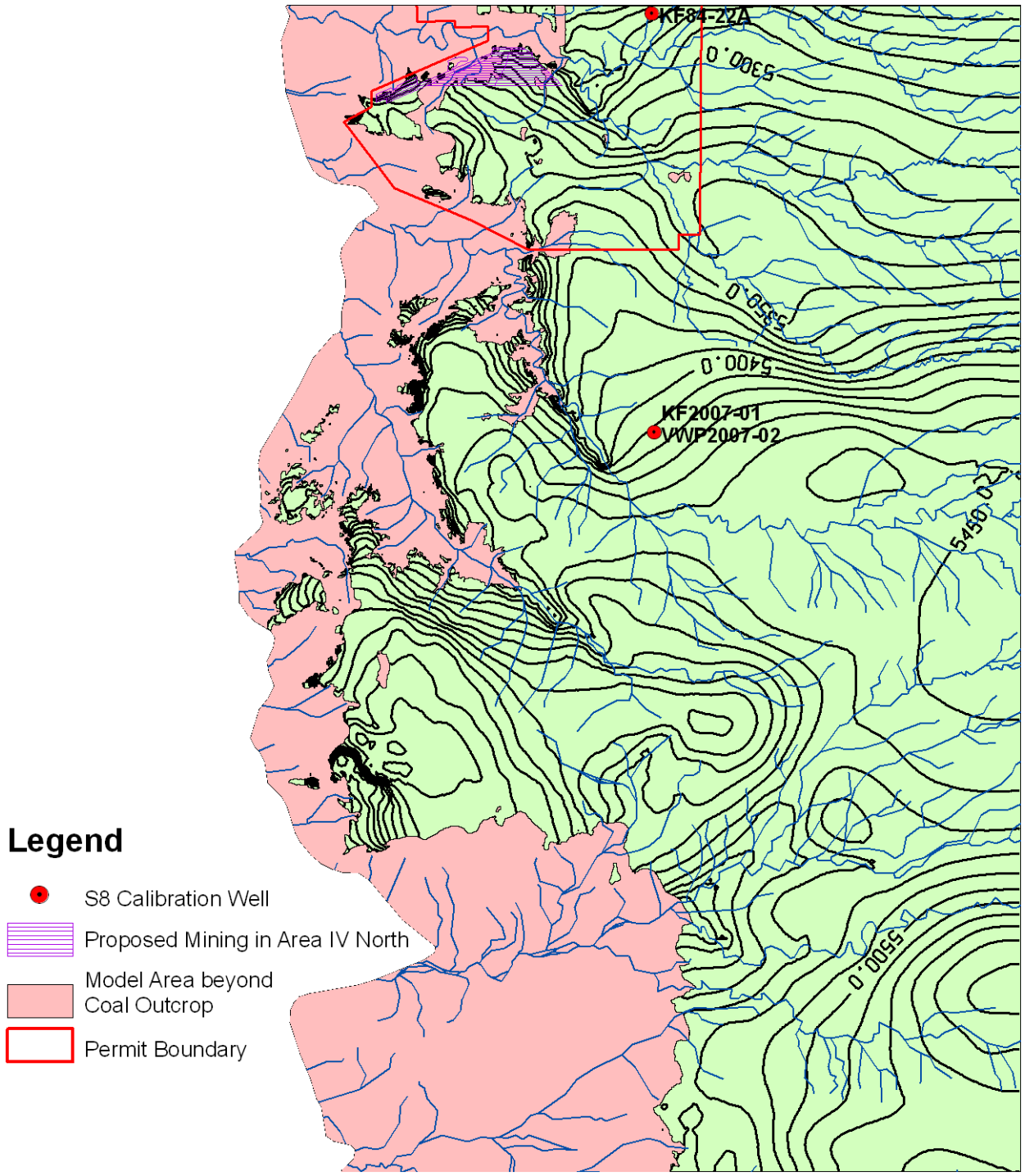
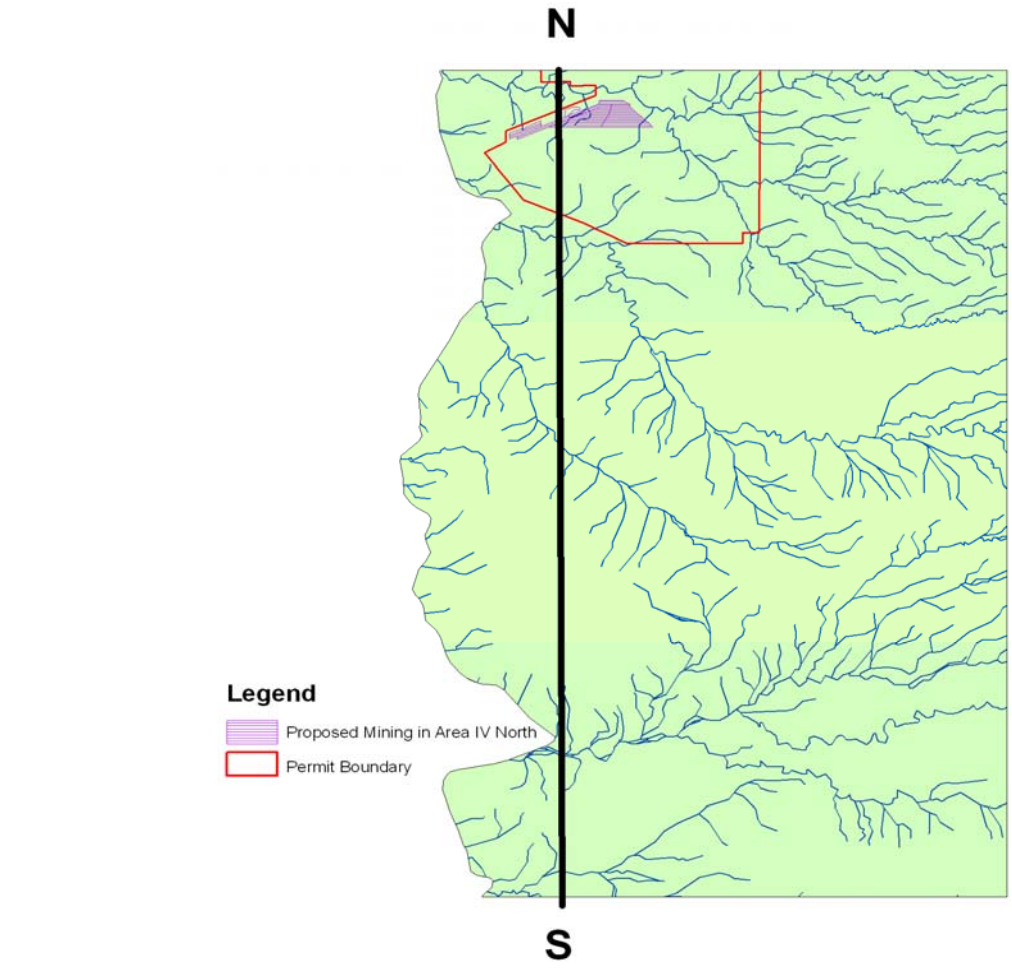
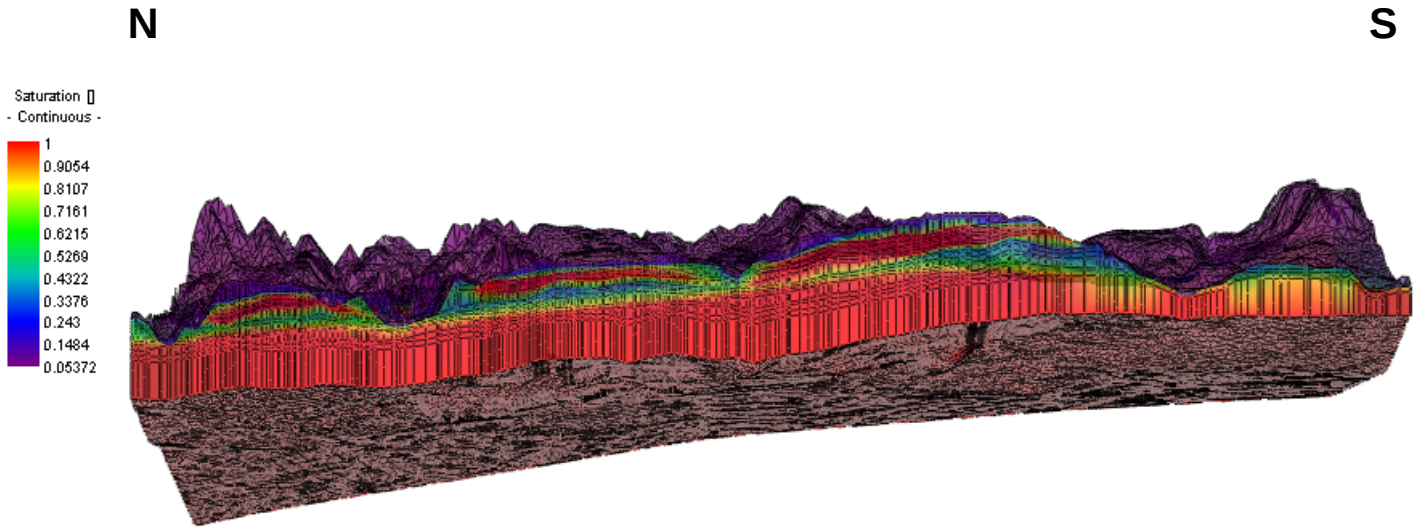


Figure 6.G-4. Modeled Saturation for a N-S Section





The calibrated numerical model helps confirm the conceptual model. The numerical model is well constrained and consistent with the recharge rates measured by Stone (1987) and with the hydraulic conductivities and heads measured within the various hydrogeologic units in the model domain.

6.G-7 References

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Appendix 6.G Tables

Table 6.G-1 Baseline Water Quality at Cottonwood Arroyo Alluvial Wells

		Cottonwood Alluvial Well		
Parameter		QACW-2	QACW-2B	GM-17
Baseline Monitoring Period		1979 - 1998	1987 - 1998	1979 - 1982
pH (SU)	n	5	10	6
	median	7.95	7.65	6.9
TDS -180° (mg/L)	n	10	32	9
	median	2,078	3,015	15,300
Bicarbonate (mg/L)	n	0	15	0
	median	NA	388	NA
Carbonate(mg/L)	n	0	15	0
	median	NA	<1	NA
Chloride (mg/L)	n	10	33	9
	median	338	138	104
Sulfate (mg/L)	n	10	32	9
	median	1,227	1,605	9,380
Calcium (mg/L)	n	5	33	6
	median	89	154	365
Magnesium (mg/L)	n	7	33	8
	median	20.0	22.7	150.0
Potassium (mg/L)	n	5	32	6
	median	2.0	6.5	25.0
Sodium (mg/L)	n	5	33	6
	median	451	778	4,610
Fluoride (mg/L)	n	10	33	9
	median	3.06	1.36	0.30
Nitrate as N (mg/L)	n	5	7	9
	median	0.18	0.09	1.06
Boron (mg/L)	n	8	33	9
	median	0.11	0.13	0.29
Iron, total (mg/L)	n	4	16	9
	median	0.03	1.04	0.62
Iron, diss.(mg/L)	n	10	33	9
	median	0.25	0.25	0.10
Manganese, total (mg/L)	n	3	16	8
	median	0.02	0.37	1.78
Manganese, diss. (mg/L)	n	10	33	9
	median	0.10	0.11	1.77

Table 6.G-2. Water Quality Criteria

Parameter (units)	Livestock and Wldlife Watering Criteria[1]	Domestic Water Supply Criteria for Surface Water by 2007 Navajo Nation Standards[2]	EPA Secondary Drinking Water Standards[3]
Arsenic (mg/L)	0.02	0.01	
Barium (mg/L)	10	1	
Boron (mg/L)	5	0.63	
Cadmium (mg/L)	0.05	0.005	
Chloride (mg/L)	600		250
Chromium (mg/L)	1	0.1	
Copper (mg/L)	0.5	1.3	1
Fluoride (mg/L)	2	4	2
Total iron (mg/L)	-		0.3
Lead (mg/L)	0.1	0.015	
Total manganese (mg/L)	-		0.05
Mercury (mg/L)[4]	0.01	0.002	
Nitrate (mg/L-N)	10	10	
pH (su)		5.0-9.0	6.5-8.5
Potassium (mg/L)			
Radium-226 (pCi/L)	30**	5**	
Radium-228 (pCi/L)	30**	5**	
Selenium (mg/L)[5]	0.05	0.05	
Silver (mg/L)		0.035	0.1
Sulfate (mg/L)	1000		250
Total dissolved solids (TDS) (mg/L)	2212		500
Uranium (mg/L)		0.03	
Zinc (mg/L)	25	2.1	5

[1] Navajo Nation Environmental Protection Agency Water Quality Program, 2004, Navajo Nation Surface Water Quality Standards.

[2] Navajo Nation Environmental Protection Agency Water Quality Program, 2008, Navajo Nation Surface Water Quality Standards 2007, passed by Navajo Nation Resources Committee on May 13, 2008

[3] http://water.epa.gov/drink/contaminants/secondarystandards.cfm

[4] Wildlife standard for mercury is 0.000012 mg/L, which is below detection limits of the analytical procedure

[5] Wildlife standard for total selenium is 0.002 mg/L

** Ra-226 + Ra-228

(-) s no analysis performed

mg/L - milligram per liter

Table 6.G-3 Water Levels in Pinabete Alluvial Monitoring Wells

Well Name	PA-1		PA-2	
Measuring point elevation (ft msl)	5352.9		5431.43	
Date	Water level (ft)	Elevation (ft msl)	Water level (ft)	Elevation (ft msl)
3/26/1998	-	-	7.61	5423.82
3/29/1998	11.35	5341.55	7.69	5423.74
4/30/1998	11.42	5341.48	7.72	5423.71
5/12/1998	11.46	5341.44	7.94	5423.49
6/11/1998	11.63	5341.27	8.16	5423.27
7/21/1998	12.04	5340.86	8.38	5423.05
8/20/1998	11.87	5341.03	8.24	5423.19
9/30/1998	11.7	5341.20	8.09	5423.34
11/8/1998	11.4	5341.50	7.88	5423.55
12/17/1998	11.18	5341.72	7.63	5423.8
8/22/2007	11.85	5341.05	8.78	5422.65
9/4/2007	11.95	5340.95	8.76	5422.67
10/4/2007	12.1	5340.80	NA	-
11/5/2007	12.14	5340.76	-	-
11/15/2007	-	-	8.76	5422.67
12/3/2007	12.09	5340.81	-	-
12/5/2007	-	-	8.7	5422.73
1/17/2008	12.0	5340.90	8.6	5422.83
2/19/2008	-	-	8.6	5422.83
2/21/2008	11.7	5341.20	-	-
3/20/2008	11.6	5341.30	8.3	5423.18
4/24/2008	11.5	5341.40	5.5	5425.93
5/27/2008	11.0	5341.90	5.0	5426.43
6/24/2008	12.0	5340.90	8.2	5423.23
7/24/2008	12.2	5340.70	9.0	5422.43
8/19/2008	-	-	9.2	5422.23
8/20/2008	11.2	5341.70	-	-
9/30/2008	11.0	5341.90	9.0	5422.4

ft msl - feet above mean sea level
(-) no measurement taken

Table 6.G-4 Alluvial Monitoring Well Summary and Aquifer Test Results

Well	Location (ft)		ID (in)	Elevation (ft)	Well depth (ft)	Test type	Transmissivity (ft^2/day)	Hydraulic conductivity		Saturated thickness (feet)
	Northing	Easting						(ft/day)	(cm/sec)	
PA-1	1990260.34	300409.2	2.1	5351.2	15.2	2.0 gpm pumping test	230.7	51.3	1.8E-02	4.5
PA-2	1980956.93	306702.8	2.1	5429.6	9.6	0.75 gpm pumping test	53.6	10.7	3.8E-03	5

ft^2/day - square feet per day
cm/sec - centimeter per second
NA - information not available
ID - inner diameter

Table 6.G-5 Water Quality at Pinabete Arroyo Alluvial Well PA-1

Parameter (units)	3/29/1998	5/15/1998	8/20/1998	11/8/1998	11/5/2007	2/21/2008	5/27/2008	8/20/2008	11/21/2008
Total Alkalinity as $CaCO_3$ (mg/L)	300	297	282	301	304	314	310	224	344
Arsenic (mg/L)	<0.005	<0.005	<0.005	<0.005	0.0008	<0.0005	0.0007	<0.0005	0.0008
Barium (mg/L)	0.05	0.03	0.9	0.03	0.0161	0.0144	0.0262	0.0164	0.0174
Bicarbonate as HCO_3 (mg/L)	365	362	344	367	371	383	378.2	216	344
Boron (mg/L)	0.17	0.2	0.2	0.22	0.787	0.2	0.2	0.2	0.2
Ion balance (%)	6.77	0.89	3.88	2.38	5.99	1.06	1.78	0.85	1.64
Cadmium (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Calcium (mg/L)	85.4	68.5	103	90.6	110	116	137	139	101
Carbonate (mg/L)	<1	<1	<1	<1	<10	<10	<10	<10	<10
Chloride (mg/L)	25	22	29	16	14	17	36	25	18
Chromium (mg/L)	0.03* (total)	<0.01	<0.01	<0.01	0.005	0.004	0.004	<0.001	<0.001
Electrical conductivity (EC) (uS/cm)	2540	2410	2310	2150	2380	2380	2680	3050	2520
Copper (mg/L)	<0.01	<0.01	<0.01	<0.01	0.0106	0.0151	0.0101	0.0094	0.0079
Fluoride (mg/L)	2.49	2.36	2.39	2.53	2.2	2.2	2.1	2.2	3
Hydroxide (mg/L)	<1	<1	<1	<1	<10	<10	<10	<10	<10
Iron (mg/L)	0.99	0.06	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05
Total iron (mg/L)	41.9	3.07	4.43	0.25	16.7	17.5	53.2	1.39	3.88
Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.0001	<0.0001	0.0002	0.0002	0.0003
Magnesium (mg/L)	15.4	13.4	16.5	13.8	16.3	17.9	22.3	22.3	16.4
Manganese, D (mg/L)	0.138	0.005	0.017	<0.01	0.118	0.057	0.488	0.218	0.087
Manganese, T (mg/L)	1.31	0.843	0.37	0.03	0.487	0.302	3.56	0.350	0.142
Mercury (mg/L)[1]	<0.001	<0.001	<0.001	<0.001	<0.0002	<0.0002	0.0002	<0.0002	<0.0002

Table 6.G-5 Water Quality at Pinabete Arroyo Alluvial Well PA-1

Parameter (units)	3/29/1998	5/15/1998	8/20/1998	11/8/1998	11/5/2007	2/21/2008	5/27/2008	8/20/2008	11/21/2008
Nitrate (mg/L-N)	0.66	0.72	<0.05	NM	0.05	0.03	0.04	0.10	0.05
pH (su)	7.6	7.5	7.5	7.7	7.61	7.54	7.53	7.48	7.78
Potassium (mg/L)	9.8	1.8	1.7	2.9	1.4	1.3	2.7	1.7	1.7
Radium-226 (pCi/L)	<1.69	5.78	NM	0.91	2.9 ± 0.9	0.42 ± 0.34	1.3 ± 0.4	0.6 ± 0.42	0.10 ± 0.22
Radium-228 (pCi/L)	<1.9	5.77	NM	11.74	1.5 ± 0.7	0.60 ± 0.40	1.1 ± 0.6	0.53 ± 0.49	0.48 ± 0.38
Selenium (mg/L)[2]	0.005	0.005	<0.005	<0.005	0.006	0.004	0.006	0.003	0.006
Silver (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.00005	<0.00005	0.00006	<0.00005	<0.00005
Sodium (mg/L)	375	458	374	377	418	457	511	503	445
Sulfate (mg/L)	893	833	875	805	1040	1060	1140	1280	980
Total dissolved solids (TDS) (mg/L)	1610	1640	1730	1500	1680	4310	1950	2030	1750
Uranium (mg/L)	-	-	-	-	0.01010	0.01080	0.01350	0.01620	0.01230
Zinc (mg/L)	0.053	0.037	<0.025	0.043	0.007	0.002	0.002	0.002	0.007

[1] Wildlife standard for mercury is 0.000012 mg/L, which is below detection limits of the analytical procedure

[2] Wildlife standard for total selenium is 0.002 mg/L

*secondary standard

** Ra-226 + Ra-228

(-) s no analysis performed

mg/L - milligram per liter

µS/cm - microsiemens per centimeter

su - standard units

pCi/L - picocuries per liter

Table 6.G-6 Water Quality at Pinabete Arroyo Alluvial Well PA-2

Parameter (units)	3/30/1998	5/15/1998	8/20/1998	11/11/1998	11/15/2007	2/21/2008	5/27/2008	8/19/2008	11/20/2008
Total alkalinity as $CaCO_3$ (mg/L)	293	281	315	327	410	308	328	405	430
Arsenic (mg/L)	<0.005	<0.005	<0.005	<0.005	0.0012	0.0007	0.0018	0.0008	0.0027
Barium (mg/L)	0.04	0.02	<0.2	0.02	0.0107	0.0129	0.0195	0.0143	0.0119
Bicarbonate as $CaCO_3$ (mg/L)	357	342	384	398	451	376	400.16	405	430
Boron (mg/L)	0.19	0.2	0.22	0.31	0.2	2.1	0.2	0.3	0.2
Ion balance (%)	4.27	2.64	1.65	3.2	16	6.5	5.57	0.61	8.18
Cadmium (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Calcium (mg/L)	56.8	61	101	95	95	96.0	96.8	90.8	92.3
Carbonate (mg/L)	<1	<1	<1	<1	24	<10	<10	<10	<10
Chloride (mg/L)	22	65	51	35	38	30	32	42	45
Chromium (mg/L)	0.03* (total)	<0.01	<0.01	<0.01	0.006	0.004	0.003	<0.001	0.009
Electrical conductivity (EC) (uS/cm)	4390	4510	4530	4520	4600	4410	4110	5010	4860
Copper (mg/L)	<0.01	<0.01	<0.01	<0.01	0.0508	0.0116	0.0225	0.0226	0.0220
Fluoride (mg/L)	2.47	2.81	3.06	2.91	2.8	2.4	2.5	3.1	3.3
Hydroxide (mg/L)	<1	<1	<1	<1	<10	<10	<10	<10	<10
Iron (mg/L)	0.11	<0.02	<0.02	0.04	<0.05	<0.05	<0.05	<0.05	<0.05
Total iron (mg/L)	63.9	2.88	6.55	0.13	1.86	5.61	3.03	1.86	3.19
Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.0001	<0.0001	0.0001	0.0002	0.0001
Magnesium (mg/L)	12	11	16	15	0.0277	15.5	16.7	15.5	16.7
Manganese (mg/L)	1.33	0.456	0.22	0.11	0.0277	0.090	0.141	0.128	0.135
Total manganese (mg/L)	3.71	0.525	0.88	0.24	0.552	1.27	0.599	0.551	0.748
Mercury (mg/L)[1]	<0.001	<0.001	<0.001	<0.001	<0.0002	<0.0002	0.0002	<0.0002	<0.0002

Table 6.G-6 Water Quality at Pinabete Arroyo Alluvial Well PA-2

Parameter (units)	3/30/1998	5/15/1998	8/20/1998	11/11/1998	11/15/2007	2/21/2008	5/27/2008	8/19/2008	11/20/2008
Nitrate (mg/L-N)	0.27	0.32	<0.05	NM	0.06	0.08	0.08	0.11	0.05
pH (su)	7.9	7.4	7.3	7.5	7.19	7.41	7.5	7.21	7.31
Potassium (mg/L)	5	2	3	5.4	2.1	2.0	2.4	3.3	3.2
Radium-226 (pCi/L)	<1.69	27.9	-	0.48	0.67 ± 0.43	0.40 ± 0.39	0.45 ± 0.34	0.60 ± 0.40	2.5 ± 0.7
Radium-228 (pCi/L)	<1.9	1.74	-	9.02	0.62 ± 0.48	1.4 ± 0.6	0.19 ± 0.56	1.2 ± 0.5	0.55 ± 0.37
Selenium (mg/L)[2]	0.0007	0.006	<0.005	<0.005	0.012	0.009	0.014	0.010	0.018
Silver (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.00005	<0.00005	0.00009	<0.00005	<0.00005
Sodium (mg/L)	781	981	872	891	809	850	907	966	1000
Sulfate (mg/L)	1670	1760	1690	1940	2200	2100	2150	1950	2400
Total Dissolved Solids (TDS) (mg/L)	2990	3150	3600	3420	3500	3070	3030	3540	3580
Uranium (mg/L)	-	-	-	-	0.01230	0.01120	0.01350	0.01160	0.01170
Zinc (mg/L)	0.051	0.025	<0.025	0.18	0.003	0.008	0.009	0.004	0.008

[1] Wildlife standard for mercury is 0.000012 mg/L, which is below detection limits of the analytical procedure

[2] Wildlife standard for total selenium is 0.002 mg/L

*secondary standard

** Ra-226 + Ra-228

(-) no analysis performed

mg/L - milligram per liter

µS/cm - microsiemens per centimeter

su - standard units

pCi/L - picocuries per liter

Table 6.G-7. Potentiometric Elevations in Coal Monitoring Wells and Piezometers

Well/VWP Name	KF-98-02	KF-98-03	KF-98-04	KF2007-01	VWP 2007-01 (yellow)	VWP 2007-01 (green)	VWP 2007-01 S6 (white)	VWP 2007-02 (yellow)	VWP 2007-02 (white)	VWP 2007-02 (blue)	VWP 2007-02 (green)	VWP 2007-03 (yellow)	VWP 2007-03 (red)	VWP 2007-05 S2 (blue)
Coal Unit	S3	S3	S3	S8	S2a/S2b	S3	S6	S2	S3	S7	S8	S3	S2	S2
Date	Potentiometric Elevation (ft msl)													
4/30/1998	5325.75	5294.77	5289.62	-	-	-	-	-	-	-	-	-	-	-
5/12/1998	5331.00	5294.95	5289.59	-	-	-	-	-	-	-	-	-	-	-
6/11/1998	5340.83	5292.87	5289.03	-	-	-	-	-	-	-	-	-	-	-
7/21/1998	5349.56	5293.74	5289.07	-	-	-	-	-	-	-	-	-	-	-
11/8/1998	5361.85	5293.78	5288.83	-	-	-	-	-	-	-	-	-	-	-
12/17/1998	5315.64	5292.75	5288.85	-	-	-	-	-	-	-	-	-	-	-
8/22/2007	-	5292.21	-	5392.33	5275.44	5278.48	5331.54	5292.06	5288.98	5372.05	5394.32	5366.22	5360.25	-
8/23/2007	5359.70	-	-	-	-	-	-	-	-	-	-	-	-	-
9/4/2007	5352.12	5292.37	-	5392.60	5273.72	5278.78	5331.85	5291.73	5288.58	5371.69	5394.47	5367.05	5357.72	-
10/4/2007	5354.47	-	5288.48	-	-	-	-	-	-	-	-	-	-	-
10/9/2007	-	-	-	5392.81	5273.44	5278.79	5330.39	5291.30	5287.63	5371.25	5393.71	5367.63	5357.26	-
11/5/2007	5356.16	-	-	-	-	-	-	-	-	-	-	5367.88	5357.23	5410.91
11/15/2007	-	-	-	5392.86	5273.37	5278.69	5329.97	5290.94	5288.21	5370.93	5393.77	-	-	-
12/3/2007	-	-	-	-	-	-	-	-	-	-	-	5367.74	5357.60	-
12/5/2007	5323.44	5291.94	-	5392.01	-	5278.56	5329.88	5291.09	5287.85	5370.81	5393.67	-	-	5410.61
1/17/2008	5329.14	5292.73	-	5393.06	-	-	-	-	-	-	-	-	-	-
1/31/2008	-	-	-	-	5273.42	5278.79	5329.84	5291.91	5288.15	5370.74	5393.81	5368.04	5357.83	5410.71
2/19/2008	5332.94	5291.73	-	5393.36	5273.05	5278.62	5330.05	5289.57	5287.20	5370.63	5393.56	5368.70	5357.74	-
3/20/2008	5328.04	5292.13	-	5392.96	5273.15	5278.39	5330.09	5289.18	5286.96	5370.63	5393.71	5366.44	5385.30	-
4/24/2008	5331.34	5292.83	-	5393.26	5273.23	5278.30	5330.11	5289.12	5286.86	5370.60	5393.67	5366.52	5385.50	5410.22
5/27/2008	-	-	-	5393.06	-	-	-	-	-	-	-	-	-	-
5/28/2008	5332.54	-	-	-	5273.42	5286.86	5330.11	5289.70	5286.86	5370.54	5390.11	5365.97	5385.40	5410.27
6/24/2008	5299.04	5291.73	-	5393.06	5273.47	5278.62	5330.15	5287.02	5287.02	5370.59	5390.11	5365.97	5385.40	5410.33
7/24/2008	5303.84	5293.43	-	5365.96	5273.30	5278.76	5330.17	5289.63	5286.89	5370.51	5390.05	5366.05	5385.50	5410.33
8/19/2008	5305.84	-	-	5392.96	5273.42	5278.56	5330.17	5286.99	5287.51	5370.45	5393.48	5366.19	5358.26	5410.33
8/20/2008	-	5293.03	-	-	-	-	-	-	-	-	-	-	-	-
9/30/2008	5300.24	5292.73	-	5392.76	5273.45	5278.53	5330.42	5287.63	5287.42	5370.51	5393.36	5366.14	5358.11	5410.39

ft msl - feet above mean sea level
VWP - vibrating wire piezometer
(-) no measurement taken

Table 6.G-8. Coal Monitoring Well Summary and Aquifer Test Results

Well	Location (ft)[1]		Coal seam	Ground Elevation (ft)	Well depth (ft)	Test type	Transmissivity (ft^2/day)	Hydraulic conductivity		Saturated thickness (feet)
	Northing	Easting						(ft/day)	(cm/sec)	
Kf-98-02	1974601.45	2526796.60	#3	5505.9	216.5	Displacement Test	0.0010	0.0001	4.6E-08	7.5
Kf-98-03	1984332.35	2527508.40	#3	5423.5	133.9	Bailed Recovery Test	0.010	0.002	7.1E-07	5
Kf-98-04	1990225.42	2523277.83	#3	5351.8	64.8	Bailed Recovery Test	0.010	0.001	3.5E-07	10
Kf2007-01	1995163.61	2525504.37	#8	5557.2	118	Papadopulos-Cooper Pumping Test	1.398	0.056	2.0E-05	25

ft^2/day - square feet per day

cm/sec - centimeter per second

[1] Coordinate system - State Plane New Mexico West, NAD 1983

Table 6.6-9. Baseline Water Quality in the Fruitland Coals at the BNCC Coal Lease

Well	Well Depth (feet)	Baseline Monitoring Period	pH (SU)		TDS -180° (mg/L)		Bicarbonate as HCO_3 (mg/L)		Carbonate as CO_3 (mg/L)		Chloride (mg/L)		Sulfate (mg/L)		Calcium (mg/L)		Magnesium (mg/L)		Potassium (mg/L)	
			n	median	n	median	n	median	n	median	n	median	n	median	n	median	n	median	n	median
KF2007-01 (No. 8)	118	2007-2008	5	8.75	5	3460	5	1490	5	260	5	338	5	740	5	3.2	5	1.6	5	17.9
KF98-02 (No. 3)	216.5	1998 2007-2008	8	8.06	8	3160	8	1329	8	40	8	925	8	119	8	6.9	8	1.0	8	12.6
KF84-21A (No 2)	119.3	1985-2001	31	7.9	31	14200	21	1180	31	ND	31	4440	31	64	31	13.4	31	15.0	31	13.4
KF84-22A (No 8)	125.5	1991-2001	30	8.02	30	4615	22	1145	12	ND	30	273	30	2050	30	15.5	30	3.5	30	6.3
KF84-22B (No 7)	141.65	1991-2001	25	7.4	25	6010	21	845	21	ND	24	3215	25	5	25	45.0	25	13.1	25	11.7
KF84-20A (No 7)	190	1985-2001	24	7.93	24	7260	14	1090	14	ND	24	3715	24	5	24	18.4	24	11.0	24	11.9
KF84-20B (No 4)	216	1986	1	12.31	1	6660	0		0		1	79	1	172	1	16.5	1	0.0	1	337.0
KF84-20C (No 2 & 3)	236	1985-2001	23	7.9	23	2770	14	1560	14	ND	23	715	23	7	23	9.6	23	5.8	23	2.9
KF84-18B (No 8)	134.7	1985-2000	24	7.1	24	9270	14	1030	14	ND	24	4890	24	5	24	113.0	24	24.2	24	14.6
KF84-18A (No. 6)	180.2	1985-2001	25	7.43	25	13400	15	451	15	ND	25	7900	25	5	25	159.0	25	51.2	25	22.5

Well	Well Depth (feet)	Baseline Monitoring Period	Sodium (mg/L)		Fluoride (mg/L)		Nitrate as N (mg/L)		Boron (mg/L)		Iron, total (mg/L)		Iron, diss.(mg/L)		Manganese, total (mg/L)		Manganese, diss. (mg/L)	
			n	median	n	median	n	median	n	median	n	median	n	median	n	median	n	median
KF2007-01 (No. 8)	118	2007-2008	5	1180	5	2.70	5	0.29	5	0.329	5	0.310	5	ND	5	0.017	5	0.008
KF98-02 (No. 3)	216.5	1998 2007-2008	8	1170.0	8	1.65	8	0.03	8	0.4	8	0.485	8	0.080	8	0.035	8	0.017
KF84-21A (No 2)	119.3	1985-2001	31	3090	31	1.57	5	0.1	30	0.61	31	0.100	18	0.220	23	0.030	23	0.100
KF84-22A (No 8)	125.5	1991-2001	30	1600	30	2.20	4	0.88	26	0.26	26	0.360	30	0.080	26	0.023	30	0.012
KF84-22B (No 7)	141.65	1991-2001	25	2330	25	0.88	1	0.08	22	0.39	23	1.130	25	0.200	23	0.300	25	0.300
KF84-20A (No 7)	190	1985-2001	24	2690	24	1.39	2	0.12	23	0.56	16	2.670	24	0.250	16	0.175	24	0.100
KF84-20B (No 4)	216	1986	1	904	1	0.80	0		1	0.13	0		1	0.037	0		1	ND
KF84-20C (No 2 & 3)	236	1985-2001	23	1040	23	1.74	2	0.18	23	0.42	16	0.640	23	0.180	16	0.075	23	0.082
KF84-18B (No 8)	134.7	1985-2000	24	3365	24	0.44	3	0.1	23	0.74	16	11.550	24	0.555	16	0.375	23	0.082
KF84-18A (No. 6)	180.2	1985-2001	25	4660	25	0.67	2	0.1	24	0.72	15	5.09	25	0.25	17	1.33	25	1.33

Table 6.G-10 Water Depths and Potentiometric Elevations in the Pictured Cliffs Sandstone Monitoring Wells and Piezometers

	Well or Piezometer Name											
Measuring point elevation (ft msl)	KPC-98-01		KPC2007-01		KPC2007-02		KPC2007-03		VWP 2007-01 Kpc (blue)	VWP 2007-02 Kpc (red)	VWP 2007-04 Kpc	VWP 2007-05 Kpc (red)
	5366.46		5355.71		5515.06		5470.23					
Date	Water depth (ft)	Elevation (ft msl)	Water depth (ft)	Elevation (ft msl)	Water depth (ft)	Elevation (ft msl)	Water depth (ft)	Elevation (ft msl)	Potentiometric elev (ft msl)	Potentiometric elev (ft- msl)	Potentiometric Elev. (ft- msl)	Potentiometric Elev. (ft- msl)
3/29/1998	91.31*	5275.15	-	-	-	-	-	-	-	-	-	-
4/30/1998	86.62	5279.84	-	-	-	-	-	-	-	-	-	-
5/12/1998	84.84	5281.62	-	-	-	-	-	-	-	-	-	-
6/11/1998	106.37	5260.09	-	-	-	-	-	-	-	-	-	-
7/21/1998	97.27	5269.19	-	-	-	-	-	-	-	-	-	-
11/8/1998	80.30	5286.16	-	-	-	-	-	-	-	-	-	-
12/17/1998	89.81	5276.65	-	-	-	-	-	-	-	-	-	-
8/22/2007	-	-	93.61	5262.10	217.55	5297.51	-	-	5270.44	-	-	-
8/23/2007	75.09	5291.37	-	-	-	-	128.66	5341.57	-	5298.44	-	-
9/4/2007	79.35	5287.11	93.68	5262.03	169.11	5345.95	128.03	5342.20	5268.35	5297.90	-	-
10/4/2007	77.56	5288.90	93.65	5262.06	-	-	-	-	-	5297.37	-	-
10/9/2007	-	-	-	-	-	-	-	-	5267.89	-	-	-
11/5/2007	76.51	5289.95	93.78	5261.93	183.30	5331.76	130.67	5339.56	-	-	5393.83	5411.60
11/15/2007	-	-	-	-	-	-	-	-	5268.14	-		
12/5/2007	78.15	5288.31	93.71	5262.00	163.16	5351.90	133.71	5336.52	5268.26	5296.81	5397.48	5411.26
1/31/2008	-	-	-	-	-	-	-	-	5268.09	5297.32	5393.68	5411.54
2/19/2008	-	-	-	-	-	-	-	-	5268.91	-	-	-
2/21/2008	-	-	-	-	-	-	-	-	-	5296.42	-	-
3/20/2008	89.80	5276.66	96.80	5258.91	158.80	5356.26	128.30	5341.93	5268.95	5296.48	5401.50	5410.79
4/24/2008	85.00	5281.46	94.10	5261.61	156.40	5358.66	123.50	5346.73	5268.78	5296.42	5401.82	5410.76
5/27/2008	81.50	5284.96	98.50	5257.21	155.90	5359.16	126.50	5343.73	-	-	-	-
5/28/2008	-	-	-	-	-	-	-	-	5269.01	5296.28	5402.20	5410.82
6/24/2008	79.90	5286.56	94.10	5261.61	157.10	5357.96	127.10	5343.13	5269.04	5296.48	5402.40	5410.88
7/24/2008	79.20	5287.26	94.00	5261.71	156.30	5358.76	126.70	5343.53	5268.76	5296.39	5402.86	5410.85
8/19/2008	-	-	-	-	157.80	5357.26	-	-	5268.83	5296.14	5402.95	5410.85
8/20/2008	78.40	5288.06	94.10	5261.61	-	-	126.70	5343.53	-	-	-	-
9/30/2008	77.70	5288.76	94.40	5261.31	155.20	5359.86	126.80	5343.43	5268.66	5296.25	5403.30	5410.94

ft msl - feet above mean sea level

*1 day after well development

(-) no measurement taken

Table 6.G-11 Pictured Cliffs Sandstone Monitoring Well Summary and Aquifer Test Results

Well	Location (ft)[1]		Elevation (ft)	Well Depth (ft)	Test type	Transmissivity (ft^2/day)	Hydraulic conductivity		Saturated thickness (ft)	Storage coefficient
	Northing	Easting					(ft/day)	(cm/sec)		
KPC-98-01	1993802	290787	5366.46	125.7	0.4 gpm pumping test	0.79	0.020	7.1E-06	39	NA
KPC2007-01	1995103	302596	5355.71	208.84	NA	0.576	0.0074	2.6E-06	78	NA
KPC2007-02	1975119	303891	5515.06	320.98	NA	NA	0.0001	3.5E-08	NA	NA
KPC2007-03	1982885	295091	5470.23	138.4	NA	NA	0.0040	1.4E-06	NA	NA
Pumping test well T4-1	1976250	289850	5520	228	0.15 gpm pumping	0.1203	0.0014	4.9E-07	84	0.00032
Recovery test well GM-30A	1975811	290347	NA	191.6	NA	0.1337	0.0016	5.6E-07	84	0.00034

[1] Coordinates State Plane New Mexico West NAD 1983

[2] 18.3 gpm for 8.7 min

ft^2/day - square feet per day

cm/sec - centimeter per second

gpm - gallon per minute

NA - information not available or not determined

Table 6.G-12 Water Quality at Pictured Cliffs Sandstone Monitoring Well KPC-98-01

Parameter (units)	3/29/1998	11/8/1998	8/23/2007	11/5/2007	2/21/2008	5/27/2008	8/20/2008	11/21/2008
Total Alkalinity as $CaCO_3$ (mg/L)	131	581	750	930	900	870	740	850
Arsenic (mg/L)	<0.005	<0.005	0.0042	0.00193	0.0019	0.002	0.0017	0.0035
Barium (mg/L)	0.02	0.02	0.0138	0.0101	0.0123	0.0236	0.0132	0.0126
Bicarbonate as HCO_3 (mg/L)	132	709	891	1135	900	870	740	850
Boron (mg/L)	0.12	0.61	0.6	1.11	0.7	0.7	0.6	0.7
Ion balance (%)	2.13	3.71	4.6	8.3	2.17	0.49	6.89	1.61
Cadmium (mg/L)	<0.001	<0.001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Calcium (mg/L)	26.5	33.1	28	25.2	26.8	30.8	28.4	28.6
Carbonate (mg/L)	14	<1	12	<10	<10	<10	<10	<10
Chloride (mg/L)	39	177	310	212	234	244	220	236
Chromium (mg/L)	<0.01* (total)	<0.01	0.018	0.124	0.012	0.004	0.001	0.021
Electrical conductivity (EC) (uS/cm)	1380	6550	5510	8250	8250	8250	8730	8700
Copper (mg/L)	<0.01	<0.01	0.0396	0.026	0.0571	0.43	0.0468	0.0807
Fluoride (mg/L)	2.29	1.13	1.3	1.4	1.4	1.3	1.5	1.5
Hydroxide (mg/L)	NM	NM	<10	<10	<10	<10	<10	<10
Iron (mg/L)	0.46	1.51	0.68	<0.05	<0.05	<0.05	<0.05	<0.05
Total iron (mg/L)	2.51	1.74	0.68	29.5	7.60	2.71	0.16	0.51
Lead (mg/L)	<0.005	0.005	0.0001	<0.0001	0.0003	0.0003	0.0002	0.0001
Magnesium (mg/L)	2.7	5.7	8.2	6.8	7.7	8	7.4	7.7
Manganese (mg/L)	0.013	0.08	0.063	0.0673	0.058	0.051	0.037	0.039
Total manganese (mg/L)	0.038	0.1	0.073	0.111	0.183	0.082	0.044	0.045
Mercury (mg/L)[1]	<0.001	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Table 6.G-12 Water Quality at Pictured Cliffs Sandstone Monitoring Well KPC-98-01

Parameter (units)	3/29/1998	11/8/1998	8/23/2007	11/5/2007	2/21/2008	5/27/2008	8/20/2008	11/21/2008
Nitrate (mg/L-N)	1.54	NM	<0.02	2.29	1.94	4.46	2.68	1.92
pH (su)	9.1	8	7.78	7.76	7.70	7.79	7.73	7.87
Potassium (mg/L)	8.2	17.3	9.2	7.1	8.6	10	8.5	8.1
Radium-226 (pCi/L)	<1.69	3.92	0.92 ± 0.49	1.0 ± 0.5	1.2 ± 0.5	1.5 ± 0.5	0.76 ± 0.44	0.61 ± 0.36
Radium-228 (pCi/L)	<1.9	5.42	1.2 ± 0.5	1.6 ± 0.6	1.1 ± 0.4	1.2 ± 0.5	1.2 ± 0.5	1.3 ± 0.4
Selenium (mg/L)[2]	<0.005	<0.005	0.005	0.00346	0.006	0.005	0.005	0.011
Silver (mg/L)	<0.01	<0.01	<0.00005	0.00006	<0.00005	0.00007	<0.00005	<0.00005
Sodium (mg/L)	202	1490	2150	1790	1930	2270	1690	1980
Sulfate (mg/L)	350	2680	3900	3350	3300	3800	3300	3400
Total dissolved solids (TDS) (mg/L)	800	4830	6640	6060	6050	5900	5820	6360
Uranium (mg/L)	-	-	0.01901	0.01230	0.01220	0.00952	0.01000	0.01010
Zinc (mg/L)	0.093	0.365	0.002	0.201	0.018	0.022	0.019	0.027

[1] Wildlife standard for mercury is 0.000012 mg/L, which is below detection limits of the analytical procedure

[2] Wildlife standard for total selenium is 0.002 mg/L

*secondary standard

** Ra-226 + Ra-228

(-) analysis not performed for parameter

mg/L - milligram per liter

µS/cm - microsiemens per centimeter

su - standard units

pCi/L - picocuries per liter

Table 6.G-13 Water Quality at Pictured Cliffs Sandstone Monitoring Well KPC2007-01

Parameter (units)	8/16/2007	11/15/2007	2/19/2008	5/28/2008	8/20/2008	11/20/2008
Total alkalinity as CaCO3 (mg/L)	1480	1870	1900	1280	1600	1440
Arsenic (mg/L)	0.006	0.0058	0.0052	0.0234	0.0025	0.0051
Barium (mg/L)	0.0342	0.0096	0.0214	0.0341	0.0191	0.0173
Bicarbonate as CaCO3 (mg/L)	1420	710	340	1220	620	1060
Boron (mg/L)	0.3	0.429	0.5	0.6	0.4	0.5
Ion balance (%)	9	10.4	11.1	6.13	17.9	7.82
Cadmium (mg/L)	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Calcium (mg/L)	13.4	3.6	2.4	18.6	3	11.6
Carbonate as CaCO3 (mg/L)	60	1160	1560	60	980	380
Chloride (mg/L)	320	304	292	374	365	580
Chromium (mg/L)	0.005	0.025	0.040	0.008	0.002	0.063
Electrical conductivity (EC) (uS/cm)	8240	8260	8070	7950	8560	9250
Copper (mg/L)	0.0934	0.104	0.0785	0.2470	0.0369	0.0412
Fluoride (mg/L)	1.7	1.5	1.5	1.8	1.6	1.6
Hydroxide as CaCO3 (mg/L)	<10	<10	<10	<10	<10	<10
Iron (mg/L)	<0.05	<0.05	<0.05	0.13	<0.05	<0.05
Total iron (mg/L)	1.11	0.0892	0.93	533	0.17	1.57
Lead (mg/L)	<0.0001	<0.0001	<0.0001	0.0004	0.0002	0.0002
Magnesium(mg/L)	7.3	0.0056	4.2	9.4	4.4	7.1
Manganese (mg/L)	0.034	0.0244	<0.005	0.022	<0.005	0.0785
Total manganese (mg/L)	0.055	0.024	0.022	9.73	0.006	0.137
Mercury (mg/L)[1]	<0.0002	<0.0002	<0.0002	0.001	<0.0002	<0.0002
Nitrate (mg/L-N)	<0.02	<0.02	0.03	0.05	0.65	0.07
pH (su)	8.19	9.82	10.3	8.35	9.85	9.14
Potassium (mg/L)	18.1	76.9	73.3	14.3	35.2	16.2
Radium-226 (pCi/L)	0.18 ± 0.28	0.61 ± 0.39	0.01 ± 0.28	2.0 ± 0.7	0.33 ± 0.32	0.10 ± 0.22
Radium-228 (pCi/L)	0.86 ± 0.57	0.19 ± 0.44	0.37 ± 0.57	0.42 ± 0.45	0.50 ± 0.47	0.37 ± 0.43
Selenium (mg/L)[2]	0.008	0.003	0.004	0.006	0.004	0.008
Silver (mg/L)	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.0001
Sodium (mg/L)	1720	2020	1920	1840	1600	2020
Sulfate (mg/L)	2750	2500	2000	2900	2350	2800
Total dissolved solids (TDS) (mg/L)	5820	5820	5650	6790	5640	6280
Uranium (mg/L)	0.00187	0.00149	0.00065	0.00472	0.00080	0.00089
Zinc (mg/L)	0.006	0.004	0.001	0.012	0.003	0.008

[1] Wildlife standard for mercury is 0.000012 mg/L, which is below detection limits of the analytical procedure

[2] Wildlife standard for total selenium is 0.002 mg/L

*secondary standard

** Ra-226 + Ra-228

mg/L - milligram per liter

µS/cm - microsiemens per centimeter

su - standard units

pCi/L - picocuries per liter

Table 6.G-14 Water Quality at Pictured Cliffs Sandstone Monitoring Well GM-19

Parameter (units)	11/16/1974	8/5/1976	8/8/1977	9/10/1979
Arsenic (mg/L)	<0.5	<0.001	<0.05	0.33
Barium (mg/L)	-	<0.1	<0.5	0.08
Boron (mg/L)	1.03	0.3	1.0	0.88
Cadmium (mg/L)	0.016	<0.001	<0.01	<.01
Chromium (mg/L)	-	0.001	<0.01	<.01
Copper (mg/L)	0.015	0.001	0.02	0.02
Iron (mg/L)	0.4	0.005	<0.05	0.01
Lead (mg/L)	<0.05	0.001	<0.05	0.1
Manganese (mg/L)	0.245	0.088	0.06	0.11
Mercury (mg/L)[1]	<0.0005	<0.0004	<0.001	-
Selenium (mg/L)[2]	<0.05	<0.01	<0.01	0.002
Silver (mg/L)	-	<0.001	<0.05	<.01
Zinc (mg/L)	0.240	0.031	0.07	0.42
Total iron (mg/L)	-	-	-	0.01
Total manganese (mg/L)	-	-	-	0.12
pH (su)	8.1	7.83	7.9	7.5
Electrical conductivity (EC) (uS/cm)	-	-	-	-
Total dissolved solids (TDS) (mg/L)	9172	8437	7810	9270
Fluoride (mg/L)	1.7	0.76	0.9	1.49
Bicarbonate (mg/L)	1000	-	-	-
Carbonate (mg/L)	-	-	-	-
Chloride (mg/L)	1020	534.8	668	1077
Sulfate (mg/L)	4050	3685	4000	4535
Calcium (mg/L)	43	13.2	200	-
Magnesium (mg/L)	19	3.83	38	-
Potassium (mg/L)	-	-	-	-
Sodium (mg/L)	3040	1610	2200	-
Hydroxide (mg/L)	-	-	-	-
Total alkalinity (mg/L)	-	-	-	-
Nitrate (mg/L-N)	-	-	1.2	-
Ion balance (%)	2.4	-	-	-

[1] Wildlife standard for mercury is 0.000012 mg/L, which is below detection limits of the analytical procedure

[2] Wildlife standard for total selenium is 0.002 mg/L

*secondary standard

(-) analysis not performed for parameter

mg/L - milligram per liter

µS/cm - microsiemens per centimeter

su - standard units

Table 16.G-15 Water Quality at Pictured Cliffs Sandstone Monitoring Well GM-20

Parameter (units)	11/16/1974	5/18/1976	10/6/1976	8/22/1977	12/20/1977	9/10/1979
Arsenic (mg/L)	<0.5	0.01	0.03	<0.01	<0.01	<0.001
Barium (mg/L)	-	0.24	<0.1	<0.5	<0.1	0.1
Boron (mg/L)	0.68	0.88	0.2	0.9	1.2	2.24
Cadmium (mg/L)	<0.010	0.001	<0.001	<0.01	0.001	<0.1
Chromium (mg/L)	-	0.013	0.019	<0.01	0.012	0.01
Copper (mg/L)	0.025	0.016	0.006	0.01	0.008	0.03
Iron (mg/L)	0.15	0.64	0.066	<0.05	0.35	0.01
Lead (mg/L)	<0.05	0.035	0.034	<0.05	<0.001	0.10
Manganese (mg/L)	0.035	0.026	0.008	<0.001	0.16	0.29
Mercury (mg/L)[1]	<0.0005	<0.0004	<0.0004	<0.001	<0.0004	-
Selenium (mg/L)[2]	<0.05	<0.01	<0.01	<0.01	<0.01	0.001
Silver (mg/L)	-	<0.001	<0.001	<0.05	<0.01	<.01
Zinc (mg/L)	0.08	0.08	<0.001	<0.05	0.04	1.06
Total iron (mg/L)	-	-	-	-	-	0.03
Total manganese (mg/L)	-	-	-	-	-	0.29
pH (su)	11.8	9.3	8.6	8.7	7.3	7
Electrical conductivity (EC) (uS/cm)	-	-	-	-	-	-
Total dissolved solids (TDS) (mg/L)	5033	5711	5822	5880	5050	5260
Fluoride (mg/L)	-	-	-	-	-	-
Bicarbonate (mg/L)	192	475	-	462	269	-
Carbonate (mg/L)	471	105	-	-	-	-
Chloride (mg/L)	1030	2118	1280	1430	757	803
Sulfate (mg/L)	1880	1725	1830	2050	2380	2250
Calcium (mg/L)	11	10.6	8.5	11	9.3	-
Magnesium (mg/L)	0.7	4.32	4.56	7	19	-
Potassium (mg/L)	-	-	-	-	-	-
Sodium (mg/L)	1640	2000	1690	2020	1600	-
Hydroxide (mg/L)	-	-	-	-	-	-
Total alkalinity (mg/L)	-	-	-	-	-	-
Nitrate (mg/L-N)	-	-	0.08	0.6	0.2	-
Ion balance (%)	9.5	9.8	-	0.9	2.5	-

[1] Wildlife standard for mercury is 0.000012 mg/L, which is below detection limits of the analytical procedure

[2] Wildlife standard for total selenium is 0.002 mg/L

*secondary standard

(-) analysis not performed for parameter

mg/L - milligram per liter

µS/cm - microsiemens per centimeter

su - standard units

Table 6.G-16 Water Quality at Pictured Cliffs Sandstone Monitoring Well GM-30A

Parameter (units)	5/19/1976	8/22/1977	9/10/1979
Arsenic (mg/L)	<0.01	<0.01	0.0019
Barium (mg/L)	0.4	<0.5	0.03
Boron (mg/L)	0.46	0.6	0.96
Cadmium (mg/L)	<0.001	<0.01	<.01
Chromium (mg/L)	0.010	<0.01	0.01
Copper (mg/L)	0.007	0.01	<.01
Iron (mg/L)	0.49	<0.05	0.01
Lead (mg/L)	0.20	<0.05	0.13
Manganese (mg/L)	0.07	0.04	<.01
Mercury (mg/L)[1]	<0.0004	<0.001	-
Selenium (mg/L)[2]	<0.01	<0.01	0.002
Silver (mg/L)	<0.001	<0.05	<.01
Zinc (mg/L)	0.09	<0.05	0.16
Total iron (mg/L)	-	-	0.02
Total manganese (mg/L)	-	-	0.05
pH (su)	7.6	7.5	7.5
Electrical conductivity (EC) (uS/cm)	-	-	-
Total dissolved solids (TDS) (mg/L)	6573	6930	7070
Fluoride (mg/L)	-	-	-
Bicarbonate (mg/L)	171	210	-
Carbonate (mg/L)	-	-	-
Chloride (mg/L)	1215	1120	1203
Sulfate (mg/L)	422	3100	3105
Calcium (mg/L)	30.8	102	-
Magnesium (mg/L)	17.7	22	-
Potassium (mg/L)	-	-	-
Sodium (mg/L)	2070	2110	-
Hydroxide (mg/L)	-	-	-
Total alkalinity (mg/L)	-	-	-
Nitrate (mg/L-N)	0.51	0.4	-
Ion balance (%)	34	4.5	-

[1] Wildlife standard for mercury is 0.000012 mg/L, which is below detection limits of the analytical procedure

[2] Wildlife standard for total selenium is 0.002 mg/L

(-) analysis not performed for parameter

mg/L - milligram per liter

µS/cm - microsiemens per centimeter

su - standard units

Table 6.G-17 Water Quality at Pictured Cliffs Sandstone Monitoring Well GM-21

Parameter (units)	11/16/1974	8/4/1976	8/22/1977	9/10/1979
Arsenic (mg/L)	<0.5	<0.01	<0.01	<.0001
Barium (mg/L)	-	<0.1	<0.5	0.05
Boron (mg/L)	0.88	0.7	1.0	1.10
Cadmium (mg/L)	0.081	<0.001	<0.01	<.01
Chromium (mg/L)	-	0.005	<0.01	0.03
Copper (mg/L)	0.025	<0.001	0.01	<0.01
Iron (mg/L)	0.2	0.198	<0.05	0.04
Lead (mg/L)	<0.05	0.001	<0.05	0.26
Manganese (mg/L)	0.05	<0.039	0.07	0.03
Mercury (mg/L)[1]	<0.0005	<0.0004	<0.001	-
Selenium (mg/L)[2]	<0.05	<0.01	<0.01	0.001
Silver (mg/L)	-	<0.001	<0.05	<0.1
Zinc (mg/L)	0.447	0.045	0.06	0.62
Total iron (mg/L)	-	-	-	0.41
Total manganese (mg/L)	-	-	-	0.11
pH (su)	7.9	7.2	7.3	7
Electrical conductivity (EC) (uS/cm)	-	-	-	-
Total dissolved solids (TDS) (mg/L)	6923	6624	6370	6140
Fluoride (mg/L)	-	-	-	-
Bicarbonate (mg/L)	585	-	-	-
Carbonate (mg/L)	-	-	-	-
Chloride (mg/L)	780	646	150	118
Sulfate (mg/L)	3600	2502	2625	3740
Calcium (mg/L)	423	155	414	-
Magnesium (mg/L)	65	148	62	-
Potassium (mg/L)	-	-	-	-
Sodium (mg/L)	1470	920	1440	-
Hydroxide (mg/L)	-	-	-	-
Total alkalinity (mg/L)	-	-	-	-
Nitrate (mg/L-N)	-	-	0.4	-
Ion balance (%)	8.2	-	-	-
Radium-226 (pCi/L)	-	-	-	0.11
Radium-228 (pCi/L)	-	-	-	-

[1] Wildlife standard for mercury is 0.000012 mg/L, which is below detection limits of the analytical procedure

[2] Wildlife standard for total selenium is 0.002 mg/L

*secondary standard

** Ra-226 + Ra-228

(-) analysis not performed for parameter

mg/L - milligram per liter

µS/cm - microsiemens per centimeter

su - standard units

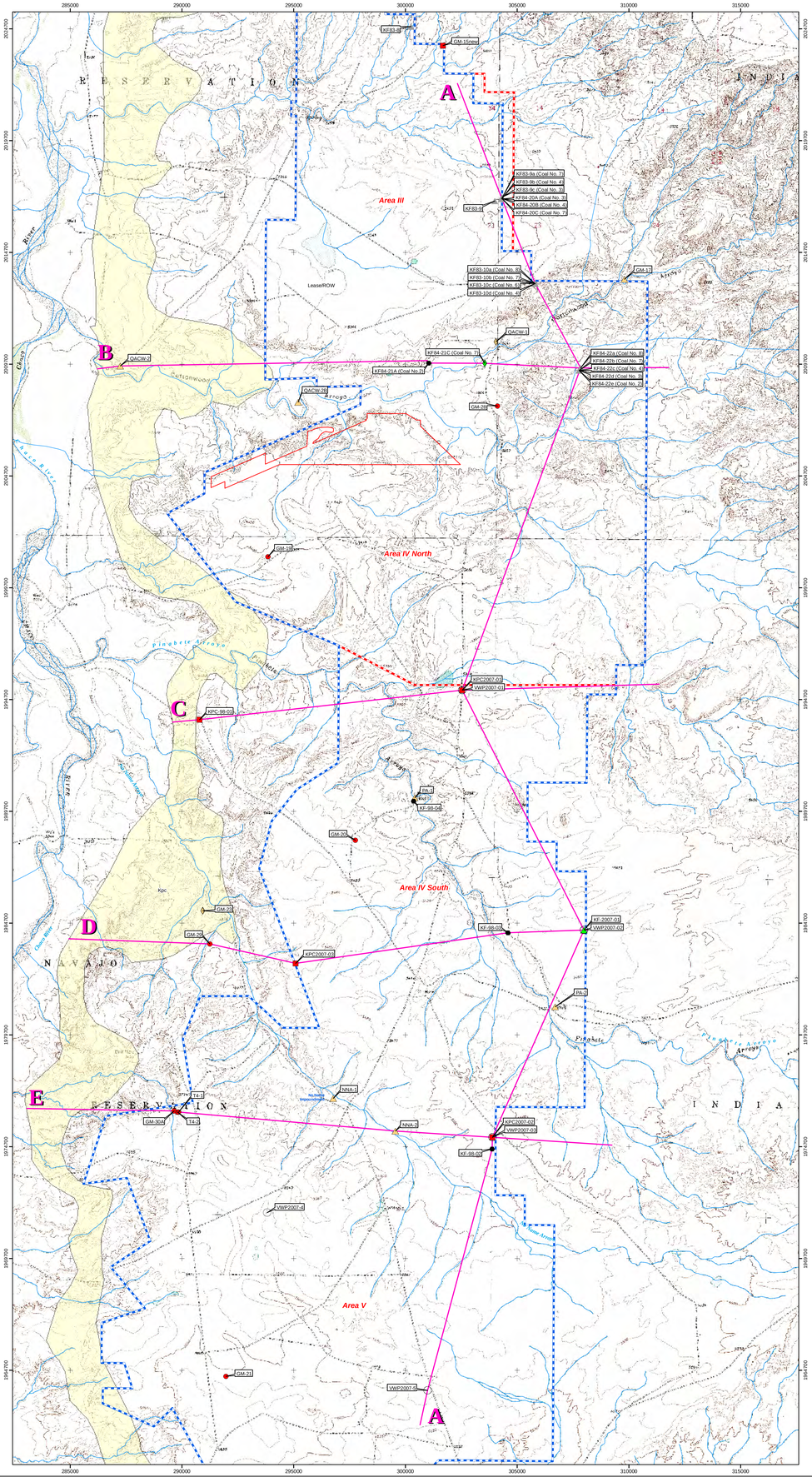
pCi/L - picocuries per liter

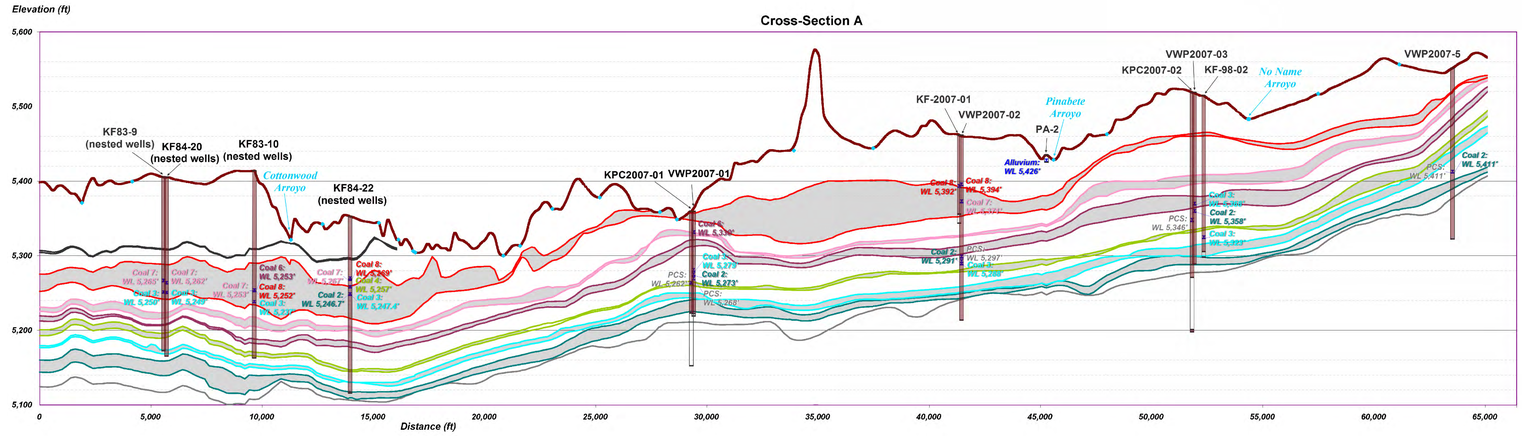
Table 6.G-18 Measured and Modeled Recharge Rates

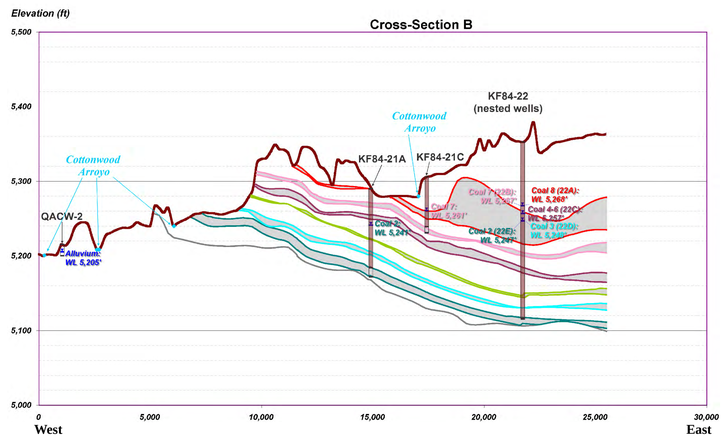
Surface characterization	Recharge range[1] (in/yr)	Mean recharge[1] (in/yr)	Modeled recharge (in/yr)
Badlands	0.002 to 0.01	0.006	
Slopes > 5%			0.002
Slopes: 2 to 5%			0.01
Upland flat	0.02 to 0.05	0.03	
Upland flat (slope <1%)			0.03
Upland (slope 1 to 2%)			0.02
Alluvial valley	0.09	0.09	0.09

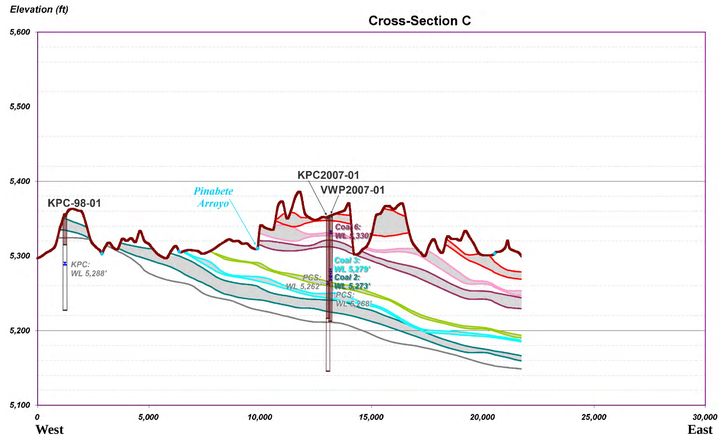
[1]From Stone 1987

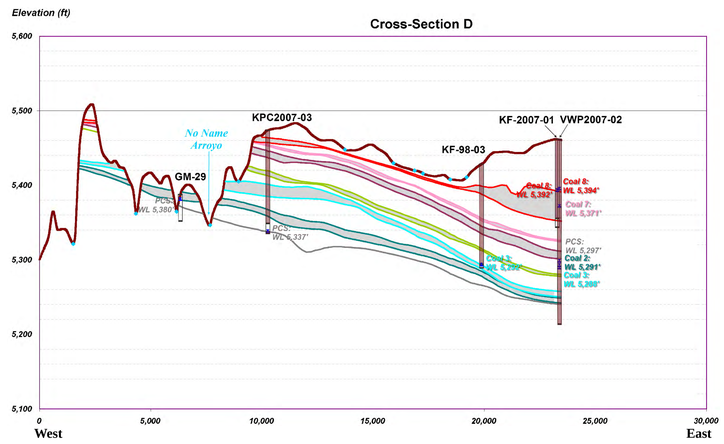
Appendix 6.G Exhibits

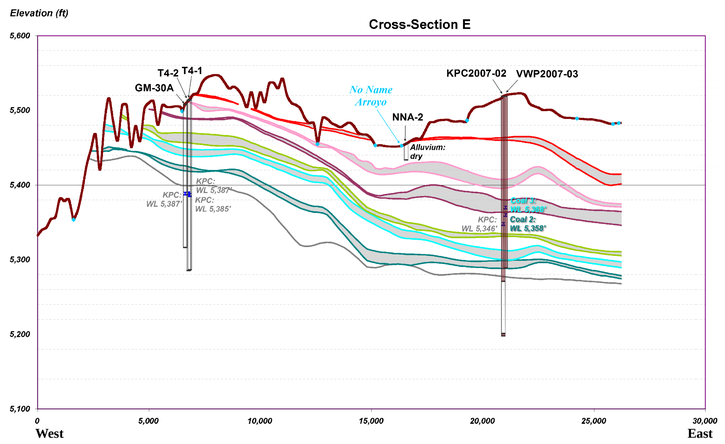












- Abandoned Alluvial Monitoring Well
- Existing Alluvial Monitoring Well
- Well, Coal No. 2, Existing
- No 3. Coal Monitoring Well
- Well, Coal No. 4, Existing
- No 6. Coal Monitoring Well
- No 7. Coal Monitoring Well
- No 8. Coal Monitoring Well
- Fruitland Well or Nested Wells
- Abandoned PCS Monitoring Well
- Existing PCS Monitoring Well
- Nested Vibrating Wire Piezometer
- BNCC Lease Area
- BNCC Permit Area
- Proposed Mining in Area IV North
- Streams
- Pictured Cliffs Formation (Kpc)

Cross-Sections :
- Pictured Cliffs Top
- S2 Coal
- S3 Coal
- S4 Coal
- S6 Coal
- S7 Coal
- S8 Coal
- S9 Coal
- Topo (2000)
- Wells
- Water Levels
- Streams

Projection Information:
State Plane New Mexico West
North American Datum 1927
FIPS 3003
feet

1:24,000

0 1,700 3,400 6,800 Feet

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	EQO.	PE.
				APPROVALS		

Exhibit 6.G-1

BHP NAVAJO COAL COMPANY

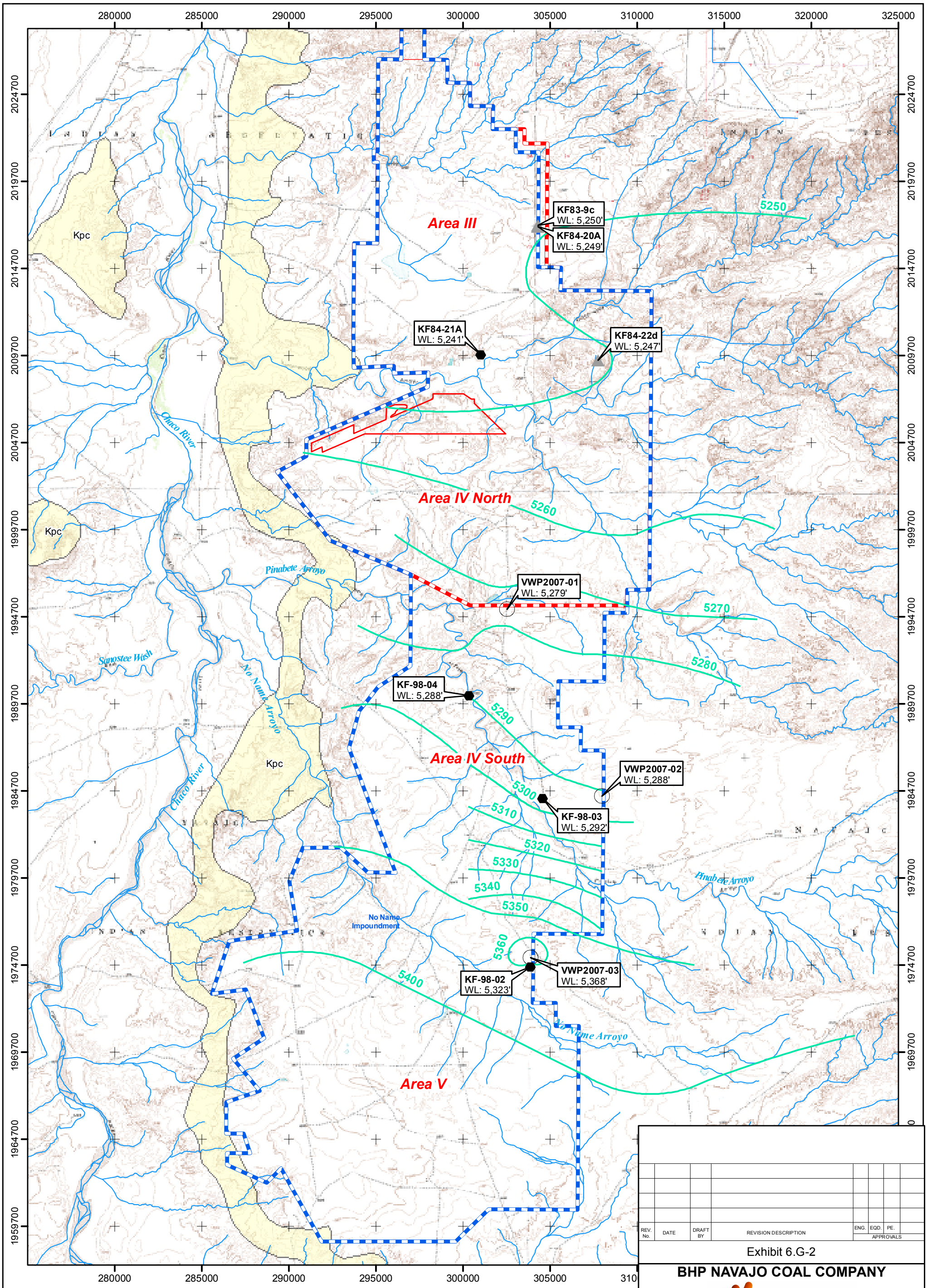
bhpbilliton

P.O.BOX 1717 FRUITLAND,NEW MEXICO 87416/PHONE 505-598-5861/FAX 505-598-3361

Navajo Mine Permit

Hydrogeologic Cross-sections,
Monitoring Wells & Piezometers
for Areas III, IV & V

PREPARED BY: MD	DRAWN BY: MD	PAPER SIZE: 34"x48"
APPROVED BY: APO	DATE: 02/09/2011	



REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	EQD.	PE.
				APPROVALS		

Exhibit 6.G-2

BHP NAVAJO COAL COMPANY

bhpbilliton

P.O.BOX 1717 FRUITLAND,NEW MEXICO 87416/PHONE 505-598-5861/FAX 505-598-3361

Navajo Mine Permit

Coal Seam No.3 Potentiometry

PREPARED BY: MD	DRAWN BY: MD	PAPER SIZE: 11"x17"
APPROVED BY: APO	DATE: 02/09/2011	

N

1:60,000

Projection Information:
State Plane New Mexico West
North American Datum 1927
FIPS 3003
feet

Feet
0 2,750 5,500 11,000

- No 3. Coal Monitoring Well
- Fruitland Nested Wells
- Nested Vibrating Wire Piezometer
- Coal Seam No. 3 Potentiometric Contours
- BNCC Lease Area
- BNCC Permit Area
- Proposed Mining in Area IV North
- Streams
- Pictured Cliffs Formation (Kpc)

285000 290000 295000 300000 305000 310000 315000 320000 325000 330000

2024700 2019700 2014700 2009700 2004700 1999700 1994700 1989700 1984700 1979700 1974700 1969700 1964700 1959700

Area III

Area IV North

Area IV South

Area V

KF83-10a
WL: 5,252'

KF84-22a
WL: 5,269'

KF-2007-01
WL: 5,392'

VWP2007-02
WL: 5,394'

5250 5300 5350 5400 5450

Chaco River

Pinabete Arroyo

No Name Arroyo

Kpc

No Name Impoundment

N A V A J O

I N D I A N R E S E R V A T I O N

285000 290000 295000 300000 305000 310000 315000

N

1:60,000

Projection Information:
State Plane New Mexico West
North American Datum 1927
FIPS 3003
feet

0 2,750 5,500 11,000 Feet

- No 8. Coal Monitoring Well
- Fruitland Nested Well
- Nested Vibrating Wire Piezometer
- Coal No.8 Potentiometric Contours
- BNCC Lease Area
- BNCC Permit Area
- Proposed Mining in Area IV North
- Streams
- Pictured Cliffs Formation (Kpc)

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	EQD.	PE.
				APPROVALS		

Exhibit 6.G-3

BHP NAVAJO COAL COMPANY

bhpbilliton

P.O.BOX 1717 FRUITLAND,NEW MEXICO 87416/PHONE 505-598-5861/FAX 505-598-3361

Navajo Mine Permit

Coal Seam No.8 Potentiometry

PREPARED BY: MD	DRAWN BY: MD	PAPER SIZE: 11"x17"
APPROVED BY: APO	DATE: 02/09/2011	

GM-15new
WL: 5,265'

GM-28
WL: 5,265'

GM-19
WL: 5,265'

KPC2007-01
WL: 5,262'

VWP2007-01
WL: 5,268'

KPC-98-01
WL: 5,288'

GM-20
WL: 5,333'

VWP2007-02
WL: 5,297'

KPC2007-03
WL: 5,337'

GM-29
WL: 5,306'

T4-1
WL: 5,385'

T4-2
WL: 5,387'

GM-30A
WL: 5,387'

KPC2007-02
WL: 5,346'

VWP2007-4
WL: 5,397'

GM-21
WL: 5,428'

VWP2007-5
WL: 5,411'

Area III

Area IV North

Area IV South

Area V

5260

5280

5300

5320

5340

5360

5380

5400

5420

Kpc

Chaco River

Pinabete Arroyo

Sanostee Wash

No Name Arroyo

No Name impoundment

1:60,000

Projection Information:
State Plane New Mexico West
North American Datum 1927
FIPS 3003
feet

0 2,900 5,800 11,600 Feet

- Abandoned PCS Monitoring Well
- Existing PCS Monitoring Well
- Nested Vibrating Wire Piezometer
- PCS Potentiometric Contour
- BNCC Lease Area
- BNCC Permit Area
- Proposed Mining in Area IV North
- Streams
- Pictured Cliffs Formation (Kpc)

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	EQD.	PE.
				APPROVALS		

Exhibit 6.G-4

BHP NAVAJO COAL COMPANY

bhpbilliton

P.O.BOX 1717 FRUITLAND,NEW MEXICO 87416/PHONE 505-598-5861/FAX 505-598-3361

Navajo Mine Permit

PCS Potentiometry

PREPARED BY: MD	DRAWN BY: MD	PAPER SIZE: 11"x17"
APPROVED BY: APO	DATE: 02/11/2011	

LEGEND

◎ DOBY-1	PROGRAM MONITORING WELLS
KF84-21A	COMPLIANCE MONITORING WELLS
8 9	NAPI SPRINGS
□ 13-14-6	NON-BHP WELLS
△ NAPI DISCHARGE POINT	NAPI IRRIGATION DISCHARGE POINT
———	PERMIT BOUNDARY

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	E.G.	E.G.	P.E.	RPLS	CHIEF ENG.
11-A	FEB-2011	PJF	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	MPO	SO			
09-A	7-12-09	PJF	ADDED IBR EASTSIDE OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB			
D	12-10-01	PJF	REMOVED THE FOLLOWING WELLS CUSTER-1, 2, 3, 4, KF84, KP84, KF84-21A, QACW-1 AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	AAY	MC		WB	
C	6-3-99	PJF	ADDED NON-BHP WELL AND NAPI SPRINGS, DISCHARGE POINTS AND SUBMITTED OSM FOR REVIEW AND APPROVAL.	AAY	MC		WB	
B	7-29-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	GW	MC		WB	
A	5-29-97	PJF	SUBMITTED TO OSM FOR APPROVAL.	GW	GW			

EXHIBIT 6–01

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

WELL LOCATION MAP
NAVAJO MINE
MARCH, 1997

PREPARED BY GW/PJF	DRAWN BY PJF	SCALE 1" = 2000'
APPROVED BY	DATE MAR. 16, 1997	MYLAR LOC.

G:\Gs\Permit F\Ch 6\Exhibit 6-001\EXH 6-1.prg
Thu Feb 10 11:46:04 2011

Path: G:\Gs\Permit F\Ch 6\Exhibit 6-001\EXH 6-1.prg
PJFoster \Thu Feb 10 11:46:04 2011

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FRUITLAND QUADRANGLE
NEW MEXICO - SAN JUAN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

NAVAJO RESERVATION BOUNDARY

MORGAN LAKE

UNSATURATED ZONE

5250 5300 5350 5400 5450 5500

Surface Use Permit Boundary

Southern Permit Boundary

LEGEND

- IMPROVED DIRT ROAD
- DIRT ROAD
- PAVED ROAD
- RAILROAD
- MINE SITES
- Drill Hole ○ DRILL HOLE
- WATER WELL
- PIPELINE
- 5450 CONTOUR ELEVATIONS
- x5356 ELEVATIONS
- DEPRESSION
- HIGH VOLTAGE POWER LINE
- TAILINGS PONDS
- BUILDINGS
- A.P.S. PROPERTY LINE
- Oil Well ○ OIL WELL
- RIVER
- HOME SITES
- PONDS
- AQUEDUCT

KF84 NO. 22 ⊙ PIEZOMETER
CONTOUR INTERVAL = 20 FT.
PERMIT BOUNDARY
BHP NAVAJO COAL COMPANY
LEASE BOUNDARY
⑤ AREA LOCATION
NAVAJO RESERVATION BOUNDARY

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

EXHIBIT 6-2

bhpbilliton

NAVAJO COAL COMPANY
P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416
PHONE (505) 598-3205 FAX (505) 598-3061

NO. 8 COAL SEAM POTENTIOMETRIC SURFACE

DRAWN BY J. GOLBE | SCALE: 1" = 2000'
APPROVED BY JCH | DATE AUG. 1985
DRAWING NO. | LOCATION NO.

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY:	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	11/87	PUT REVISION BLOCK ON, CHANGED CO. NAME TO BHP-UI, REMOVED NUMBER IN TITLE BLOCK, CONFIDENTIAL STATEMENT ADDED SOUTHERN BOUNDARY	GG.			
2	9-11-98	ADDED NEW EXH. NO. FORMER NLK A,B,C & D BOUNDARY AND CHANGE CO. NAME.	PJF			
3	FEB-2011	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	PJF	MPO		

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FRUITLAND QUADRANGLE
NEW MEXICO-SAN JUAN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

NAVAJO RESERVATION BOUNDARY

MORGAN LAKE

A III

A IV

A V

UNSATURATED

SATURATED

Surface Use Permit Boundary

KFB4-20(a)
(5264.55)

KFB4-9(a)
(5254.9)

KF84-21(a)
(5262.50)

KF84-22(a)
(5266.11)

LEGEND

- IMPROVED DIRT ROAD
- DIRT ROAD
- PAVED ROAD
- RAILROAD
- MINE SITES
- Drill Hole O DRILL HOLE
- WATER WELL
- PIPELINE
- 5450 CONTOUR ELEVATIONS
- x5356 ELEVATIONS
- DEPRESSION
- HIGH VOLTAGE POWER LINE
- TAILINGS PONDS
- BUILDINGS
- A.P.S. PROPERTY LINE
- Oil Well O OIL WELL
- RIVER
- HOME SITES
- PONDS
- AQUEDUCT
- KF84 PIEZOMETER LOCATION
- PERMIT BOUNDARY
- BHP NAVAJO COAL COMPANY LEASE BOUNDARY
- AREA LOCATION
- NAVAJO RESERVATION BOUNDARY

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

EXHIBIT 6-3

bhpbilliton

NAVAJO COAL COMPANY
P.O. BOX 1717
FRUITLAND, NEW MEXICO 87416
PHONE (505) 598-3200
FAX (505) 598-3361

NO. 7 COAL SEAM POTENTIOMETRIC SURFACE

DRAWN BY J.GOLBE | SCALE 1"= 2000'
APPROVED BY | DATE AUG. 1983
DRAWING NO. | LOCATION NO.

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	11/87	PUT REVISION BLOCK ON. CHANGED CO. NAME TO BHP-UI. REMOVED CONFIDENTIAL STATEMENT. PUT EXHIBIT NUMBER IN TITLE BLOCK.	CG			
2	9-11-93	ADDED NEW EXH. NO. FORMER NLK A,B,C & D BOUNDARY AND CHANGE CO. NAME.	PJF			
3	FEB-2011	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	PJF	MPO		

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FRUITLAND QUADRANGLE
NEW MEXICO - SAN JUAN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

NAVAJO RESERVATION BOUNDARY

MORGAN LAKE

N A V A J O

R E S E R V A T I O N

I N D I A N

UNMINED COAL

MINED

A II

A III

A IV

A V

KF84-2(b)

KF84-22(c)

Surface Use Permit Boundary

Southern Permit Boundary

LEGEND

- IMPROVED DIRT ROAD
- DIRT ROAD
- PAVED ROAD
- RAILROAD
- MINE SITES
- Drill Hole ○ DRILL HOLE
- WATER WELL
- PIPELINE
- 5450 CONTOUR ELEVATIONS
- x5356 ELEVATIONS
- DEPRESSION
- HIGH VOLTAGE POWER LINE
- TAILINGS PONDS
- BUILDINGS
- A.P.S. PROPERTY LINE
- Oil Well ○ OIL WELL
- RIVER
- HOME SITES
- PONDS
- AQUEDUCT
- KF84-20 ⊙ PIEZOMETER
- CONTOUR INTERVAL = 5 FT.
- PERMIT BOUNDARY BHP NAVAJO COAL COMPANY LEASE BOUNDARY
- ⑤ AREA LOCATION
- NAVAJO RESERVATION BOUNDARY

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

EXHIBIT 6-4

bhpbilliton

NAVAJO COAL COMPANY
P.O. BOX 1717
FRUITLAND, NEW MEXICO 87416
PHONE (505) 598-3000
Fax (505) 598-3091

№4, & 6 COAL SEAM POTENTIOMETRIC SURFACE MAP

DRAWN BY J. GOLBE | SCALE 1" = 2000'
APPROVED BY [illegible] | DATE AUG. 1983
DRAWING NO. | LOCATION NO.

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	11/87	PUT REVISION BLOCK ON, CHANGED CO. NAME TO BHP-UI, PUT EXHIBIT NUMBER IN TITLE BLOCK, REMOVED CONFIDENTIAL STATEMENT, ADDED SOUTHER PERMIT BOUNDARY	GG			
2	9-11-93	ADDED NEW EXH. NO. FORMER BLK A,B,C & D BOUNDARY AND CHANGE CO. NAME.	PJP			
3	FEB-2011	AREA 4 NORTH REVISION RESUBMITAL TO OSM FOR REVIEW AND APPROVAL	PJF	MPO		

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FRUITLAND QUADRANGLE
NEW MEXICO - SAN JUAN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

NAVAJO RESERVATION BOUNDARY

MORGAN LAKE

Surface Use Permit Boundary

Southern Permit Boundary

A II

A III

A IV

A V

KF84-20(c)

KF84-21(c)

KF84-22(d)

KF84-22(c)

LEGEND

- IMPROVED DIRT ROAD
- DIRT ROAD
- PAVED ROAD
- RAILROAD
- MINE SITES
- Drill Hole ○ DRILL HOLE
- WATER WELL
- PIPELINE
- 5450 CONTOUR ELEVATIONS
- x5356 ELEVATIONS
- DEPRESSION
- HIGH VOLTAGE POWER LINE
- TAILINGS PONDS
- BUILDINGS
- A.P.S. PROPERTY LINE
- Oil Well ○ OIL WELL
- RIVER
- HOME SITES
- PONDS
- AQUEDUCT
- KF84-22 ⊙ PIEZOMETER
- CONTOUR INTERVAL = 1 FT.
- PERMIT BOUNDARY
- BHP NAVAJO COAL COMPANY LEASE BOUNDARY
- ③ AREA LOCATION
- NAVAJO RESERVATION BOUNDARY

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

EXHIBIT 6-5

bhpbilliton

NAVAJO COAL COMPANY
P.O. BOX 1717
FRUITLAND, NEW MEXICO 87416
PHONE (505) 598-3000
Fax (505) 598-3061

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT DY.	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	11/87	PUT REVISION BLOCK ON, CHANGED CO. CHANGED TO BHP-UM, PUT EXHIBIT NUMBER IN TITLE BLOCK, REMOVED CONFIDENTIAL STATEMENT, ADDED SOUTHERN PERMIT BOUNDARY	CG			
2	9-11-93	ADDED NEW EXH. NO., FORMER NUX A,B,C & D BOUNDARY AND CHANGE CO. NAME.	PJF			
3	FEB-2011	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	PJF	MPO		

N°2 & 3 COAL SEAM POTENTIOMETRIC SURFACE MAP

DRAWN BY J GOLBE | SCALE 1" = 6000'
APPROVED BY [illegible] | DATE AUG 1983
DRAWING NO. | LOCATION NO

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FRUITLAND QUADRANGLE
NEW MEXICO - SAN JUAN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

NAVAJO RESERVATION BOUNDARY

SJKF84-2
SJKF84-3
SJKF84-4
KF84-15
KF84-16
KF85-1
KF83-2 (Dry)
KF84-17 (Plugged)
CUSTER 5 (dry)
KF83-3 (Dry)
GM9
GM10
KF84-18
KF83
KF84-19
KF84-20
KF85-9(a)(b)(c)
KF84-20(a)(b)(c)(d)
KF85-10(a)(b)(c)(d)
GM17
KF84-22(a)(b)(c)(d)(e)
CWM-2
GM16
GM30
T4-1

MORGAN LAKE

Surface Use Permit Boundary

Southern Permit Boundary

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

- IMPROVED DIRT ROAD
- DIRT ROAD
- PAVED ROAD
- RAILROAD
- MINE SITES
- Drill Hole — DRILL HOLE
- WATER WELL
- PIPELINE
- 5450 — CONTOUR ELEVATIONS
- x5356 — ELEVATIONS
- DEPRESSION
- HIGH VOLTAGE POWER LINE
- TAILINGS PONDS
- BUILDINGS
- A.P.S. PROPERTY LINE
- Oil Well — OIL WELL
- RIVER
- HOME SITES
- PONDS
- AQUEDUCT
- ▲ GM AND T4 WELLS
- KF83-1 — PIEZOMETER OR WELL LOCATION
- PERMIT BOUNDARY
- BHP NAVAJO COAL COMPANY LEASE BOUNDARY
- AREA LOCATION
- NAVAJO RESERVATION BOUNDARY

REV NO	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR	CHIEF ENGR	PROJECT MGR.
4	FEB-2011	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	PJF	MPO		
3	9-11-93	ADDED NEW EXH. NO., FORMER BLK A,B,C & D BOUNDARY AND CHANGE CO. NAME	PJF			
1	11/87	PUT REVISION BLOCK ON, CHANGED CO. NAME TO BHP-NA, PUT PERMIT NUMBER IN TITLE BLOCK, CONFIDENTIAL STATEMENT ADDED SOUTHERN PERMIT BOUNDARY	GB			
2	1/89	ADDED NEW EXH. NO. FORMER BLK A,B,C & D BOUNDARY AND CHANGE CO., NAME.	JG	RHB		

EXHIBIT 6-6

bhpbilliton

NAVAJO COAL COMPANY
P.O. BOX 1717
FRUITLAND, NEW MEXICO 87416
PHONE (505) 598-3500
FAX (505) 598-3251

LOCATION OF WELL/ PIEZOMETER SITES

DRAWN BY J. GOLDE | SCALE 1" = 2000'
APPROVED BY [illegible] | DATE AUG. 1983
DRAWING NO | LOCATION NO

Comparison of predicted sediment concentrations with measured sediment samples from storm runoff events on Cottonwood Arroyo shows total suspended sediment concentrations of the magnitude predicted by SEDCAD 4.0 for events of a magnitude similar to that predicted for a 10-yr., 6-hr storm or less. Table 7-6 lists the SEDCAD predictions for different design events. The results suggest that the SEDCAD 4.0 predictions for peak sediment concentration in Cottonwood Arroyo are reasonable compared to observed conditions.

The storm events of August 21, 1998 and August 3, 1999 may have been equivalent to a 25 year, 6 hour event or larger in portions of the watershed. Although the SEDCAD predictions for peak discharge, runoff volume and sediment yields are greater, the results compare reasonably to actual data for large flow events.

7.2.10 Pinabete Arroyo

Pinabete Arroyo flows east to west through the BNCC lease area south of the existing permit area to the Chaco River. Pinabete Arroyo is a large ephemeral stream that flows only in direct response to precipitation events. The Pinabete Arroyo has a drainage basin of approximately 59.1 square miles of which approximately 2.9 percent lies within the permit area.

For the pre- mine, the hydrology modeling was done only on the subwatersheds or the tributaries to the Pinabete Arroyo that are projected to be disturbed by mining and reclamation support activities, not on the entire drainage basin. This should be appropriate since the stream channel will not be disturbed and only a small portion of the drainage basin (approximately 0.002 percent) will be disturbed by mining and reclamation support activities.

The peak flows and sediment yields were predicted using the SEDCAD+ computer program following the methodology and assumptions outlined in Section 7.2.3.2. The computer model was used to simulate the 2, 10, 25 and 100 year-6 hour storm events, the results are presented in Appendix 7-O. The watershed subdivisions used to model the hydrology are presented on Exhibit 7-4. The post-mining predictions and hydrologic impacts are reported in CHAPTER 11, Section 11.6.3.12.

APPENDIX 7-H

COTTONWOOD ARROYO PRE-MINING HYDROLOGY & SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, &100 YR-6 HR STORM EVENTS)

February 2011

Copyright 1998 -2007 Pamela J. Schwab

Cottonwood Arroyo Pre-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is shown on Exhibit 7-4.

Revised Febuary 2011

AAY/LR/RY

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

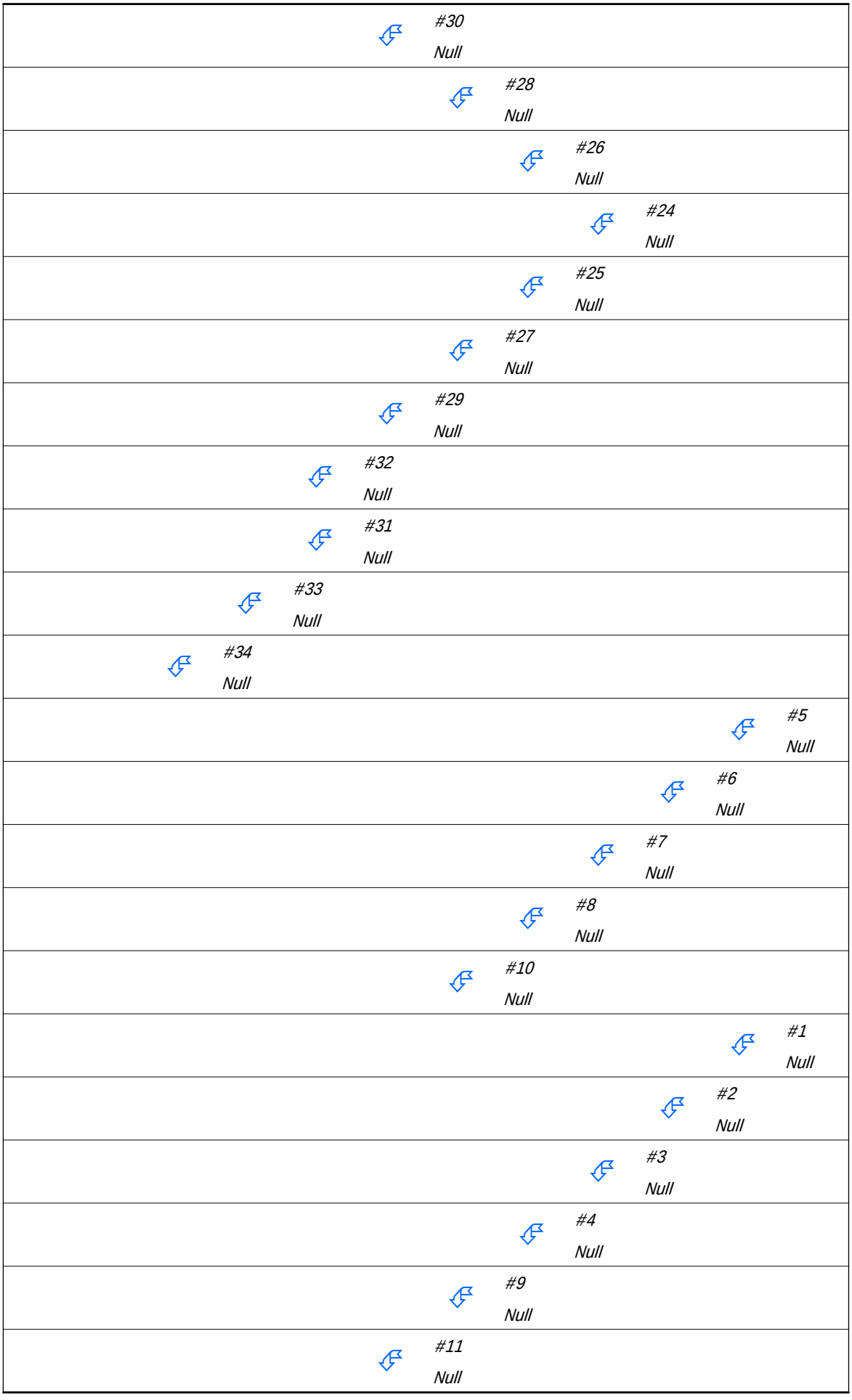
Storm Type:	Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.961	0.307	
Null	#2	==>	#3	0.068	0.331	
Null	#3	==>	#4	0.000	0.000	
Null	#4	==>	#9	0.718	0.281	
Null	#5	==>	#6	1.205	0.328	
Null	#6	==>	#7	0.189	0.304	
Null	#7	==>	#8	0.000	0.000	
Null	#8	==>	#10	0.989	0.300	
Null	#9	==>	#11	0.000	0.000	
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#21	0.495	0.453	
Null	#12	==>	#13	0.076	0.330	
Null	#13	==>	#14	3.790	0.314	
Null	#14	==>	#16	1.198	0.286	
Null	#15	==>	#16	1.198	0.286	
Null	#16	==>	#20	0.911	0.280	
Null	#17	==>	#19	0.000	0.000	
Null	#18	==>	#19	0.000	0.000	
Null	#19	==>	#20	0.915	0.252	
Null	#20	==>	#22	0.000	0.000	
Null	#21	==>	#22	0.000	0.000	
Null	#22	==>	#23	0.811	0.247	
Null	#23	==>	#35	0.000	0.000	
Null	#24	==>	#25	0.964	0.340	
Null	#25	==>	#27	1.454	0.333	
Null	#26	==>	#27	1.454	0.333	
Null	#27	==>	#29	0.800	0.323	
Null	#28	==>	#29	0.800	0.323	
Null	#29	==>	#32	0.479	0.298	
Null	#30	==>	#32	0.479	0.298	
Null	#31	==>	#33	0.000	0.000	
Null	#32	==>	#33	0.000	0.000	
Null	#33	==>	#34	1.372	0.293	Inlet to North Fork Diversion
Null	#34	==>	#35	0.000	0.000	
Null	#35	==>	#36	0.735	0.251	
Null	#36	==>	#37	3.388	0.246	
Null	#37	==>	End	0.000	0.000	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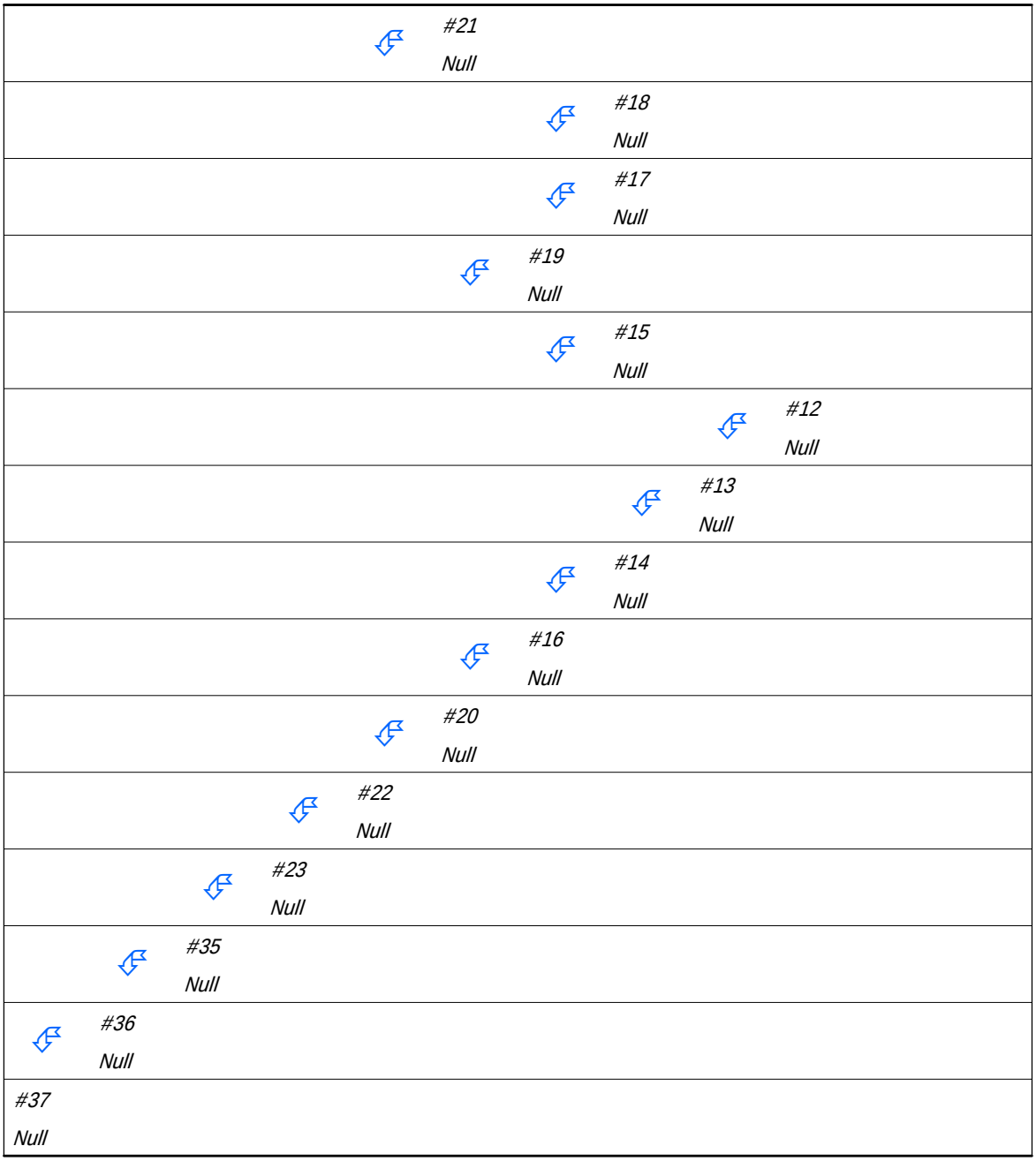

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.81	76.00	9,347.00	2.70	0.961
#1	**Muskingum K:**					**0.961**
#2	8. Large gullies, diversions, and low flowing streams	1.23	10.00	814.00	3.32	0.068
#2	**Muskingum K:**					**0.068**
#3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.53	30.00	5,637.00	2.18	0.718
#4	**Muskingum K:**					**0.718**
#5	8. Large gullies, diversions, and low flowing streams	1.17	165.00	14,065.00	3.24	1.205
#5	**Muskingum K:**					**1.205**
#6	8. Large gullies, diversions, and low flowing streams	0.78	14.00	1,799.25	2.64	0.189
#6	**Muskingum K:**					**0.189**
#8	8. Large gullies, diversions, and low flowing streams	0.72	65.00	9,046.00	2.54	0.989
#8	**Muskingum K:**					**0.989**
#11	8. Large gullies, diversions, and low flowing streams	30.00	8,801.00	29,336.66	16.43	0.495
#11	**Muskingum K:**					**0.495**
#12	8. Large gullies, diversions, and low flowing streams	1.21	11.00	906.00	3.30	0.076
#12	**Muskingum K:**					**0.076**
#13	8. Large gullies, diversions, and low flowing streams	0.92	363.00	39,301.00	2.88	3.790
#13	**Muskingum K:**					**3.790**
#14	8. Large gullies, diversions, and low flowing streams	0.58	57.00	9,834.00	2.28	1.198
#14	**Muskingum K:**					**1.198**
#15	8. Large gullies, diversions, and low flowing streams	0.58	57.00	9,834.00	2.28	1.198
#15	**Muskingum K:**					**1.198**
#16	8. Large gullies, diversions, and low flowing streams	0.52	37.00	7,084.00	2.16	0.911
#16	**Muskingum K:**					**0.911**
#19	8. Large gullies, diversions, and low flowing streams	0.33	19.00	5,699.00	1.73	0.915
#19	**Muskingum K:**					**0.915**
#22	8. Large gullies, diversions, and low flowing streams	0.31	15.00	4,852.00	1.66	0.811
#22	**Muskingum K:**					**0.811**
#24	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,568.00	3.62	0.964
#24	**Muskingum K:**					**0.964**
#25	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.00	3.39	1.454
#25	**Muskingum K:**					**1.454**
#26	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.62	3.39	1.454
#26	**Muskingum K:**					**1.454**
#27	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#27	**Muskingum K:**					**0.800**
#28	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#28	**Muskingum K:**					**0.800**
#29	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#29	**Muskingum K:**					**0.479**
#30	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#30	**Muskingum K:**					**0.479**
#33	8. Large gullies, diversions, and low flowing streams	0.65	77.00	11,910.00	2.41	1.372
#33	**Muskingum K:**					**1.372**
#35	8. Large gullies, diversions, and low flowing streams	0.33	15.00	4,554.00	1.72	0.735
#35	**Muskingum K:**					**0.735**
#36	8. Large gullies, diversions, and low flowing streams	0.30	60.00	20,005.00	1.64	3.388
#36	**Muskingum K:**					**3.388**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	0.20	0.03	0.1	3,489	2.23	1.76
#28	1,217.900	1,217.900	127.50	16.94	739.9	45,906	0.00	0.00
#26	2,486.400	2,486.400	5.44	1.83	8.0	4,125	2.21	1.71
#24	8,061.800	8,061.800	6.64	3.90	9.6	3,240	1.51	0.84
#25	1,015.700	9,077.500	25.38	7.24	39.4	12,153	6.31	2.07
#27	1,783.700	13,347.600	51.42	14.78	134.0	17,591	8.96	3.39
#29	966.000	15,531.500	173.24	44.74	1,587.3	54,538	2.41	1.14
#32	293.700	16,301.600	178.81	50.64	1,694.8	49,619	0.00	0.00
#31	957.100	957.100	135.01	17.47	610.8	34,117	0.32	0.24
#33	0.000	17,258.700	243.60	68.11	2,305.6	39,263	0.10	0.06
#34	932.500	18,191.200	256.20	80.12	2,205.4	32,513	0.05	0.03
#5	2,023.000	2,023.000	171.21	20.33	462.4	32,307	2.05	1.05
#6	1,743.200	3,766.200	212.42	40.43	934.0	28,405	0.14	0.08
#7	2,395.300	6,161.500	387.09	85.94	2,914.9	36,696	0.00	0.00
#8	0.000	6,161.500	387.09	85.94	2,914.9	36,696	0.00	0.00
#10	1,053.200	7,214.700	408.03	101.32	2,888.5	33,288	0.04	0.03
#1	2,411.100	2,411.100	102.40	16.59	452.6	29,702	2.57	1.72
#2	1,497.000	3,908.100	165.97	41.66	776.1	20,475	0.10	0.07
#3	862.700	4,770.800	217.82	52.22	899.7	17,142	0.03	0.02
#4	0.000	4,770.800	217.82	52.22	899.7	17,142	0.03	0.02
#9	425.500	5,196.300	225.97	58.39	914.0	14,897	0.00	0.00
#11	0.000	12,411.000	567.35	159.72	3,802.5	27,497	0.01	0.01
#21	1,080.800	13,491.800	591.22	170.38	3,862.9	26,737	0.00	0.00
#18	848.500	848.500	63.40	10.11	89.4	9,383	0.00	0.00
#17	182.200	182.200	46.10	3.64	42.5	12,532	0.29	0.20
#19	0.000	1,030.700	106.20	13.75	132.0	8,986	0.07	0.05
#15	1,992.700	1,992.700	132.09	21.29	666.2	35,689	0.30	0.19
#12	3,494.500	3,494.500	29.47	6.13	64.8	10,798	5.21	3.74
#13	2,720.700	6,215.200	61.66	11.51	150.5	14,172	7.19	4.86
#14	5,096.800	11,312.000	166.07	56.22	1,310.1	62,956	0.45	0.12
#16	876.500	14,181.200	302.67	94.57	2,485.3	41,640	0.46	0.21
#20	681.900	15,893.800	327.56	120.97	2,763.2	31,815	0.24	0.12
#22	0.000	29,385.600	870.59	291.35	6,626.1	27,392	0.08	0.05
#23	752.900	30,138.500	867.57	297.93	6,609.5	26,955	0.00	0.00
#35	0.000	48,329.700	1,063.48	378.05	8,814.9	25,656	0.01	0.01
#36	730.590	49,060.290	1,061.94	382.05	8,845.9	29,111	0.00	0.00
#37	2,208.500	51,268.790	1,055.02	394.73	8,889.8	26,564	0.12	0.07

Particle Size Distribution(s) at Each Structure

Structure #30:

Size (mm)	In/Out
2.0000	100.000%
0.1000	42.445%
0.0500	24.052%
0.0020	15.563%
0.0010	0.000%

Structure #28:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #26:

Size (mm)	In/Out
2.0000	100.000%
0.1000	69.288%
0.0500	39.263%
0.0020	25.406%
0.0010	0.000%

Structure #24:

Size (mm)	In/Out
2.0000	100.000%
0.1000	84.148%
0.0500	49.683%
0.0020	32.148%

Size (mm)	In/Out
0.0010	0.000%

Structure #25:

Size (mm)	In/Out
2.0000	100.000%
0.1000	71.787%
0.0500	41.659%
0.0020	26.956%
0.0010	0.000%

Structure #27:

Size (mm)	In/Out
2.0000	100.000%
0.1000	75.596%
0.0500	43.126%
0.0020	27.905%
0.0010	0.000%

Structure #29:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.956%
0.0500	95.215%
0.0020	93.528%
0.0010	0.000%

Structure #32:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #31:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.356%
0.0010	0.000%

Structure #33 (Inlet to North Fork Diversion):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.300%
0.0010	0.000%

Structure #34:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.556%
0.0010	0.000%

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	93.482%
0.0020	90.338%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.640%

Size (mm)	In/Out
0.0010	0.000%

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #8:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #10:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.878%
0.0020	99.809%
0.0010	0.000%

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.983%
0.0500	90.770%
0.0020	87.230%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.573%
0.0010	0.000%

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.513%
0.0010	0.000%

Structure #4:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.513%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #11:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.855%

Size (mm)	In/Out
0.0010	0.000%

Structure #21:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #18:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #17:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	93.383%
0.0010	0.000%

Structure #19:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.868%
0.0010	0.000%

Structure #15:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.622%
0.0010	0.000%

Structure #12:

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.060%
0.0500	47.068%
0.0020	30.456%
0.0010	0.000%

Structure #13:

Size (mm)	In/Out
2.0000	100.000%
0.1000	76.526%
0.0500	43.365%
0.0020	28.060%
0.0010	0.000%

Structure #14:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.990%
0.0010	0.000%

Structure #16:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	96.912%

Size (mm)	In/Out
0.0010	0.000%

Structure #20:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.911%
0.0010	0.000%

Structure #22:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.129%
0.0010	0.000%

Structure #23:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #35:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.889%
0.0010	0.000%

Structure #36:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #37:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.531%
0.0020	99.309%
0.0010	0.000%

Structure Detail:

Structure #30 (Null)

Structure #28 (Null)

Structure #26 (Null)

Structure #24 (Null)

Structure #25 (Null)

Structure #27 (Null)

Structure #29 (Null)

Structure #32 (Null)

Structure #31 (Null)

Structure #33 (Null)

Inlet to North Fork Diversion

Structure #34 (Null)

Structure #5 (Null)

Structure #6 (Null)

Structure #7 (Null)

Structure #8 (Null)

Structure #10 (Null)

Structure #1 (Null)

Structure #2 (Null)

Structure #3 (Null)

Structure #4 (Null)

Structure #9 (Null)

Structure #11 (Null)

Structure #21 (Null)

Structure #18 (Null)

Structure #17 (Null)

Structure #19 (Null)

Structure #15 (Null)

Structure #12 (Null)

Structure #13 (Null)

Structure #14 (Null)

Structure #16 (Null)

Structure #20 (Null)

Structure #22 (Null)

Structure #23 (Null)

Structure #35 (Null)

Structure #36 (Null)

Structure #37 (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)
#30	1	476.400	1.131	0.000	0.000	73.100	M	0.20	0.034
	Σ	**476.400**						**0.20**	**0.034**
#28	1	772.300	0.657	0.523	0.334	90.400	M	106.00	10.740
	2	445.600	0.587	0.000	0.000	90.400	M	65.74	6.199
	Σ	**1,217.900**						**127.50**	**16.939**
#26	1	447.600	2.192	0.000	0.000	74.200	M	0.34	0.091
	2	2,038.800	3.000	0.000	0.000	77.000	M	5.10	1.740
	Σ	**2,486.400**						**5.44**	**1.831**
#24	1	2,607.500	5.367	2.377	0.305	75.200	M	2.02	0.992
	2	2,331.900	4.813	2.431	0.304	74.700	M	1.48	0.662
	3	1,758.500	2.231	1.788	0.297	76.200	M	3.66	1.087
	4	1,363.900	2.618	0.000	0.000	77.000	M	3.63	1.164
	Σ	**8,061.800**						**6.64**	**3.905**
#25	1	515.200	0.990	0.342	0.357	78.200	M	3.32	0.663
	2	130.500	0.787	0.342	0.357	78.100	M	0.89	0.163
	3	370.000	0.516	0.000	0.000	85.700	M	25.34	2.504
	Σ	**9,077.500**						**25.38**	**7.235**
#27	1	354.400	0.612	1.233	0.337	83.100	M	11.81	1.500
	2	305.200	0.529	1.054	0.328	84.000	M	14.02	1.532
	3	289.800	0.692	0.551	0.328	75.500	M	0.59	0.129
	4	253.000	0.361	0.551	0.328	79.400	M	3.26	0.463
	5	581.300	0.980	0.000	0.000	82.300	M	12.58	2.093
	Σ	**13,347.600**						**51.42**	**14.783**
#29	1	508.800	0.409	0.416	0.312	89.500	M	80.63	6.230
	2	233.200	0.521	0.291	0.312	91.600	M	44.78	3.842
	3	224.000	0.467	0.000	0.000	90.000	M	35.63	2.942
	Σ	**15,531.500**						**173.24**	**44.736**
#32	1	293.700	0.576	0.000	0.000	93.000	M	65.60	5.870
	Σ	**16,301.600**						**178.81**	**50.641**
#31	1	431.100	0.588	0.450	0.336	91.500	M	75.71	7.004
	2	325.800	0.432	0.149	0.327	93.000	M	85.40	6.520
	3	200.200	0.373	0.000	0.000	92.900	M	55.57	3.945
	Σ	**957.100**						**135.01**	**17.469**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#33	**∑**	**17,258.700**						**243.60**	**68.110**
#34	1	91.700	0.244	0.965	0.300	92.300	M	28.02	1.678
	2	105.200	0.256	0.965	0.300	93.000	M	34.57	2.114
	3	735.600	0.885	0.000	0.000	88.900	M	65.22	8.216
	∑	**18,191.200**						**256.20**	**80.118**
#5	1	503.600	0.618	0.000	0.000	87.600	M	44.56	4.621
	2	406.500	0.388	0.501	0.350	84.800	M	27.28	2.356
	3	439.600	0.342	0.681	0.347	87.800	M	57.48	4.181
	4	162.600	0.280	0.681	0.347	86.000	M	16.74	1.161
	5	294.100	0.375	1.021	0.348	92.000	M	71.65	5.116
	6	216.600	0.272	1.018	0.348	90.100	M	46.35	2.899
	∑	**2,023.000**						**171.21**	**20.334**
#6	1	149.100	0.331	0.000	0.000	92.600	M	41.87	2.831
	2	245.000	0.529	0.192	0.328	88.100	M	26.07	2.430
	3	276.200	0.450	0.461	0.319	89.500	M	41.36	3.372
	4	158.400	0.380	1.385	0.185	93.000	M	44.23	3.163
	5	206.200	0.402	0.796	0.320	89.400	M	32.46	2.488
	6	414.000	0.430	1.066	0.323	87.200	M	42.38	3.578
	7	294.300	0.535	1.066	0.323	86.400	M	22.70	2.235
	∑	**3,766.200**						**212.42**	**40.431**
#7	1	731.700	1.274	0.000	0.000	93.000	M	96.39	14.602
	2	445.800	1.043	0.000	0.000	93.000	M	67.76	8.894
	3	270.800	0.804	0.000	0.000	93.000	M	49.02	5.404
	4	78.900	0.267	1.035	0.328	93.000	M	25.53	1.584
	5	154.900	0.310	1.071	0.326	93.000	M	47.40	3.105
	6	101.400	0.288	1.164	0.328	92.900	M	31.46	2.004
	7	117.700	0.298	1.344	0.329	92.200	M	32.72	2.112
	8	494.100	0.518	1.344	0.329	91.300	M	90.89	7.807
	∑	**6,161.500**						**387.09**	**85.942**
#8	1	0.000	0.000	0.000	0.000	1.000	0.00	0.000	
	∑	**6,161.500**						**387.09**	**85.942**
#10	1	355.500	1.286	0.000	0.000	93.000	M	46.51	7.093
	2	307.100	1.282	0.668	0.305	83.200	M	7.05	1.324
	3	147.300	1.245	0.517	0.303	90.600	M	13.65	2.105
	4	126.400	0.585	0.517	0.303	93.000	M	27.97	2.527
	5	116.900	1.179	0.621	0.305	93.000	M	16.29	2.333
	∑	**7,214.700**						**408.03**	**101.324**
#1	1	557.400	0.941	0.000	0.000	83.600	M	16.72	2.594

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	2	169.600	1.616	0.677	0.333	93.000	M	18.75	3.384
	3	636.400	1.842	0.729	0.333	81.000	M	6.98	1.726
	4	223.400	0.846	1.005	0.336	84.100	M	7.97	1.141
	5	77.700	0.330	1.392	0.341	81.400	M	2.25	0.232
	6	746.600	0.678	1.392	0.341	88.200	M	69.45	7.514
	Σ	**2,411.100**						**102.40**	**16.592**
#2	1	257.000	0.423	0.000	0.000	93.000	M	68.09	5.147
	2	180.500	0.562	0.478	0.281	91.800	M	34.14	3.055
	3	200.700	0.687	0.574	0.283	93.000	M	40.21	4.007
	4	438.600	0.811	0.574	0.283	93.000	M	78.94	8.755
	5	420.200	1.247	0.801	0.293	88.000	M	25.21	4.099
	Σ	**3,908.100**						**165.97**	**41.656**
#3	1	172.600	0.443	0.000	0.000	93.000	M	44.66	3.448
	2	311.200	0.890	0.000	0.000	88.900	M	27.49	3.477
	3	378.900	0.632	0.209	0.314	87.900	M	34.90	3.641
	Σ	**4,770.800**						**217.82**	**52.221**
#4	**Σ**	**4,770.800**						**217.82**	**52.221**
#9	1	425.500	0.830	0.000	0.000	90.700	M	52.76	6.171
	Σ	**5,196.300**						**225.97**	**58.392**
#11	**Σ**	**12,411.000**						**567.35**	**159.716**
#21	1	272.800	0.819	0.000	0.000	86.900	M	17.75	2.243
	2	230.500	0.388	0.694	0.266	89.200	M	35.79	2.694
	3	181.100	0.289	0.877	0.256	91.300	M	44.96	2.866
	4	396.400	0.939	0.877	0.256	86.100	M	20.22	2.863
	Σ	**13,491.800**						**591.22**	**170.383**
#18	1	301.700	0.652	0.000	0.000	93.000	M	62.47	6.029
	2	546.800	0.768	0.561	0.320	86.300	M	32.97	4.083
	Σ	**848.500**						**63.40**	**10.112**
#17	1	182.200	0.462	0.000	0.000	93.000	M	46.10	3.640
	Σ	**182.200**						**46.10**	**3.640**
#19	**Σ**	**1,030.700**						**106.20**	**13.753**
#15	1	437.400	0.803	0.000	0.000	91.300	M	60.86	6.898
	2	549.000	0.637	0.654	0.327	91.300	M	88.81	8.663
	3	1,006.300	1.023	0.768	0.331	84.700	M	36.49	5.725
	Σ	**1,992.700**						**132.09**	**21.286**
#12	1	517.800	0.791	0.000	0.000	81.900	M	11.30	1.714

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	2	229.000	0.571	0.043	0.418	80.100	M	3.43	0.501
	3	592.700	0.706	0.044	0.417	81.500	M	12.26	1.800
	4	1,806.900	1.542	0.487	0.362	76.700	M	5.34	1.374
	5	348.100	0.618	0.487	0.362	80.000	4.94	0.743	
	∑	**3,494.500**						**29.47**	**6.132**
#13	1	411.600	0.725	0.000	0.000	79.700	M	5.01	0.813
	2	636.400	0.774	0.322	0.336	80.700	M	10.16	1.611
	3	319.000	0.575	0.685	0.318	85.500	M	19.58	2.087
	4	231.700	0.314	0.923	0.328	80.400	M	4.67	0.548
	5	1,122.000	1.308	0.923	0.328	74.700	M	1.29	0.319
	∑	**6,215.200**						**61.66**	**11.510**
#14	1	405.900	0.384	0.000	0.000	90.800	M	81.84	5.970
	2	411.100	0.452	0.707	0.308	90.700	M	74.57	5.964
	3	787.400	0.658	0.975	0.307	91.400	M	126.78	12.610
	4	144.200	0.341	1.716	0.310	86.200	M	13.94	1.064
	5	343.800	0.289	1.970	0.312	86.500	M	38.50	2.659
	6	392.800	0.806	2.107	0.316	81.900	M	8.49	1.301
	7	528.200	0.518	2.544	0.316	87.200	M	48.43	4.560
	8	890.900	1.253	2.544	0.316	83.500	M	22.13	4.068
	9	741.400	1.076	3.047	0.316	84.800	M	26.61	4.293
	10	451.100	0.916	3.354	0.316	83.900	M	14.69	2.221
	∑	**11,312.000**						**166.07**	**56.222**
#16	1	329.600	0.641	0.000	0.000	93.000	M	68.96	6.584
	2	348.400	0.542	0.509	0.286	92.500	M	74.85	6.493
	3	198.500	0.266	0.943	0.279	93.000	M	64.31	3.984
	∑	**14,181.200**						**302.67**	**94.568**
#20	1	296.300	0.667	0.000	0.000	91.700	M	49.57	4.948
	2	385.600	0.713	0.476	0.440	93.000	M	75.43	7.699
	∑	**15,893.800**						**327.56**	**120.968**
#22	**∑**	**29,385.600**						**870.59**	**291.351**
#23	1	442.400	0.960	0.000	0.000	85.300	M	18.91	2.793
	2	310.500	0.538	0.559	0.291	89.500	M	41.66	3.791
	∑	**30,138.500**						**867.57**	**297.934**
#35	**∑**	**48,329.700**						**1,063.48**	**378.052**
#36	1	298.200	0.987	0.000	0.000	85.000	M	11.77	1.788
	2	196.800	0.441	0.000	0.000	87.900	M	22.54	1.893
	3	235.590	0.885	0.166	0.372	78.300	M	1.65	0.313

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**49,060.290**						**1,061.94**	**382.046**
#37	1	744.000	1.756	0.000	0.000	84.800	M	19.52	4.306
	2	296.000	0.439	1.780	0.243	87.800	M	33.37	2.805
	3	237.700	0.333	1.649	0.246	85.500	M	20.26	1.561
	4	561.400	1.502	1.780	0.243	84.100	M	14.17	2.866
	5	369.400	0.817	2.236	0.284	81.600	M	7.35	1.147
	Σ	**51,268.790**						**1,055.02**	**394.731**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#30	1	0.095	200.00	3.80	0.3720	1.0000	2	0.1	3,489	2.23	1.76
	Σ							**0.1**	**3,489**	**2.23**	**1.76**
#28	1	0.187	100.00	10.10	0.3750	1.0000	3	555.9	52,723	0.00	0.00
	2	0.196	100.00	10.20	0.3930	1.0000	3	348.4	58,373	0.00	0.00
	Σ							**739.9**	**45,906**	**0.00**	**0.00**
#26	1	0.155	400.00	1.40	0.3480	1.0000	2	0.2	2,448	1.53	1.18
	2	0.155	300.00	2.40	0.3340	1.0000	2	7.8	4,238	2.26	1.74
	Σ							**8.0**	**4,125**	**2.21**	**1.71**
#24	1	0.128	300.00	2.30	0.3360	1.0000	2	2.7	2,661	1.33	1.00
	2	0.136	300.00	2.70	0.3440	1.0000	2	2.3	3,360	1.86	1.39
	3	0.107	300.00	2.30	0.3330	1.0000	2	3.3	2,811	1.56	1.23
	4	0.163	400.00	1.60	0.3210	1.0000	2	3.9	3,194	1.73	1.35
	Σ							**9.6**	**3,240**	**1.51**	**0.84**
#25	1	0.125	400.00	1.90	0.3440	1.0000	2	2.6	3,677	1.96	1.55
	2	0.124	300.00	2.60	0.3280	1.0000	2	0.7	3,754	2.08	1.63
	3	0.122	175.00	4.90	0.2660	1.0000	2	28.7	12,170	6.76	4.66
	Σ							**39.4**	**12,153**	**6.31**	**2.07**
#27	1	0.127	175.00	5.90	0.3160	1.0000	2	20.7	13,801	7.09	5.20
	2	0.122	150.00	7.50	0.2920	1.0000	2	23.8	15,793	8.49	6.12
	3	0.070	125.00	8.40	0.3270	1.0000	2	0.7	4,438	2.66	2.32
	4	0.097	125.00	9.60	0.3170	1.0000	2	6.0	12,370	6.54	5.00
	5	0.126	125.00	8.90	0.3290	1.0000	2	35.7	16,624	7.78	5.85
	Σ							**134.0**	**17,591**	**8.96**	**3.39**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#29	1	0.190	125.00	9.80	0.3930	1.0000	3	387.3	64,968	0.38	0.26
	2	0.203	125.00	8.90	0.3940	1.0000	3	197.0	53,216	0.00	0.00
	3	0.193	125.00	8.40	0.3940	1.0000	3	129.6	47,000	0.00	0.00
	Σ							**1,587.3**	**54,538**	**2.41**	**1.14**
#32	1	0.210	150.00	7.70	0.3990	1.0000	3	289.6	51,320	0.00	0.00
	Σ							**1,694.8**	**49,619**	**0.00**	**0.00**
#31	1	0.204	125.00	8.70	0.3620	1.0000	3	329.8	48,526	0.00	0.00
	2	0.210	150.00	7.30	0.3990	1.0000	3	338.0	54,451	1.63	1.12
	3	0.210	175.00	4.50	0.3980	1.0000	3	136.5	37,227	1.56	1.06
	Σ							**610.8**	**34,117**	**0.32**	**0.24**
#33	Σ							**2,305.6**	**39,263**	**0.10**	**0.06**
#34	1	0.189	175.00	4.60	0.2250	1.0000	3	29.8	18,628	1.29	0.90
	2	0.206	175.00	5.10	0.3620	1.0000	3	73.8	36,250	2.51	1.76
	3	0.176	175.00	4.20	0.2510	1.0000	3	111.6	13,883	0.00	0.00
	Σ							**2,205.4**	**32,513**	**0.05**	**0.03**
#5	1	0.149	75.00	12.50	0.3230	1.0000	3	165.7	37,263	0.00	0.00
	2	0.133	75.00	15.80	0.3190	1.0000	2	102.5	45,635	26.07	18.02
	3	0.103	100.00	11.00	0.2030	1.0000	3	78.2	20,017	0.17	0.12
	4	0.093	75.00	13.80	0.2130	1.0000	2	20.6	19,161	11.51	7.80
	5	0.123	100.00	11.00	0.1370	1.0000	3	80.0	16,445	0.58	0.40
	6	0.149	75.00	14.70	0.1990	1.0000	3	98.7	35,948	1.74	1.20
	Σ							**462.4**	**32,307**	**2.05**	**1.05**
#6	1	0.208	175.00	4.30	0.3980	1.0000	3	91.6	35,102	1.73	1.16
	2	0.183	175.00	5.40	0.3910	1.0000	3	69.3	29,853	0.00	0.00
	3	0.188	150.00	7.60	0.3900	1.0000	3	141.7	44,004	0.00	0.00
	4	0.210	150.00	6.30	0.3990	1.0000	3	135.6	42,816	1.77	1.28
	5	0.185	125.00	8.10	0.3860	1.0000	3	99.0	41,472	0.28	0.20
	6	0.104	100.00	11.30	0.2240	1.0000	3	69.9	20,288	0.00	0.00
	7	0.164	100.00	11.20	0.3740	1.0000	3	98.6	44,820	0.00	0.00
	Σ							**934.0**	**28,405**	**0.14**	**0.08**
#7	1	0.208	150.00	7.80	0.3780	1.0000	3	568.9	38,847	0.00	0.00
	2	0.209	100.00	10.20	0.3940	1.0000	3	464.2	52,246	0.00	0.00
	3	0.210	150.00	6.70	0.3990	1.0000	3	205.7	38,872	0.00	0.00
	4	0.210	100.00	11.50	0.3990	1.0000	3	122.7	79,219	5.29	3.71
	5	0.210	150.00	7.10	0.3990	1.0000	3	156.1	51,819	2.96	2.08
	6	0.209	150.00	7.90	0.3990	1.0000	3	107.1	54,958	3.37	2.37
	7	0.206	75.00	15.50	0.3990	1.0000	3	201.7	96,052	5.25	3.72

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	8	0.202	75.00	14.50	0.3980	1.0000	3	669.7	85,902	0.00	0.00
	Σ							**2,914.9**	**36,696**	**0.00**	**0.00**
#8	1	0.000	0.00	0.00	0.0000	1.0000	0	0.0	1	0.00	0.00
	Σ							**2,914.9**	**36,696**	**0.00**	**0.00**
#10	1	0.190	300.00	2.70	0.1930	1.0000	3	46.3	6,587	0.00	0.00
	2	0.153	200.00	3.50	0.3610	1.0000	2	10.6	7,825	3.48	2.62
	3	0.189	200.00	3.70	0.3190	1.0000	3	22.9	10,906	0.00	0.00
	4	0.190	300.00	2.10	0.1940	1.0000	3	15.6	6,459	0.00	0.00
	5	0.201	300.00	2.00	0.3030	1.0000	3	17.5	7,554	0.00	0.00
	Σ							**2,888.5**	**33,288**	**0.04**	**0.03**
#1	1	0.157	150.00	6.80	0.3830	1.0000	2	54.3	20,582	9.89	7.35
	2	0.210	150.00	6.60	0.3990	1.0000	3	91.1	26,615	0.00	0.00
	3	0.149	200.00	3.90	0.3870	1.0000	2	14.2	7,833	3.10	2.38
	4	0.169	175.00	4.70	0.3950	1.0000	2	19.1	16,624	8.23	6.06
	5	0.157	100.00	10.10	0.3940	1.0000	2	6.6	28,074	15.42	11.39
	6	0.175	75.00	12.60	0.2840	1.0000	3	290.9	39,015	0.00	0.00
	Σ							**452.6**	**29,702**	**2.57**	**1.72**
#2	1	0.190	150.00	7.90	0.1930	1.0000	3	123.1	25,644	0.82	0.56
	2	0.184	175.00	4.80	0.2010	1.0000	3	42.3	14,436	0.00	0.00
	3	0.202	200.00	3.90	0.3220	1.0000	3	68.3	17,482	0.00	0.00
	4	0.203	150.00	7.40	0.3220	1.0000	3	301.9	34,875	0.00	0.00
	5	0.181	175.00	5.10	0.3710	1.0000	3	81.0	19,571	0.00	0.00
	Σ							**776.1**	**20,475**	**0.10**	**0.07**
#3	1	0.190	175.00	5.20	0.1930	1.0000	3	56.3	17,538	0.48	0.33
	2	0.177	175.00	4.20	0.2560	1.0000	3	43.6	12,816	0.00	0.00
	3	0.166	175.00	4.30	0.2290	1.0000	3	43.8	12,524	0.00	0.00
	Σ							**899.7**	**17,142**	**0.03**	**0.02**
#4	Σ							**899.7**	**17,142**	**0.03**	**0.02**
#9	1	0.189	175.00	4.44	0.1970	1.0000	3	74.9	12,497	0.00	0.00
	Σ							**914.0**	**14,897**	**0.00**	**0.00**
#11	Σ							**3,802.5**	**27,497**	**0.01**	**0.01**
#21	1	0.177	175.00	4.44	0.2560	1.0000	3	28.1	12,793	0.00	0.00
	2	0.184	175.00	5.81	0.2210	1.0000	3	53.4	20,771	0.18	0.13
	3	0.185	300.00	2.70	0.2180	1.0000	3	30.0	10,952	0.56	0.39
	4	0.175	300.00	2.66	0.2690	1.0000	3	22.1	7,715	0.00	0.00
	Σ							**3,862.9**	**26,737**	**0.00**	**0.00**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#18	1	0.193	300.00	2.80	0.2200	1.0000	3	59.6	10,362	0.00	0.00
	2	0.173	175.00	4.70	0.3880	1.0000	3	86.9	21,485	0.00	0.00
	Σ							**89.4**	**9,383**	**0.00**	**0.00**
#17	1	0.196	300.00	2.60	0.2600	1.0000	3	42.5	12,532	0.29	0.20
	Σ							**42.5**	**12,532**	**0.29**	**0.20**
#19	Σ							**132.0**	**8,986**	**0.07**	**0.05**
#15	1	0.201	125.00	8.20	0.3960	1.0000	3	284.0	41,954	0.00	0.00
	2	0.161	100.00	11.40	0.3060	1.0000	3	372.2	43,886	0.00	0.00
	3	0.118	100.00	10.20	0.2850	1.0000	2	104.7	18,046	8.67	6.42
	Σ							**666.2**	**35,689**	**0.30**	**0.19**
#12	1	0.124	150.00	6.30	0.3070	1.0000	2	20.4	11,661	5.67	4.23
	2	0.132	200.00	3.60	0.3500	1.0000	2	3.5	6,903	3.51	2.63
	3	0.136	175.00	5.00	0.3330	1.0000	2	22.6	12,336	6.09	4.54
	4	0.188	200.00	3.40	0.3570	1.0000	2	11.0	7,280	4.16	3.35
	5	0.228	175.00	4.10	0.3640	1.0000	2	12.6	16,394	8.29	6.26
	Σ							**64.8**	**10,798**	**5.21**	**3.74**
#13	1	0.128	150.00	6.90	0.3390	1.0000	2	10.6	12,556	6.27	4.76
	2	0.130	175.00	5.70	0.3300	1.0000	2	20.5	12,360	6.02	4.53
	3	0.191	175.00	6.00	0.2890	1.0000	2	46.2	22,620	12.32	8.80
	4	0.122	175.00	5.10	0.3460	1.0000	2	6.4	11,408	6.15	4.62
	5	0.137	175.00	4.20	0.3530	1.0000	2	2.2	6,078	3.78	3.16
	Σ							**150.5**	**14,172**	**7.19**	**4.86**
#14	1	0.196	100.00	10.20	0.3980	1.0000	3	390.8	70,290	1.68	1.13
	2	0.193	150.00	6.70	0.4020	1.0000	3	254.4	44,287	0.26	0.18
	3	0.169	75.00	13.80	0.3240	1.0000	3	675.2	54,052	0.00	0.00
	4	0.114	100.00	11.00	0.2980	1.0000	3	26.7	25,596	0.00	0.00
	5	0.078	100.00	10.10	0.1830	1.0000	3	29.3	11,302	0.14	0.10
	6	0.084	150.00	7.10	0.2700	1.0000	2	9.9	7,446	3.61	2.71
	7	0.087	100.00	10.00	0.1840	1.0000	3	48.3	10,687	0.00	0.00
	8	0.126	150.00	6.70	0.2740	1.0000	2	46.3	11,063	4.96	3.74
	9	0.117	150.00	7.30	0.2600	1.0000	2	50.6	11,548	5.49	4.11
	10	0.115	125.00	8.50	0.2610	1.0000	2	27.1	11,936	5.79	4.34
	Σ							**1,310.1**	**62,956**	**0.45**	**0.12**
#16	1	0.200	200.00	3.30	0.3000	1.0000	3	96.3	15,320	0.00	0.00
	2	0.204	150.00	6.00	0.3630	1.0000	3	229.8	36,609	0.07	0.05
	3	0.210	150.00	6.10	0.3990	1.0000	3	184.0	47,468	3.18	2.24
	Σ							**2,485.3**	**41,640**	**0.46**	**0.21**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#20	1	0.186	175.00	4.80	0.2130	1.0000	3	73.2	15,471	0.00	0.00
	2	0.194	200.00	3.80	0.2330	1.0000	3	94.9	12,766	0.00	0.00
	Σ							**2,763.2**	**31,815**	**0.24**	**0.12**
#22	Σ							**6,626.1**	**27,392**	**0.08**	**0.05**
#23	1	0.172	175.00	4.20	0.2810	1.0000	3	33.4	11,905	0.00	0.00
	2	0.185	150.00	6.00	0.2160	1.0000	3	66.0	18,149	0.00	0.00
	Σ							**6,609.5**	**26,955**	**0.00**	**0.00**
#35	Σ							**8,814.9**	**25,656**	**0.01**	**0.01**
#36	1	0.190	175.00	5.94	0.2830	1.0000	3	30.8	17,048	0.00	0.00
	2	0.180	125.00	9.92	0.2410	1.0000	3	57.7	32,827	0.00	0.00
	3	0.151	300.00	2.63	0.3890	1.0000	2	1.9	5,825	3.11	2.43
	Σ							**8,845.9**	**29,111**	**0.00**	**0.00**
#37	1	0.196	200.00	3.80	0.3980	1.0000	2	55.5	12,520	5.18	3.91
	2	0.193	175.00	5.40	0.4020	1.0000	3	93.4	33,384	0.00	0.00
	3	0.173	150.00	7.11	0.2770	1.0000	3	37.8	24,351	0.00	0.00
	4	0.171	150.00	6.52	0.2990	1.0000	2	42.8	14,476	6.23	4.70
	5	0.078	400.00	1.20	0.1830	1.0000	2	1.2	1,055	0.51	0.39
	Σ							**8,889.8**	**26,564**	**0.12**	**0.07**

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	3.65	50.00	1,369.00	1.910	0.199
		8. Large gullies, diversions, and low flowing streams	1.57	157.00	10,030.00	3.750	0.742
#1	**1**	**Time of Concentration:**					**0.941**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	6.63	70.00	1,056.00	2.570	0.114
		5. Nearly bare and untilled, and alluvial valley fans	1.98	150.00	7,573.00	1.400	1.502
#1	**2**	**Time of Concentration:**					**1.616**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	1.65	117.00	7,070.00	1.280	1.534
		8. Large gullies, diversions, and low flowing streams	2.43	126.00	5,188.00	4.670	0.308
#1	**3**	**Time of Concentration:**					**1.842**
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.77	260.00	4,506.00	2.400	0.521

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.84	168.00	5,924.00	5.050	0.325
#1	**4**	**Time of Concentration:**					**0.846**
#1	5	5. Nearly bare and untilled, and alluvial valley fans	19.93	180.00	903.00	4.460	0.056
		8. Large gullies, diversions, and low flowing streams	3.30	178.00	5,393.00	5.450	0.274
#1	**5**	**Time of Concentration:**					**0.330**
#1	6	5. Nearly bare and untilled, and alluvial valley fans	13.43	105.00	782.00	3.660	0.059
		8. Large gullies, diversions, and low flowing streams	2.62	283.00	10,822.00	4.850	0.619
#1	**6**	**Time of Concentration:**					**0.678**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.84	70.00	1,024.00	2.610	0.108
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,325.00	3.810	0.315
#2	**1**	**Time of Concentration:**					**0.423**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	5.56	45.00	810.00	2.350	0.095
		8. Large gullies, diversions, and low flowing streams	0.86	40.00	4,663.00	2.770	0.467
#2	**2**	**Time of Concentration:**					**0.562**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	5.89	50.00	849.00	2.420	0.097
		8. Large gullies, diversions, and low flowing streams	1.17	80.00	6,862.00	3.230	0.590
#2	**3**	**Time of Concentration:**					**0.687**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	12.63	95.00	752.00	3.550	0.058
		8. Large gullies, diversions, and low flowing streams	1.40	135.00	9,630.00	3.550	0.753
#2	**4**	**Time of Concentration:**					**0.811**
#2	5	5. Nearly bare and untilled, and alluvial valley fans	11.02	70.00	635.00	3.320	0.053
		8. Large gullies, diversions, and low flowing streams	0.46	40.00	8,732.00	2.030	1.194
#2	**5**	**Time of Concentration:**					**1.247**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	10.00	805.00	1.110	0.201
		8. Large gullies, diversions, and low flowing streams	1.33	40.00	3,017.00	3.450	0.242
#3	**1**	**Time of Concentration:**					**0.443**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.68	10.00	1,478.00	0.820	0.500
		8. Large gullies, diversions, and low flowing streams	1.78	100.00	5,622.00	4.000	0.390
#3	**2**	**Time of Concentration:**					**0.890**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	3	5. Nearly bare and untilled, and alluvial valley fans	4.66	70.00	1,501.00	2.150	0.193
		8. Large gullies, diversions, and low flowing streams	1.17	60.00	5,126.00	3.240	0.439
#3	**3**	**Time of Concentration:**					**0.632**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	19.06	285.00	1,495.00	4.360	0.095
		8. Large gullies, diversions, and low flowing streams	2.64	242.00	9,174.00	4.870	0.523
#5	**1**	**Time of Concentration:**					**0.618**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	14.27	105.00	736.00	3.770	0.054
		8. Large gullies, diversions, and low flowing streams	4.08	297.00	7,279.00	6.050	0.334
#5	**2**	**Time of Concentration:**					**0.388**
#5	3	5. Nearly bare and untilled, and alluvial valley fans	8.27	35.00	423.00	2.870	0.040
		8. Large gullies, diversions, and low flowing streams	3.44	208.00	6,049.00	5.560	0.302
#5	**3**	**Time of Concentration:**					**0.342**
#5	4	5. Nearly bare and untilled, and alluvial valley fans	14.58	85.00	583.00	3.810	0.042
		8. Large gullies, diversions, and low flowing streams	4.53	248.00	5,473.00	6.380	0.238
#5	**4**	**Time of Concentration:**					**0.280**
#5	5	5. Nearly bare and untilled, and alluvial valley fans	5.07	70.00	1,382.00	2.250	0.170
		8. Large gullies, diversions, and low flowing streams	3.89	170.00	4,375.00	5.910	0.205
#5	**5**	**Time of Concentration:**					**0.375**
#5	6	5. Nearly bare and untilled, and alluvial valley fans	12.48	90.00	721.00	3.530	0.056
		8. Large gullies, diversions, and low flowing streams	5.16	274.00	5,308.02	6.810	0.216
#5	**6**	**Time of Concentration:**					**0.272**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	5.36	75.00	1,399.00	2.310	0.168
		8. Large gullies, diversions, and low flowing streams	2.41	66.00	2,742.00	4.650	0.163
#6	**1**	**Time of Concentration:**					**0.331**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.39	80.00	2,359.00	1.840	0.356
		8. Large gullies, diversions, and low flowing streams	2.63	80.00	3,039.00	4.860	0.173
#6	**2**	**Time of Concentration:**					**0.529**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	4.60	34.00	739.00	2.140	0.095
		8. Large gullies, diversions, and low flowing streams	2.33	136.00	5,845.00	4.570	0.355

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	**3**	**Time of Concentration:**					**0.450**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	6.06	85.00	1,402.00	2.460	0.158
		8. Large gullies, diversions, and low flowing streams	2.52	96.00	3,810.00	4.760	0.222
#6	**4**	**Time of Concentration:**					**0.380**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	7.24	70.00	967.00	2.690	0.099
		8. Large gullies, diversions, and low flowing streams	2.34	117.00	5,003.00	4.580	0.303
#6	**5**	**Time of Concentration:**					**0.402**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	31.83	183.00	575.00	5.640	0.028
		8. Large gullies, diversions, and low flowing streams	3.38	270.00	7,990.00	5.510	0.402
#6	**6**	**Time of Concentration:**					**0.430**
#6	7	5. Nearly bare and untilled, and alluvial valley fans	23.08	325.00	1,408.00	4.800	0.081
		8. Large gullies, diversions, and low flowing streams	2.88	240.00	8,327.00	5.090	0.454
#6	**7**	**Time of Concentration:**					**0.535**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	11.42	90.00	788.00	3.370	0.064
		8. Large gullies, diversions, and low flowing streams	1.46	230.00	15,769.00	3.620	1.210
#7	**1**	**Time of Concentration:**					**1.274**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	10.97	60.00	547.00	3.310	0.045
		8. Large gullies, diversions, and low flowing streams	1.61	220.00	13,660.00	3.800	0.998
#7	**2**	**Time of Concentration:**					**1.043**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	938.00	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.72	171.00	9,931.00	3.930	0.701
#7	**3**	**Time of Concentration:**					**0.804**
#7	4	5. Nearly bare and untilled, and alluvial valley fans	19.23	80.00	416.00	4.380	0.026
		8. Large gullies, diversions, and low flowing streams	2.45	100.00	4,083.00	4.690	0.241
#7	**4**	**Time of Concentration:**					**0.267**
#7	5	5. Nearly bare and untilled, and alluvial valley fans	6.09	67.00	1,101.00	2.460	0.124
		8. Large gullies, diversions, and low flowing streams	2.51	80.00	3,184.00	4.750	0.186
#7	**5**	**Time of Concentration:**					**0.310**
#7	6	5. Nearly bare and untilled, and alluvial valley fans	5.93	63.00	1,062.00	2.430	0.121

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.74	82.00	2,993.00	4.960	0.167
#7	**6**	**Time of Concentration:**					**0.288**
#7	7	5. Nearly bare and untilled, and alluvial valley fans	7.97	65.00	816.00	2.820	0.080
		8. Large gullies, diversions, and low flowing streams	3.48	153.00	4,400.00	5.590	0.218
#7	**7**	**Time of Concentration:**					**0.298**
#7	8	5. Nearly bare and untilled, and alluvial valley fans	6.60	50.00	758.00	2.560	0.082
		8. Large gullies, diversions, and low flowing streams	4.66	473.00	10,157.00	6.470	0.436
#7	**8**	**Time of Concentration:**					**0.518**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	3.35	90.00	2,687.00	1.830	0.407
		8. Large gullies, diversions, and low flowing streams	0.58	20.00	3,463.00	2.270	0.423
#9	**1**	**Time of Concentration:**					**0.830**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	41.00	3,317.00	1.110	0.830
		8. Large gullies, diversions, and low flowing streams	0.70	29.00	4,125.00	2.510	0.456
#10	**1**	**Time of Concentration:**					**1.286**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	2.25	125.00	5,554.00	1.500	1.028
		8. Large gullies, diversions, and low flowing streams	2.13	85.00	3,997.00	4.370	0.254
#10	**2**	**Time of Concentration:**					**1.282**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.39	68.00	4,904.00	1.170	1.164
		8. Large gullies, diversions, and low flowing streams	4.73	90.00	1,904.00	6.520	0.081
#10	**3**	**Time of Concentration:**					**1.245**
#10	4	5. Nearly bare and untilled, and alluvial valley fans	3.76	51.00	1,357.00	1.930	0.195
		8. Large gullies, diversions, and low flowing streams	0.65	22.00	3,385.00	2.410	0.390
#10	**4**	**Time of Concentration:**					**0.585**
#10	5	5. Nearly bare and untilled, and alluvial valley fans	1.63	88.00	5,391.16	1.270	1.179
#10	**5**	**Time of Concentration:**					**1.179**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	4.50	75.00	1,667.00	2.120	0.218
		8. Large gullies, diversions, and low flowing streams	1.85	155.00	8,400.00	4.070	0.573
#12	**1**	**Time of Concentration:**					**0.791**
#12	2	5. Nearly bare and untilled, and alluvial valley fans	2.99	50.00	1,674.03	1.720	0.270

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.67	70.00	4,201.17	3.870	0.301
#12	**2**	**Time of Concentration:**					**0.571**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	4.04	57.00	1,411.00	2.000	0.195
		8. Large gullies, diversions, and low flowing streams	1.55	107.00	6,884.00	3.740	0.511
#12	**3**	**Time of Concentration:**					**0.706**
#12	4	5. Nearly bare and untilled, and alluvial valley fans	2.23	84.00	3,771.04	1.490	0.703
		8. Large gullies, diversions, and low flowing streams	1.62	186.00	11,515.60	3.810	0.839
#12	**4**	**Time of Concentration:**					**1.542**
#12	5	5. Nearly bare and untilled, and alluvial valley fans	3.68	53.00	1,442.00	1.910	0.209
		8. Large gullies, diversions, and low flowing streams	1.95	120.00	6,155.00	4.180	0.409
#12	**5**	**Time of Concentration:**					**0.618**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	4.62	62.00	1,342.00	2.140	0.174
		8. Large gullies, diversions, and low flowing streams	1.91	157.00	8,225.00	4.140	0.551
#13	**1**	**Time of Concentration:**					**0.725**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	2.91	50.00	1,717.00	1.700	0.280
		8. Large gullies, diversions, and low flowing streams	2.28	183.00	8,039.00	4.520	0.494
#13	**2**	**Time of Concentration:**					**0.774**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	6.18	95.00	1,537.00	2.480	0.172
		8. Large gullies, diversions, and low flowing streams	2.13	135.00	6,347.00	4.370	0.403
#13	**3**	**Time of Concentration:**					**0.575**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.17	10.00	315.00	1.780	0.049
		8. Large gullies, diversions, and low flowing streams	2.30	100.00	4,344.00	4.550	0.265
#13	**4**	**Time of Concentration:**					**0.314**
#13	5	5. Nearly bare and untilled, and alluvial valley fans	3.10	70.00	2,255.00	1.760	0.355
		8. Large gullies, diversions, and low flowing streams	1.23	140.00	11,392.00	3.320	0.953
#13	**5**	**Time of Concentration:**					**1.308**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	10.59	63.00	595.00	3.250	0.050
		8. Large gullies, diversions, and low flowing streams	2.60	151.00	5,808.00	4.830	0.334
#14	**1**	**Time of Concentration:**					**0.384**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	2	5. Nearly bare and untilled, and alluvial valley fans	7.28	67.00	920.00	2.690	0.095
		8. Large gullies, diversions, and low flowing streams	2.17	123.00	5,670.00	4.410	0.357
#14	**2**	**Time of Concentration:**					**0.452**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	21.46	150.00	699.00	4.630	0.041
		8. Large gullies, diversions, and low flowing streams	3.10	364.00	11,728.00	5.280	0.617
#14	**3**	**Time of Concentration:**					**0.658**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	3.39	35.00	1,032.00	1.840	0.155
		8. Large gullies, diversions, and low flowing streams	2.97	103.00	3,470.00	5.160	0.186
#14	**4**	**Time of Concentration:**					**0.341**
#14	5	5. Nearly bare and untilled, and alluvial valley fans	28.15	125.00	444.00	5.300	0.023
		8. Large gullies, diversions, and low flowing streams	4.18	246.00	5,886.00	6.130	0.266
#14	**5**	**Time of Concentration:**					**0.289**
#14	6	5. Nearly bare and untilled, and alluvial valley fans	3.18	40.00	1,257.00	1.780	0.196
		8. Large gullies, diversions, and low flowing streams	2.29	228.00	9,963.00	4.530	0.610
#14	**6**	**Time of Concentration:**					**0.806**
#14	7	5. Nearly bare and untilled, and alluvial valley fans	16.72	100.00	598.00	4.080	0.040
		8. Large gullies, diversions, and low flowing streams	2.81	243.00	8,649.00	5.020	0.478
#14	**7**	**Time of Concentration:**					**0.518**
#14	8	5. Nearly bare and untilled, and alluvial valley fans	1.70	47.00	2,765.00	1.300	0.590
		8. Large gullies, diversions, and low flowing streams	2.44	274.00	11,208.00	4.690	0.663
#14	**8**	**Time of Concentration:**					**1.253**
#14	9	5. Nearly bare and untilled, and alluvial valley fans	2.87	105.00	3,657.00	1.690	0.601
		8. Large gullies, diversions, and low flowing streams	2.43	194.00	7,991.00	4.670	0.475
#14	**9**	**Time of Concentration:**					**1.076**
#14	10	5. Nearly bare and untilled, and alluvial valley fans	2.75	80.00	2,907.00	1.650	0.489
		8. Large gullies, diversions, and low flowing streams	2.41	172.00	7,149.00	4.650	0.427
#14	**10**	**Time of Concentration:**					**0.916**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	12.80	54.00	422.00	3.570	0.032
		8. Large gullies, diversions, and low flowing streams	1.68	181.00	10,781.00	3.880	0.771

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#15	**1**	**Time of Concentration:**					**0.803**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	44.22	260.00	588.00	6.640	0.024
		8. Large gullies, diversions, and low flowing streams	2.45	254.00	10,354.00	4.690	0.613
#15	**2**	**Time of Concentration:**					**0.637**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	10.04	85.00	847.00	3.160	0.074
		8. Large gullies, diversions, and low flowing streams	2.34	366.00	15,663.00	4.580	0.949
#15	**3**	**Time of Concentration:**					**1.023**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	4.17	15.00	360.00	2.040	0.049
		8. Large gullies, diversions, and low flowing streams	1.42	108.00	7,618.00	3.570	0.592
#16	**1**	**Time of Concentration:**					**0.641**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	8.70	62.00	713.00	2.940	0.067
		8. Large gullies, diversions, and low flowing streams	1.99	144.00	7,241.00	4.230	0.475
#16	**2**	**Time of Concentration:**					**0.542**
#16	3	5. Nearly bare and untilled, and alluvial valley fans	6.88	32.00	465.00	2.620	0.049
		8. Large gullies, diversions, and low flowing streams	2.29	81.00	3,543.00	4.530	0.217
#16	**3**	**Time of Concentration:**					**0.266**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	9.37	65.00	694.00	3.060	0.062
		8. Large gullies, diversions, and low flowing streams	1.19	56.00	4,712.00	3.270	0.400
#17	**1**	**Time of Concentration:**					**0.462**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	9.00	60.00	667.00	2.990	0.061
		8. Large gullies, diversions, and low flowing streams	0.97	61.00	6,287.00	2.950	0.591
#18	**1**	**Time of Concentration:**					**0.652**
#18	2	5. Nearly bare and untilled, and alluvial valley fans	2.47	33.00	1,336.00	1.570	0.236
		8. Large gullies, diversions, and low flowing streams	2.01	164.00	8,154.00	4.250	0.532
#18	**2**	**Time of Concentration:**					**0.768**
#20	1	5. Nearly bare and untilled, and alluvial valley fans	11.87	45.00	379.00	3.440	0.030
		8. Large gullies, diversions, and low flowing streams	0.75	45.00	5,969.00	2.600	0.637
#20	**1**	**Time of Concentration:**					**0.667**
#20	2	5. Nearly bare and untilled, and alluvial valley fans	5.40	45.00	833.00	2.320	0.099

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.30	98.00	7,547.00	3.410	0.614
#20	**2**	**Time of Concentration:**					**0.713**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	4.09	60.00	1,467.00	2.020	0.201
		8. Large gullies, diversions, and low flowing streams	0.93	60.00	6,433.00	2.890	0.618
#21	**1**	**Time of Concentration:**					**0.819**
#21	2	5. Nearly bare and untilled, and alluvial valley fans	3.50	50.00	1,430.00	1.860	0.213
		8. Large gullies, diversions, and low flowing streams	2.15	60.00	2,785.00	4.400	0.175
#21	**2**	**Time of Concentration:**					**0.388**
#21	3	5. Nearly bare and untilled, and alluvial valley fans	1.70	15.00	881.00	1.300	0.188
		9. Small streams flowing bankfull	1.49	60.00	4,014.00	11.000	0.101
#21	**3**	**Time of Concentration:**					**0.289**
#21	4	5. Nearly bare and untilled, and alluvial valley fans	2.21	40.00	1,811.02	1.480	0.339
		8. Large gullies, diversions, and low flowing streams	0.84	50.00	5,949.54	2.750	0.600
#21	**4**	**Time of Concentration:**					**0.939**
#23	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	65.00	2,660.01	1.560	0.473
		8. Large gullies, diversions, and low flowing streams	0.33	10.00	3,017.50	1.720	0.487
#23	**1**	**Time of Concentration:**					**0.960**
#23	2	5. Nearly bare and untilled, and alluvial valley fans	3.49	60.00	1,718.01	1.860	0.256
		8. Large gullies, diversions, and low flowing streams	1.66	65.00	3,926.06	3.860	0.282
#23	**2**	**Time of Concentration:**					**0.538**
#24	1	5. Nearly bare and untilled, and alluvial valley fans	1.71	430.00	25,118.00	1.300	5.367
#24	**1**	**Time of Concentration:**					**5.367**
#24	2	5. Nearly bare and untilled, and alluvial valley fans	1.84	430.00	23,393.00	1.350	4.813
#24	**2**	**Time of Concentration:**					**4.813**
#24	3	5. Nearly bare and untilled, and alluvial valley fans	1.82	155.00	8,498.00	1.350	1.748
		8. Large gullies, diversions, and low flowing streams	0.84	40.00	4,771.00	2.740	0.483
#24	**3**	**Time of Concentration:**					**2.231**
#24	4	5. Nearly bare and untilled, and alluvial valley fans	1.24	50.00	4,042.00	1.110	1.011
		8. Large gullies, diversions, and low flowing streams	0.49	60.00	12,150.00	2.100	1.607
#24	**4**	**Time of Concentration:**					**2.618**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#25	1	5. Nearly bare and untilled, and alluvial valley fans	0.51	10.00	1,950.00	0.710	0.762
		8. Large gullies, diversions, and low flowing streams	1.81	60.00	3,322.00	4.030	0.228
#25	**1**	**Time of Concentration:**					**0.990**
#25	2	5. Nearly bare and untilled, and alluvial valley fans	1.11	25.00	2,254.00	1.050	0.596
		8. Large gullies, diversions, and low flowing streams	2.36	75.00	3,178.00	4.600	0.191
#25	**2**	**Time of Concentration:**					**0.787**
#25	3	5. Nearly bare and untilled, and alluvial valley fans	3.23	30.00	929.00	1.790	0.144
		8. Large gullies, diversions, and low flowing streams	2.45	154.00	6,297.00	4.690	0.372
#25	**3**	**Time of Concentration:**					**0.516**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	1.20	103.00	8,602.00	1.090	2.192
#26	**1**	**Time of Concentration:**					**2.192**
#26	2	5. Nearly bare and untilled, and alluvial valley fans	1.23	120.00	9,780.00	1.100	2.469
		8. Large gullies, diversions, and low flowing streams	2.18	184.00	8,454.00	4.420	0.531
#26	**2**	**Time of Concentration:**					**3.000**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.32	50.00	1,158.02	2.070	0.155
		8. Large gullies, diversions, and low flowing streams	2.53	198.00	7,838.16	4.760	0.457
#27	**1**	**Time of Concentration:**					**0.612**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	5.26	30.00	570.00	2.290	0.069
		8. Large gullies, diversions, and low flowing streams	3.15	278.00	8,822.00	5.320	0.460
#27	**2**	**Time of Concentration:**					**0.529**
#27	3	5. Nearly bare and untilled, and alluvial valley fans	16.33	80.00	490.00	4.040	0.033
		8. Large gullies, diversions, and low flowing streams	2.15	225.00	10,443.00	4.400	0.659
#27	**3**	**Time of Concentration:**					**0.692**
#27	4	5. Nearly bare and untilled, and alluvial valley fans	12.43	65.00	523.00	3.520	0.041
		8. Large gullies, diversions, and low flowing streams	3.49	225.00	6,454.00	5.600	0.320
#27	**4**	**Time of Concentration:**					**0.361**
#27	5	5. Nearly bare and untilled, and alluvial valley fans	9.40	25.00	266.00	3.060	0.024
		8. Large gullies, diversions, and low flowing streams	2.32	364.00	15,700.00	4.560	0.956
#27	**5**	**Time of Concentration:**					**0.980**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	40.00	762.00	2.290	0.092
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**1**	**Time of Concentration:**					**0.657**
#28	2	5. Nearly bare and untilled, and alluvial valley fans	25.86	105.00	406.00	5.080	0.022
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**2**	**Time of Concentration:**					**0.587**
#29	1	5. Nearly bare and untilled, and alluvial valley fans	11.58	30.00	259.00	3.400	0.021
		8. Large gullies, diversions, and low flowing streams	3.61	288.00	7,976.00	5.700	0.388
#29	**1**	**Time of Concentration:**					**0.409**
#29	2	5. Nearly bare and untilled, and alluvial valley fans	8.06	40.00	496.00	2.830	0.048
		8. Large gullies, diversions, and low flowing streams	2.90	252.00	8,693.55	5.100	0.473
#29	**2**	**Time of Concentration:**					**0.521**
#29	3	5. Nearly bare and untilled, and alluvial valley fans	7.25	25.00	345.00	2.690	0.035
		8. Large gullies, diversions, and low flowing streams	2.26	158.00	7,001.00	4.500	0.432
#29	**3**	**Time of Concentration:**					**0.467**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	35.00	710.00	2.220	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	243.00	14,540.00	3.870	1.043
#30	**1**	**Time of Concentration:**					**1.131**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.91	15.00	515.00	1.700	0.084
		8. Large gullies, diversions, and low flowing streams	2.74	247.00	9,006.00	4.960	0.504
#31	**1**	**Time of Concentration:**					**0.588**
#31	2	5. Nearly bare and untilled, and alluvial valley fans	7.46	25.00	335.00	2.730	0.034
		8. Large gullies, diversions, and low flowing streams	2.18	138.00	6,335.00	4.420	0.398
#31	**2**	**Time of Concentration:**					**0.432**
#31	3	5. Nearly bare and untilled, and alluvial valley fans	3.84	20.00	521.00	1.950	0.074
		8. Large gullies, diversions, and low flowing streams	2.24	108.00	4,826.00	4.480	0.299
#31	**3**	**Time of Concentration:**					**0.373**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	22.00	632.00	1.860	0.094
		8. Large gullies, diversions, and low flowing streams	1.56	101.00	6,494.00	3.740	0.482

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#32	**1**	**Time of Concentration:**					**0.576**
#34	1	5. Nearly bare and untilled, and alluvial valley fans	3.21	25.00	779.00	1.790	0.120
		8. Large gullies, diversions, and low flowing streams	2.80	63.00	2,251.00	5.010	0.124
#34	**1**	**Time of Concentration:**					**0.244**
#34	2	5. Nearly bare and untilled, and alluvial valley fans	5.75	40.00	696.00	2.390	0.080
		8. Large gullies, diversions, and low flowing streams	23.00	2,100.00	9,130.43	14.380	0.176
#34	**2**	**Time of Concentration:**					**0.256**
#34	3	5. Nearly bare and untilled, and alluvial valley fans	2.67	40.00	1,500.00	1.630	0.255
		8. Large gullies, diversions, and low flowing streams	1.28	98.00	7,675.00	3.380	0.630
#34	**3**	**Time of Concentration:**					**0.885**
#36	1	5. Nearly bare and untilled, and alluvial valley fans	3.21	105.00	3,274.00	1.790	0.508
		8. Large gullies, diversions, and low flowing streams	0.21	5.00	2,367.00	1.370	0.479
#36	**1**	**Time of Concentration:**					**0.987**
#36	2	5. Nearly bare and untilled, and alluvial valley fans	5.50	140.00	2,547.00	2.340	0.302
		8. Large gullies, diversions, and low flowing streams	1.58	30.00	1,897.00	3.770	0.139
#36	**2**	**Time of Concentration:**					**0.441**
#36	3	5. Nearly bare and untilled, and alluvial valley fans	2.03	80.00	3,938.62	1.420	0.770
		8. Large gullies, diversions, and low flowing streams	2.52	50.00	1,981.86	4.760	0.115
#36	**3**	**Time of Concentration:**					**0.885**
#37	1	5. Nearly bare and untilled, and alluvial valley fans	4.68	129.00	2,754.05	2.160	0.354
		8. Large gullies, diversions, and low flowing streams	0.16	10.00	6,108.73	1.210	1.402
#37	**1**	**Time of Concentration:**					**1.756**
#37	2	5. Nearly bare and untilled, and alluvial valley fans	7.32	90.00	1,229.00	2.700	0.126
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,309.01	3.820	0.313
#37	**2**	**Time of Concentration:**					**0.439**
#37	3	5. Nearly bare and untilled, and alluvial valley fans	8.10	100.00	1,234.00	2.840	0.120
		8. Large gullies, diversions, and low flowing streams	2.66	100.00	3,763.21	4.890	0.213
#37	**3**	**Time of Concentration:**					**0.333**
#37	4	5. Nearly bare and untilled, and alluvial valley fans	5.09	90.00	1,768.03	2.250	0.218

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	0.36	30.00	8,326.39	1.800	1.284
#37	**4**	**Time of Concentration:**					**1.502**
#37	5	5. Nearly bare and untilled, and alluvial valley fans	0.81	20.00	2,466.09	0.900	0.761
		8. Large gullies, diversions, and low flowing streams	4.06	50.00	1,231.01	6.040	0.056
#37	**5**	**Time of Concentration:**					**0.817**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	1.29	107.00	8,294.00	3.400	0.677
#1	**2**	**Muskingum K:**					**0.677**
#1	3	8. Large gullies, diversions, and low flowing streams	1.27	113.00	8,880.00	3.380	0.729
#1	**3**	**Muskingum K:**					**0.729**
#1	4	8. Large gullies, diversions, and low flowing streams	1.35	171.00	12,634.00	3.490	1.005
#1	**4**	**Muskingum K:**					**1.005**
#1	5	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**5**	**Muskingum K:**					**1.392**
#1	6	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**6**	**Muskingum K:**					**1.392**
#2	2	8. Large gullies, diversions, and low flowing streams	0.53	20.00	3,756.00	2.180	0.478
#2	**2**	**Muskingum K:**					**0.478**
#2	3	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**3**	**Muskingum K:**					**0.574**
#2	4	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**4**	**Muskingum K:**					**0.574**
#2	5	8. Large gullies, diversions, and low flowing streams	0.65	45.00	6,955.00	2.410	0.801
#2	**5**	**Muskingum K:**					**0.801**
#3	3	8. Large gullies, diversions, and low flowing streams	0.92	20.00	2,168.00	2.880	0.209
#3	**3**	**Muskingum K:**					**0.209**
#5	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#5	**1**	**Muskingum K:**					**0.000**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	2	8. Large gullies, diversions, and low flowing streams	1.75	125.00	7,149.00	3.960	0.501
#5	**2**	**Muskingum K:**					**0.501**
#5	3	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**3**	**Muskingum K:**					**0.681**
#5	4	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**4**	**Muskingum K:**					**0.681**
#5	5	8. Large gullies, diversions, and low flowing streams	1.67	239.00	14,273.00	3.880	1.021
#5	**5**	**Muskingum K:**					**1.021**
#5	6	8. Large gullies, diversions, and low flowing streams	1.68	239.00	14,223.00	3.880	1.018
#5	**6**	**Muskingum K:**					**1.018**
#6	2	8. Large gullies, diversions, and low flowing streams	1.16	26.00	2,241.00	3.230	0.192
#6	**2**	**Muskingum K:**					**0.192**
#6	3	8. Large gullies, diversions, and low flowing streams	1.00	50.00	4,987.00	3.000	0.461
#6	**3**	**Muskingum K:**					**0.461**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	1.00	50.00	4,987.00	1.000	1.385
#6	**4**	**Muskingum K:**					**1.385**
#6	5	8. Large gullies, diversions, and low flowing streams	1.02	89.00	8,685.00	3.030	0.796
#6	**5**	**Muskingum K:**					**0.796**
#6	6	8. Large gullies, diversions, and low flowing streams	1.06	126.00	11,860.00	3.090	1.066
#6	**6**	**Muskingum K:**					**1.066**
#6	7	8. Large gullies, diversions, and low flowing streams	1.06	126.00	11,860.00	3.090	1.066
#6	**7**	**Muskingum K:**					**1.066**
#7	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**1**	**Muskingum K:**					**0.000**
#7	2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**2**	**Muskingum K:**					**0.000**
#7	4	8. Large gullies, diversions, and low flowing streams	1.16	140.00	12,037.00	3.230	1.035
#7	**4**	**Muskingum K:**					**1.035**
#7	5	8. Large gullies, diversions, and low flowing streams	1.14	140.00	12,307.69	3.190	1.071
#7	**5**	**Muskingum K:**					**1.071**
#7	6	8. Large gullies, diversions, and low flowing streams	1.17	158.00	13,546.00	3.230	1.164
#7	**6**	**Muskingum K:**					**1.164**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	7	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**7**	**Muskingum K:**					**1.344**
#7	8	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**8**	**Muskingum K:**					**1.344**
#10	3	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**3**	**Muskingum K:**					**0.517**
#10	4	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**4**	**Muskingum K:**					**0.517**
#10	5	8. Large gullies, diversions, and low flowing streams	0.79	47.00	5,956.00	2.660	0.621
#10	**5**	**Muskingum K:**					**0.621**
#12	2	8. Large gullies, diversions, and low flowing streams	8.24	111.00	1,347.00	8.610	0.043
#12	**2**	**Muskingum K:**					**0.043**
#12	3	8. Large gullies, diversions, and low flowing streams	8.01	109.00	1,360.00	8.490	0.044
#12	**3**	**Muskingum K:**					**0.044**
#12	4	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**4**	**Muskingum K:**					**0.487**
#12	5	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**5**	**Muskingum K:**					**0.487**
#13	2	8. Large gullies, diversions, and low flowing streams	1.34	54.00	4,025.00	3.470	0.322
#13	**2**	**Muskingum K:**					**0.322**
#13	3	8. Large gullies, diversions, and low flowing streams	0.98	72.00	7,333.00	2.970	0.685
#13	**3**	**Muskingum K:**					**0.685**
#13	4	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**4**	**Muskingum K:**					**0.923**
#13	5	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**5**	**Muskingum K:**					**0.923**
#14	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#14	**1**	**Muskingum K:**					**0.000**
#14	2	8. Large gullies, diversions, and low flowing streams	0.83	58.00	6,957.00	2.730	0.707
#14	**2**	**Muskingum K:**					**0.707**
#14	3	8. Large gullies, diversions, and low flowing streams	0.81	77.00	9,480.00	2.700	0.975
#14	**3**	**Muskingum K:**					**0.975**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	4	8. Large gullies, diversions, and low flowing streams	0.86	147.00	17,117.00	2.770	1.716
#14	**4**	**Muskingum K:**					**1.716**
#14	5	8. Large gullies, diversions, and low flowing streams	0.88	175.00	19,934.00	2.810	1.970
#14	**5**	**Muskingum K:**					**1.970**
#14	6	8. Large gullies, diversions, and low flowing streams	0.95	211.00	22,155.00	2.920	2.107
#14	**6**	**Muskingum K:**					**2.107**
#14	7	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**7**	**Muskingum K:**					**2.544**
#14	8	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**8**	**Muskingum K:**					**2.544**
#14	9	8. Large gullies, diversions, and low flowing streams	0.95	307.00	32,146.59	2.930	3.047
#14	**9**	**Muskingum K:**					**3.047**
#14	10	8. Large gullies, diversions, and low flowing streams	0.96	339.00	35,382.00	2.930	3.354
#14	**10**	**Muskingum K:**					**3.354**
#15	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#15	**1**	**Muskingum K:**					**0.000**
#15	2	8. Large gullies, diversions, and low flowing streams	1.14	86.00	7,535.00	3.200	0.654
#15	**2**	**Muskingum K:**					**0.654**
#15	3	8. Large gullies, diversions, and low flowing streams	1.25	115.00	9,236.00	3.340	0.768
#15	**3**	**Muskingum K:**					**0.768**
#16	2	8. Large gullies, diversions, and low flowing streams	0.58	24.00	4,161.00	2.270	0.509
#16	**2**	**Muskingum K:**					**0.509**
#16	3	8. Large gullies, diversions, and low flowing streams	0.51	37.00	7,269.00	2.140	0.943
#16	**3**	**Muskingum K:**					**0.943**
#17	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#17	**1**	**Muskingum K:**					**0.000**
#18	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#18	**1**	**Muskingum K:**					**0.000**
#18	2	8. Large gullies, diversions, and low flowing streams	1.02	62.00	6,103.00	3.020	0.561
#18	**2**	**Muskingum K:**					**0.561**
#20	2	8. Large gullies, diversions, and low flowing streams	17.00	3,605.00	21,205.88	12.360	0.476
#20	**2**	**Muskingum K:**					**0.476**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#21	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#21	**1**	**Muskingum K:**					**0.000**
#21	2	8. Large gullies, diversions, and low flowing streams	0.41	20.00	4,824.00	1.930	0.694
#21	**2**	**Muskingum K:**					**0.694**
#21	3	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,626.00	1.780	0.877
#21	**3**	**Muskingum K:**					**0.877**
#21	4	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,626.00	1.780	0.877
#21	**4**	**Muskingum K:**					**0.877**
#23	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#23	**1**	**Muskingum K:**					**0.000**
#23	2	8. Large gullies, diversions, and low flowing streams	0.63	30.00	4,771.75	2.370	0.559
#23	**2**	**Muskingum K:**					**0.559**
#24	1	8. Large gullies, diversions, and low flowing streams	0.79	180.00	22,769.00	2.660	2.377
#24	**1**	**Muskingum K:**					**2.377**
#24	2	8. Large gullies, diversions, and low flowing streams	0.78	180.00	23,111.00	2.640	2.431
#24	**2**	**Muskingum K:**					**2.431**
#24	4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#24	**4**	**Muskingum K:**					**0.000**
#25	1	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**1**	**Muskingum K:**					**0.342**
#25	2	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**2**	**Muskingum K:**					**0.342**
#25	3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#25	**3**	**Muskingum K:**					**0.000**
#27	1	8. Large gullies, diversions, and low flowing streams	1.38	216.00	15,629.00	3.520	1.233
#27	**1**	**Muskingum K:**					**1.233**
#27	2	8. Large gullies, diversions, and low flowing streams	1.17	144.00	12,301.00	3.240	1.054
#27	**2**	**Muskingum K:**					**1.054**
#27	3	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**3**	**Muskingum K:**					**0.551**
#27	4	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**4**	**Muskingum K:**					**0.551**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	1	8. Large gullies, diversions, and low flowing streams	1.30	84.00	6,445.17	3.420	0.523
#28	**1**	**Muskingum K:**					**0.523**
#29	1	8. Large gullies, diversions, and low flowing streams	0.88	37.00	4,210.00	2.810	0.416
#29	**1**	**Muskingum K:**					**0.416**
#29	2	8. Large gullies, diversions, and low flowing streams	0.88	26.00	2,949.00	2.810	0.291
#29	**2**	**Muskingum K:**					**0.291**
#31	1	8. Large gullies, diversions, and low flowing streams	1.35	76.00	5,639.00	3.480	0.450
#31	**1**	**Muskingum K:**					**0.450**
#31	2	8. Large gullies, diversions, and low flowing streams	1.15	20.00	1,734.00	3.220	0.149
#31	**2**	**Muskingum K:**					**0.149**
#34	1	8. Large gullies, diversions, and low flowing streams	0.73	65.00	8,900.00	2.560	0.965
#34	**1**	**Muskingum K:**					**0.965**
#34	2	8. Large gullies, diversions, and low flowing streams	0.73	65.00	8,900.00	2.560	0.965
#34	**2**	**Muskingum K:**					**0.965**
#36	3	8. Large gullies, diversions, and low flowing streams	2.71	80.00	2,957.00	4.930	0.166
#36	**3**	**Muskingum K:**					**0.166**
#37	2	8. Large gullies, diversions, and low flowing streams	0.29	30.00	10,319.91	1.610	1.780
#37	**2**	**Muskingum K:**					**1.780**
#37	3	8. Large gullies, diversions, and low flowing streams	0.31	30.00	9,800.71	1.650	1.649
#37	**3**	**Muskingum K:**					**1.649**
#37	4	8. Large gullies, diversions, and low flowing streams	0.29	30.00	10,319.91	1.610	1.780
#37	**4**	**Muskingum K:**					**1.780**
#37	5	8. Large gullies, diversions, and low flowing streams	0.56	100.00	17,956.54	2.230	2.236
#37	**5**	**Muskingum K:**					**2.236**

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	12.85	2.37	14.2	5,823	2.63	1.99
#28	1,217.900	1,217.900	348.89	44.53	2,235.4	51,499	0.14	0.10
#26	2,486.400	2,486.400	65.87	20.75	120.8	5,583	1.83	1.40
#24	8,061.800	8,061.800	94.58	59.06	203.0	3,780	0.64	0.43
#25	1,015.700	9,077.500	103.41	74.45	286.7	13,375	3.76	0.80
#27	1,783.700	13,347.600	236.67	122.48	960.5	24,353	10.74	2.54
#29	966.000	15,531.500	535.73	201.59	5,382.3	61,965	5.75	1.80
#32	293.700	16,301.600	553.89	217.52	5,815.1	55,468	2.48	0.87
#31	957.100	957.100	333.75	41.62	1,654.1	37,577	0.51	0.39
#33	0.000	17,258.700	646.50	259.13	7,469.2	47,241	1.78	0.79
#34	932.500	18,191.200	673.81	291.44	7,139.8	39,505	0.08	0.03
#5	2,023.000	2,023.000	506.93	59.77	1,630.2	37,031	3.51	1.88
#6	1,743.200	3,766.200	630.69	115.88	3,138.3	32,912	0.18	0.11
#7	2,395.300	6,161.500	1,047.30	222.75	8,489.7	41,428	0.00	0.00
#8	0.000	6,161.500	1,047.30	222.75	8,489.7	41,428	0.00	0.00
#10	1,053.200	7,214.700	1,090.14	261.44	8,415.3	37,733	0.09	0.06
#1	2,411.100	2,411.100	349.94	55.56	1,695.8	33,350	4.70	3.13
#2	1,497.000	3,908.100	424.36	116.70	2,361.2	21,959	0.16	0.11
#3	862.700	4,770.800	559.86	145.57	2,728.8	17,946	0.05	0.04
#4	0.000	4,770.800	559.86	145.57	2,728.8	17,946	0.05	0.04
#9	425.500	5,196.300	582.11	161.54	2,763.7	15,917	0.00	0.00
#11	0.000	12,411.000	1,509.13	422.98	11,178.9	31,017	0.06	0.04
#21	1,080.800	13,491.800	1,551.27	454.62	11,229.3	30,029	0.02	0.01
#18	848.500	848.500	169.02	27.56	312.0	12,741	0.08	0.05
#17	182.200	182.200	108.99	8.41	110.0	13,892	0.66	0.46
#19	0.000	1,030.700	255.08	35.96	422.0	11,926	0.20	0.14
#15	1,992.700	1,992.700	386.36	60.50	2,083.2	40,738	1.65	1.01
#12	3,494.500	3,494.500	193.05	40.14	518.1	13,885	6.21	4.23
#13	2,720.700	6,215.200	371.99	71.83	1,125.3	16,885	8.41	5.71
#14	5,096.800	11,312.000	509.48	208.73	4,412.1	73,888	1.32	0.27
#16	876.500	14,181.200	826.28	308.99	7,823.8	48,939	1.39	0.52
#20	681.900	15,893.800	880.92	374.91	8,627.8	37,115	0.74	0.33
#22	0.000	29,385.600	2,341.22	829.53	19,857.1	31,245	0.28	0.16
#23	752.900	30,138.500	2,329.13	849.99	19,615.8	30,259	0.00	0.00
#35	0.000	48,329.700	2,891.62	1,141.43	26,755.6	28,682	0.01	0.01
#36	730.590	49,060.290	2,879.45	1,156.16	26,828.2	32,691	0.01	0.01
#37	2,208.500	51,268.790	2,841.60	1,203.14	26,816.0	28,166	0.22	0.13

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	30.89	5.19	36.1	6,848	3.20	2.38
#28	1,217.900	1,217.900	503.94	63.61	3,353.7	53,603	0.44	0.31
#26	2,486.400	2,486.400	129.71	39.61	252.2	6,132	2.13	1.63
#24	8,061.800	8,061.800	187.84	116.49	438.7	4,231	0.75	0.49
#25	1,015.700	9,077.500	192.60	142.05	565.2	13,913	3.62	0.76
#27	1,783.700	13,347.600	390.94	227.10	1,814.3	26,321	11.54	2.57
#29	966.000	15,531.500	811.81	340.27	8,464.1	64,471	7.33	2.05
#32	293.700	16,301.600	841.49	364.08	9,178.5	57,790	4.40	1.40
#31	957.100	957.100	468.62	57.72	2,405.5	38,963	0.70	0.54
#33	0.000	17,258.700	933.80	421.80	11,584.0	49,667	3.18	1.28
#34	932.500	18,191.200	970.74	468.31	11,094.0	41,995	0.16	0.06
#5	2,023.000	2,023.000	759.22	88.30	2,575.9	39,084	4.33	2.35
#6	1,743.200	3,766.200	937.84	170.00	4,873.0	34,451	0.20	0.12
#7	2,395.300	6,161.500	1,511.91	317.58	12,625.5	43,159	0.00	0.00
#8	0.000	6,161.500	1,511.91	317.58	12,625.5	43,159	0.00	0.00
#10	1,053.200	7,214.700	1,570.05	372.35	12,524.8	39,453	0.12	0.07
#1	2,411.100	2,411.100	539.70	85.33	2,707.2	34,591	5.44	3.63
#2	1,497.000	3,908.100	639.70	170.84	3,692.2	22,950	0.17	0.12
#3	862.700	4,770.800	796.58	212.60	4,101.8	17,905	0.05	0.04
#4	0.000	4,770.800	796.58	212.60	4,101.8	17,905	0.05	0.04
#9	425.500	5,196.300	828.60	235.31	4,152.0	16,461	0.00	0.00
#11	0.000	12,411.000	2,176.63	607.66	16,676.8	32,376	0.07	0.05
#21	1,080.800	13,491.800	2,235.06	654.51	16,746.8	31,156	0.03	0.02
#18	848.500	848.500	254.46	39.93	510.1	14,524	0.14	0.09
#17	182.200	182.200	150.01	11.54	157.1	14,384	0.80	0.55
#19	0.000	1,030.700	355.05	51.47	667.3	13,576	0.27	0.19
#15	1,992.700	1,992.700	573.85	88.69	3,170.2	42,664	2.31	1.40
#12	3,494.500	3,494.500	342.58	71.01	983.8	14,979	6.87	4.65
#13	2,720.700	6,215.200	652.52	126.55	2,108.3	17,849	9.04	6.17
#14	5,096.800	11,312.000	855.51	331.51	7,120.7	78,733	2.33	0.46
#16	876.500	14,181.200	1,197.97	474.97	12,195.1	52,354	2.06	0.73
#20	681.900	15,893.800	1,271.46	567.91	13,409.7	39,944	1.24	0.53
#22	0.000	29,385.600	3,381.04	1,222.43	30,156.4	32,772	0.47	0.26
#23	752.900	30,138.500	3,362.72	1,253.09	29,810.4	31,775	0.08	0.05
#35	0.000	48,329.700	4,201.38	1,721.40	40,904.4	29,996	0.09	0.05
#36	730.590	49,060.290	4,182.58	1,744.59	41,011.3	33,567	0.02	0.01
#37	2,208.500	51,268.790	4,121.09	1,818.24	40,933.4	30,075	0.28	0.15

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	65.84	10.21	80.6	7,897	3.88	2.84
#28	1,217.900	1,217.900	724.22	90.75	5,014.7	55,579	0.74	0.53
#26	2,486.400	2,486.400	239.85	71.16	491.1	6,676	2.47	1.87
#24	8,061.800	8,061.800	347.67	214.00	875.6	4,680	0.88	0.57
#25	1,015.700	9,077.500	355.36	255.52	1,084.6	14,498	3.70	0.80
#27	1,783.700	13,347.600	632.57	400.49	3,310.4	27,999	12.29	2.66
#29	966.000	15,531.500	1,224.41	562.17	13,267.6	67,394	9.00	2.29
#32	293.700	16,301.600	1,271.84	598.03	14,429.8	60,085	6.29	1.84
#31	957.100	957.100	658.11	80.24	3,502.4	40,447	0.93	0.73
#33	0.000	17,258.700	1,380.10	678.27	17,932.2	51,948	4.61	1.71
#34	932.500	18,191.200	1,400.95	745.11	17,024.5	43,308	0.74	0.29
#5	2,023.000	2,023.000	1,134.33	129.85	4,047.1	40,903	5.32	2.95
#6	1,743.200	3,766.200	1,388.71	248.47	7,527.5	36,069	0.30	0.18
#7	2,395.300	6,161.500	2,178.26	452.80	18,760.6	44,925	0.00	0.00
#8	0.000	6,161.500	2,178.26	452.80	18,760.6	44,925	0.00	0.00
#10	1,053.200	7,214.700	2,258.75	530.48	18,793.8	41,539	0.16	0.10
#1	2,411.100	2,411.100	823.47	129.88	4,276.8	35,752	6.14	4.11
#2	1,497.000	3,908.100	957.23	249.69	5,734.6	23,757	0.18	0.13
#3	862.700	4,770.800	1,132.66	309.97	6,206.0	18,918	0.06	0.05
#4	0.000	4,770.800	1,132.66	309.97	6,206.0	18,918	0.06	0.05
#9	425.500	5,196.300	1,179.29	342.25	6,277.3	17,458	0.00	0.00
#11	0.000	12,411.000	3,137.48	872.73	25,071.1	34,011	0.10	0.06
#21	1,080.800	13,491.800	3,219.23	941.73	25,165.8	32,434	0.03	0.02
#18	848.500	848.500	380.92	57.77	823.4	16,272	0.19	0.12
#17	182.200	182.200	206.29	15.91	224.8	14,878	0.93	0.64
#19	0.000	1,030.700	494.85	73.68	1,048.2	15,219	0.34	0.23
#15	1,992.700	1,992.700	849.14	129.64	4,812.3	44,608	3.06	1.85
#12	3,494.500	3,494.500	584.36	120.82	1,787.9	16,061	7.55	5.09
#13	2,720.700	6,215.200	1,103.87	214.86	3,780.1	18,686	9.62	6.62
#14	5,096.800	11,312.000	1,402.27	519.98	11,403.3	82,900	4.66	0.89
#16	876.500	14,181.200	1,733.22	725.28	18,947.3	55,490	3.31	1.13
#20	681.900	15,893.800	1,832.17	856.51	20,783.5	42,612	2.15	0.89
#22	0.000	29,385.600	4,878.63	1,798.24	45,949.4	34,369	0.80	0.44
#23	752.900	30,138.500	4,851.70	1,843.91	45,442.9	33,353	0.32	0.17
#35	0.000	48,329.700	6,100.87	2,589.01	62,467.4	31,240	0.36	0.21
#36	730.590	49,060.290	6,071.91	2,625.03	62,622.7	34,666	0.27	0.13
#37	2,208.500	51,268.790	5,977.12	2,738.89	62,441.9	31,125	0.32	0.17

APPENDIX 7-O

CHACO AND PINEBETE TRIBUTARIES

PRE-MINING HYDROLOGY AND SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, 25 YR-6HR, & 100 YR-6 HR STORM EVENTS)

February 2011

Tributary A to the Chaco Wash

Pre-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is presented on Exhibit 7-4.

Revised Feb2011

LR / RY

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PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

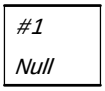
Storm Type:	Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Tributary A to Chaco



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	456.280	456.280	2.53	0.62	4.1	6,170	2.99	2.35

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	82.737%
0.0500	46.884%
0.0020	30.337%
0.0010	0.000%

Structure Detail:

Structure #1 (Null)

Tributary A to Chaco

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	456.280	1.570	0.000	0.000	78.400	M	2.53	0.625
	Σ	**456.280**						**2.53**	**0.625**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.151	200.00	3.48	0.3870	1.0000	2	4.1	6,170	2.99	2.35
	Σ							**4.1**	**6,170**	**2.99**	**2.35**

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	1.33	80.00	6,028.18	1.150	1.456
		8. Large gullies, diversions, and low flowing streams	2.00	35.00	1,752.01	4.240	0.114
#1	**1**	**Time of Concentration:**					**1.570**

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	456.280	456.280	24.01	4.85	46.0	9,274	4.03	3.03

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	456.280	456.280	45.58	8.76	91.7	10,334	4.71	3.50

General Information

Storm Information:

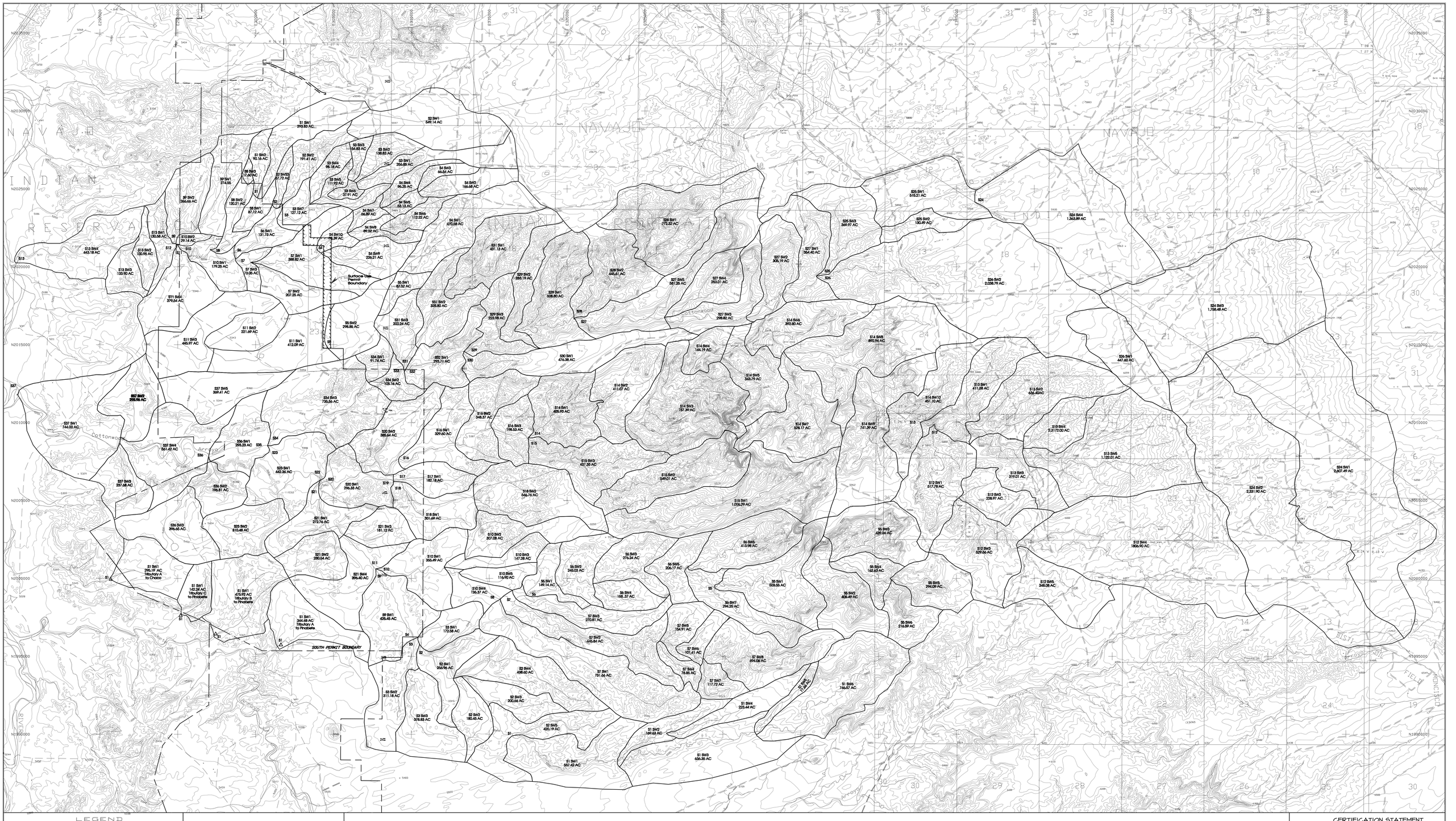
Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

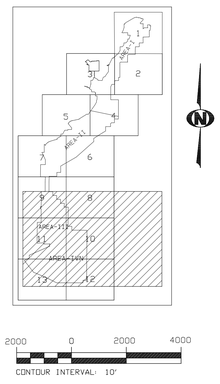
Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	456.280	456.280	82.07	15.12	173.0	11,391	5.41	3.98



LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 ⊕ 5422.45 — HORIZ. & VERT. CONTROL
- L-30 — LEASE CORNER
- PERMIT BOUNDARY



CONTOUR INTERVAL: 10'

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 — REGISTERED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENGR	E.G.	P.E.	P.S.	CHIEF ENG.
					APPROVALS			
11-A	FEB-2011	PJF	Area 4 North Revision Resubmittal to OSM for Review and Approval		RCV	SG	RCV	
09-A	7-12-09	PJF	ADDED TDS EXTENSION OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.		Brown & Caldwell	YB	KAB	
B	11-15-04	PJF	ADDED TRIBUTARIES TO CHACO, PINABETE AND SUBMITTED TO OSM FOR REVIEW.		LR	MC	LR	
A	5-10-01	PJF	ADDED TRIBUTARY A,B,C AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.		LR	MC	LR	

EXHIBIT 7-4

BHP NAVAJO COAL COMPANY

NAVAJO MINE

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

LOWE, COTTONWOOD AND PINABETE ARROYO PRE-MINING SEDCAD DRAINAGE SUBDIVISIONS

PREPARED BY AAY/LR	DRAWN BY PJFOSTER	SCALE 1" = 2000'
APPROVED BY AAY/LR	DATE APRIL 27, 2001	

G:\Gs\Permits F\Ch 7\Exhibit 7-004\EXH 7-4_PER-MINE_ DATA.prs

Plotted: 08/Dec/2011 11:14 - F:\Ch 7\Exhibit 7-004\EXH 7-4_PER-MINE_ DATA.prs

Match Line see Exhibit 8-1, 5 of 7

Surface Use Permit Boundary

N 2,012,500

N 2,010,000

Match Line see Exhibit 8-1, 7 of 7

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 / 5422.45 HORIZ. & VERT. CONTROL
- L-30 LEASE CORNER
- PERMIT BOUNDARY

SOIL MAPPING UNITS

Ba	Badlands
Bd	Bacobi and Monierco
Bc	Blancot
Bh	Blancot, very hard
Dst	Disturbed Areas
Fa	Farb and Persayo
Gr	Grieta
Jc	Jocity—Gilco
Jh	Jocity, very hard
Ma	Mack
Mn	Mayqueen
Ms	Mayqueen—Shiprock
Mv	Mayqueen—Shiprock, very hard
Na	Nakai
Nt	Natrargids
Nv	Natrargids, overblown
Pnd	Ponds
Ra	Razito
Rcl	Reclaimed Areas
Rh	Razito, very hard
Rl	Redlands Variant
Rv	Redlands Variant, very hard
Sc	Shiprock
Sh	Shiprock, very hard
Sl	Shiprock—Blancot
Sv	Shiprock Variant
Sz	Stumble
Ta	Trail
Th	Trail, very hard
Ts	Topsoil Stockpile

Soil Mapping Unit — Map Unit Delineation — Nt 370 — Sample Site

Mitigation Resource Areas

Mitigation Borrow Areas

11-a	2-8-11	WPD	REMOVED OLD AR/ANN BOUNDARY AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL	KA	SD			
B	8-15-00	PJF	UPDATED AND RESUBMITTED SOILS RESOURCES TO OSM (LETTER DATED 5/04/00)	LW	MC			
A	7-21-00	PJF	SOILS RESOURCES UPDATE PER OSM LETTER DATED 5/04/00	LW	MC			
REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	E.G.	E.G.	P.E.	P.S.	CHIEF ENG.
				APPROVALS				

EXHIBIT 8-1

BHP NAVAJO COAL COMPANY

NAVAJO MINE

P. O. BOX 1717 FRUITLAND, NEW MEXICO 87416

DETAILED SOILS MAP AREA – III AND IV NORTH

PREPARED BY	Kent Applegate, Mine Planner	DRAWN BY	PJFOSTER
APPROVED BY		DATE	JULY 20, 2000
SCALE	1" = 500'	SHEET	6 OF 7

PATH G:\Gis\Permit F\Ch 8\Ch_08-DETAIL SOILS MAPS\DETAIL SOILS\EXH 8-1_6of7.dwg

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CONTOUR INTERVAL: 10'

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2082500 2080000 2077500 2075000 2072500 2070000

814 N-36

Th/Br Sa Bd Al/Wa Du

NAVAJO MINE NORTH FACILITIES

Legend

- Navajo Mine Permit Area
- BNCC Lease Area

Range Sites

- Alkali Wash (Al/Wa)
- Arroyo Shrub (Ar/Sh)
- Badlands (Bd)
- Calcareous Sands (Ca/Sa)
- Dunes (Du)
- Sands (Sa)
- Saline Sands (Sa/Sa)
- Thinbreaks (Th/Br)

Coordinate System: NAD 1927 StatePlane New Mexico West FIPS 3003
Projection: Transverse Mercator
Datum: North American 1927
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -107.8333
Scale Factor: 0.9999
Latitude Of Origin: 31.0000
Units: Foot US

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1:6,000

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	Dwn.	ECS	Pk.	APPROVED
11-A	2/8/11	MPO	Removed Old ASHA Entity & Submitted to OSM for Review		KA		
A	4/21/04	PJP	Updated Exhibit and Submitted to OSM for Review		KA		

Exhibit 9-1A

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resourcing the future

BHP NAVAJO COAL COMPANY

Navajo Mine
Range Sites

(Sheet 1 of 6)

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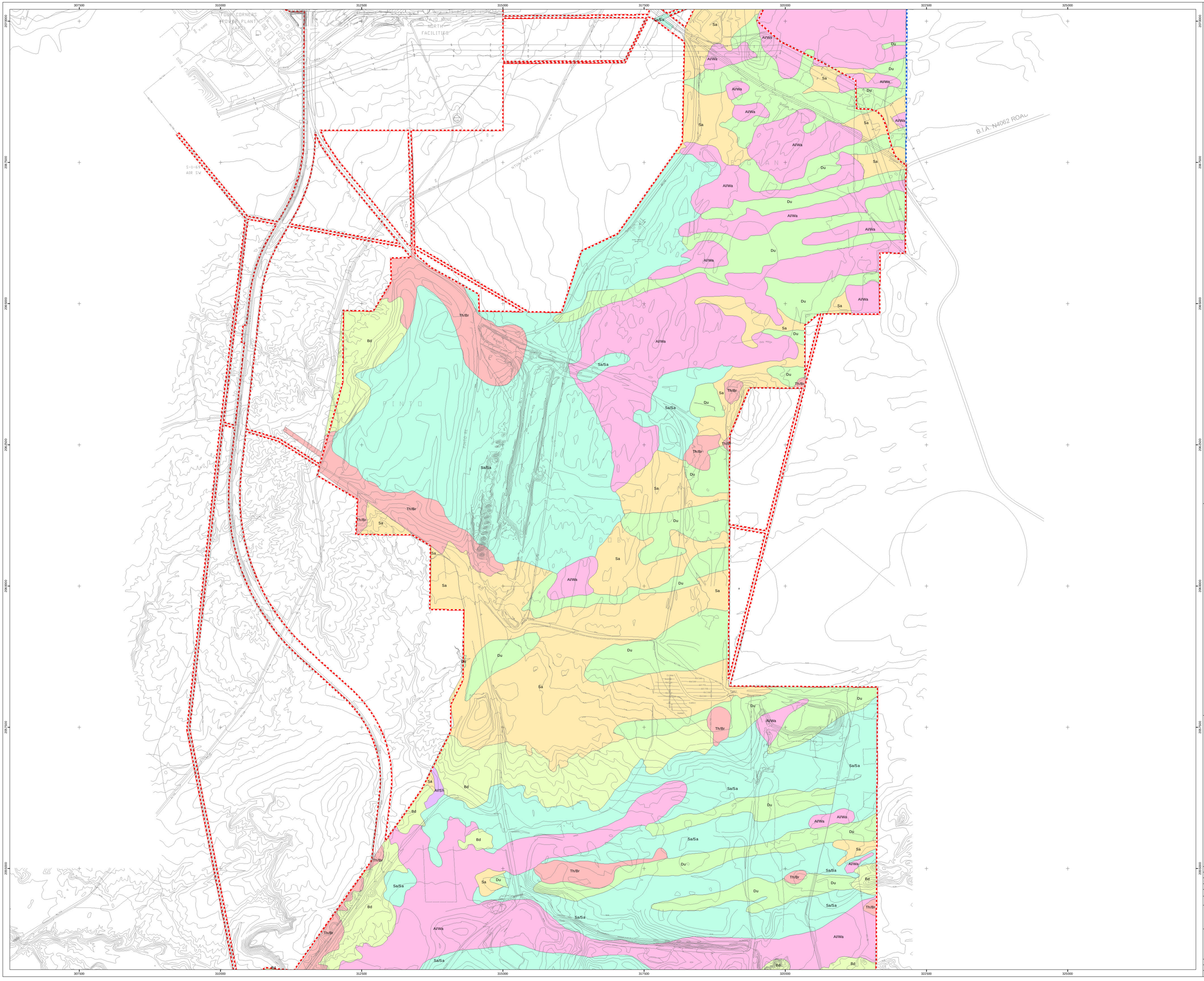
APPROVED BY: CKA	DATE: 2/8/2011	

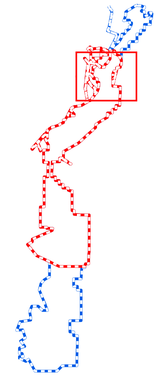


Legend

- Navajo Mine Permit Area
- BNCC Lease Area

Range Sites

- Alkali Wash (Al/Wa)
- Arroyo Shrub (Ar/Sh)
- Badlands (Bd)
- Calcareous Sands (Ca/Sa)
- Dunes (Du)
- Sands (Sa)
- Saline Sands (Sa/Sa)
- Thinbreaks (Th/Br)



Coordinate System: NAD 1927 StatePlane New Mexico West FIPS 3003
Projection: Transverse Mercator
Datum: North American 1927
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Central Meridian: -107.8333
Scale Factor: 0.9999
Latitude Of Origin: 31.0000
Units: Foot US

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NO.	DATE	DRAFT BY	REVISION DESCRIPTION	DWG	TECH	PE
11-A	2/8/11	MPO	Removed Old A3/A4 Body & Submitted As 00dl for Review		KA	
A	4/21/04	KJR	Updated Exhibit and Submitted to OSM for Review		KA	

Exhibit 9-1B

bhpbilliton
resourcing the future

BHP NAVAJO COAL COMPANY

Navajo Mine
Range Sites

(Sheet 2 of 6)

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APPROVED BY: CKA	DATE: 2/8/2011
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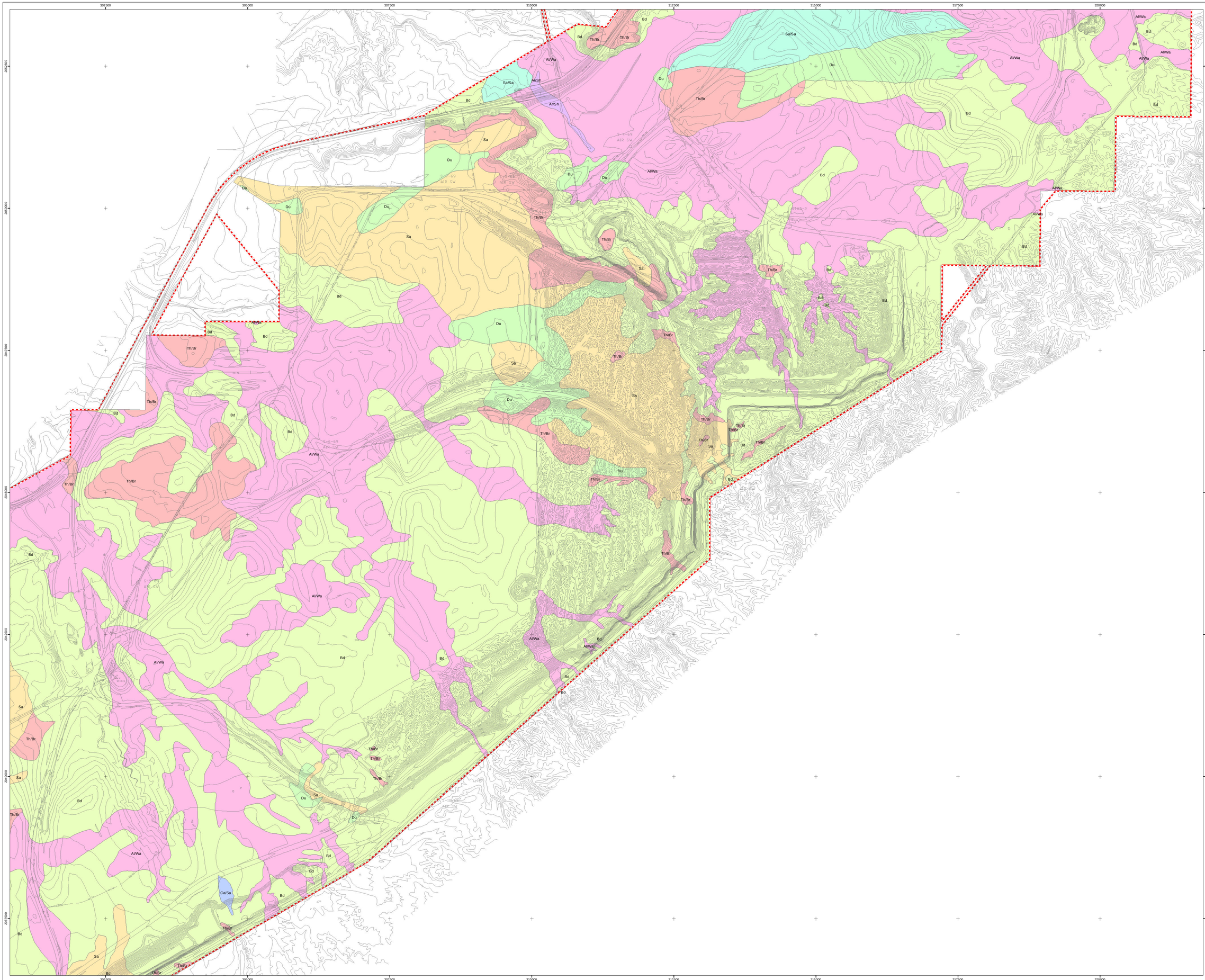
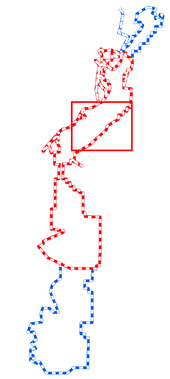


Legend

- Navajo Mine Permit Area
- BNCC Lease Area

Range Sites

- Alkali Wash (Al/Wa)
- Arroyo Shrub (Ar/Sh)
- Badlands (Bd)
- Calcareous Sands (Ca/Sa)
- Dunes (Du)
- Sands (Sa)
- Saline Sands (Sa/Sa)
- Thinbreaks (Th/Br)



Coordinate System: NAD 1927 StatePlane New Mexico West FIPS 3003
Projection: Transverse Mercator
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False Northing: 0.0000
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Units: Foot US

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1:6,000

REA. No.	DATE	DRAFT BY	REVISION DESCRIPTION	Dsn.	TECH	PE
11-A	2/8/11	MPO	Removed Old A3X4 Body & Submitted to DEM for Review		KA	
A	4/21/04	PJP	Updated Exhibit and Submitted to DSM for Review		KA	

Exhibit 9-1C

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BHP NAVAJO COAL COMPANY

Navajo Mine
Range Sites

(Sheet 3 of 6)

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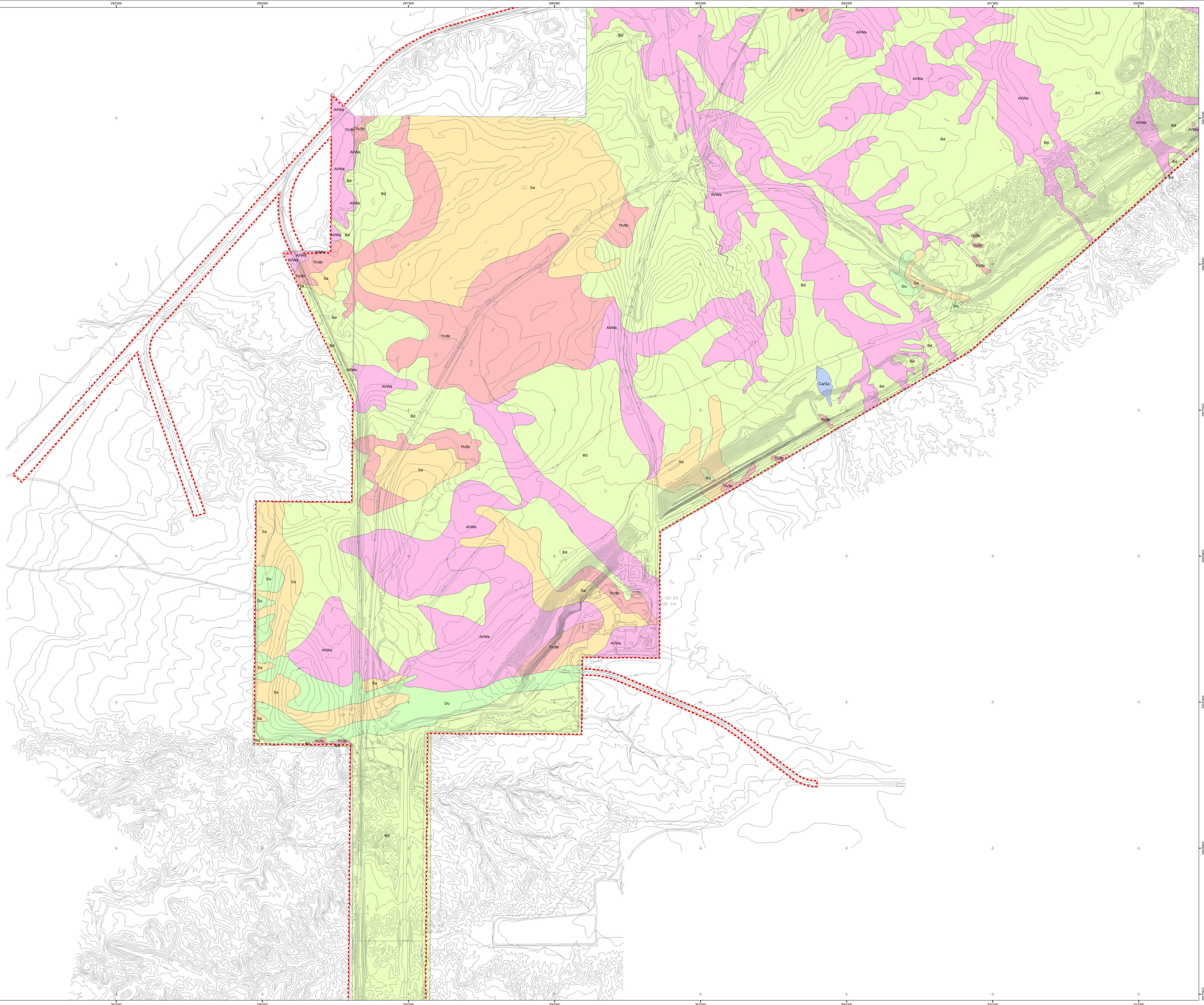
APPROVED BY: CKA	DATE: 2/8/2011	

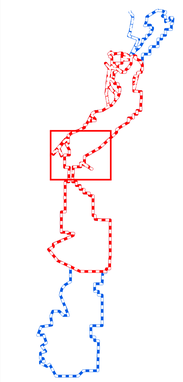


Legend

- Navajo Mine Permit Area
- BNCC Lease Area

Range Sites

- Alkali Wash (Al/Wa)
- Arroyo Shrub (Ar/Sh)
- Badlands (Bd)
- Calcareous Sands (Ca/Sa)
- Dunes (Du)
- Sands (Sa)
- Saline Sands (Sa/Sa)
- Thinbreaks (Th/Br)



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Projection: Transverse Mercator
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Central Meridian: -107.8333
Scale Factor: 0.9999
Latitude Of Origin: 31.0000
Units: Foot US

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1:6,000

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG. REV.	PE
11-A	2/8/11	MPO	Removed Old A3/4-6 Body & Submitted to OSM for Review		KA
A	4/21/04	PJP	Updated Exhibit and Submitted to OSM for Review		KA

Exhibit 9-1D

bhpbilliton
resourcing the future

BHP NAVAJO COAL COMPANY

Navajo Mine
Range Sites

(Sheet 4 of 6)

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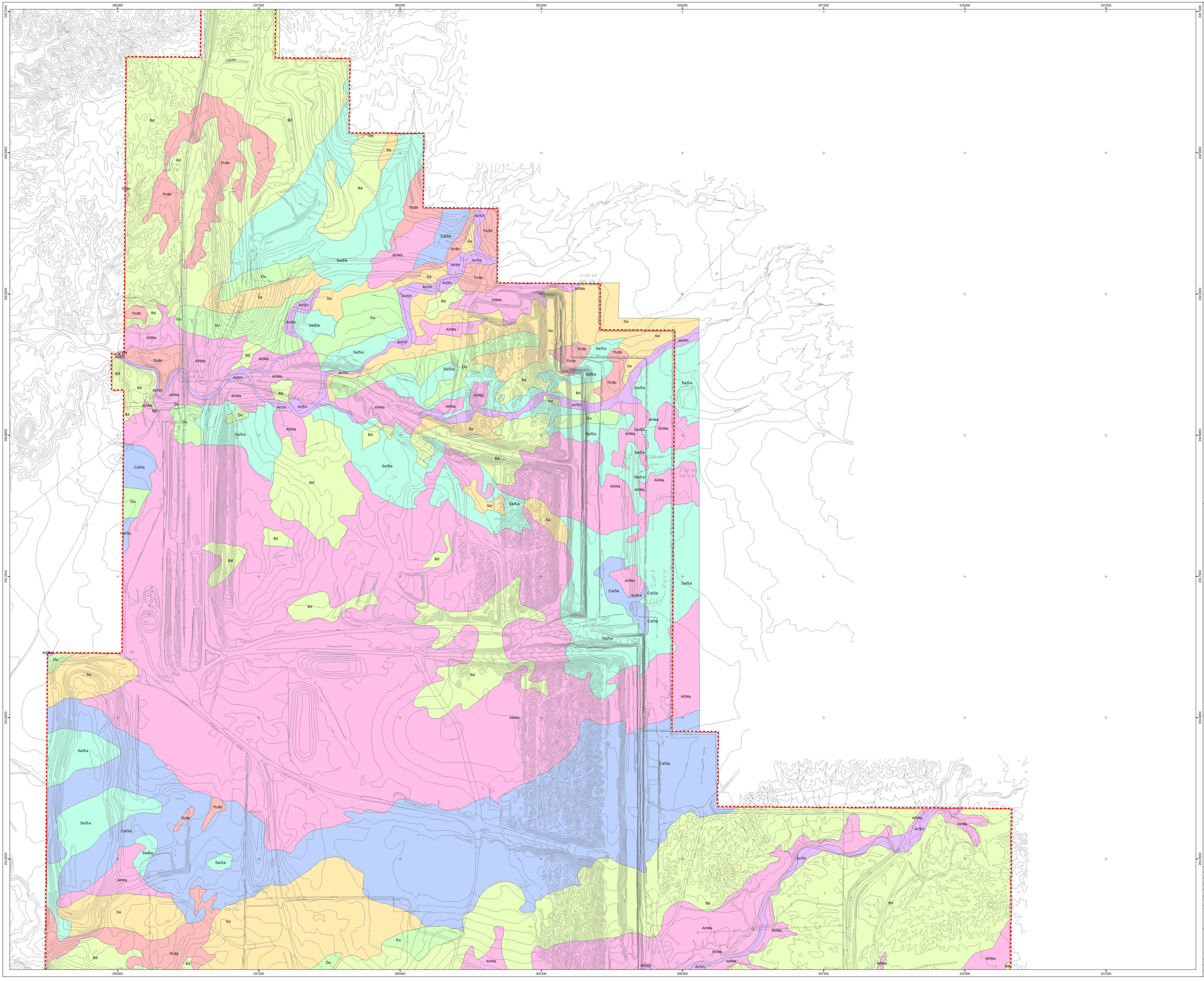
APPROVED BY: CKA	DATE: 2/8/2011	

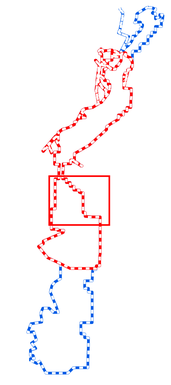


Legend

- Navajo Mine Permit Area
- BNCC Lease Area

Range Sites

- Alkali Wash (Al/Wa)
- Arroyo Shrub (Ar/Sh)
- Badlands (Bd)
- Calcareous Sands (Ca/Sa)
- Dunes (Du)
- Sands (Sa)
- Saline Sands (Sa/Sa)
- Thinbreaks (Th/Br)



Coordinate System: NAD 1927 StatePlane New Mexico West FIPS 3003
Projection: Transverse Mercator
Datum: North American 1927
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -107.8333
Scale Factor: 0.9999
Latitude Of Origin: 31.0000
Units: Foot US

0 250 500 1,000 1,500
Feet
1:6,000

NO.	DATE	PREPARED BY	REVISION DESCRIPTION	APPROVED
11-A	2/8/11	MPO	Removed Old A3/A4 Entity & Submitted to OSM for Review	KA
A	4/21/04	PJP	Updated Exhibit and Submitted to OSM for Review	KA

Exhibit 9-1E

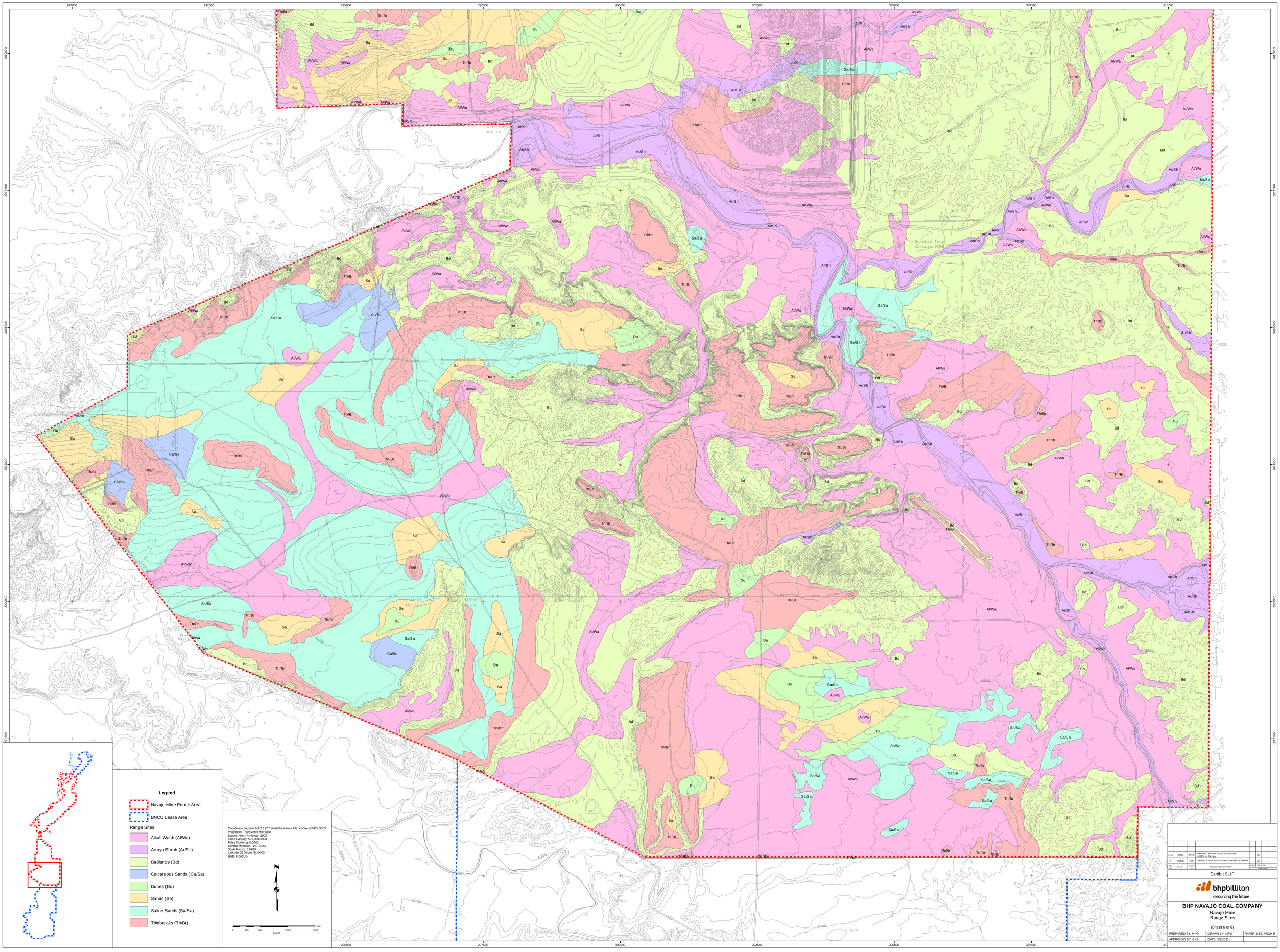
bhpbilliton
resourcing the future

BHP NAVAJO COAL COMPANY

Navajo Mine
Range Sites

(Sheet 5 of 6)

PREPARED BY: MPO	DRAWN BY: MPO	PAPER SIZE: ARCH E
APPROVED BY: CKA	DATE: 2/8/2011	



11-K	2/8/11	MPO	Removed Old A3x4 Body & Submitted to OSM for Review		KA	
A	4/21/04	PJF	Updated Exhibit and Submitted to OSM for Review		KA	
REV. No.	DATE	CHART BY	REVISION DESCRIPTION		DES.	EQ'D.	PE. APPROVAL

Exhibit 9-1F

bhpbilliton
resourcing the future

BHP NAVAJO COAL COMPANY

Navajo Mine
Range Sites

(Sheet 6 of 6)

PREPARED BY: MPO	DRAWN BY: MPO	PAPER SIZE: ARCH E
APPROVED BY: CKA	DATE: 2/8/2011	

LEGEND

P-6 Pre-Mining Stock Watering Pond

Stock Watering Pond

Permit Boundary

Note: Pond surface area not to scale.

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	E.Q.	E.G.	P.E.	RPLS	CHIEF ENG.
11-A	FEB-2011	PJF	Area 4 North Revision Resubmittal to OSM for Review and Approval.	RCV	SO			
A	9-29-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	GW	MC			

EXHIBIT 10–3

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

STOCK WATERING POND SITES ON AND NEAR THE PERMIT AREA

PREPARED BY GW/PJF	DRAWN BY PJF	SCALE 1" = 2000'
APPROVED BY	DATE SEPT. 21, 1998	MYLAR LOC.

G:\Gs\Permit F\Ch 10\Ch_10-STOCK WATER PONDS\EXH 10-03.pro
Thu Feb 03 12:53:46 2011

CHAPTER 11

OPERATION PLAN

11.1 LAND STATUS AND MARKERS

EXHIBITS 11-1 through 11-6 show the land status classifications of lands within the Navajo Mine leasehold. These lands are divided into Pre-Law, Interim, and Permanent Program land classifications.
Signs clearly identifying BHP Minerals and/or Navajo Mine, the permit identification number, and blast warning signs are posted at all points of public or permittee road access into the permit area. Signs are made of durable material and will be maintained until bond release.

11.1.1 Stream Buffer Zones

Stream Buffer Zone designations have been evaluated and identified for the permit areas and lands adjacent to the leasehold (see Section 11.6.4). A buffer zone was established in December 1995. The requirements under 30 CFR § 816.57 will be observed, and the zones marked as specified under Section 816.11. Identified Stream Buffer Zone designations and authorized stream crossings are delineated and shown on EXHIBITS 11-9 through 11-11.

The markers are spaced approximately 300 feet apart and are routinely checked and maintained. Any adjustments to the buffer zone boundary will be made as necessary.

Activities that necessitate travel into or through the designated crossings follow. Access to surface water samplers, access to groundwater wells, access to Area IV North for environmental data and resource gathering for future mine planning (i.e. surveys, core drilling), access for locals (public) use, and access for routine maintenance (i.e. powerlines, roads, Lowe Diversion outlet, etc.).

11.1.2 Incidental Boundary Revision (IBR)

The IBR appends an additional 106 acres contiguous with the permit boundary along the east boundary of the Lowe and Dixon pits in Area 3 as shown in Exhibit 1-2, Sheet 2 of 2. The IBR area will be used for power lines and access roads, and to facilitate activities ancillary to mining and reclamation. The IBR area will not be used for any new major facilities such as preparation plants or coal mine waste disposal areas. The IBR area will not increase the size of the area from which coal will be removed beyond the existing permit boundary in accordance with the current Resource Recovery and Protection Plan (R2P2).

denoted based upon their *in situ* location in the soil profile. The material found in the top 60 inches of the soil profile is called "topdressing", while the material found deeper than 60 inches in the soil profile is called "regolith".

Navajo Mine will salvage all suitable topdressing for use as topsoil substitute. The maximum extent of allowable disturbance in front of the pit is 1,800 feet beyond the extent of mining (i.e., highwall). Topdressing removal will precede pre-stripping activities where required or to facilitate mining activities where no pre-stripping is required, refer to section 11.2.3.2 Overburden Stripping Method. The extent of topdressing removal will fully consider and comply with the applicable hydrology performance standards.

The defined extent of topdressing removal will facilitate the ability to utilize opportunistic direct live haul of topdressing, which may result in increased reclamation success. In addition, the defined extent offers greater flexibility in mining and equipment operations.

Navajo Mine currently has no in situ reserves for Areas I and II. There is in-situ topdressing material remaining in Area III and IV North. This material will be direct hauled to active reclamation areas whenever possible. Topdressing removal activities are conducted in opportunistic blocks that maximize the direct haul and respread of the topdressing into active reclamation plots.

Suitable regolith may be salvaged for use in reclamation as either topsoil substitute or root-zone material, or it may be spoiled if deemed necessary by the operator. Regolith in each resource area (I, II, III, and IV North) will be salvaged or spoiled depending on the need for topsoil or root-zone material in that specific resource area. Where practical and feasible, regolith that has been found

At the Navajo Mine, the pit names are also associated with area names such as; Area 1, Area 2 and Area 3. The progression of uncovered coal is in linear strips as shown on Exhibits 12-02 and 12-03. Pre-Stripping is done in the deeper parts of Area 3 and Area 2 to keep the total pit depth for the dragline under 200 feet. Pre-Stripping is accomplished using a fleet of end-dump haul trucks and a front-end loader. Pre-Strip material will be removed in front of the active mining strip and placed in final grading areas. Information compiled from Exhibits 12-02 and 12-03 is on Table 11-25 (Areas Mined by Year). This table summarizes pit locations, mining sequences, start and end dates of mining and approximate acres disturbed.

Refer to Exhibit 12-02 for Area 2. The current active pits in this area are Hosteen/Yazzie and Yazzie Overlook. Pre-Stripping with a truck and loader fleet will occur for the entire area. Exhibit 12-02 provides specific stripping sequence by permit term year. Upon finishing the Hosteen/Yazzie and Yazzie Overlook pits, coal-mining activities in Area 2 will be complete.

For Area-3, refer to Exhibit 12-03. The current active pits in Area-3 are Lowe and Dixon pit. Exhibit 12-03 provides specific stripping sequence by permit term year. Pre-Stripping with a truck and loader fleet in Area 3 will continue 4 strips ahead of the active mining strip. Lowe pit will be mined out ahead of Dixon Pit. Upon finishing Dixon pit, coal-mining activities in Area 3 will be completed.

For Area-4N, refer to Exhibit 12-03. A single mine pit is planned for Area 4 North. Refer to Exhibit 12-03 for the timing of specific striping sequence by permit term. Upon finishing Area 4 North pit, coal-mining activities in Area 4 North will be complete.

Table 11-25 Areas Mined by Year

YEAR	LOCATION AREA	PIT NAMES	STRIP #	APPROXIMATE ACRES DISTURBED
1	Area 2	Hosteen / Yazzie	13-17	103
1	Area 3	Lowe	58-60	39
1	Area 3	Dixon	60-62	101
	Sub Total Year 1			**243**
2	Area 2	Hosteen/Yazzie	18-19	19
2	Area 2	Overlook	23-24	10
2	Area 3	Lowe	63-64	29
2	Area 3	Dixon	63-65	82
	Sub Total Year 2			**140**
3	Area 3	Lowe	65-67	48
3	Area 3	Dixon	66-68	76
3	Area 4N	Area 4N	OC-BC1	79
	Sub Total Year 3			**203**
4	Area 3	Corridor Road	1-5	29
4	Area 3	Dixon	69-71	72
4	Area 4N	Area 4N	BC2-S2	46
	Sub Total Year 4			**147**
5	Area 3	Dixon	72-74	63
5	Area 4N	Area 4N	3-9	114
	Sub Total Year 5			**177**
6-10	Area 3	Dixon	75-86	236
6-10	Area 4N	Area 4N	10-20	303
	Sub Total Years 6-10			**539**

* table does not include prestrip disturbance ahead of mining

Year 1 Commences Sept. 1, 2009

(Appendix 11-LL), Department of Transportation (DOT), and Office of Safety and Hazard Administration regulations. Non-hazardous materials that can be recycled or reused, are accumulated, managed, and recycled or reused following applicable EPA regulations. The nonhazardous materials that can not be recycled or reused are accumulated, managed, shipped offsite and disposed of following applicable EPA and DOT regulations. Railroad ties are stored and reused on the mine site or offsite for landscaping. Railroad ties are not disposed of on the mine site. Ties that can not be reused are disposed of following the applicable environmental standards.

11.2.5.1 Historic Coal Combustion By-products (Ash) Disposal

Between 1971 and January 2008 BNCC placed Coal Combustion Byproducts (CCB) from Four Corners Power Plant (FCPP) in mined-out pits or ramps at Navajo Mine. BNCC does not intend to use CCB materials for future reclamation within the permit boundary. The following permit text is maintained for historical context.

Under Navajo Mine's fuel supply contract with Arizona Public Service (APS), Navajo Mine accepted Coal Combustion Byproducts (CCB) or ash, from Four Corners Power Plant units 4 and 5 for disposal in final pits and ramps. CCB disposed of at Navajo Mine included: fly ash, scrubber sludge and bottom ash. In general, the major chemical constituents of CCB disposed of at Navajo Mine include: Silicon Dioxide (SiO_2), Aluminum Oxide (Al_2O_3) and Calcium Sulfite ($CaSO_3$) (see the Leach Study, APPENDIX 11-K).

Fly ash and bottom ash are generated by the combustion of coal at Four Corners Power Plant. The fly ash is collected in emission control baghouses. Fabric bags in the baghouses act as a filter removing the fly ash from the flue gas stream of units 4 and 5. Ash too large to be carried by the

flue gas to the baghouse falls to the bottom of the boiler during the combustion process and is removed as bottom ash. Scrubber sludge is the byproduct of removing SO_2 from the flue gas. The SO_2 reacts with lime to form calcium sulfite and calcium sulfate. A description of the physical and chemical properties of the CCB is contained in APPENDIX 11-K.

11.2.5.1.1 Ash Disposal Areas

Historic Ash disposal locations at Navajo Mine through January 2008 on interim and permanent program areas are shown on Exhibit 11-149.

11.2.5.1.2 Ash Disposal Method

The haulage and disposal of CCB utilized any of the equipment listed in Section 11.4 of the PAP. Typically, ash was hauled in 85-ton end dump trucks and is dumped into the pit. A dozer was used to push ash into the backfilled pit and for dump site maintenance. When equipment or other needs dictate, a single lift or multiple lifts were used to backfill the pits and ramps. A grader and water truck were used to maintain the ash haul road and to control fugitive dust.

11.2.5.1.3 Ash Regulatory Compliance

In 1993 the United States Environmental Protection Agency (U.S.EPA) made a final regulatory determination that CCB are exempt from regulation as a hazardous waste under Subtitle C of the Resource Conservation and Recovery Act (RCRA, 58 FR 42466, August 9, 1993). In its regulatory determination, EPA concluded that the State or Tribal industrial solid waste management programs implemented under Subtitle D of RCRA were adequate regulatory controls for managing the disposal of CCB.

The Navajo Nation codified the Navajo Nation Solid Waste Act on 18 October 1990 (4 N.T.C. 101 as amended by the Navajo Nation Council Resolution No. CJY–51– 97) and finalized their regulations on February 1, 1999. The Navajo Nation Solid Waste Regulations specifically excludes CCB from the definition of a Solid Waste. Based on this exclusion, CCB are not

regulated as a solid waste. In accordance with the following documents, BNCC had the right to dump CCB (ash) on leased premises. A mining lease between the Navajo Nation and BHP (Utah Construction Company) dated July 26, 1957 and the subsequent amendments. Resolution ACAP-43-68 of the Advisory Committee of the Navajo Tribal Council dated April 15, 1968, Approval of Resolution ACAP-43-68 by the Bureau of Indian Affairs dated May 15, 1968. Copies of these documents will be kept on the mine site at all times and may be reviewed by the regulatory authority upon request.

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These facilities have been constructed to minimize erosion and siltation. Embankments and drainageways are regularly examined after each storm event. The location of the water loadouts is shown on EXHIBITS 11-9 through 11-11.

11.5.1.5 Electric Power Lines

Arizona Public Service Company supplies the mine with power at 69,000 volts. Approximately 31 miles of mainline and nine miles of stublines make up the existing power distribution network for Areas II, III, and IV North. The mainlines originate at the Four Corners Power Plant and branch to the east and west sides of the pits in Areas II, and III, and IV North. Stublines service the pits about every 5,000' from the east side. On the west, the power line follows the railroad catenary. See EXHIBITS 11-9 through 11-11 for details. Power lines will be constructed to meet the recommended design criteria (Miller et al., 1975) to prevent the electrocution of raptors.

11.5.1.6 ANFO/Explosives Storage

There are three ammonium nitrate storage facilities at Navajo Mine:

1. Barber Stockpile,
2. Yazzie Pit area, and
3. Dixon.

A typical ANFO facility has nitrate silos, diesel fuel storage tanks, and silos for emulsion blasting product.

There are explosives magazines at the north-end of Lowe Pit which was built in accordance with the Bureau of Alcohol, Tobacco, and Firearms Division regulations 26 CFR Parts 181.198 and 181.200. This area is used for storing primers, blasting cord, delays, and wet hole blasting product. See EXHIBIT 11-7 for locations of these stores.

11.5.2 Coal Facilities

11.5.2.1 Coal Storage

The Navajo Mine has four coal stockpiles. Three are field stockpiles located at railroad spurs and the fourth stockpile is an emergency coal stockpile located near the north area coal plant. The approximate maximum capacities and date of construction of these stockpiles are:

Name	Capacity (tons)	Construction Date
Barber	1,500,000	1973
Hosteen	800,000	1974
Emergency	80,000	1988
Lowe	2,700,000	1982
Total	5,080,000	

Barber Hosteen and Lowe field stockpiles are divided down the center by the railroad spur to facilitate blending. This division allows coal of varying qualities to be stacked on either side of the rail.

TABLE 11-3

TOPDRESSING STOCKPILE APPROXIMATE VOLUME

New Stockpile Name[1]	Old Stockpile Name	Approx. Volume (cyds)[3]
Airport_TS	Airport 1	9,919
DBR12_TS_E[2]	Doby 1	732,845
DBR13_TS_W	Doby R13	412,272
HSR1_TS_S	-	144,865
BBR3_TS_S		36,016
BBR5_TS_S	Barber 5	164,829
LWR1_TS_W[2]	Lowe 2	250,338
LWR2_TS_E	Lowe 4	17,162
LWR4_TS_N	-	716,713
LWR4_TS_E	Lowe/Dixon 1	118,668
LWR4_TS_S	-	0
DXR1_TS_N	-	0
DXR1_TS_S	-	372,164
DXR2_TS_W	-	413,515
DXR4_TS	-	899,820
TS-401	-	60,333
TS-402	-	71,444
TS-403	-	148,000
IBR_TS_N	-	136,200

Regolith Stockpiles Capacities

New Stockpile Name[1]	Old Stockpile Name	Approx. Volume (cyds)[3]
DXR1_RG_W	Dixon 3	475,100
LWR1_RG_N	Lowe 9	1,818,552
LWR4_RG_N	Lowe 10	468,633

[1]Topdressing stockpiles are shown on EXHIBITS 11-9, 11-10 & 11-11 (CHAPTER 11).
TS, Topdressing stockpiles. RG, Regolith stockpiles.
[2]Designates stockpiles that have snow fences installed.
[3] Volumes were calculated using aerial survey and/or loader count. Volumes do not include 10% rehandling loss so total volume will differ from 12-4 and 12-9.

Table 11-5 Pond Cross Reference

Cont'd

Pond Name	Pond Information
Block C Pond 1	Table 11-5AG
Block C Pond 2	Table 11-5AH
Block C Pond 3	Table 11-5AI
Lowe 3 Pond 3	Table 11-5AJ
Mason Pond	Table 11-5AK
Employee Coal Dump Pond	Table 11-5AL
Pond 401	Table 11-5AM
Area 4 North Pond 412	Table 11-5AN
South Dixon Pond 7	Table 11-5AO
Area 4 North Pond 3	Table 11-5AP
Area 4 North Pond 4	Table 11-5AQ
Pond 405	Table 11-5AR
Pond 411	Table 11-5AS
Pond 413	Table 11-5AT
Pond 402	Table 11-5AU
Pond 404	Table 11-5AW
Pond 408	Table 11-5AX
Pond 409	Table 11-5AY
Pond 410	Table 11-5AZ
Pond 301	Table 11-5BA
Pond 302	Table 11-5BB

Table 11-5AM Area 4 North Pond 401

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from box cut spoils
Design Information	APPENDIX 11-AA and Exhibit 11-01D
As-Built Information	Exhibit 11-01 As-built
Intended Life Span	Until Completion of Final Reclamation
Watershed Area (ac)	20.8
As-Built Capacity (ac-ft)	3.9 plus 1-foot freeboard (as-built)
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	1.45
Max. Permissible Gauge Reading for Water/Sediment (ft)	7.4 (as-built)
Depth at Upstream Toe (ft)	9
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 11-5AN Area 4 North Pond 412

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from box cut spoils
Design Information	APPENDIX 11-AA and Exhibit 11-111D
As-Built Information	Exhibit 11-111 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	30.6
As-Built Capacity (ac-ft)	3.2 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year – 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	3.0
Max. Permissible Gauge Reading for Water/Sediment (ft)	1.7 (as-built)
Depth at Upstream Toe (ft)	9.8
NRCS Hazard Classification	Low
Spillway Type	Not required
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 11-5AP Area 4 North Pond 3

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from box cut spoils
Design Information	APPENDIX 11-AA and Exhibit 11-115D
As-Built Information	Exhibit 11-115 Asuilt
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	8.6
As-Built Capacity (ac-ft)	1.2 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	0.8
Max. Permissible Gauge Reading for Water/Sediment (ft)	2.4
Depth at Upstream Toe (ft)	7
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 11-5AQ Area 4 North Pond 4

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from box cut spoils
Design Information	APPENDIX 11-AA and Exhibit 11-118D
As-Built Information	Exhibit 11-118 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	46.3
As-Built Capacity (ac-ft)	5.6 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year – 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	4.5
Max. Permissible Gauge Reading for Water/Sediment (ft)	3.2
Depth at Upstream Toe (ft)	8.7
NRCS Hazard Classification	Low
Spillway Type	Not required
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 11-5AR Area 4 North Pond 405

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from box cut spoils
Design Information	APPENDIX 11-AA and Exhibit 11-05D
As-Built Information	Exhibit 11-05 As-built
Intended Life Span	2016
Watershed Area (ac)	90.6
As-Built Capacity (ac-ft)	8.2
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year-6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	6.3
Max. Permissible Gauge Reading for Water/Sediment (ft)	4.9
Depth at Upstream Toe (ft)	8.9
NRCS Hazard Classification	Low
Spillway Type	Not required
25 yr - 6 hr Peak Discharge (cfs)	NA
Foundation Soil Type	Sandy Clay
Comments	

Table 11-5AS Area 4 North Pond 411

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from mining area
Design Information	APPENDIX 11-AA and Exhibit 11-161D
As-Built Information	Exhibit 11-161 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	12.5
As-Built Capacity (ac-ft)	1.7 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year – 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	1.2
Max. Permissible Gauge Reading for Water/Sediment (ft)	3.2
Depth at Upstream Toe (ft)	8.3
NRCS Hazard Classification	Low
Spillway Type	Not required
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Clay
Comments	

Table 11-5AT Area 4 North Pond 413

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from mining area
Design Information	APPENDIX 11-AA and Exhibit 11-6D
As-Built Information	Exhibit 11-6 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	6.8
As-Built Capacity (ac-ft)	2.6 plus 1-foot freeboard
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	0.6
Max. Permissible Gauge Reading for Water/Sediment (ft)	7.7
Depth at Upstream Toe (ft)	10
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

Table 11-5AU Area 4 North Pond 402

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from box cut spoils
Design Information	APPENDIX 11-AA and Exhibit 11-02D
As-Built Information	Exhibit 11-04 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	96.8
As-Built Capacity (ac-ft)	7.9
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	6.8
Max. Permissible Gauge Reading for Water/Sediment (ft)	6.0
Depth at Upstream Toe (ft)	15.4
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

Table 11-5AW Area 4 North Pond 404

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from box cut spoils
Design Information	APPENDIX 11-AA and Exhibit 11-04D
As-Built Information	Exhibit 11-04 As-built
Intended Life Span	2016
Watershed Area (ac)	11.7
As-Built Capacity (ac-ft)	1.6
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	1.0
Max. Permissible Gauge Reading for Water/Sediment (ft)	3.9
Depth at Upstream Toe (ft)	6.1
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

Table 11-5AX Area 4 North Pond 408

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from topsoil stockpile TS-401
Design Information	APPENDIX 11-AA and Exhibit 11-158D
As-Built Information	Exhibit 11-158 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	6.18
As-Built Capacity (ac-ft)	1.5
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	0.4
Max. Permissible Gauge Reading for Water/Sediment (ft)	4.5
Depth at Upstream Toe (ft)	5.2
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

Table 11-5AY Area 4 North Pond 409

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from topsoil stockpile TS-402
Design Information	APPENDIX 11-AA and Exhibit 11-159D
As-Built Information	Exhibit 11-159 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	2.83
As-Built Capacity (ac-ft)	0.26
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	0.2
Max. Permissible Gauge Reading for Water/Sediment (ft)	1.6
Depth at Upstream Toe (ft)	3.5
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

Table 11-5AZ Area 4 North Pond 410

Type of Pond	Sediment
Location	EXHIBIT 11-13F
Purpose	Retains the runoff from topsoil stockpile TS-402
Design Information	APPENDIX 11-AA and Exhibit 11-159D
As-Built Information	Exhibit 11-159 As-built
Intended Life Span	Until completion of final reclamation
Watershed Area (ac)	2.37
As-Built Capacity (ac-ft)	0.93
Curve Number (SCS)	Refer to Appendix 11-AA
Design Storm Event	100 year 6 hour
Peak Discharge (cfs)	Refer to Appendix 11-AA
Runoff Volume (ac-ft)	0.17
Max. Permissible Gauge Reading for Water/Sediment (ft)	2.7
Depth at Upstream Toe (ft)	3.0
NRCS Hazard Classification	Low
Spillway Type	N/A
25 yr - 6 hr Peak Discharge (cfs)	N/A
Foundation Soil Type	Sandy Loam
Comments	

TABLE 11-7

HIGHWALL IMPOUNDMENTS AND IMPOUNDMENTS
HAZARD CLASSIFICATION

IMPOUNDMENT ID.	LOCATION	CURRENT STATUS	WATERSHED AREA (ACRES)	CAPACITY (AC-FT)	DEPTH AT UPSTREAM TOE (FT)	HAZARD POTENTIAL	COMMENTS[(1)]:
Lowe Hole 3 Pond 2	Lowe	active	688.0	11.6	see comment	Low	impoundment (incised), see App.11-AA, Exh. 11-127A & 11-127D
Lowe Hole 3 Pond 3	Lowe	active	41.8	4.6	12.0	Low	impoundment, see Appendix 11-AA and Exhibit 11-127B.
Lowe-Dixon Diversion Pond	Lowe	active	1,604.6	19.5	11.8	Low	Impoundment
North Fork Pond	Dixon	active	198.7	19.5	12.3	Low	Impoundment
South Dixon Pond 7	Dixon	active	25.3	11.8	10.0	Low	Impoundment
Area 4-North Pond 406	A4N	active	238.1	14.2	9.0	Low	Impoundment, see Appendix 11-AA and Exhibit 11-156.
Area 4-North Pond 407	A4N	active	124.8	15.4	15.0	Low	Impoundment, see Appendix 11-AA and Exhibit 11-157.

(1) The standard design and as-built information for the highwall impoundments are in Appendix 11-II.

The existing side drainages entering the diversion channel will be riprapped to control erosion. The riprap material is sized for the 10 year-6 hour peak flow. The locations and details of the riprapped downdrains are presented on EXHIBIT 11-74B and 11-74C. The hydrology and design data for the downdrains are in Appendix 11-RR in the PAP.

The design criteria for the riprapped downdrains was revised, the flows to the downdrains are from ephemeral streams such flows are classified as miscellaneous flows. Temporary diversions for miscellaneous flows are designed to safely pass the peak flow from the 2 year-6 hour storm event (CFR 816.43(c)(3)). The revised design data for the riprapped downdrains are presented in Appendix 11-RR (as-built data) of the PAP.

The Burnham Road will be re-routed three times to facilitate the mining of Dixon Pit Extension. The first re-route will occur during or prior to the construction of Lowe/Dixon Diversion Channel Extension. This re-route will be a short segment that will be aligned along the east side of the diversion channel extension as shown on EXHIBIT 11-74. The second re-route will occur just prior to mining out the Lowe/Dixon Diversion Channel and the extension. This re-route will align the road around the northern and eastern boundary of the pit extension area. The alignment and the design of the re-routes will be coordinated with the BIA Roads Department. For the location and alignment of the re-routes refer to Exhibits 11-143. For more detailed information refer to Section 11.5.6.1.7 “Relocation or Use of Public Roads”.

When the diversion is no longer needed it will be re-graded and reclaimed in accordance with the guidelines and procedures outlined in Chapter 12, Sections 12.3, 12.5 and 12.6.

Table 11-11
Primary Road Segments

Road Areas	Length (feet)	Width (feet)	Grade (%)	Surface Material	Use	Area (acres)	Constr. Date	Anticipated Removal Date	Located on Exhibit	References
Area 3 By-pass Road	3970	70	0-4%	Gravel/Dirt	Access/Haul	6.37	1982	2019	11-82	Exhibit 11-90 to 92
Area III Main Access Road	5,160	60	0-4%	Pavement	Access	7.09	1982	2019	11-82	Design shown on EX. 11-112D and 11-12E
Barber By-pass Road	6,300	70	0-6%	Gravel/Dirt	Access/Haul	10.10	2003	2019	11-82	Exhibit 11-100 and 11-101A-C
Barber Haulroad	11,000	60	0-6%	Dirt	Haul	15.12	1978	2019	11-82	Modification design shown in EX. 11-129. Typical shown on EX. 11-84a.
Barber Hosteen Bypass (Gorman Road)	4,850	70	0-6%	Dirt	Access	7.78	1978	2019	11-81, 82	Typical shown on EX. 11-84A. Also known as Gorman Haulroad Road.
Big Fill Road	19,450	60	0-5%	Gravel/Dirt	Access	26.74	1973	2019	11-81	Typical shown on EX. 11-84A.
Block B Access Road	13,220	60	0-4%	Gravel/Dirt	Access	18.17	1992	2019	11-82	EX. 34-7F (CH. 34, NM-0003C PAP).
Burn's Pass Road	2,980	70	0-7%	Dirt	Access/Haul	4.78	1977	2019	11-81	Exhibit 11-64
Coal Plant Road	3,780	40	0-8%	Gravel/Dirt	Access	3.46	1996	2019	11-80	As-built shown on EX. 11-122a-d.
Dixon Haul Road	8,150	70	0-4%	Gravel/Dirt	Access/Haul	13.07	1999	2019	11-83	Exhibit 11-137, 137A & B
Doby Road	6,175	60	0-5%	Gravel/Dirt	Access	8.49	1970	2019	11-80	Typical shown on EX. 11-84A.
Employee Coal Dump Access Road	270	35	5%	Dirt	Access	0.22	1999	2019	11-82	Figure 11-28, Typical shown on EX. 11-84a.
Hosteen Haulroad	7,000	60	0-6%	Dirt	Haul	9.62	1977	2019	11-81	Drainage design shown in EX. 11-130. Typical shown on EX. 11-84a.
Hosteen Yazzie Haulroad	11,700	60	0-5%	Dirt	Haul	16.08	2000	2019	11-82	As-built shown on EX. 11-141c-e
Lowe Boxcut Road	5,720	70	0-6%	Gravel/Dirt	Access	9.17	1996	2019	11-82	As-built shown on EX. 11-103d-h.
Lowe Bypass Road	5,910	30	0-6%	Gravel/Dirt	Access	4.06	1994	2019	11-83	Design and as-built are shown on EX. 11-102a & b
Lynch Skyline	2,050	65	1-6%	Dirt	Access	3.05	1983	2019	11-81, 82	Typical shown on EX. 11-84A.
Mason Road	5,225	70	0-2%	Dirt	Access/Haul	8.38	1980	2019	11-82	Asbuilt shown on Exh. 11-138*.
Neck Road	8,500	120	0-6%	Gravel/Dirt	Access	23.37	1978	2019	11-82	Typical shown on EX. 11-84A.
Pinto Reroute	4,500	70	0-5%	Gravel/Dirt	Access	7.22	1989	2019	11-80	Typical shown on EX. 11-84A.
Pinto Road	5,500	60	0-5%	Gravel/Dirt	Access/Haul	7.56	1965	2019	11-80	Typical shown on EX. 11-84A.
Re-aligned Ramp 7 Road	5,225	30	0-6%	Gravel/Dirt	Access	3.59	1998	2019	11-80	As-built shown on EX. 11-119c-f.
Yazzie Skyline Road	6,450	65	0-7%	Dirt	Access	9.60	1970	2019	11-81	Typical shown on EX. 11-84A.
Yazzie Spoil Side Road	3,450	70	0-4%	Dirt	Access/Haul	5.53	2004	2019	11-81	Design shown on Exhibit 11-95
Yazzie Silos Access Road	400	50	0-8%	Dirt	Access	0.46	2005	2019	11-81	Design shown on Exhibit 11-07
Lowe Ramp-2 Haulroad	687	70	4%	Dirt	Access/Haul	1.40	2008	2019	11-83	As-built shown on EX. 11-153.
Dixon Ramp-2 Haulroad	1,398	60	0-7%	Dirt	Access/Haul	2.60	2008	2019	11-83	As-built shown on EX. 11-154.
Cottonwood Crossing Road	1,250	120	0-3%	Gravel/Dirt	Access/Haul	3.40	2009	2019	11-84	As-built shown in Appendix-TT
Area IVN Perimeter Haulroad (East segment)	2,200	120	0-1%	Gravel/Dirt	Access/Haul	6.05	2009	2019	11-94	Location shown on Exhibit 11-84
Area IVN Perimeter Haulroad (West segment)	4,100	120	0-4%	Gravel/Dirt	Access/Haul	11.27	2009	2019	11-94	Location shown on Exhibit 11-84
Total Length/Area Primary Roads [miles/acres]	31.5					253.8				

Note*Typical Cross-sections for primary road is shown on Exhibit 11-84A
Road locations shown on Exhibit 11-79 to 11-84.

As shown in these EXHIBITS 11-79 through 11-84 one continuous Primary road is shown traversing through Areas I, II, III and IV North. This road is the main Primary road with an approximate length of 15 miles. The point of beginning for the road is the North Area facilities, ending at Area IV North. There are several turnouts off this road which are also considered as Primary roads. Refer to TABLE 11-11 for more detail.

Ancillary Roads

Locations of roads classified as Ancillary are shown in EXHIBITS 11-79 through 11-84.

Where it is appropriate, most Ancillary roads are located where minimal or no road work is required for construction. Ancillary roads are usually one lane (7 ft. to 12 ft.) roads with no embankment.

11.5.6.1.3 Primary Road Conditions

Refer to EXHIBITS 11-84A and 11-112D (Area III Main Access Road) for Primary Road Typical Cross Sections. TABLE 11-11 contains information on each of the Primary Road segments.

Pinto Haulroad and Pinto Reroute

This haulroad was built during the early periods of Area I coal mining operations. The approximate date of Pinto Haulroad construction is 1965. The road is approximately 60 feet in width. Presently the road is in good condition and maintained by periodic blade work and side ditch cleaning.

A portion of the Pinto Haulroad was rerouted in 1989. The newer section of the road is shown as Pinto Reroute in EXHIBIT 11-80.

Dixon Haulroad

The Dixon Haulroad begins at the south end of Dixon pit, bends to the west toward the spoils, and then follows the regraded area north to the Lowe Coal Stockpile. The road will be used for truck haulage for coal mining and reclamation, and as an access road to south Dixon and eventually to Area IV North. The road is designed to Primary Road standards per Section 11.5.6. The road design and location can be found in Exhibit 11-137 and 11-83, respectively. The road information is included in TABLE 11-11, Section 11.5.6. Hydrology information for culvert design on CP-128 is located in Appendix 11-V, with the culvert location on Exhibit 11-12E also in this appendix. The road shall be constructed and maintained as outlined in Section 11.5.6.1.6 "Roads General Performance Standards".

Burn's Pass Road

The Burn's Pass Road begins at Turnout #2 (shown on EXHIBIT 11-81) and ends at the intersection with North Hosteen Ramp #1.

This road is primarily a maintenance access road to North Hosteen Ramp #1 and the main irrigation line. The road's sub-grade is mostly original ground that has been bladed. The road is in good condition.

Hosteen Haulroad

The Hosteen Haul Road serves Hosteen Pit Ramps #1 and #3. The haulroad is also the continuation of the Burn's Pass Road at the top of Ramp #1.

This road is used mainly for hauling the Hosteen Pit coal to the railroad stockpile. The majority of the road is built on reclaimed surface and is presently in good condition.

Hosteen Yazzie Haulroad

The Hosteen Yazzie Haulroad will be used to facilitate the Area II pre-stripping activities in the North Barber and Hosteen Yazzie Pits. The primary function of the road shall serve as a truck haulage road. The road is designed to Primary Road standards per Section 11.5.6.1 of the PAP and 30 CFR 816.151. The road design and as-builts can be found in Exhibits 11-141, 141a – e, and location on Exhibit 11-81. The road information is included in TABLE 11-11, Section 11.5.6. For hydrology information on culvert designs CP-129 through CP-149 (excluding CP-135, 140, and 147), refer to Appendix 11-V and Exhibit 11-12 & 12C-1. The road was constructed and will be maintained as outlined in Section 11.5.6.1.6 "Roads General Performance Standards".

Cottonwood Crossing

The Cottonwood Crossing connects with the south end of the Dixon Haulroad and continues south across the Cottonwood Arroyo connecting with the Area IV North East and West Perimeter Roads. This road serves as the primary access to the mining activities in Area IV North. The Cottonwood Crossing is used for coal haulage, pit access, and power line access. The location of the crossing is shown on Exhibit 11-84 and the detail designs are presented in Appendix 11-TT. Only the detail civil drawings and the hydraulic analysis of the box culverts and spillway are included in Appendix 11-TT. The structural and geotechnical detail engineering data and drawings were not included in Appendix 11-TT. This information however can be made available upon request. The road is constructed and maintained as outlined in Section 11.5.6.1.6 "Roads General Performance Standards".

Area IV North West Perimeter Road

This road connects with the Cottonwood crossing and bends around the west end of the Area IV North pit. This road intersects with the ramps coming out the Area IV North pit. The West Perimeter Road is used for coal haulage, pit access, access around

the west end of the pit, and power line access. The location of the road is shown on Exhibit 11-84 and the design is shown on 11-94A thru C. Road information can be found on Table 11-11 (Section 11.5.6). The road is constructed and maintained as outlined in Section 11.5.6.1.6 "Roads General Performance Standards". Slope stability analysis for the road embankments have been completed, see Appendix 11-I.

Area IV North East Perimeter Road

This road connects with the Cottonwood crossing and bends around the east end of the Area IV North pit. This road intersects with the ramps coming out the Area IV North pit. The East Perimeter Road is used for coal haulage, pit access, access around the east end of the pit, and power line access. The location of the road is shown on Exhibit 11-84 and the design is shown on Exhibit 11-94. Road information can be found on Table 11-11 (Section 11.5.6). The road is constructed and maintained as outlined in Section 11.5.6.1.6 "Roads General Performance Standards". Slope stability analysis for the road embankments have been completed, see Appendix 11-I.

Area 3 By-pass Road

In order to facilitate the uninterrupted mining of the remaining South Barber strips, a single reroute around the remaining mining strips was constructed in December 1994. The by-pass road is 60 foot wide, approximately 4,000 feet long, and is located west of the Area III Facility Complex.

Exhibit 11-82 shows the location of the Area 3 By-pass Road. Typical traffic will consist of pickup trucks and passenger vehicles using the road for pit access. Other traffic will include: 1) one-ton service trucks, 2) low boy delivery of dozers, drills, and dragline buckets, 3) forty-ton fuel and lube trucks, and 4) special delivery to the north area of the mine.

Table 11-12a Primary Road Culverts

(Culvert locations can be found on Exhibits 11-12B through 11-12E)

Culvert Label	Watershed Area (ac)	Culvert Diameter (inches)	Installed Slope (%)	Culvert Length (feet)	Tailwater Depth (ft)	Design Q (cfs)	Required HW (ft)	Available HW (ft)	Hydrology Information Appendix
CP-185	24.38	24	9.0	130	0	9.94	1.8	3.2	11-V
CP-186	108.5	24	2.9	206	0	13.02	2.0	5.3	11.V
CP-187	54.5	24	1.5	206	0	4.95	1.3	3.95	11.V
CP-189	90.6	30	5.2	330	0	65.69	10	23	11.V
CP-300	8.9	24	8.2	110	0	4.59	1.0	3.2	11.V
CP-301	1.3	24.0	6.3	122	0	1.24	0.5	8.90	11.V
CP-302	8.4	18.0	5.6	80	0	8.31	1.3	3.50	11.V
CP-303	2.4	18.0	4.1	86	0	2.85	0.8	3.3	11.V
CP-304	2.3	18.0	5.0	80	0	2.23	0.7	2.8	11.V
CP-305A&B	14.6	18 (2)	6.3	120	0	8.23	1.5	2.6	11.V
CP-306	2.7	18	3.3	80	0	2.67	0.7	5.5	11.V
CP-307	20.6	18	5.4	80	0	11.5	1.3	6.8	11.V
CP-308A&B	22.2	18	2.7	80	0	12.01	1.8	2.3	11.V
CP-309	9.2	18	2.3	80	0	9.08	1.3	5	11-V
CP-310	23317.7	96	1.0	120	0	564.05	8.0	12.5	11-V
CP-311	37.9	24	1.3	100	0	17.73	1.5	7.3	11-V
CP-312	5.5	24.0	2.4	80	0	4.76	1.0	2.60	11-V
CP-313	9.4	24.0	2.0	100	0	8.07	1.5	2.60	11-V
CP-314	10.4	24.0	1.1	80	0	6.30	1.5	3	11-V
CP-315	84.5	24.0	1.3	100	0	31.67	2.0	6.5	11-V
CP-316	23.7	24	2.0	100	0	8.9	1.3	6.3	11-V
CP-317	23687.4	96	1.0	93	0	561.93	8.0	13	11-V
CP-318	5.2	24	1.6	92	0	6.22	1.0	5.6	11-V
CP-319	6.2	24	2.4	100	0	7.52	1.3	4	11-V
CP-320A&B	10.0	18 (2)	1.3	80	0	12.01	1.5	4.9	11-V
CP-321	28.4	24	1.4	100	0	33.95	2.0	7.1	11-V
CP-322	28.7	24	1.3	60	0	20.79	1.8	4.8	11-V
CP-323	106.8	18	1.0	124	0	7.03	1.8	3	11-V

To facilitate the mining activities in the Dixon Pit extension area portions of N5028 will be relocated in three phases as described below. BHP will follow the guidelines as outlined under 30 CFR 761.12(d) (Procedures) and 780.33 (Relocation or use of public roads).

- The first phase of relocating N5028, as detailed on the Exhibit 11-143, "South Dixon Pit Extension – Burnham Road Re-route Location Map", re-routed approximately 3,750 feet of the road along the east side of the Lowe/Dixon Diversion Extension. This phase of the Burnham Road Re-route was mined through in 2009.
- The second phase the road relocation re-routed N5028 around the northern and eastern side of the Dixon Pit extension, see Exhibit 11-143 for alignment. The length of the re-route is approximately 14,500 feet increasing the length of the road by approximately 8,500 feet. Culverts were installed where drainages intersect the roadway. This road will also meet county road specifications and be passable in inclement weather and will be maintained by BHP. For more detailed information refer to Exhibit 11-60 and 11-60A thru C. The duration of this road alignment will be approximately 2009 to 2011.
- The final phase will be the permanent reroute of the road, which will move the N5028 alignment east of the Cottonwood Arroyo North Fork diversion. The approximate timing for this phase is 2011. The permanent road re-route will be constructed to meet the county road specifications, be passable in inclement weather, and be maintained by BHP until being released back to the BIA Roads Department.

Blasting operations in the vicinity of N5028 will follow the procedures outlined in Section 11.2.2 Blasting Operations.

No. 4-6 Coal Seam

The No. 4-6 Coal Seam is only partially saturated within the permit area. These saturated areas are restricted to Area III and the extreme eastern permit boundary of mid-Area II. As discussed in CHAPTER 6, the No. 4-6 unit pinches out entirely in the southern portion of the North Area. Flow from this seam is then encompassed in that of the interbedded lithologic units of the Fruitland Formation. Flow from the entire formation is considered in Section 11.6.2.3.4.3.

11.6.2.3.4.2 Areas II-III

In Area II, the No. 8 Coal Seam was not found to contain water within the permit area. Because of this fact, no transport of water will occur and no hydrologic impact assessment is needed.

As discussed in CHAPTER 6, the No. 8, 7, 4-6, and 2-3 Coal Seams all exhibit extremely low permeabilities and flow velocities. Travel times for all these units from the extreme southern portion of Area III, assuming that leachate will take the shortest path of travel towards Cottonwood Arroyo located in Area IV North, are in excess of 1,000 years.

11.6.2.3.4.3 Coal Seams and Interbedded Lithologic Units Treated as a Single Aquifer

When the coal seams and interbedded lithologic units of the Fruitland Formation are treated as a single aquifer, the potential migration of spoil leachate in groundwater is found to be similar to that predicted using No. 8 Coal Seam (i.e., flow rates were found to be 0.06 feet per day). Travel time, using the formation as a whole, from the northern most point on the mine to the San Juan River was found to be at least 240 years. See CHAPTER 6 for a complete discussion

TABLE 11-22

COMPARISON OF PRE- & POSTMINING AREAS, PEAK FLOWS AND SEDIMENT YIELDS
COTTONWOOD WASH
10-YEAR, 6-HOUR PRECIPITATION EVENT

SEDCAD 4.0 WATERSHED DESIGNATION		Pre-Mine				Post-Mine				Difference From Pre-Mine			
Pre	Post	Area (acres)	Peak Flow (cfs)	Sediment (tons)	Yield (tons/acre)	Area (acres)	Peak Flow (cfs)	Sediment (tons)	Yield (tons/acre)	Area (acres)	Peak Flow (cfs)	Sediment (tons)	Yield (tons/acre)
S21	S21	13,492	1,551	11,133	0.8	13,532	1,546	11,417	0.8	40	-5	284	0.0
S34	S34	18,191	674	7,201	0.4	18,279	665	7,298	0.4	88	-9	97	0.0
S36 (lease line)	S36	49,060	2,879	26,803	0.5	49,184	2,903	27,364	0.6	124	24	561	0.0
S37(Outlet)	S37	51,269	2,842	26,947	0.5	51,477	2,855	27,017	0.5	208	13	70	0.0

The comparison indicates there is no significant change between the pre and post-mine peak sediment and peak settleable concentrations. For the same storm event the total sediment yield in tons per acre declined for the post-mine condition.

11.6.3.12 Pinabete/Chaco Tributaries

Three tributaries to the Pinabete Arroyo will be disturbed by mining and reclamation support activities (powerlines, ancillary roads, and monitoring stations) in Area 4 North. The tributaries are identified as Tributary A, B, and C on Exhibit 11-77. The Pinabete Arroyo drainage basin is about 59.1 square miles. A small portion, approximately 11.5 square miles or 0.002 percent of the drainage basin will be disturbed.

A tributary to the Chaco Wash will also be disturbed by mining and reclamation support activities (powerlines, ancillary roads, monitoring stations) in Area 4 North. The tributary is identified as Tributary A to the Chaco on Exhibit 11-77. The Chaco Wash drainage basin is approximately 4,350 square miles. A very small portion, approximately 8.2 acres (2.9×10^{-6} percent) square miles will be disturbed by the mining and reclamation support activities.

Pre-mining drainage density within the Area 4 North disturbance area was estimated to be 2.64 mi./sq. mile. The surface support facilities planned within the Pinabete Arroyo and Chaco Wash watersheds will not affect the pre-mine drainage densities within these watersheds..

Final Surface Configuration designs were developed in CHAPTER 12 (see Section 12.3, EXHIBITS 12-7A). For design of the reclaimed channels, see Section 11.6.5.3.

The reclamation of the surface support facilities (ancillary roads, powerlines, and monitoring stations) will only require minor final regrading and revegetation to tie the area into the existing topography. Based on the planned activities within these watersheds, BNCC is not anticipating any changes in the sediment yields, runoff volumes, and peak sediment concentrations for the

three tributaries to the Pinabete Arroyo tributary or to the Chaco Wash. Refer to Appendix 7.O, for the pre-mining Chaco and Pinabete Tributaries hydrology and sedimentology.

TABLE 11-30. The comparison of the peak flows and sediment yields from the 10 year-6 hour storm event indicates decreases in flow and sediment yield in the post-mine conditions from Tributary B and C to the Pinabete that are sufficient to offset the increases in sediment yield and flow from Tributary A to the Chaco and Tributary A to the Pinabete. The total sediment yield is predicted to decline from 468 tons pre-mine to 346 tons post-mine. The total flow leaving the permit area is predicted to decline from 238 cfs pre-mine to 180 cfs post-mine.

The runoff volume resulting from a 10 year-6 hour precipitation event in the post-mine condition is predicted to decline from a pre-mining estimate of 30 ac-ft to a post-mining estimate of 23 ac-ft for all the tributaries combined.

The SEDCAD 4.0 modeling for the 10 year-6 hour event indicates that the predicted peak sediment concentration for Tributary A to the Chaco and Tributary B to the Pinabete in the post-mining conditions are similar to pre-mine even though the predicted peak settleable solids concentration increased from 8 ml/l to 9 ml/l and 0 ml/l to 11 ml/l, respectively. The increase in peak settleable solids is attributable to replacement of premining badland areas (clay-rich) with a postmining sandy loam soil. The clay rich areas will increase the suspended solids concentration, while sandy loam areas will decrease the suspended solids concentration and increase the settable solids (sand) concentration.

The modeling also indicates a decrease in peak sediment concentration for Tributary C to the Pinabete in the post-mine condition that is sufficient to offset the increase peak sediment concentration for Tributary A to the Pinabete. The peak sediment concentration for Tributary C and A to the Pinabete are 41,628 mg/l pre-mine, 31,607 mg/l post-mine and 9,517 mg/l pre-mine, 15,224 mg/l post-mine, respectively. The overall sediment yield, all tributaries combined, is 0.4 tons/acre pre-mine and 0.2 tons/acre post-mine.

11.6.5.2 Ephemeral Stream Diversion Designs

All streams within the Navajo Mine Permit Area with the possible exception of Chinde Arroyo are hydrologically ephemeral streams. Nevertheless, OSM regulations classify all streams with drainage areas greater than one square mile as intermittent streams regardless of flow conditions. Therefore, this section provides information concerning design of permanent diversions for ephemeral streams and addresses low order stream segments with drainage areas less than one square mile. Reclamation structures will be designed in accordance with the Reclamation Surface Stabilization Handbook.

Design flows were developed using the SEDCAD+ computer model following the procedures and assumptions described in CHAPTER 7.

11.6.5.3 Area IV North Reclaimed Channels

All the drainage basins in post-mining topography are less than one square mile (640 acres). Per the Reclamation Surface Stabilization Handbook the channels for these drainage basins will not require detail designs. The detail designs will be developed during the final regrading and reclamation process.

11.6.5.4 Area I South Reclaimed Channels

There is one reclaimed channel in the Area I South FSC with a watershed larger than 640 acres, which requires detailed designs according to the Reclamation Surface Stabilization Handbook. The reclaimed channel is designated as the Doby North Channel. The alignment of the reclaimed channel is shown on EXHIBIT 11-85 and 12-5A.

In the vicinity of Doby Pit, the pre-mine surface sloped down towards the west with primarily sheet flow drainages and some small channels. The post-mine topography changed the pre-mine drainage pattern by diverting the westward drainages from the off lease undisturbed surface towards the south via a post-mine channel that runs north to south along the eastern lease

APPENDIX 11-I

STABILITY ANALYSES

August 2009

GEOMAT INC
2060 Afton Place ◆ Farmington, NM 87401 ◆ Tel (505) 327-7928 ◆ Fax (505) 326-5721

August 27, 2009

Ron C. Van Valkenburg, P.E.
BHP Billiton
BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico 87416

RE: Proposed Area 4 North Coal Haulage/Small Vehicles Road
Pond Embankment Slope Stability Analysis
Ponds 401, 402, 403, 404, and 405
GEOMAT Project No. 92-0893

GEOMAT Inc. (GEOMAT) has completed geotechnical engineering analyses to evaluate the stability of the proposed roadway embankments which will form the dams of the Navajo Mine Area 4 North Ponds 401, 402, 403, 404, and 405 at the referenced project site. As shown on the Plan and Profile sheets (provided by BHP Billiton) in Appendix A, Ponds 401 through 405 will be located along the south side of Cottonwood Wash between Stations 157+00 and 108+00 on the south side of the proposed Area 4 North Road. The pond embankments will range from approximately 200 to 900 feet in length and 12 to 50 feet in height. We understand the embankments will be constructed of compacted materials obtained from two on-site borrow areas as shown on the Site Plan in Appendix A. The ponds will retain sediment from storm runoff. The maximum depth of water retained in the ponds will range from approximately eight feet in Ponds 401 and 405 to 18 feet in Pond 404. We also understand the topsoil present at the embankment sites will be removed and stockpiled prior to construction of the ponds.

Our scope of services for this project included a site reconnaissance by a geotechnical engineer, a subsurface exploration program, laboratory analyses, and slope stability analyses. Our services were performed in general accordance with our Proposal No. 92-08-04 dated August 5, 2009.

SITE RECONNAISSANCE

A geotechnical engineer from our office performed a site reconnaissance on August 6 and 10, 2009. Selected photographs taken during the reconnaissance trips are presented in Appendix B.

SUBSURFACE EXPLORATION

Subsurface conditions were explored on August 10, 2009 by drilling one exploratory boring at each of the five proposed pond embankment sites as shown on the Site Plan in Appendix C. The borings were advanced with a CME-45 truck-mounted drill using a combination of 4-inch O.D. solid stem and 7-inch O.D. hollow-stem augers. Each boring was advanced to a depth of approximately 20 feet below existing ground surface, with the exception of boring B-5, which was terminated at a depth of about 13 feet due to auger refusal on sandstone.

The borings were continuously monitored by a geologist from our office who examined and

classified the subsurface materials encountered, obtained representative samples, observed groundwater conditions, and maintained a continuous log of each boring. Soil samples were obtained from the borings using a combination of standard 2-inch O.D. split spoon and 3-inch O.D. modified California ring barrel samplers. The samplers were driven using a 140-pound hammer falling 30 inches. The standard penetration resistance was determined by recording the number of hammer blows required to advance the sampler in six-inch increments.

Groundwater evaluations were made in each boring at the time of site exploration. Soils were classified in accordance with the Unified Soil Classification System described in Appendix C. Boring logs were prepared and are presented in Appendix C.

In addition to the borings, an exploratory test pit was excavated at each of the two proposed borrow sites at the approximate locations shown on the Site Plan in Appendix C. The test pits were excavated using a rubber-tire backhoe with a 24-inch bucket. Logs of the test pits were prepared and are presented in Appendix C. Bulk samples of the materials were obtained for laboratory testing.

In borings B-1 and B-2 (Ponds 401 and 402, respectively), we encountered loose silty sand to the total depths explored. In borings B-3, B-4, and B-5 (Ponds 403, 404, and 405, respectively), we encountered approximately five feet of clayey sand overlying sandstone, shale, and coal.

Groundwater was encountered at a depth of approximately 20 feet in boring B-2. Groundwater was not observed in the other borings.

LABORATORY ANALYSIS

Laboratory analyses of representative samples indicate that the silty/clayey sand soils encountered in the borings have fines contents (silt- and/or clay-sized particles passing the U.S. No. 200 sieve) ranging from approximately 13 to 50 percent. The plasticity index of a sample of the clayey sand was 12. In-place dry densities of the sandy soils from the borings ranged from approximately 96 to 106 pounds per cubic foot (pcf), with natural moisture contents on the order of 2 to 7 percent.

Samples of the proposed borrow material from the test pits were analyzed for suitability as fill material. Fines contents of this material were on the order of 30 percent and the plasticity index was about 16. Laboratory maximum dry densities of two samples tested were approximately 108 and 112 pcf at optimum moisture contents of 18 and 16 percent, respectively (as determined by ASTM D 698, Standard Proctor).

Direct shear analyses were performed on undisturbed samples of the silty sand soils from borings B-1 and B-2 at depths of 10 feet below ground surface. The tests were conducted in accordance with ASTM D 3080-04. The phi angles of the samples were 33.9 and 33.0 degrees for the samples from B-1 and B-2, respectively. Both samples were cohesionless.

A summary of laboratory results is presented in Appendix C.

SLOPE STABILITY ANALYSIS

Both the pond side and the non-pond sides of the embankments at Ponds 401 through 405 were analyzed. The embankments were analyzed with the ponds full and empty and with and without pseudo-static earthquake forces of 0.1g. The configurations of the embankments, properties of the native soils/rock and imported soils that will be used to construct the embankments, and surcharge loading conditions which were used in the analyses are as follows:

- Slopes of both the pond and non-pond sides of the embankments were analyzed,
- Slopes of safety berms: 1.5:1 H:V,
- Elevations of the embankments were provided to us by BHP,
- Embankment material to be used: compacted on-site clayey sand and gravel: compacted density 130 pcf; cohesion 250 psf; angle of internal friction (phi) 35 degrees,
- Material type and strength data for the soil to be used in the embankments are based on information obtained by GEOMAT for this project from the exploratory borings and laboratory tests.
- The shoe ground pressure of 25.3 psi imposed by the Marion 7920 Dragline while traveling on the haul road was the design surcharge used for all the analyses.

The location and configuration of the embankments and ponds are depicted on the Plan and Profile sheets in Appendix A. Appendix A also contains a sheet (provided by BHP Billiton) showing the embankment cross-sections.

We understand that the ponds will be used to retain sediment from storm runoff water. The ponds are not expected to impound water for long periods of time.

The Galena Slope Stability Analysis System computer software, version 4.02 was used to analyze the stability of both sides (the pond-side and non-pond-side) of the embankments. It should be noted that due to requirements of the program, all the slopes are plotted ascending to the right. Both the pond-side and non-pond sides were analyzed with and without water. The analyses were also performed with and without a pseudo-static earthquake force of 0.1g. The analyses were performed using the soil strength/density parameters that were obtained by GEOMAT and that are presented in Appendix C of this report.

In our analysis, we assumed removal of the top five feet of soil (topsoil) before construction of the embankments. The underlying layers of sandstone were defined as having a cohesion ranging from about 100,000 to 200,000 psf and a phi angle of approximately 2 to 4 degrees. The coal seam was modeled with a unit weight of 80 pcf, a cohesion of 2,000 psf (approximately 14 psi) and a phi angle of 3 degrees. These values are estimates intended to be conservative for these material types.

Rapid drawdown conditions were not analyzed, since a phreatic surface should not develop during the short time the water is expected to be impounded.

The results of the analyses are shown in the following table. Individual sheets showing the details of the calculations and the configurations of the slopes used in the calculations are available upon request.

Pond Area	Side	Water Condition	Pseudo Static Earthquake (%g)	Calculated Factor of Safety
401	Pond	Reservoir empty	0.0	2.0
401	Pond	Reservoir empty	0.1	1.8
401	Pond	Reservoir full	0.1	1.7
401	Non-Pond	Reservoir empty	0.0	2.0
401	Non-Pond	Reservoir empty	0.1	1.6
401	Non-Pond	Reservoir full	0.1	1.4
402	Pond	Reservoir empty	0.0	2.1
402	Pond	Reservoir empty	0.1	1.7
402	Pond	Reservoir full	0.1	1.4
402	Non-Pond	Reservoir empty	0.0	2.0
402	Non-Pond	Reservoir empty	0.1	1.7
402	Non-Pond	Reservoir full	0.1	1.7
403	Pond	Reservoir empty	0.0	2.2
403	Pond	Reservoir empty	0.1	1.8
403	Pond	Reservoir full	0.1	1.6
403	Non-Pond	Reservoir empty	0.0	1.9
403	Non-Pond	Reservoir empty	0.1	1.6
403	Non-Pond	Reservoir full	0.1	1.3

Pond Area	Side	Water Condition	Pseudo Static Earthquake (%g)	Calculated Factor of Safety
404	Pond	Reservoir empty	0.0	2.1
404	Pond	Reservoir empty	0.1	1.7
404	Pond	Reservoir full	0.1	1.5
404	Non-Pond	Reservoir empty	0.0	1.7
404	Non-Pond	Reservoir empty	0.1	1.5
404	Non-Pond	Reservoir full	0.1	1.2
405	Pond	Reservoir empty	0.0	1.7
405	Pond	Reservoir empty	0.1	1.4
405	Pond	Reservoir full	0.1	1.3
405	Non-Pond	Reservoir empty	0.0	1.6
405	Non-Pond	Reservoir empty	0.1	1.4
405	Non-Pond	Reservoir full	0.1	1.2

As shown in the above table, the calculated factors of safety range from 1.2 to 2.2 for the 1.5:1 H:V embankment slope. All of the slopes and conditions met what we understand is the Office of Surface Mining (OSM) required factor of safety of 1.3, except for the non-pond side of 404 and the non-pond side of 405. The factors of safety for these two embankments were 1.2 under the conditions of the reservoirs being full at the time there was an earthquake. Since the conditions of the earthquake and high water occurring at the same time are unlikely and the factors of safety are within 0.1 of the 1.3 value, it is our opinion that the design conditions are adequate. If higher factors of safety are required, the slopes could be reduced from 1.5:1 H:V to 2:1 H:V.

The analysis and recommendations submitted in this report are contingent upon proper compaction of the fill material used to construct the embankments. Soils should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557 (modified proctor) at a moisture content between two (2.0) percent below and four (4.0) percent above the optimum moisture content. Fill should be placed in lift thicknesses that can be compacted to the required density by the type of compaction equipment being used.

The nature and variation of the native materials and the materials to be used to construct the embankment may not become evident until construction or until the final source location and type

of material to be used in the embankment is determined. If variations then appear, it will be necessary to reevaluate the recommendations of this report. Likewise, in the event that any changes in the nature, design, configuration or location of the embankment slopes are made, the recommendations contained in this report shall not be considered valid unless the changes are reviewed and the recommendations of this report modified or verified in writing by GEOMAT.

Thank you for the opportunity to work with you on this project. If you have any questions or need additional information, please let us know.

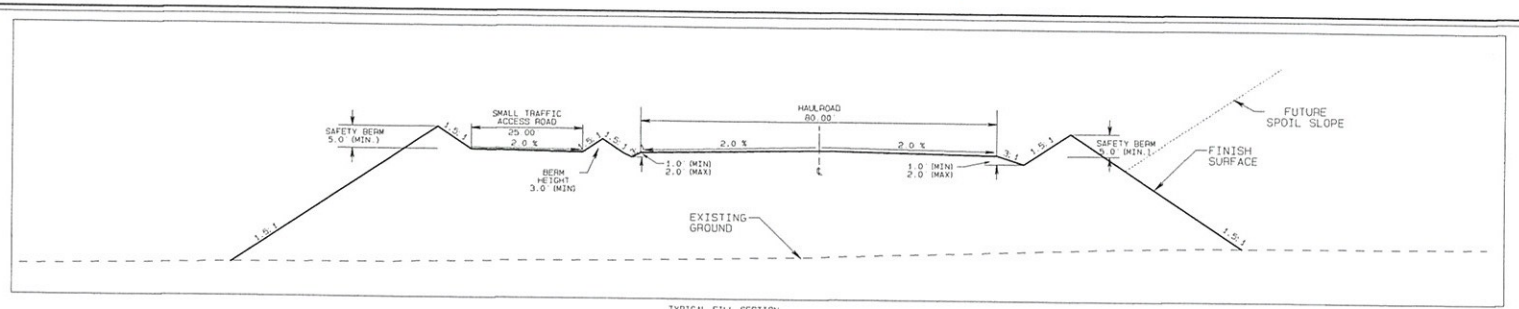
Sincerely yours,
GEOMAT Inc.

GEORGE A. MADRID
NEW MEXICO
9110
REGISTERED PROFESSIONAL ENGINEER

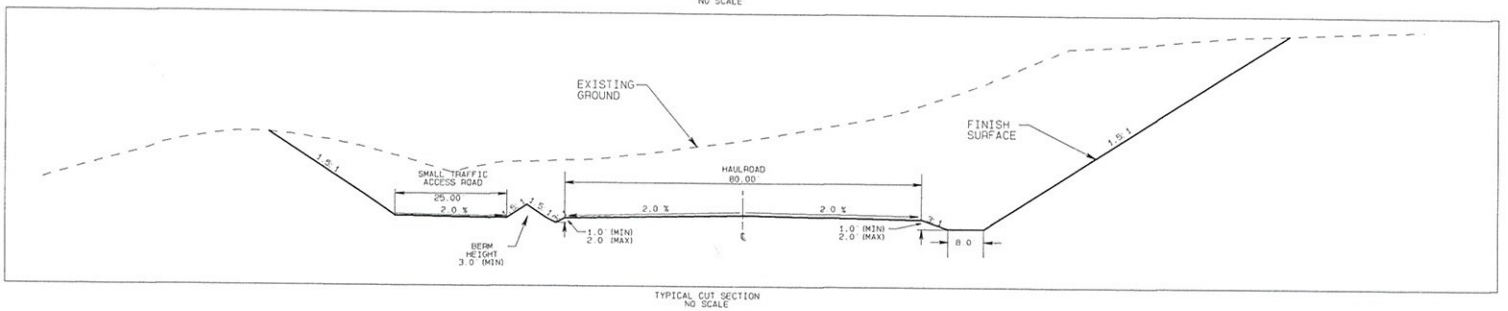
George A. Madrid, P.E. 8.27.09
President, Principal Engineer

Distribution: Addressee (1)

Appendix A

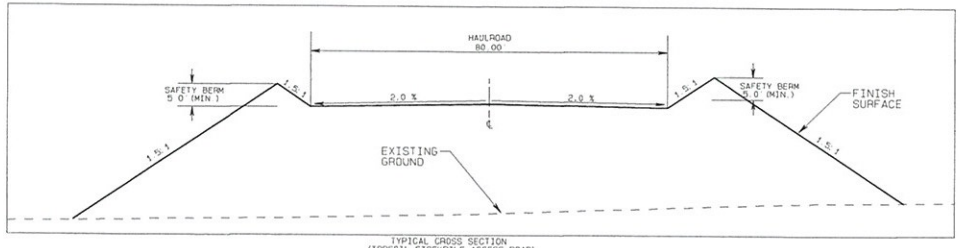


TYPICAL FILL SECTION
NO SCALE

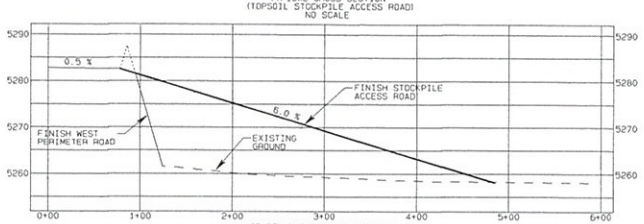


TYPICAL CUT SECTION
NO SCALE

ABOVE TYPICAL CUT AND FILL SECTIONS
EAST PERIMETER ROAD (VIEW LOOKING SE)
WEST PERIMETER ROAD (VIEW LOOKING NE)



TYPICAL CROSS SECTION
(TOPSOIL STOCKPILE ACCESS ROAD)
NO SCALE



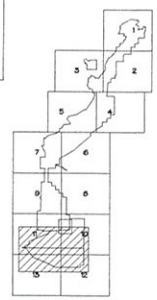
CENTERLINE OF ROAD PROFILE
(TOPSOIL STOCKPILE ACCESS ROAD)
Horizontal - 1"=60
Vertical - 1"=12

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5429.45 LEASE CORNER
- L-30
- PERMIT/LEASE BOUNDARY

NOTES

1. For hydrology and design information refer to Appendix 11-2 in the approved PAP.



SCALE AS NOTED

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 REGISTERED PROFESSIONAL ENGINEER

bhpbilliton
BHP NAVAJO COAL CO.

PROJECT MANAGER: DK
DSGN BY: MICHAEL LA
REV #1: 4/6 HC 9/00
SPVD BY: RICHARD
REV #2: 4/6 HC

REVISION
1 SUBMITTED TO OSM FOR APPROVAL
2
3
4
5
6
DATE
12/27/04

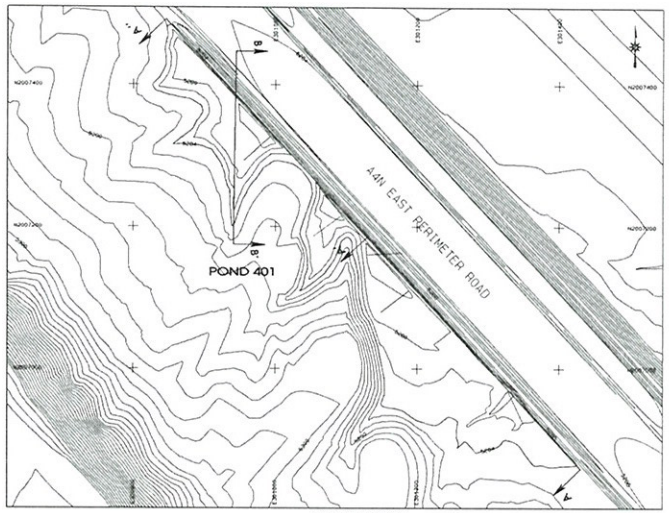
ACCEPT-
DATE: OCTOBER 10, 2004
DRAWN BY: RH
CHECKED BY: RH
APPROVED BY: LA

PLAN, PROFILE AND SECTIONS

EXHIBIT 11-94C
AREA 4 NORTH
EAST & WEST PERIMETER ROAD
Design

DRAWING

SHEET 3 OF 3



PLAN VIEW
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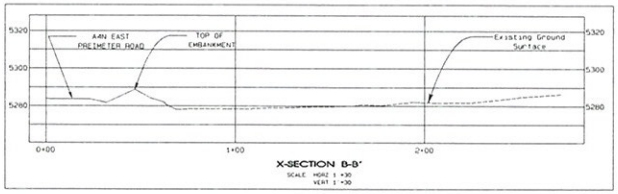

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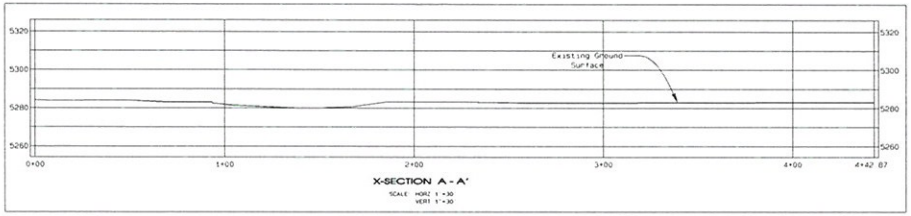
VERT 1"=30



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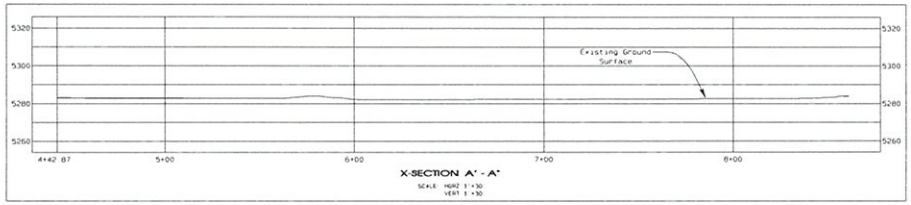


X-SECTION A'-A"
SCALE HORZ 1"=30
VERT 1"=30

LEGEND

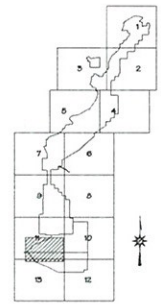
- ROAD
- BUILDING
- FENCE
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5290 INTERMEDIATE CONTOUR
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5AM of the MM PAP

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM VOLUME ac-ft
5274	0.046	0.00	0.00
5276	0.199	0.20	0.20
5278	0.471	0.70	0.90
5280	0.949	1.40	2.30
5282	1.237	2.20	4.50



SCALE AS NOTED

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

REVISION	DATE
0 ISSUED WITH NEW MINE PLAN SUBMITTAL	Aug 31 09

PROJECT MANAGER: F. DOMAN
PROJ. # 80108 401 11 MN PLANS
DRAWN BY: MCP
DESIGN BY: MCP
REVIEW BY: MC

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717 FARMINGTON NEW MEXICO 87499 PHONE 505-598-3000 FAX 505-598-3381

PROJECT: MM
DATE: AUG 2009
DESIGNED BY: RCV
DRAWN BY: SUPPORTED
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 11-001
AREA 4 NORTH
POND 401
Design

DRAWING:

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OF 0

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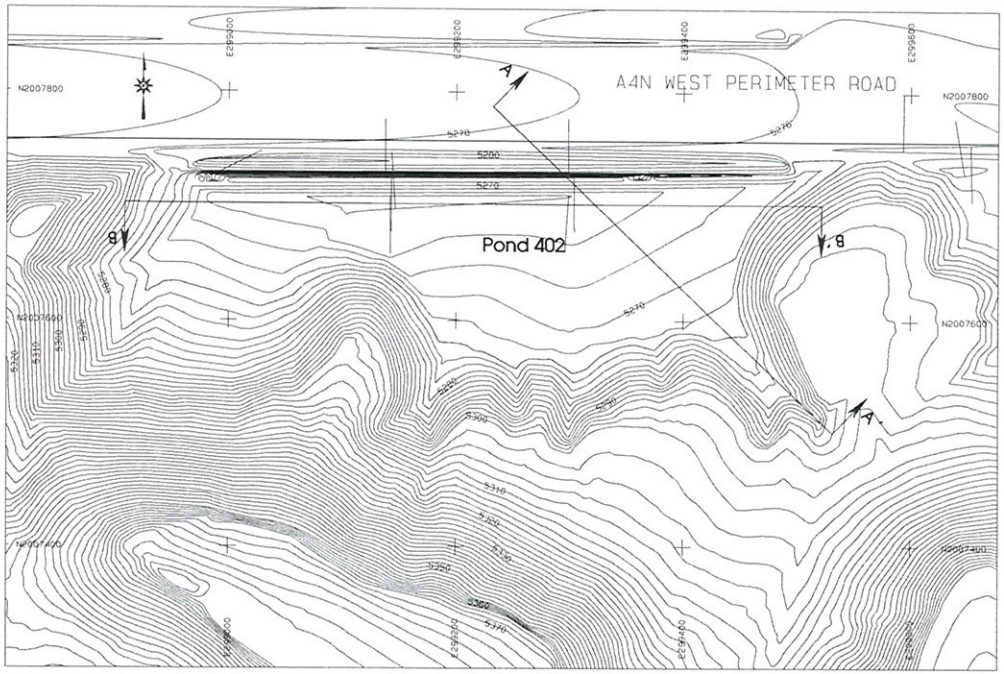

PLAN VIEW
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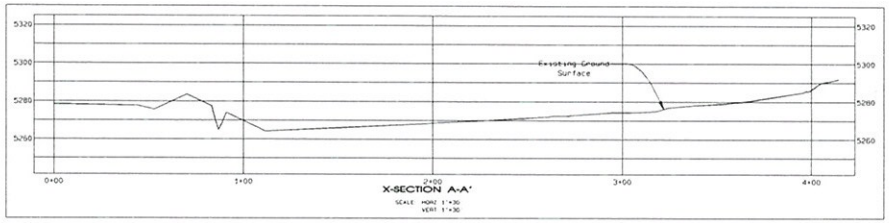

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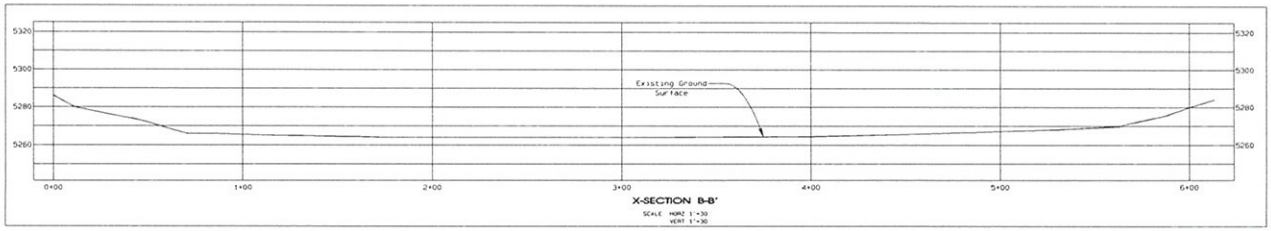
VERT 1"=30



X-SECTION B-B'
SCALE: HORZ 1"=30
VERT 1"=30

LEGEND

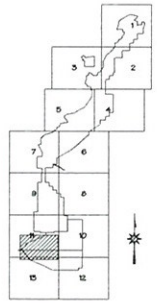
- ROAD
- BUILDING
- FENCE
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5290 INTERMEDIATE CONTOUR
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5AM of the NM PAP

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM VOLUME ac-ft
5260	0.09	0.00	0.00
5262	0.31	0.40	0.40
5264	0.49	0.80	1.20
5266	0.66	1.10	2.30
5268	0.84	1.50	3.80
5270	1.06	1.90	5.70
5272	1.33	2.40	8.10
5274	1.54	2.90	11.00
5276	1.75	3.30	14.30



SCALE AS NOTED

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

bhpbillion
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717 FARMINGTON NEW MEXICO 87499 PHONE 505-598-3208 FAX 505-598-3381

PROJECT: AMM
DATE: AUG 8 2013
DESIGNED BY: RCV
DRAWN BY: P.PORTER
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 11-02
AREA 4 NORTH
POND 402
Design

DRAWING
SHEET
OF 6

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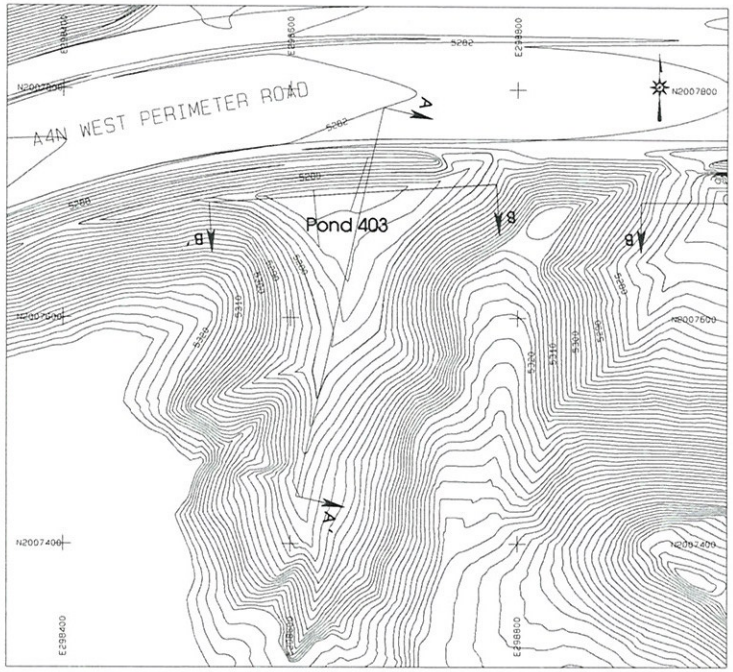

PLAN VIEW
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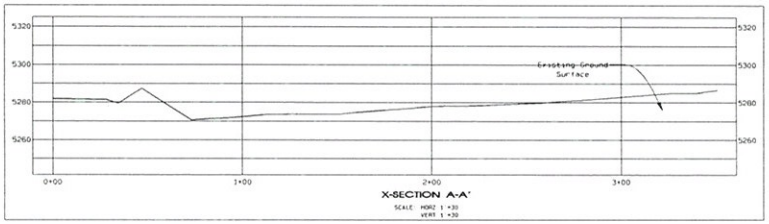

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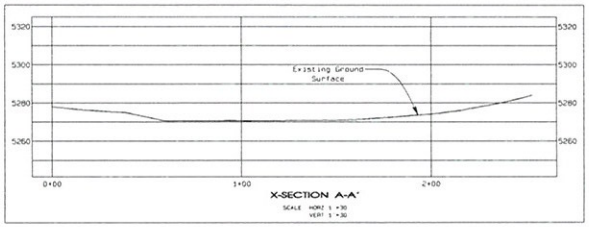


X-SECTION A-A'
SCALE HORZ 1 =30
VERT 1 =30

LEGEND

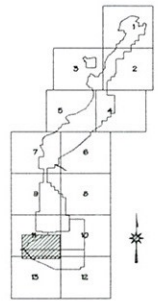
- ROAD
- BUILDING
- FENCE
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13P
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5AM of the NM PAP

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM VOLUME ac-ft
5265	0.00	0.00	0.00
5268	0.02	0.00	0.00
5270	0.05	0.10	0.10
5272	0.09	0.10	0.20
5274	0.15	0.20	0.50
5276	0.24	0.40	0.90
5278	0.33	0.60	1.40
5280	0.45	0.80	2.20



SCALE AS NOTED

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 REGISTERED PROFESSIONAL ENGINEER

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717 FRUITLAND NEW MEXICO 87416 PHONE 505-598-3805 FAX 505-598-3861

PROJECT: AS BUILT
DATE: AUG 8, 2013
DESIGNED BY: MCV
DRAWN BY: EXPLOTER
CHECKED BY: MCV
APPROVED BY: MCV

PLAN, PROFILE AND SECTION

EXHIBIT 11-03
AREA 4 NORTH
POND 403
Design

DRAWING

SHEET
OF 0

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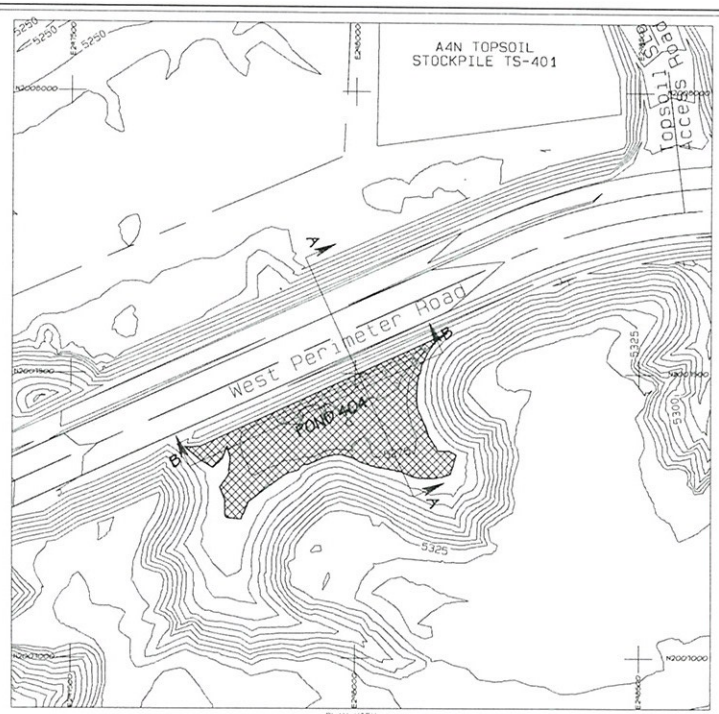

PLAN VIEW
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LEGEND

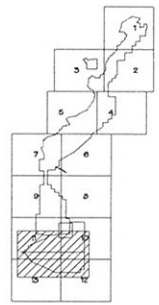
ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
×5338.5 SPOT ELEVATION
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
218 / 5422.45
L-30 LEASE CORNER
PERMIT/LEASE BOUNDARY

NOTES

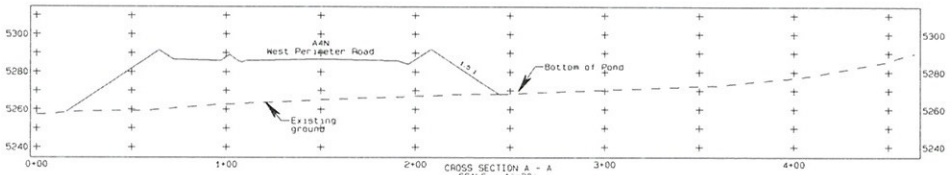
1. For hydrology and design information refer to Appendix 11-2 in the approved PAP
1. Refer to Exhibit 11-13F for watershed information and location of ponds

STAGE STORAGE DATA

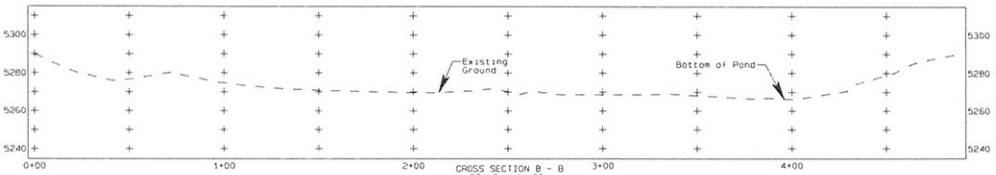
ELEV feet	AREA acres	VOLUME ac-ft	CUM VOLUME ac-ft
5266	0.0	0.0	0.00
5268	0.03	0.0	0.0
5270	0.15	0.2	0.2
5272	0.45	0.6	0.8
5274	0.68	1.1	1.9
5276	0.87	1.5	3.5
5278	1.06	1.9	5.4
5280	1.32	2.4	7.8
5282	1.58	2.9	10.7
5284	1.83	3.4	14.1



SCALE AS NOTED



CROSS SECTION A - A
SCALE - 1 "=30



CROSS SECTION B - B
SCALE - 1 "=30

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 CERTIFIED PROFESSIONAL ENGINEER

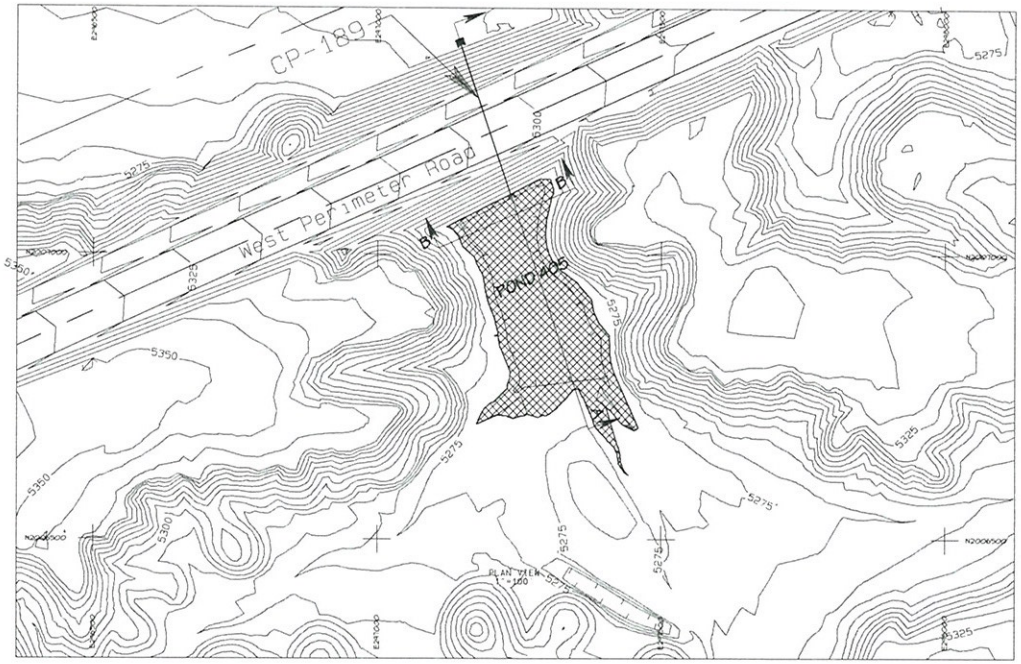
BHP NAVAJO COAL CO.
NAVAJO MINE

EXHIBIT 11-4
AREA 4 NORTH
POND 404
Design

PLAN, PROFILE AND SECTIONS

DRAWING

SHEET 1 OF 1



LEGEND

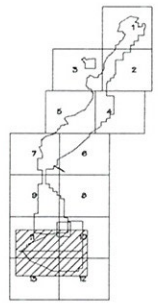
ROAD
WATERSHED
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
×5338.5 SPOT ELEVATION
5300 INDEX CONTOUR
5298 INTERMEDIATE CONTOUR
219 / 5422.45
L-30 LEASE CORNER
PERMIT/LEASE BOUNDARY

NOTES

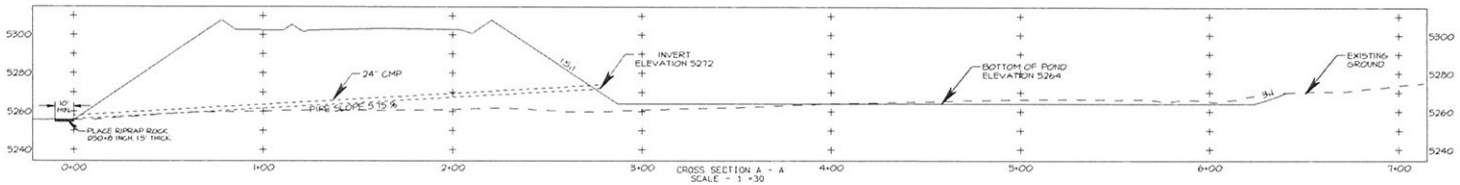
1. For hydrology and design information refer to appendix 11-2 in the approved PAP
2. The watershed areas for culverts are shown on Exhibit 11-12F
3. The watershed areas and location for Ponds are shown on Exhibit 11-13F

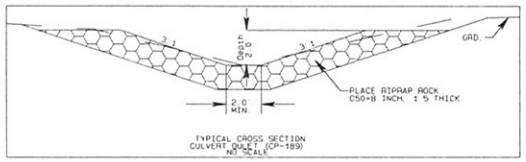
STAGE STORAGE DATA

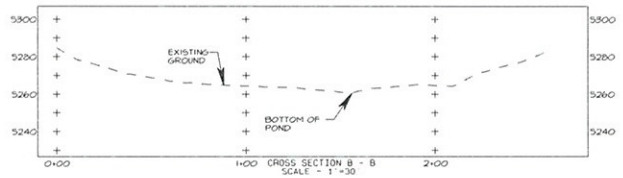
ELEV feet	AREA acres	VOLUME ac-ft	CUM VOLUME ac-ft
5264	0.93	0.0	0.00
5266	1.07	2.0	2.0
5268	1.24	2.3	4.3
5270	1.56	2.8	7.1
5272	2.12	3.7	10.8



SCALE AS NOTED







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

REVISION	DATE
1 SUBMITTED TO OSM FOR APPROVAL	08/31/09
2	
3	
4	

PROJECT MANAGER: FG
PLAN of RECORD: REV 10
DRAW of RECORD: REV 10

BHP NAVAJO COAL CO.

ACCOUNT:
DATE: AUGUST 31, 2009
DESIGNED BY: RCV
DRAWN BY: RCV
CHECKED BY: MCT
APPROVED BY: MCT

PLAN, PROFILE AND SECTIONS

EXHIBIT 11-5
AREA 2 NORTH
PAGE 405
Design

DRAWING

SHEET 1 OF 1

Appendix B

SITE PHOTOGRAPHS

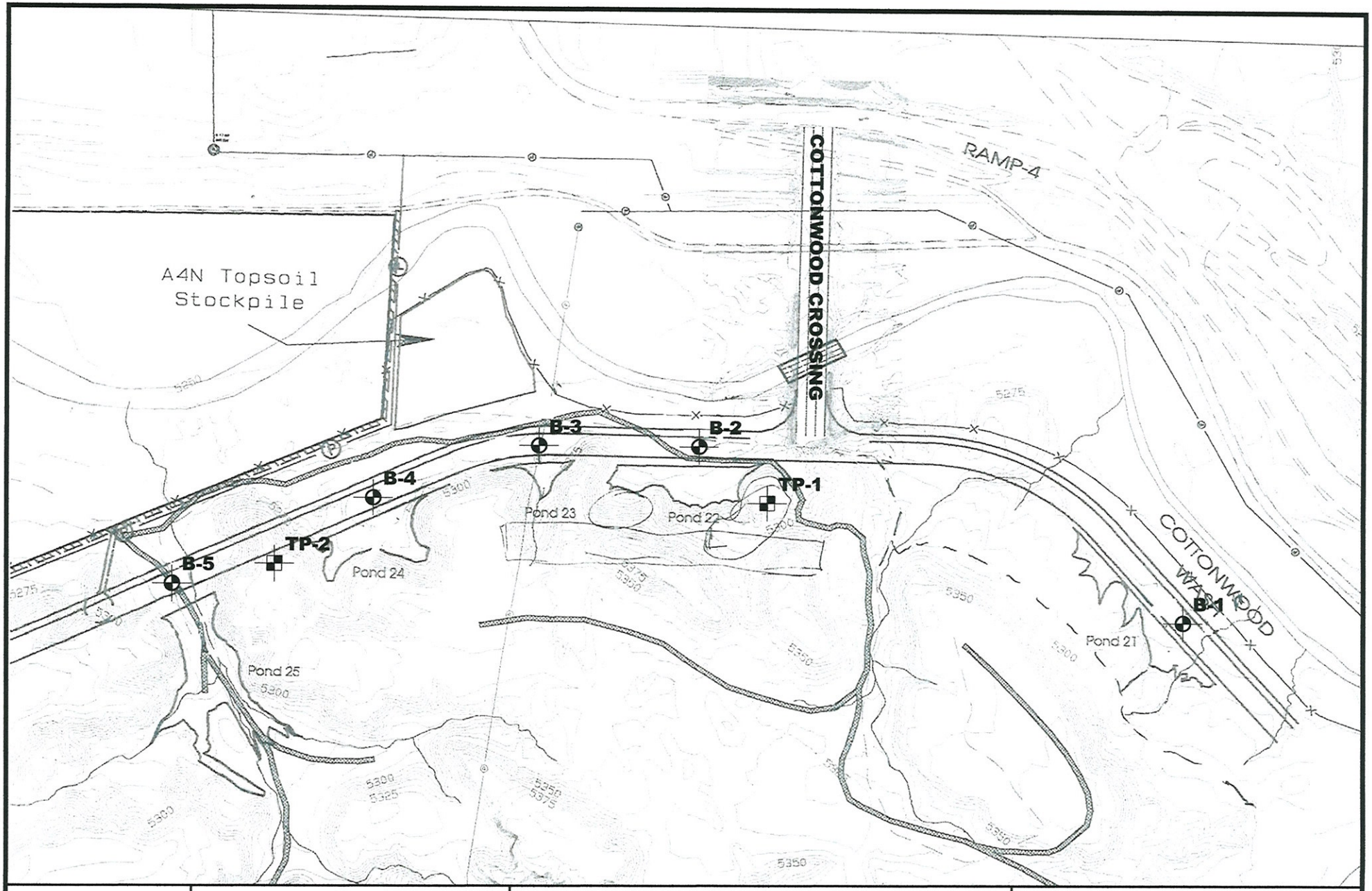
Test Pit TP-1 (Borrow Site)

Borrow Material from Test Pit TP-1

Drill Rig at Pond 405

Test Pit TP-2 (Borrow Site)

APPENDIX C



Approximate Not to Scale	SITE PLAN Boring Locations (approximate) GEOMAT Project No. 92-0893 Date Test Pits Excavated: 8-10-09 Date Borings Drilled: 8-10-09	PROJECT A4N Pond Embankment Stability Analysis Navajo Mine Area 4 North San Juan County, New Mexico

GEOMAT INC

Appendix 11-I

GEOMAT INC.
2060 Afton Place
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-1

Project Name: A4N Pond Embankment Stability
Project Number: 92-0893
Client: BHP Billiton
Site Location: Navajo Mine Area 4 North
Rig Type: CME-45
Drilling Method: 4" O.D. Solid Stem Auger
Sampling Method: Ring and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 8/10/2009
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: Don Baldwin
Remarks: Pond 401

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
									1	SILTY SAND with trace gravel, gray, fine-grained, loose, dry to moist, weak cementation
									2	
									3	
									4	
106.4	24		2.9	3-7-10	MC 18				5	
									6	
									7	
									8	
									9	
				5-5-8	MC 18		SM		10	
									11	color change to dark gray trace of fine-grained organic material
									12	
									13	
									14	
									15	
				2-11-15	MC 18				16	becoming medium dense white salt stringers
									17	coal fragments
									18	
									19	
									20	
				3-6-8	SS 18				21	
									22	Total Depth 21.5 feet
									23	
									24	
									25	

A = Auger Cuttings GRAB = Hand Sample MC = Modified California (Ring Sample) SS = Split Spoon

GEOMAT 92-0893.GPJ GEOMAT.GDT 08/26/09

GEOMAT INC.
2060 Afton Place
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-2

Project Name: A4N Pond Embankment Stability
Project Number: 92-0893
Client: BHP Billiton
Site Location: Navajo Mine Area 4 North
Rig Type: CME-45
Drilling Method: 4" O.D. Solid Stem Auger
Sampling Method: Modified California with Rings
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 8/10/2009
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: 20.5 feet (approx) during drilling
Logged By: Don Baldwin
Remarks: Pond 402

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
									1	SILTY SAND, brown, fine- to medium-grained, loose to medium dense, dry to moist, weak cementation
									2	
									3	
									4	
96.2	13		2.3	7-11-16	MC 18				5	
									6	
									7	
									8	
									9	
				2-4-10	MC 18		SM		10	
									11	
									12	
									13	
									14	
				2-5-12	MC 18				15	
									16	fine- to coarse-grained
									17	
									18	
									19	
									20	
				5-12-11	MC 18				21	▽groundwater at approximately 20.5 foot depth during drilling
									22	Total Depth 21.5 feet
									23	
									24	
									25	

A = Auger Cuttings GRAB = Hand Sample MC = Modified California (Ring Sample) SS = Split Spoon

GEOMAT 92-0893.GPJ GEOMAT.GDT 08/26/09

GEOMAT INC.
2060 Afton Place
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-3

Project Name: A4N Pond Embankment Stability
Project Number: 92-0893
Client: BHP Billiton
Site Location: Navajo Mine Area 4 North
Rig Type: CME-45
Drilling Method: 4" O.D. Solid Stem Auger
Sampling Method: Ring and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 8/10/2009
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: Don Baldwin
Remarks: Pond 403

Laboratory Results										
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
97.2	50	12	6.7	4-8-14	MC 18		SC		1–6	CLAYEY SAND, gray, fine-grained, loose, dry to moist, no cementation
				50/5	MC 5		RK		7–13	SANDSTONE, gray, moderately weathered, moderately soft, weakly to moderately cemented; slightly weathered, moderately hard
				4-12-27	MC 18		RK		14–18	SHALE, dark gray to black, slightly weathered, moderately hard, weakly fissile, waxy
				32/6	SS 6		RK		19–20	COAL, black, fresh, moderately hard, fractured
									21–25	Total Depth 20.5 feet

A = Auger Cuttings GRAB = Hand Sample MC = Modified California (Ring Sample) SS = Split Spoon

GEOMAT 92-0893.GPJ GEOMAT.GDT 08/26/09

GEOMAT INC.
2060 Afton Place
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-4

Project Name: A4N Pond Embankment Stability
Project Number: 92-0893
Client: BHP Billiton
Site Location: Navajo Mine Area 4 North
Rig Type: CME-45
Drilling Method: 4" O.D. Solid Stem Auger
Sampling Method: Modified California with Rings
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 8/10/2009
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: Don Baldwin
Remarks: Pond 404

Laboratory Results											
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
							SC		1–5	CLAYEY SAND with gravel, gray, fine- to medium-grained, loose, dry to moist, no cementation
				4-9-15	MC 18		RK		6	SHALE, gray, moderately weathered, moderately soft
							RK		7–13	SANDSTONE, gray, fine- to coarse-grained, slightly weathered, moderately hard, moderately cemented
				9-29-50/5	MC 17					
				9-50/4	MC 10		RK		14–18	COAL, black, fresh, moderately hard, fractured
							RK		19–20	SILTSTONE grading to SHALE, gray, fresh, moderately hard
				19-50/2	MC 8				21–25	Total Depth 20.7 feet

A = Auger Cuttings GRAB = Hand Sample MC = Modified California (Ring Sample) SS = Split Spoon

GEOMAT 92-0893.GPJ GEOMAT.GDT 08/26/09

GEOMAT INC.
2060 Afton Place
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-5

Project Name: A4N Pond Embankment Stability
Project Number: 92-0893
Client: BHP Billiton
Site Location: Navajo Mine Area 4 North
Rig Type: CME-45
Drilling Method: 7" O.D. Hollow Stem Auger
Sampling Method: Ring and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 8/10/2009
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: Don Baldwin
Remarks: Pond 405

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
							SC		1 2 3 4	CLAYEY SAND with gravel, gray, fine- to medium-grained, loose, dry to moist, no cementation
				7-21-51	MC 18		RK		5	SANDSTONE, brown, fine-grained, highly weathered, soft, weakly cemented
							RK		6 7 8	COAL, black, fresh, moderately hard, fractured
				50/2	MC 2		RK		9 10 11 12	SANDSTONE, gray, fine- to medium-grained, fresh, moderately hard, moderately cemented
				50/3	SS 3				13	auger refusal at 13 foot depth on sandstone
									14 15 16 17 18 19 20 21 22 23 24 25	Total Depth 13.3 feet

A = Auger Cuttings GRAB = Hand Sample MC = Modified California (Ring Sample) SS = Split Spoon

GEOMAT 92-0893.GPJ GEOMAT.GDT 08/26/09

PROJECT A4N Pond Embankment Stability
Navajo Mine Area 4 North

JOB NO. 92-0893 **DATE** 08/10/09

LOG OF TEST PIT NO. TP-1

LOGGED BY George Madrid
BACKHOE TYPE JD 310SJ
LOCATION See Site Plan
SURFACE ELEV. Not Determined **DATUM** N/A

Depth in Feet	Graphical Log	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				SC		CLAYEY SAND, brown, fine- to medium-grained, loose, dry, no cementation
1						
		D				PI = 16 -200 = 30%
2						
				RK		SANDSTONE, brown, fine- to medium-grained, moderately weathered, moderately soft, moderate cementation, fractured
3						
				RK		SILTSTONE, gray, moderately weathered, moderately soft (PARTING)
4						
5						
6		D				PI = 15 -200 = 32
7						
8						
9						
10						Test pit completed at 10 foot depth No groundwater encountered

GEOTECH TP2 92-0893 TP.GPJ AGRA ALB.GDT 08/26/09

SAMPLE TYPE

B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample

GEOMAT INC.

PROJECT A4N Pond Embankment Stability
Navajo Mine Area 4 North

JOB NO. 92-0893 **DATE** 08/10/09

LOG OF TEST PIT NO. TP-2

LOGGED BY George Madrid
BACKHOE TYPE JD 310SJ
LOCATION See Site Plan
SURFACE ELEV. Not Determined **DATUM** N/A

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SC		CLAYEY SAND, brown, fine- to medium-grained, loose, dry, no cementation
3					RK		SILTSTONE, gray, moderately weathered, moderately soft (PARTING)
10							Test pit completed at 10 foot depth No groundwater encountered

GEOTECH TP2 92-0893 TP.GPJ AGRA ALB.GDT 08/26/09

SAMPLE TYPE

B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample

GEOMAT INC.

UNIFIED SOIL CLASSIFICATION SYSTEM					CONSISTENCY OR RELATIVE DENSITY CRITERIA		
Major Divisions			Group Symbols	Typical Names			
Coarse-Grained Soils More than 50% retained on No. 200 sieve	**Gravels** 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Standard Penetration Test Density of Granular Soils		
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	Penetration Resistance, N (blows/ft.)	Relative Density	
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures	0-4	Very Loose	
			GC	Clayey gravels, gravel-sand-clay mixtures	5-10	Loose	
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines	11-30	Medium Dense	
			SP	Poorly graded sands and gravelly sands, little or no fines	31-50	Dense	
		Sands with Fines	SM	Silty sands, sand-silt mixtures	>50	Very Dense	
			SC	Clayey sands, sand-clay mixtures	Standard Penetration Test Density of Granular Soils		
Fine-Grained Soils 50% or more passes No. 200 sieve	**Silts and Clays** Liquid Limit 50 or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	Penetration Resistance, N (blows/ft.)	Consistency	Unconfined Compressive Strength (Tons/ft2)
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	<2	Very Soft	<0.25
			OL	Organic silts and organic silty clays of low plasticity	2-4	Soft	0.25-0.50
	Silts and Clays Liquid Limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous free sands or silts, elastic silts	4-8	Firm	0.50-1.00
			CH	Inorganic clays of high plasticity, fat clays	8-15	Stiff	1.00-2.00
			OH	Organic clays of medium to high plasticity	15-30	Very Stiff	2.00-4.00
Highly Organic Soils			PT	Peat, mucic & other highly organic soils	>30	Hard	>4.0

U.S. Standard Sieve Sizes	3"	3/4"	#4		#10		#40	#200
Unified Soil Classification	Cobbles	Gravel		Sand				Silt or Clay
		coarse	fine	coarse	medium	fine		

MOISTURE CONDITIONS	
Dry	Absence of moist, dusty, dry to the touch
Slightly Damp	Below optimum moisture content for compaction
Moist	Near optimum moisture content, will moisten the hand
Very Moist	Above optimum moisture content
Wet	Visible free water, below water table

MATERIAL QUANTITY	
trace	0-5%
few	5-10%
little	10-25%
some	25-45%
mostly	50-100%

OTHER SYMBOLS	
R	Ring Sample
S	SPT Sample
B	Bulk Sample
▼	Ground Water

BASIC LOG FORMAT:

Group name, Group symbol, (grain size), color, moisture, consistency or relative density. Additional comments: odor, presence of roots, mica, gypsum, coarse particles, etc.

EXAMPLE:

SILTY SAND w/trace silt (SM-SP), Brown, loose to med. Dense, fine to medium grained, damp

UNIFIED SOIL CLASSIFICATION SYSTEM

TEST DRILLING EQUIPMENT & PROCEDURES

Description of Subsurface Exploration Methods

Drilling Equipment – Truck-mounted drill rigs powered with gasoline or diesel engines are used in advancing test borings. Drilling through soil or softer rock is performed with hollow-stem auger or continuous flight auger. Carbide insert teeth are normally used on bits to penetrate soft rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NX rods using water or air as a drilling fluid.

Sampling Procedures - Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 test procedure. In most cases, 2" outside diameter, 1 3/8" inside diameter, samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" outside diameter samplers lined with 2.42" inside diameter brass rings. The driving energy is generally recorded as the number of blows of a 140-pound, 30-inch free fall drop hammer required to advance the samplers in 6-inch increments. These values are expressed in blows per foot on the boring logs. However, in stratified soils, driving resistance is sometimes recorded in 2- or 3-inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. "Undisturbed" sampling of softer soils is sometimes performed with thin-walled Shelby tubes (ASTM D1587). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings. Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113).

Boring Records - Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487), with appropriate group symbols being shown on the logs.

LAB NO.	BORING NO.	SAMPLE DEPTH (ft)	ASTM D698		MOISTURE CONT. (%)	DENSITY		ATTERBERG LIMITS			SWELL (%)	PHI ANGLE (degrees)	% PASS #200 SIEVE	CLASSIFICATION	
			Density	Moisture		WET (pcf)	DRY (pcf)	LL	PL	PI					
7959	TP-1	0 - 2.5	111.8	15.9				34	18	16			30	SC	Clayey SAND w/ trace gravel
7960	TP-1	3.5 - 10.0	107.6	18.3				36	21	15			32	GC	Clayey GRAVEL w/ sand
7978	B-1	5.0			2.9	109.5	106.4						24	SM	Silty SAND
7979	B-1	10.0										33.9		SM	Silty SAND
7980	B-2	5.0			2.3	98.4	96.2	NLL	NPL	NP			13	SM	Silty SAND
7981	B-2	10.0										33.0		SM	Silty SAND
7982	B-3	5.0			6.7	103.7	97.2	29	17	12			50	SC/CL	Clayey SAND/Sandy CLAY

GEOMAT INC.

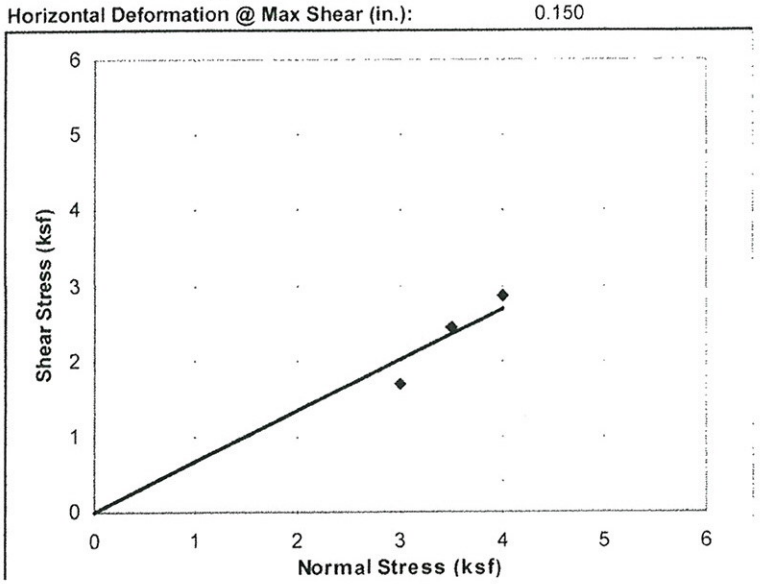
SUMMARY OF SOIL TESTS

Project	Area 4 North Pond Embankments
Job No.	92-0893
Location	BHP Navajo Mine
Date Drilled	8/10/2009

Client:	Geomat, Inc. 2060 Afton Place Farmington, NM 87401-	**Report Date:**	August 21, 2009
		Project #:	8-519-005130
		Work Order #:	11
Attn:	George Madrid	**Lab #:**	9-0928-01
		Sampled By:	D. Baldwin
Project Name:	GeoMat 2008 Miscellaneous Testing Various Locations Farmington, NM	**Date Sampled:**	08/10/2009
		Visual Description of Material:	Geomat/Soil Sample #7979
		Sample Source:	Area 4 North Pond Embankments/ BH B-1 @ 10' Project #92-0893
Project Manager:	Robert Romero	**SOILS / AGGREGATES**	

Direct Shear Test of Soils Under Consolidated Drained Conditions (ASTM D3080-04)

Direct Shear Point Number:	1	2	3
Initial Diameter of specimen (in.):	2.42	2.42	2.42
Initial Thickness of specimen (in.):	1.00	1.00	1.00
Dry Mass of Specimen (g):	97.5	104.8	108.5
Initial Moisture (%):	8.8%	9.2%	9.2%
Initial Wet Density (pcf):	88.1	94.8	98.1
Initial Dry Density (pcf):	81.0	86.8	89.8
Final Thickness of specimen (in.)::	0.98	0.99	0.99
Final Moisture (%):	7.6%	8.6%	7.2%
Final Wet Density (pcf):	88.8	95.3	97.4
Final Dry Density (pcf):	82.5	87.7	90.9
Normal Stress (ksf):	3.00	3.50	4.00
Maximum Shearing Stress (ksf):	1.7	2.4	2.9
Vertical Deformation @ Max Shear (in.):	-0.003	0.002	0.011
Horizontal Deformation @ Max Shear (in.):	0.150	0.155	0.170



Shearing Device Used:
Geomatic Direct Shear Apparatus, Model 8914

Rate of Deformation (in./min.):	0.015
Internal Friction Angle (deg.):	33.9
Cohesion (kips/sq.ft.):	0.0000

Reviewed By: for Bob R.
hg

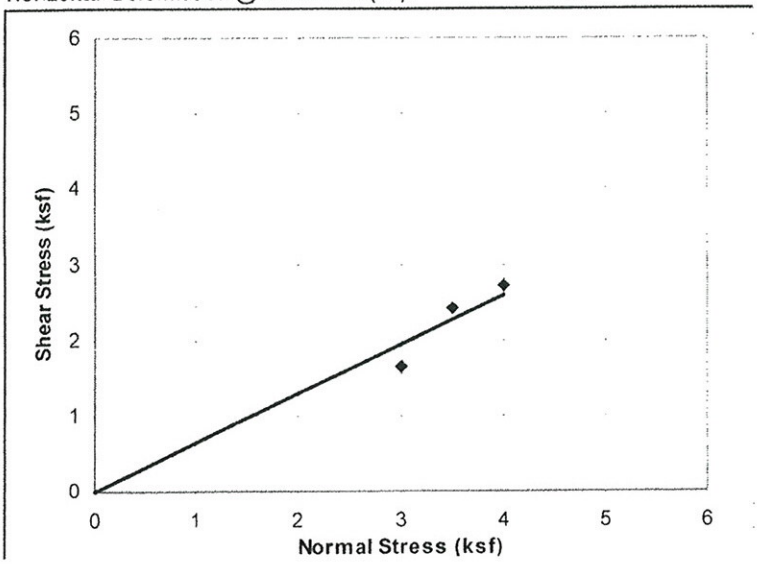
Distribution: Client ✓ File: ✓ Supplier: ✓ Other: Addressee (1)
Email: George Madrid (email) (1)
(1)

AMEC Earth Environmental, Inc.
8519 Jefferson NE
Albuquerque, NM 87113
Tel 5058211801
Fax 5058217371
www.amec.com

Client:	Geomat, Inc. 2060 Afton Place Farmington, NM 87401-	**Report Date:**	August 21, 2009
		Project #:	8-519-005130
		Work Order #:	11
Attn:	George Madrid	**Lab #:**	9-0928-02
		Sampled By:	D. Baldwin
Project Name:	GeoMat 2008 Miscellaneous Testing Various Locations Farmington, NM	**Date Sampled:**	08/10/2009
		Visual Description of Material:	Geomat/Soil Sample #7981
		Sample Source:	Area 4 North Pond Embankments/ BH B-2 @ 10' Project #92-0893
Project Manager:	Robert Romero	**SOILS / AGGREGATES**	

Direct Shear Test of Soils Under Consolidated Drained Conditions (ASTM D3080-04)

Direct Shear Point Number:	1	2	3
Initial Diameter of specimen (in.):	2.42	2.42	2.42
Initial Thickness of specimen (in.):	1.00	1.00	1.00
Dry Mass of Specimen (g):	132.7	129.2	129.3
Initial Moisture (%):	2.9%	3.0%	2.5%
Initial Wet Density (pcf):	113.5	110.7	110.2
Initial Dry Density (pcf):	110.3	107.4	107.5
Final Thickness of specimen (in.)::	0.99	1.00	0.99
Final Moisture (%):	2.0%	2.3%	1.9%
Final Wet Density (pcf):	113.8	110.2	110.3
Final Dry Density (pcf):	111.6	107.8	108.2
Normal Stress (ksf):	3.00	3.50	4.00
Maximum Shearing Stress (ksf):	1.6	2.4	2.7
Vertical Deformation @ Max Shear (in.):	0.001	0.007	0.013
Horizontal Deformation @ Max Shear (in.):	0.225	0.150	0.210



Shearing Device Used:
Geomatic Direct Shear Apparatus, Model 8914

Rate of Deformation (in./min.):	0.015
Internal Friction Angle (deg.):	33.0
Cohesion (kips/sq.ft.):	0.0000

Reviewed By: _____ for BdR.
hg

Distribution: Client ✓ File: ✓ Supplier: ✓ Other: Addressee (1)
Email: ✓ George Madrid (email) (1)
(1)

AMEC Earth Environmental, Inc.
8519 Jefferson NE
Albuquerque, NM 87113
Tel 5058211801
Fax 5058217371
www.amec.com

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Cottonwood Arroyo Post-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is shown on Exhibit 11-77.

Revised January 31, 2011

AAY/LR/RY

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

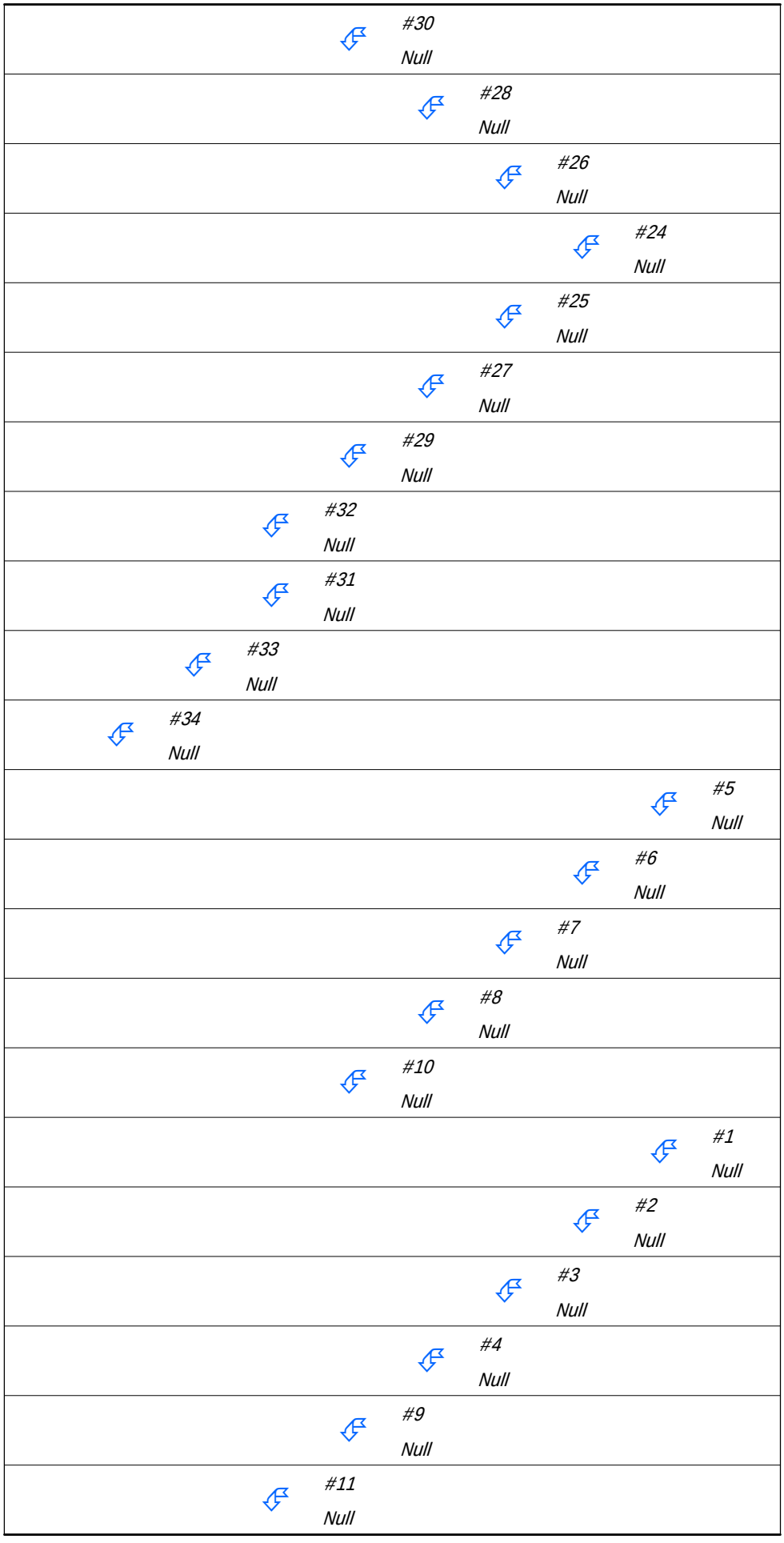
Storm Type:	NRCS Type II - 60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.961	0.307	
Null	#2	==>	#3	0.068	0.331	
Null	#3	==>	#4	0.000	0.000	
Null	#4	==>	#9	0.718	0.281	
Null	#5	==>	#6	1.205	0.328	
Null	#6	==>	#7	0.189	0.304	
Null	#7	==>	#8	0.000	0.000	
Null	#8	==>	#10	0.989	0.300	
Null	#9	==>	#11	0.000	0.000	
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#21	0.495	0.453	
Null	#12	==>	#13	0.076	0.330	
Null	#13	==>	#14	3.790	0.314	
Null	#14	==>	#16	1.579	0.287	
Null	#15	==>	#16	1.579	0.287	
Null	#16	==>	#23	0.000	0.000	
Null	#17	==>	#19	0.000	0.000	
Null	#18	==>	#19	0.000	0.000	
Null	#19	==>	#20	0.915	0.252	
Null	#20	==>	#22	0.000	0.000	End of Middle Fork
Null	#21	==>	#22	0.000	0.000	End of South Fork
Null	#22	==>	#36	1.315	0.260	
Null	#23	==>	#20	0.593	0.281	
Null	#24	==>	#25	0.964	0.340	
Null	#25	==>	#27	1.454	0.333	
Null	#26	==>	#27	1.454	0.333	
Null	#27	==>	#29	0.800	0.323	
Null	#28	==>	#29	0.800	0.323	
Null	#29	==>	#32	0.479	0.298	
Null	#30	==>	#32	0.479	0.298	
Null	#31	==>	#33	0.000	0.000	
Null	#32	==>	#33	0.000	0.000	
Null	#33	==>	#34	1.348	0.294	Inlet to North Fork Diversion
Null	#34	==>	#36	0.825	0.261	End of North Fork
Null	#35	==>	#23	0.203	0.259	
Null	#36	==>	#37	3.388	0.246	
Null	#37	==>	End	0.000	0.000	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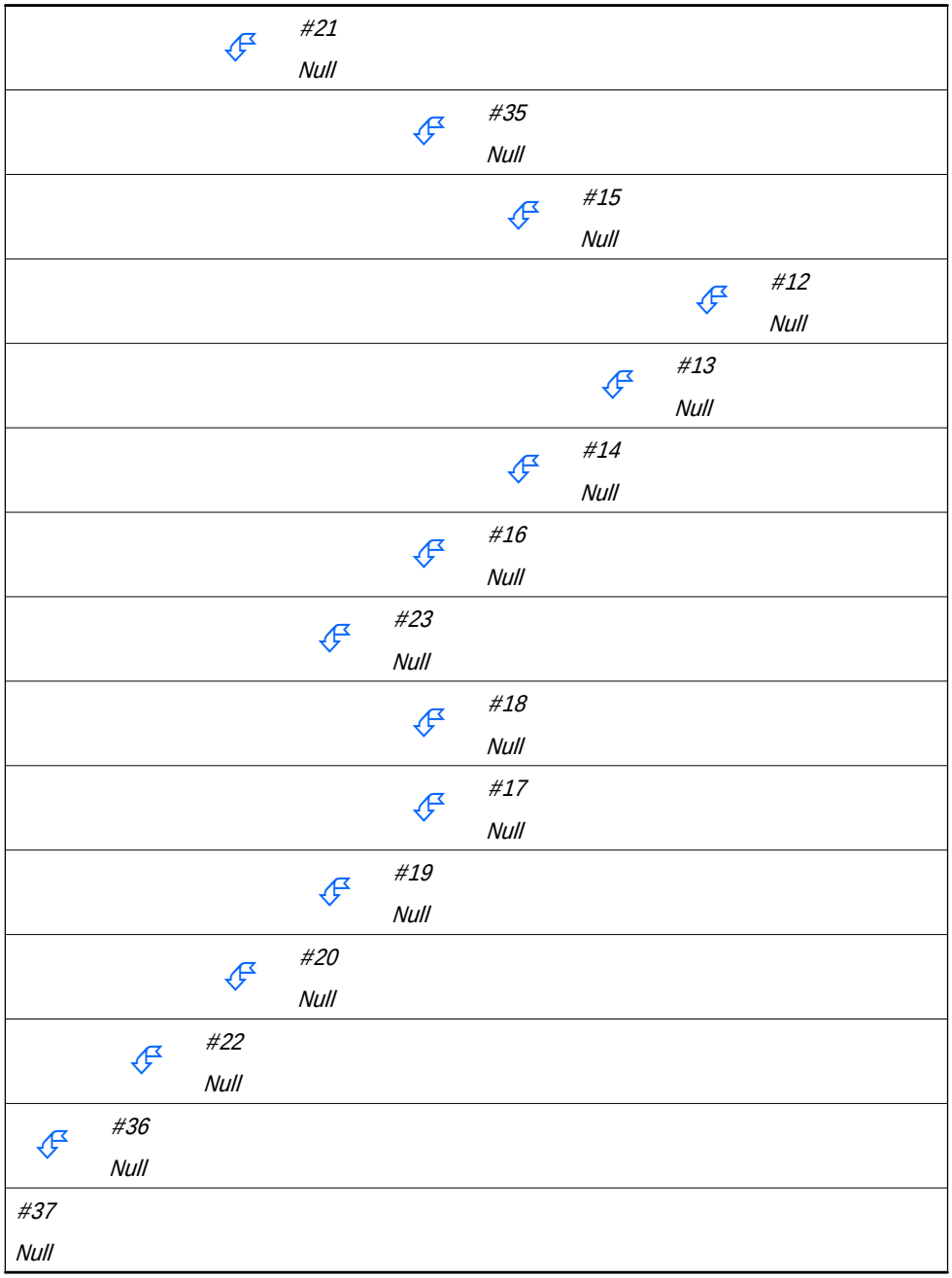

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.81	76.00	9,347.00	2.70	0.961
#1	**Muskingum K:**					**0.961**
#2	8. Large gullies, diversions, and low flowing streams	1.23	10.00	814.00	3.32	0.068
#2	**Muskingum K:**					**0.068**
#3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.53	30.00	5,637.00	2.18	0.718
#4	**Muskingum K:**					**0.718**
#5	8. Large gullies, diversions, and low flowing streams	1.17	165.00	14,065.00	3.24	1.205
#5	**Muskingum K:**					**1.205**
#6	8. Large gullies, diversions, and low flowing streams	0.78	14.00	1,799.25	2.64	0.189
#6	**Muskingum K:**					**0.189**
#8	8. Large gullies, diversions, and low flowing streams	0.72	65.00	9,046.00	2.54	0.989
#8	**Muskingum K:**					**0.989**
#11	8. Large gullies, diversions, and low flowing streams	30.00	8,801.00	29,336.66	16.43	0.495
#11	**Muskingum K:**					**0.495**
#12	8. Large gullies, diversions, and low flowing streams	1.21	11.00	906.00	3.30	0.076
#12	**Muskingum K:**					**0.076**
#13	8. Large gullies, diversions, and low flowing streams	0.92	363.00	39,301.00	2.88	3.790
#13	**Muskingum K:**					**3.790**
#14	8. Large gullies, diversions, and low flowing streams	0.59	77.00	13,075.22	2.30	1.579
#14	**Muskingum K:**					**1.579**
#15	8. Large gullies, diversions, and low flowing streams	0.59	77.00	13,075.00	2.30	1.579
#15	**Muskingum K:**					**1.579**
#16	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#16	**Muskingum K:**					**0.000**
#19	8. Large gullies, diversions, and low flowing streams	0.33	19.00	5,699.00	1.73	0.915
#19	**Muskingum K:**					**0.915**
#22	8. Large gullies, diversions, and low flowing streams	0.38	33.00	8,713.00	1.84	1.315
#22	**Muskingum K:**					**1.315**
#23	8. Large gullies, diversions, and low flowing streams	0.53	25.00	4,680.00	2.19	0.593
#23	**Muskingum K:**					**0.593**
#24	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,568.00	3.62	0.964
#24	**Muskingum K:**					**0.964**
#25	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.00	3.39	1.454
#25	**Muskingum K:**					**1.454**
#26	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.62	3.39	1.454

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#26	**Muskingum K:**					**1.454**
#27	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#27	**Muskingum K:**					**0.800**
#28	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#28	**Muskingum K:**					**0.800**
#29	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#29	**Muskingum K:**					**0.479**
#30	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#30	**Muskingum K:**					**0.479**
#33	8. Large gullies, diversions, and low flowing streams	0.66	77.00	11,748.55	2.42	1.348
#33	**Muskingum K:**					**1.348**
#34	8. Large gullies, diversions, and low flowing streams	0.38	21.00	5,497.38	1.85	0.825
#34	**Muskingum K:**					**0.825**
#35	8. Large gullies, diversions, and low flowing streams	0.37	5.00	1,338.00	1.83	0.203
#35	**Muskingum K:**					**0.203**
#36	8. Large gullies, diversions, and low flowing streams	0.30	60.00	20,005.00	1.64	3.388
#36	**Muskingum K:**					**3.388**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	0.20	0.03	0.1	3,489	2.23	1.76
#28	1,217.900	1,217.900	127.50	16.94	739.9	45,906	0.00	0.00
#26	2,486.400	2,486.400	5.44	1.83	8.0	4,125	2.21	1.71
#24	8,061.800	8,061.800	6.64	3.90	9.6	3,240	1.51	0.84
#25	1,015.700	9,077.500	25.38	7.24	39.4	12,153	6.31	2.07
#27	1,783.700	13,347.600	51.42	14.78	134.0	17,591	8.96	3.39
#29	966.000	15,531.500	173.24	44.74	1,587.3	54,538	2.41	1.14
#32	293.700	16,301.600	178.81	50.64	1,694.8	49,619	0.00	0.00
#31	957.100	957.100	135.01	17.47	610.8	34,117	0.32	0.24
#33	0.000	17,258.700	243.60	68.11	2,305.6	39,263	0.10	0.06
#34	1,020.000	18,278.700	249.26	73.26	2,254.3	35,683	0.13	0.08
#5	2,023.000	2,023.000	171.21	20.33	462.4	32,307	2.05	1.05
#6	1,743.200	3,766.200	212.42	40.43	934.0	28,405	0.14	0.08
#7	2,395.300	6,161.500	387.09	85.94	2,914.9	36,696	0.00	0.00
#8	0.000	6,161.500	387.09	85.94	2,914.9	36,696	0.00	0.00
#10	1,053.200	7,214.700	408.03	101.32	2,888.5	33,288	0.04	0.03
#1	2,411.100	2,411.100	102.40	16.59	452.6	29,702	2.57	1.72
#2	1,497.000	3,908.100	165.97	41.66	776.1	20,475	0.10	0.07
#3	862.700	4,770.800	217.82	52.22	899.7	17,142	0.03	0.02
#4	0.000	4,770.800	217.82	52.22	899.7	17,142	0.03	0.02
#9	445.600	5,216.400	220.11	55.28	915.8	16,187	0.35	0.26
#11	0.000	12,431.100	561.70	156.61	3,804.3	27,763	0.17	0.11
#21	1,100.460	13,531.560	585.86	167.44	3,901.5	27,009	0.53	0.34
#35	160.400	160.400	24.45	3.20	28.0	8,923	0.00	0.00
#15	1,992.700	1,992.700	132.09	21.29	666.2	35,689	0.30	0.19
#12	3,494.500	3,494.500	29.47	6.13	64.8	10,798	5.21	3.74
#13	2,720.700	6,215.200	61.66	11.51	150.5	14,172	7.19	4.86
#14	5,096.800	11,312.000	166.07	56.22	1,310.1	62,956	0.45	0.12
#16	1,022.000	14,326.700	306.00	96.71	2,476.6	38,833	0.43	0.20
#23	0.000	14,487.100	310.83	99.91	2,504.6	37,565	0.41	0.20
#18	848.500	848.500	63.40	10.11	89.4	9,383	0.00	0.00
#17	182.200	182.200	46.10	3.64	42.5	12,532	0.29	0.20
#19	0.000	1,030.700	106.20	13.75	132.0	8,986	0.07	0.05
#20	271.100	15,788.900	330.16	116.92	2,663.4	31,871	0.33	0.17
#22	0.000	29,320.460	859.53	284.36	6,564.9	27,432	0.44	0.27
#36	1,584.680	49,183.840	1,061.17	362.40	8,876.1	30,628	0.39	0.23
#37	2,292.810	51,476.650	1,054.04	370.54	8,832.4	27,265	0.12	0.08

Particle Size Distribution(s) at Each Structure

Structure #30:

Size (mm)	In/Out
2.0000	100.000%
0.1000	42.445%
0.0500	24.052%
0.0020	15.563%
0.0010	0.000%

Structure #28:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #26:

Size (mm)	In/Out
2.0000	100.000%
0.1000	69.288%
0.0500	39.263%
0.0020	25.406%
0.0010	0.000%

Structure #24:

Size (mm)	In/Out
2.0000	100.000%
0.1000	84.148%
0.0500	49.683%
0.0020	32.148%

Size (mm)	In/Out
0.0010	0.000%

Structure #25:

Size (mm)	In/Out
2.0000	100.000%
0.1000	71.787%
0.0500	41.659%
0.0020	26.956%
0.0010	0.000%

Structure #27:

Size (mm)	In/Out
2.0000	100.000%
0.1000	75.596%
0.0500	43.126%
0.0020	27.905%
0.0010	0.000%

Structure #29:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.956%
0.0500	95.215%
0.0020	93.528%
0.0010	0.000%

Structure #32:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #31:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.356%
0.0010	0.000%

Structure #33 (Inlet to North Fork Diversion):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.300%
0.0010	0.000%

Structure #34 (End of North Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.796%
0.0500	99.570%
0.0020	99.516%
0.0010	0.000%

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	93.482%
0.0020	90.338%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.640%

Size (mm)	In/Out
0.0010	0.000%

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #8:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #10:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.878%
0.0020	99.809%
0.0010	0.000%

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.983%
0.0500	90.770%
0.0020	87.230%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.573%
0.0010	0.000%

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.513%
0.0010	0.000%

Structure #4:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.513%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.127%
0.0500	97.609%
0.0020	96.908%
0.0010	0.000%

Structure #11:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.790%
0.0500	99.332%
0.0020	99.111%

Size (mm)	In/Out
0.0010	0.000%

Structure #21 (End of South Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.807%
0.0500	97.721%
0.0020	97.307%
0.0010	0.000%

Structure #35:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #15:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.622%
0.0010	0.000%

Structure #12:

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.060%
0.0500	47.068%
0.0020	30.456%
0.0010	0.000%

Structure #13:

Size (mm)	In/Out
2.0000	100.000%
0.1000	76.526%
0.0500	43.365%
0.0020	28.060%
0.0010	0.000%

Structure #14:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.990%
0.0010	0.000%

Structure #16:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	96.916%
0.0010	0.000%

Structure #23:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	96.950%
0.0010	0.000%

Structure #18:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%

Size (mm)	In/Out
0.0010	0.000%

Structure #17:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	93.383%
0.0010	0.000%

Structure #19:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.868%
0.0010	0.000%

Structure #20 (End of Middle Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.049%
0.0010	0.000%

Structure #22:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.291%
0.0500	98.646%
0.0020	97.202%
0.0010	0.000%

Structure #36:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.444%
0.0500	98.900%
0.0020	97.815%
0.0010	0.000%

Structure #37:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.855%
0.0020	98.893%
0.0010	0.000%

Structure Detail:

Structure #30 (Null)

Structure #28 (Null)

Structure #26 (Null)

Structure #24 (Null)

Structure #25 (Null)

Structure #27 (Null)

Structure #29 (Null)

Structure #32 (Null)

Structure #31 (Null)

Structure #33 (Null)

Inlet to North Fork Diversion

Structure #34 (Null)

End of North Fork

Structure #5 (Null)

Structure #6 (Null)

Structure #7 (Null)

Structure #8 (Null)

Structure #10 (Null)

Structure #1 (Null)

Structure #2 (Null)

Structure #3 (Null)

Structure #4 (Null)

Structure #9 (Null)

Structure #11 (Null)

Structure #21 (Null)

End of South Fork

Structure #35 (Null)

Structure #15 (Null)

Structure #12 (Null)

Structure #13 (Null)

Structure #14 (Null)

Structure #16 (Null)

Structure #23 (Null)

Structure #18 (Null)

Structure #17 (Null)

Structure #19 (Null)

Structure #20 (Null)

End of Middle Fork

Structure #22 (Null)

Structure #36 (Null)

Structure #37 (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)
#30	1	476.400	1.131	0.000	0.000	73.100	M	0.20	0.034
	Σ	**476.400**						**0.20**	**0.034**
#28	1	772.300	0.657	0.523	0.334	90.400	M	106.00	10.740
	2	445.600	0.587	0.000	0.000	90.400	M	65.74	6.199
	Σ	**1,217.900**						**127.50**	**16.939**
#26	1	447.600	2.192	0.000	0.000	74.200	M	0.34	0.091
	2	2,038.800	3.000	0.000	0.000	77.000	M	5.10	1.740
	Σ	**2,486.400**						**5.44**	**1.831**
#24	1	2,607.500	5.367	2.377	0.305	75.200	M	2.02	0.992
	2	2,331.900	4.813	2.431	0.304	74.700	M	1.48	0.662
	3	1,758.500	2.231	1.788	0.297	76.200	M	3.66	1.087
	4	1,363.900	2.618	0.000	0.000	77.000	M	3.63	1.164
	Σ	**8,061.800**						**6.64**	**3.905**
#25	1	515.200	0.990	0.342	0.357	78.200	M	3.32	0.663
	2	130.500	0.787	0.342	0.357	78.100	M	0.89	0.163
	3	370.000	0.516	0.000	0.000	85.700	M	25.34	2.504
	Σ	**9,077.500**						**25.38**	**7.235**
#27	1	354.400	0.612	1.233	0.337	83.100	M	11.81	1.500
	2	305.200	0.529	1.054	0.328	84.000	M	14.02	1.532
	3	289.800	0.692	0.551	0.328	75.500	M	0.59	0.129
	4	253.000	0.361	0.551	0.328	79.400	M	3.26	0.463
	5	581.300	0.980	0.000	0.000	82.300	M	12.58	2.093
	Σ	**13,347.600**						**51.42**	**14.783**
#29	1	508.800	0.409	0.416	0.312	89.500	M	80.63	6.230
	2	233.200	0.521	0.291	0.312	91.600	M	44.78	3.842
	3	224.000	0.467	0.000	0.000	90.000	M	35.63	2.942
	Σ	**15,531.500**						**173.24**	**44.736**
#32	1	293.700	0.576	0.000	0.000	93.000	M	65.60	5.870
	Σ	**16,301.600**						**178.81**	**50.641**
#31	1	431.100	0.588	0.450	0.336	91.500	M	75.71	7.004
	2	325.800	0.432	0.149	0.327	93.000	M	85.40	6.520
	3	200.200	0.373	0.000	0.000	92.900	M	55.57	3.945
	Σ	**957.100**						**135.01**	**17.469**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#33	**∑**	**17,258.700**						**243.60**	**68.110**
#34	1	251.500	0.423	1.019	0.292	90.500	M	45.94	3.555
	2	219.100	0.611	0.267	0.322	80.000	M	3.12	0.468
	3	246.200	0.688	0.466	0.293	80.000	M	3.36	0.525
	4	303.200	0.370	0.000	0.000	79.700	M	4.27	0.600
	∑	**18,278.700**						**249.26**	**73.258**
#5	1	503.600	0.618	0.000	0.000	87.600	M	44.56	4.621
	2	406.500	0.388	0.501	0.350	84.800	M	27.28	2.356
	3	439.600	0.342	0.681	0.347	87.800	M	57.48	4.181
	4	162.600	0.280	0.681	0.347	86.000	M	16.74	1.161
	5	294.100	0.375	1.021	0.348	92.000	M	71.65	5.116
	6	216.600	0.272	1.018	0.348	90.100	M	46.35	2.899
	∑	**2,023.000**						**171.21**	**20.334**
#6	1	149.100	0.331	0.000	0.000	92.600	M	41.87	2.831
	2	245.000	0.529	0.192	0.328	88.100	M	26.07	2.430
	3	276.200	0.450	0.461	0.319	89.500	M	41.36	3.372
	4	158.400	0.380	1.385	0.185	93.000	M	44.23	3.163
	5	206.200	0.402	0.796	0.320	89.400	M	32.46	2.488
	6	414.000	0.430	1.066	0.323	87.200	M	42.38	3.578
	7	294.300	0.535	1.066	0.323	86.400	M	22.70	2.235
	∑	**3,766.200**						**212.42**	**40.431**
#7	1	731.700	1.274	0.000	0.000	93.000	M	96.39	14.602
	2	445.800	1.043	0.000	0.000	93.000	M	67.76	8.894
	3	270.800	0.804	0.000	0.000	93.000	M	49.02	5.404
	4	78.900	0.267	1.035	0.328	93.000	M	25.53	1.584
	5	154.900	0.310	1.071	0.326	93.000	M	47.40	3.105
	6	101.400	0.288	1.164	0.328	92.900	M	31.46	2.004
	7	117.700	0.298	1.344	0.329	92.200	M	32.72	2.112
	8	494.100	0.518	1.344	0.329	91.300	M	90.89	7.807
	∑	**6,161.500**						**387.09**	**85.942**
#8	1	0.000	0.000	0.000	0.000	1.000	0.00	0.000	
	∑	**6,161.500**						**387.09**	**85.942**
#10	1	355.500	1.286	0.000	0.000	93.000	M	46.51	7.093
	2	307.100	1.282	0.668	0.305	83.200	M	7.05	1.324
	3	147.300	1.245	0.517	0.303	90.600	M	13.65	2.105
	4	126.400	0.585	0.517	0.303	93.000	M	27.97	2.527
	5	116.900	1.179	0.621	0.305	93.000	M	16.29	2.333
	∑	**7,214.700**						**408.03**	**101.324**

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	557.400	0.941	0.000	0.000	83.600	M	16.72	2.594
	2	169.600	1.616	0.677	0.333	93.000	M	18.75	3.384
	3	636.400	1.842	0.729	0.333	81.000	M	6.98	1.726
	4	223.400	0.846	1.005	0.336	84.100	M	7.97	1.141
	5	77.700	0.330	1.392	0.341	81.400	M	2.25	0.232
	6	746.600	0.678	1.392	0.341	88.200	M	69.45	7.514
	Σ	**2,411.100**						**102.40**	**16.592**
#2	1	257.000	0.423	0.000	0.000	93.000	M	68.09	5.147
	2	180.500	0.562	0.478	0.281	91.800	M	34.14	3.055
	3	200.700	0.687	0.574	0.283	93.000	M	40.21	4.007
	4	438.600	0.811	0.574	0.283	93.000	M	78.94	8.755
	5	420.200	1.247	0.801	0.293	88.000	M	25.21	4.099
	Σ	**3,908.100**						**165.97**	**41.656**
#3	1	172.600	0.443	0.000	0.000	93.000	M	44.66	3.448
	2	311.200	0.890	0.000	0.000	88.900	M	27.49	3.477
	3	378.900	0.632	0.209	0.314	87.900	M	34.90	3.641
	Σ	**4,770.800**						**217.82**	**52.221**
#4	**Σ**	**4,770.800**						**217.82**	**52.221**
#9	1	445.600	0.987	0.000	0.000	85.800	M	20.71	3.062
	Σ	**5,216.400**						**220.11**	**55.283**
#11	**Σ**	**12,431.100**						**561.70**	**156.607**
#21	1	292.400	0.819	0.000	0.000	86.900	M	19.03	2.405
	2	230.540	0.388	0.694	0.266	89.200	M	35.80	2.695
	3	181.120	0.289	0.878	0.256	91.300	M	44.97	2.866
	4	396.400	0.939	0.878	0.256	86.100	M	20.22	2.863
	Σ	**13,531.560**						**585.86**	**167.435**
#35	1	160.400	1.039	0.000	0.000	93.000	M	24.45	3.201
	Σ	**160.400**						**24.45**	**3.201**
#15	1	437.400	0.803	0.000	0.000	91.300	M	60.86	6.898
	2	549.000	0.637	0.654	0.327	91.300	M	88.81	8.663
	3	1,006.300	1.023	0.768	0.331	84.700	M	36.49	5.725
	Σ	**1,992.700**						**132.09**	**21.286**
#12	1	517.800	0.791	0.000	0.000	81.900	M	11.30	1.714
	2	229.000	0.571	0.043	0.418	80.100	M	3.43	0.501
	3	592.700	0.706	0.044	0.417	81.500	M	12.26	1.800
	4	1,806.900	1.542	0.487	0.362	76.700	M	5.34	1.374
	5	348.100	0.618	0.487	0.362	80.000	4.94	0.743	

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**3,494.500**						**29.47**	**6.132**
#13	1	411.600	0.725	0.000	0.000	79.700	M	5.01	0.813
	2	636.400	0.774	0.322	0.336	80.700	M	10.16	1.611
	3	319.000	0.575	0.685	0.318	85.500	M	19.58	2.087
	4	231.700	0.314	0.923	0.328	80.400	M	4.67	0.548
	5	1,122.000	1.308	0.923	0.328	74.700	M	1.29	0.319
	Σ	**6,215.200**						**61.66**	**11.510**
#14	1	405.900	0.384	0.000	0.000	90.800	M	81.84	5.970
	2	411.100	0.452	0.707	0.308	90.700	M	74.57	5.964
	3	787.400	0.658	0.975	0.307	91.400	M	126.78	12.610
	4	144.200	0.341	1.716	0.310	86.200	M	13.94	1.064
	5	343.800	0.289	1.970	0.312	86.500	M	38.50	2.659
	6	392.800	0.806	2.107	0.316	81.900	M	8.49	1.301
	7	528.200	0.518	2.544	0.316	87.200	M	48.43	4.560
	8	890.900	1.253	2.544	0.316	83.500	M	22.13	4.068
	9	741.400	1.076	3.047	0.316	84.800	M	26.61	4.293
	10	451.100	0.916	3.354	0.316	83.900	M	14.69	2.221
	Σ	**11,312.000**						**166.07**	**56.222**
#16	1	475.100	1.721	0.000	0.000	92.400	M	45.79	8.728
	2	348.400	0.542	0.951	0.283	92.500	M	74.85	6.493
	3	198.500	0.266	1.384	0.278	93.000	M	64.31	3.984
	Σ	**14,326.700**						**306.00**	**96.712**
#23	**Σ**	**14,487.100**						**310.83**	**99.913**
#18	1	301.700	0.652	0.000	0.000	93.000	M	62.47	6.029
	2	546.800	0.768	0.561	0.320	86.300	M	32.97	4.083
	Σ	**848.500**						**63.40**	**10.112**
#17	1	182.200	0.462	0.000	0.000	93.000	M	46.10	3.640
	Σ	**182.200**						**46.10**	**3.640**
#19	**Σ**	**1,030.700**						**106.20**	**13.753**
#20	1	271.100	0.978	0.000	0.000	89.400	M	24.47	3.259
	Σ	**15,788.900**						**330.16**	**116.925**
#22	**Σ**	**29,320.460**						**859.53**	**284.360**
#36	1	283.020	0.468	1.457	0.305	77.100	M	1.52	0.251
	2	301.840	0.632	1.051	0.286	90.100	M	40.41	4.016
	3	223.850	0.703	1.051	0.286	74.300	M	0.23	0.049
	4	262.400	0.419	0.835	0.229	78.000	M	2.09	0.318

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	222.760	0.421	0.475	0.224	74.500	M	0.27	0.056
	6	290.810	0.526	0.000	0.000	74.800	M	0.41	0.088
	Σ	**49,183.840**						**1,061.17**	**362.396**
#37	1	744.000	1.756	0.000	0.000	84.800	M	19.52	4.306
	2	303.330	0.416	1.859	0.242	87.800	M	35.36	2.881
	3	223.850	0.703	1.179	0.270	74.300	M	0.23	0.049
	4	262.400	0.419	0.835	0.229	78.000	M	2.09	0.318
	5	222.760	0.421	0.475	0.224	74.500	M	0.27	0.056
	6	290.810	0.526	0.000	0.000	74.800	M	0.41	0.088
	7	245.660	0.561	1.487	0.252	79.400	M	2.97	0.448
	Σ	**51,476.650**						**1,054.04**	**370.542**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#30	1	0.095	200.00	3.80	0.3720	1.0000	2	0.1	3,489	2.23	1.76
	Σ							**0.1**	**3,489**	**2.23**	**1.76**
#28	1	0.187	100.00	10.10	0.3750	1.0000	3	555.9	52,723	0.00	0.00
	2	0.196	100.00	10.20	0.3930	1.0000	3	348.4	58,373	0.00	0.00
	Σ							**739.9**	**45,906**	**0.00**	**0.00**
#26	1	0.155	400.00	1.40	0.3480	1.0000	2	0.2	2,448	1.53	1.18
	2	0.155	300.00	2.40	0.3340	1.0000	2	7.8	4,238	2.26	1.74
	Σ							**8.0**	**4,125**	**2.21**	**1.71**
#24	1	0.128	300.00	2.30	0.3360	1.0000	2	2.7	2,661	1.33	1.00
	2	0.136	300.00	2.70	0.3440	1.0000	2	2.3	3,360	1.86	1.39
	3	0.107	300.00	2.30	0.3330	1.0000	2	3.3	2,811	1.56	1.23
	4	0.163	400.00	1.60	0.3210	1.0000	2	3.9	3,194	1.73	1.35
	Σ							**9.6**	**3,240**	**1.51**	**0.84**
#25	1	0.125	400.00	1.90	0.3440	1.0000	2	2.6	3,677	1.96	1.55
	2	0.124	300.00	2.60	0.3280	1.0000	2	0.7	3,754	2.08	1.63
	3	0.122	175.00	4.90	0.2660	1.0000	2	28.7	12,170	6.76	4.66
	Σ							**39.4**	**12,153**	**6.31**	**2.07**
#27	1	0.127	175.00	5.90	0.3160	1.0000	2	20.7	13,801	7.09	5.20
	2	0.122	150.00	7.50	0.2920	1.0000	2	23.8	15,793	8.49	6.12
	3	0.070	125.00	8.40	0.3270	1.0000	2	0.7	4,438	2.66	2.32

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.097	125.00	9.60	0.3170	1.0000	2	6.0	12,370	6.54	5.00
	5	0.126	125.00	8.90	0.3290	1.0000	2	35.7	16,624	7.78	5.85
	Σ							**134.0**	**17,591**	**8.96**	**3.39**
#29	1	0.190	125.00	9.80	0.3930	1.0000	3	387.3	64,968	0.38	0.26
	2	0.203	125.00	8.90	0.3940	1.0000	3	197.0	53,216	0.00	0.00
	3	0.193	125.00	8.40	0.3940	1.0000	3	129.6	47,000	0.00	0.00
	Σ							**1,587.3**	**54,538**	**2.41**	**1.14**
#32	1	0.210	150.00	7.70	0.3990	1.0000	3	289.6	51,320	0.00	0.00
	Σ							**1,694.8**	**49,619**	**0.00**	**0.00**
#31	1	0.204	125.00	8.70	0.3620	1.0000	3	329.8	48,526	0.00	0.00
	2	0.210	150.00	7.30	0.3990	1.0000	3	338.0	54,451	1.63	1.12
	3	0.210	175.00	4.50	0.3980	1.0000	3	136.5	37,227	1.56	1.06
	Σ							**610.8**	**34,117**	**0.32**	**0.24**
#33	**Σ**							**2,305.6**	**39,263**	**0.10**	**0.06**
#34	1	0.193	200.00	3.84	0.2460	1.0000	3	49.4	14,450	0.17	0.12
	2	0.214	200.00	3.66	0.3150	1.0000	1	4.8	9,950	5.38	4.05
	3	0.214	300.00	2.54	0.3150	1.0000	1	4.3	7,920	4.23	3.20
	4	0.242	200.00	3.50	0.3150	1.0000	1	7.1	11,319	6.28	4.82
	Σ							**2,254.3**	**35,683**	**0.13**	**0.08**
#5	1	0.149	75.00	12.50	0.3230	1.0000	3	165.7	37,263	0.00	0.00
	2	0.133	75.00	15.80	0.3190	1.0000	2	102.5	45,635	26.07	18.02
	3	0.103	100.00	11.00	0.2030	1.0000	3	78.2	20,017	0.17	0.12
	4	0.093	75.00	13.80	0.2130	1.0000	2	20.6	19,161	11.51	7.80
	5	0.123	100.00	11.00	0.1370	1.0000	3	80.0	16,445	0.58	0.40
	6	0.149	75.00	14.70	0.1990	1.0000	3	98.7	35,948	1.74	1.20
	Σ							**462.4**	**32,307**	**2.05**	**1.05**
#6	1	0.208	175.00	4.30	0.3980	1.0000	3	91.6	35,102	1.73	1.16
	2	0.183	175.00	5.40	0.3910	1.0000	3	69.3	29,853	0.00	0.00
	3	0.188	150.00	7.60	0.3900	1.0000	3	141.7	44,004	0.00	0.00
	4	0.210	150.00	6.30	0.3990	1.0000	3	135.6	42,816	1.77	1.28
	5	0.185	125.00	8.10	0.3860	1.0000	3	99.0	41,472	0.28	0.20
	6	0.104	100.00	11.30	0.2240	1.0000	3	69.9	20,288	0.00	0.00
	7	0.164	100.00	11.20	0.3740	1.0000	3	98.6	44,820	0.00	0.00
	Σ							**934.0**	**28,405**	**0.14**	**0.08**
#7	1	0.208	150.00	7.80	0.3780	1.0000	3	568.9	38,847	0.00	0.00
	2	0.209	100.00	10.20	0.3940	1.0000	3	464.2	52,246	0.00	0.00
	3	0.210	150.00	6.70	0.3990	1.0000	3	205.7	38,872	0.00	0.00

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.210	100.00	11.50	0.3990	1.0000	3	122.7	79,219	5.29	3.71
	5	0.210	150.00	7.10	0.3990	1.0000	3	156.1	51,819	2.96	2.08
	6	0.209	150.00	7.90	0.3990	1.0000	3	107.1	54,958	3.37	2.37
	7	0.206	75.00	15.50	0.3990	1.0000	3	201.7	96,052	5.25	3.72
	8	0.202	75.00	14.50	0.3980	1.0000	3	669.7	85,902	0.00	0.00
	Σ							**2,914.9**	**36,696**	**0.00**	**0.00**
#8	1	0.000	0.00	0.00	0.0000	1.0000	0	0.0	1	0.00	0.00
	Σ							**2,914.9**	**36,696**	**0.00**	**0.00**
#10	1	0.190	300.00	2.70	0.1930	1.0000	3	46.3	6,587	0.00	0.00
	2	0.153	200.00	3.50	0.3610	1.0000	2	10.6	7,825	3.48	2.62
	3	0.189	200.00	3.70	0.3190	1.0000	3	22.9	10,906	0.00	0.00
	4	0.190	300.00	2.10	0.1940	1.0000	3	15.6	6,459	0.00	0.00
	5	0.201	300.00	2.00	0.3030	1.0000	3	17.5	7,554	0.00	0.00
	Σ							**2,888.5**	**33,288**	**0.04**	**0.03**
#1	1	0.157	150.00	6.80	0.3830	1.0000	2	54.3	20,582	9.89	7.35
	2	0.210	150.00	6.60	0.3990	1.0000	3	91.1	26,615	0.00	0.00
	3	0.149	200.00	3.90	0.3870	1.0000	2	14.2	7,833	3.10	2.38
	4	0.169	175.00	4.70	0.3950	1.0000	2	19.1	16,624	8.23	6.06
	5	0.157	100.00	10.10	0.3940	1.0000	2	6.6	28,074	15.42	11.39
	6	0.175	75.00	12.60	0.2840	1.0000	3	290.9	39,015	0.00	0.00
	Σ							**452.6**	**29,702**	**2.57**	**1.72**
#2	1	0.190	150.00	7.90	0.1930	1.0000	3	123.1	25,644	0.82	0.56
	2	0.184	175.00	4.80	0.2010	1.0000	3	42.3	14,436	0.00	0.00
	3	0.202	200.00	3.90	0.3220	1.0000	3	68.3	17,482	0.00	0.00
	4	0.203	150.00	7.40	0.3220	1.0000	3	301.9	34,875	0.00	0.00
	5	0.181	175.00	5.10	0.3710	1.0000	3	81.0	19,571	0.00	0.00
	Σ							**776.1**	**20,475**	**0.10**	**0.07**
#3	1	0.190	175.00	5.20	0.1930	1.0000	3	56.3	17,538	0.48	0.33
	2	0.177	175.00	4.20	0.2560	1.0000	3	43.6	12,816	0.00	0.00
	3	0.166	175.00	4.30	0.2290	1.0000	3	43.8	12,524	0.00	0.00
	Σ							**899.7**	**17,142**	**0.03**	**0.02**
#4	**Σ**							**899.7**	**17,142**	**0.03**	**0.02**
#9	1	0.212	175.00	4.17	0.2490	1.0000	2	40.1	13,069	6.46	4.74
	Σ							**915.8**	**16,187**	**0.35**	**0.26**
#11	**Σ**							**3,804.3**	**27,763**	**0.17**	**0.11**
#21	1	0.206	175.00	4.44	0.2760	1.0000	2	38.1	16,164	8.46	6.07

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	2	0.241	175.00	5.81	0.3130	1.0000	1	99.1	38,260	23.85	16.65
	3	0.185	300.00	2.70	0.2180	1.0000	3	30.0	10,949	0.56	0.39
	4	0.220	200.00	2.66	0.2980	1.0000	1	27.3	9,507	5.10	3.75
	Σ							**3,901.5**	**27,009**	**0.53**	**0.34**
#35	1	0.194	200.00	3.42	0.2330	1.0000	3	28.0	8,923	0.00	0.00
	Σ							**28.0**	**8,923**	**0.00**	**0.00**
#15	1	0.201	125.00	8.20	0.3960	1.0000	3	284.0	41,954	0.00	0.00
	2	0.161	100.00	11.40	0.3060	1.0000	3	372.2	43,886	0.00	0.00
	3	0.118	100.00	10.20	0.2850	1.0000	2	104.7	18,046	8.67	6.42
	Σ							**666.2**	**35,689**	**0.30**	**0.19**
#12	1	0.124	150.00	6.30	0.3070	1.0000	2	20.4	11,661	5.67	4.23
	2	0.132	200.00	3.60	0.3500	1.0000	2	3.5	6,903	3.51	2.63
	3	0.136	175.00	5.00	0.3330	1.0000	2	22.6	12,336	6.09	4.54
	4	0.188	200.00	3.40	0.3570	1.0000	2	11.0	7,280	4.16	3.35
	5	0.228	175.00	4.10	0.3640	1.0000	2	12.6	16,394	8.29	6.26
	Σ							**64.8**	**10,798**	**5.21**	**3.74**
#13	1	0.128	150.00	6.90	0.3390	1.0000	2	10.6	12,556	6.27	4.76
	2	0.130	175.00	5.70	0.3300	1.0000	2	20.5	12,360	6.02	4.53
	3	0.191	175.00	6.00	0.2890	1.0000	2	46.2	22,620	12.32	8.80
	4	0.122	175.00	5.10	0.3460	1.0000	2	6.4	11,408	6.15	4.62
	5	0.137	175.00	4.20	0.3530	1.0000	2	2.2	6,078	3.78	3.16
	Σ							**150.5**	**14,172**	**7.19**	**4.86**
#14	1	0.196	100.00	10.20	0.3980	1.0000	3	390.8	70,290	1.68	1.13
	2	0.193	150.00	6.70	0.4020	1.0000	3	254.4	44,287	0.26	0.18
	3	0.169	75.00	13.80	0.3240	1.0000	3	675.2	54,052	0.00	0.00
	4	0.114	100.00	11.00	0.2980	1.0000	3	26.7	25,596	0.00	0.00
	5	0.078	100.00	10.10	0.1830	1.0000	3	29.3	11,302	0.14	0.10
	6	0.084	150.00	7.10	0.2700	1.0000	2	9.9	7,446	3.61	2.71
	7	0.087	100.00	10.00	0.1840	1.0000	3	48.3	10,687	0.00	0.00
	8	0.126	150.00	6.70	0.2740	1.0000	2	46.3	11,063	4.96	3.74
	9	0.117	150.00	7.30	0.2600	1.0000	2	50.6	11,548	5.49	4.11
	10	0.115	125.00	8.50	0.2610	1.0000	2	27.1	11,936	5.79	4.34
	Σ							**1,310.1**	**62,956**	**0.45**	**0.12**
#16	1	0.201	300.00	2.78	0.3030	1.0000	3	87.9	10,044	0.00	0.00
	2	0.204	150.00	6.00	0.3630	1.0000	3	229.8	36,204	0.07	0.05
	3	0.210	150.00	6.10	0.3990	1.0000	3	184.0	46,797	3.13	2.24
	Σ							**2,476.6**	**38,833**	**0.43**	**0.20**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#23	Σ							**2,504.6**	**37,565**	**0.41**	**0.20**
#18	1	0.193	300.00	2.80	0.2200	1.0000	3	59.6	10,362	0.00	0.00
	2	0.173	175.00	4.70	0.3880	1.0000	3	86.9	21,485	0.00	0.00
	Σ							**89.4**	**9,383**	**0.00**	**0.00**
#17	1	0.196	300.00	2.60	0.2600	1.0000	3	42.5	12,532	0.29	0.20
	Σ							**42.5**	**12,532**	**0.29**	**0.20**
#19	Σ							**132.0**	**8,986**	**0.07**	**0.05**
#20	1	0.192	200.00	3.19	0.2430	1.0000	3	27.4	8,570	0.00	0.00
	Σ							**2,663.4**	**31,871**	**0.33**	**0.17**
#22	Σ							**6,564.9**	**27,432**	**0.44**	**0.27**
#36	1	0.172	200.00	3.14	0.1950	1.0000	2	1.0	3,526	2.19	1.77
	2	0.195	150.00	6.18	0.1680	1.0000	3	56.6	14,434	0.00	0.00
	3	0.166	150.00	7.47	0.1830	1.0000	3	0.3	5,009	0.44	0.38
	4	0.187	175.00	5.07	0.1810	1.0000	1	2.4	7,085	4.34	3.39
	5	0.173	175.00	4.89	0.1800	1.0000	1	0.3	3,772	2.51	2.26
	6	0.177	175.00	5.15	0.1840	1.0000	1	0.5	4,227	2.74	2.47
	Σ							**8,876.1**	**30,628**	**0.39**	**0.23**
#37	1	0.172	200.00	3.14	0.1950	1.0000	2	20.0	4,526	1.87	1.41
	2	0.195	150.00	6.18	0.1680	1.0000	3	43.5	15,229	0.00	0.00
	3	0.166	150.00	7.47	0.1830	1.0000	3	0.3	5,015	0.44	0.38
	4	0.187	175.00	5.07	0.1810	1.0000	1	2.4	7,085	4.34	3.39
	5	0.173	175.00	4.89	0.1800	1.0000	2	0.3	3,772	2.44	2.20
	6	0.177	175.00	5.15	0.1840	1.0000	1	0.5	4,227	2.74	2.47
	7	0.175	175.00	4.90	0.2080	1.0000	2	3.7	7,824	4.06	3.14
	Σ							**8,832.4**	**27,265**	**0.12**	**0.08**

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	3.65	50.00	1,369.00	1.910	0.199
		8. Large gullies, diversions, and low flowing streams	1.57	157.00	10,030.00	3.750	0.742
#1	**1**	**Time of Concentration:**					**0.941**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	6.63	70.00	1,056.00	2.570	0.114

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	1.98	150.00	7,573.00	1.400	1.502
#1	**2**	**Time of Concentration:**					**1.616**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	1.65	117.00	7,070.00	1.280	1.534
		8. Large gullies, diversions, and low flowing streams	2.43	126.00	5,188.00	4.670	0.308
#1	**3**	**Time of Concentration:**					**1.842**
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.77	260.00	4,506.00	2.400	0.521
		8. Large gullies, diversions, and low flowing streams	2.84	168.00	5,924.00	5.050	0.325
#1	**4**	**Time of Concentration:**					**0.846**
#1	5	5. Nearly bare and untilled, and alluvial valley fans	19.93	180.00	903.00	4.460	0.056
		8. Large gullies, diversions, and low flowing streams	3.30	178.00	5,393.00	5.450	0.274
#1	**5**	**Time of Concentration:**					**0.330**
#1	6	5. Nearly bare and untilled, and alluvial valley fans	13.43	105.00	782.00	3.660	0.059
		8. Large gullies, diversions, and low flowing streams	2.62	283.00	10,822.00	4.850	0.619
#1	**6**	**Time of Concentration:**					**0.678**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.84	70.00	1,024.00	2.610	0.108
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,325.00	3.810	0.315
#2	**1**	**Time of Concentration:**					**0.423**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	5.56	45.00	810.00	2.350	0.095
		8. Large gullies, diversions, and low flowing streams	0.86	40.00	4,663.00	2.770	0.467
#2	**2**	**Time of Concentration:**					**0.562**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	5.89	50.00	849.00	2.420	0.097
		8. Large gullies, diversions, and low flowing streams	1.17	80.00	6,862.00	3.230	0.590
#2	**3**	**Time of Concentration:**					**0.687**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	12.63	95.00	752.00	3.550	0.058
		8. Large gullies, diversions, and low flowing streams	1.40	135.00	9,630.00	3.550	0.753
#2	**4**	**Time of Concentration:**					**0.811**
#2	5	5. Nearly bare and untilled, and alluvial valley fans	11.02	70.00	635.00	3.320	0.053
		8. Large gullies, diversions, and low flowing streams	0.46	40.00	8,732.00	2.030	1.194
#2	**5**	**Time of Concentration:**					**1.247**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	10.00	805.00	1.110	0.201
		8. Large gullies, diversions, and low flowing streams	1.33	40.00	3,017.00	3.450	0.242
#3	**1**	**Time of Concentration:**					**0.443**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.68	10.00	1,478.00	0.820	0.500
		8. Large gullies, diversions, and low flowing streams	1.78	100.00	5,622.00	4.000	0.390
#3	**2**	**Time of Concentration:**					**0.890**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	4.66	70.00	1,501.00	2.150	0.193
		8. Large gullies, diversions, and low flowing streams	1.17	60.00	5,126.00	3.240	0.439
#3	**3**	**Time of Concentration:**					**0.632**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	19.06	285.00	1,495.00	4.360	0.095
		8. Large gullies, diversions, and low flowing streams	2.64	242.00	9,174.00	4.870	0.523
#5	**1**	**Time of Concentration:**					**0.618**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	14.27	105.00	736.00	3.770	0.054
		8. Large gullies, diversions, and low flowing streams	4.08	297.00	7,279.00	6.050	0.334
#5	**2**	**Time of Concentration:**					**0.388**
#5	3	5. Nearly bare and untilled, and alluvial valley fans	8.27	35.00	423.00	2.870	0.040
		8. Large gullies, diversions, and low flowing streams	3.44	208.00	6,049.00	5.560	0.302
#5	**3**	**Time of Concentration:**					**0.342**
#5	4	5. Nearly bare and untilled, and alluvial valley fans	14.58	85.00	583.00	3.810	0.042
		8. Large gullies, diversions, and low flowing streams	4.53	248.00	5,473.00	6.380	0.238
#5	**4**	**Time of Concentration:**					**0.280**
#5	5	5. Nearly bare and untilled, and alluvial valley fans	5.07	70.00	1,382.00	2.250	0.170
		8. Large gullies, diversions, and low flowing streams	3.89	170.00	4,375.00	5.910	0.205
#5	**5**	**Time of Concentration:**					**0.375**
#5	6	5. Nearly bare and untilled, and alluvial valley fans	12.48	90.00	721.00	3.530	0.056
		8. Large gullies, diversions, and low flowing streams	5.16	274.00	5,308.02	6.810	0.216
#5	**6**	**Time of Concentration:**					**0.272**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	5.36	75.00	1,399.00	2.310	0.168
		8. Large gullies, diversions, and low flowing streams	2.41	66.00	2,742.00	4.650	0.163

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	**1**	**Time of Concentration:**					**0.331**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.39	80.00	2,359.00	1.840	0.356
		8. Large gullies, diversions, and low flowing streams	2.63	80.00	3,039.00	4.860	0.173
#6	**2**	**Time of Concentration:**					**0.529**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	4.60	34.00	739.00	2.140	0.095
		8. Large gullies, diversions, and low flowing streams	2.33	136.00	5,845.00	4.570	0.355
#6	**3**	**Time of Concentration:**					**0.450**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	6.06	85.00	1,402.00	2.460	0.158
		8. Large gullies, diversions, and low flowing streams	2.52	96.00	3,810.00	4.760	0.222
#6	**4**	**Time of Concentration:**					**0.380**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	7.24	70.00	967.00	2.690	0.099
		8. Large gullies, diversions, and low flowing streams	2.34	117.00	5,003.00	4.580	0.303
#6	**5**	**Time of Concentration:**					**0.402**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	31.83	183.00	575.00	5.640	0.028
		8. Large gullies, diversions, and low flowing streams	3.38	270.00	7,990.00	5.510	0.402
#6	**6**	**Time of Concentration:**					**0.430**
#6	7	5. Nearly bare and untilled, and alluvial valley fans	23.08	325.00	1,408.00	4.800	0.081
		8. Large gullies, diversions, and low flowing streams	2.88	240.00	8,327.00	5.090	0.454
#6	**7**	**Time of Concentration:**					**0.535**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	11.42	90.00	788.00	3.370	0.064
		8. Large gullies, diversions, and low flowing streams	1.46	230.00	15,769.00	3.620	1.210
#7	**1**	**Time of Concentration:**					**1.274**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	10.97	60.00	547.00	3.310	0.045
		8. Large gullies, diversions, and low flowing streams	1.61	220.00	13,660.00	3.800	0.998
#7	**2**	**Time of Concentration:**					**1.043**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	938.00	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.72	171.00	9,931.00	3.930	0.701
#7	**3**	**Time of Concentration:**					**0.804**
#7	4	5. Nearly bare and untilled, and alluvial valley fans	19.23	80.00	416.00	4.380	0.026

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.45	100.00	4,083.00	4.690	0.241
#7	**4**	**Time of Concentration:**					**0.267**
#7	5	5. Nearly bare and untilled, and alluvial valley fans	6.09	67.00	1,101.00	2.460	0.124
		8. Large gullies, diversions, and low flowing streams	2.51	80.00	3,184.00	4.750	0.186
#7	**5**	**Time of Concentration:**					**0.310**
#7	6	5. Nearly bare and untilled, and alluvial valley fans	5.93	63.00	1,062.00	2.430	0.121
		8. Large gullies, diversions, and low flowing streams	2.74	82.00	2,993.00	4.960	0.167
#7	**6**	**Time of Concentration:**					**0.288**
#7	7	5. Nearly bare and untilled, and alluvial valley fans	7.97	65.00	816.00	2.820	0.080
		8. Large gullies, diversions, and low flowing streams	3.48	153.00	4,400.00	5.590	0.218
#7	**7**	**Time of Concentration:**					**0.298**
#7	8	5. Nearly bare and untilled, and alluvial valley fans	6.60	50.00	758.00	2.560	0.082
		8. Large gullies, diversions, and low flowing streams	4.66	473.00	10,157.00	6.470	0.436
#7	**8**	**Time of Concentration:**					**0.518**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	3.01	55.00	1,829.00	1.730	0.293
		8. Large gullies, diversions, and low flowing streams	0.76	50.00	6,548.00	2.620	0.694
#9	**1**	**Time of Concentration:**					**0.987**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	41.00	3,317.00	1.110	0.830
		8. Large gullies, diversions, and low flowing streams	0.70	29.00	4,125.00	2.510	0.456
#10	**1**	**Time of Concentration:**					**1.286**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	2.25	125.00	5,554.00	1.500	1.028
		8. Large gullies, diversions, and low flowing streams	2.13	85.00	3,997.00	4.370	0.254
#10	**2**	**Time of Concentration:**					**1.282**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.39	68.00	4,904.00	1.170	1.164
		8. Large gullies, diversions, and low flowing streams	4.73	90.00	1,904.00	6.520	0.081
#10	**3**	**Time of Concentration:**					**1.245**
#10	4	5. Nearly bare and untilled, and alluvial valley fans	3.76	51.00	1,357.00	1.930	0.195
		8. Large gullies, diversions, and low flowing streams	0.65	22.00	3,385.00	2.410	0.390
#10	**4**	**Time of Concentration:**					**0.585**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	5	5. Nearly bare and untilled, and alluvial valley fans	1.63	88.00	5,391.16	1.270	1.179
#10	**5**	**Time of Concentration:**					**1.179**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	4.50	75.00	1,667.00	2.120	0.218
		8. Large gullies, diversions, and low flowing streams	1.85	155.00	8,400.00	4.070	0.573
#12	**1**	**Time of Concentration:**					**0.791**
#12	2	5. Nearly bare and untilled, and alluvial valley fans	2.99	50.00	1,674.03	1.720	0.270
		8. Large gullies, diversions, and low flowing streams	1.67	70.00	4,201.17	3.870	0.301
#12	**2**	**Time of Concentration:**					**0.571**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	4.04	57.00	1,411.00	2.000	0.195
		8. Large gullies, diversions, and low flowing streams	1.55	107.00	6,884.00	3.740	0.511
#12	**3**	**Time of Concentration:**					**0.706**
#12	4	5. Nearly bare and untilled, and alluvial valley fans	2.23	84.00	3,771.04	1.490	0.703
		8. Large gullies, diversions, and low flowing streams	1.62	186.00	11,515.60	3.810	0.839
#12	**4**	**Time of Concentration:**					**1.542**
#12	5	5. Nearly bare and untilled, and alluvial valley fans	3.68	53.00	1,442.00	1.910	0.209
		8. Large gullies, diversions, and low flowing streams	1.95	120.00	6,155.00	4.180	0.409
#12	**5**	**Time of Concentration:**					**0.618**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	4.62	62.00	1,342.00	2.140	0.174
		8. Large gullies, diversions, and low flowing streams	1.91	157.00	8,225.00	4.140	0.551
#13	**1**	**Time of Concentration:**					**0.725**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	2.91	50.00	1,717.00	1.700	0.280
		8. Large gullies, diversions, and low flowing streams	2.28	183.00	8,039.00	4.520	0.494
#13	**2**	**Time of Concentration:**					**0.774**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	6.18	95.00	1,537.00	2.480	0.172
		8. Large gullies, diversions, and low flowing streams	2.13	135.00	6,347.00	4.370	0.403
#13	**3**	**Time of Concentration:**					**0.575**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.17	10.00	315.00	1.780	0.049
		8. Large gullies, diversions, and low flowing streams	2.30	100.00	4,344.00	4.550	0.265
#13	**4**	**Time of Concentration:**					**0.314**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	5	5. Nearly bare and untilled, and alluvial valley fans	3.10	70.00	2,255.00	1.760	0.355
		8. Large gullies, diversions, and low flowing streams	1.23	140.00	11,392.00	3.320	0.953
#13	**5**	**Time of Concentration:**					**1.308**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	10.59	63.00	595.00	3.250	0.050
		8. Large gullies, diversions, and low flowing streams	2.60	151.00	5,808.00	4.830	0.334
#14	**1**	**Time of Concentration:**					**0.384**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	7.28	67.00	920.00	2.690	0.095
		8. Large gullies, diversions, and low flowing streams	2.17	123.00	5,670.00	4.410	0.357
#14	**2**	**Time of Concentration:**					**0.452**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	21.46	150.00	699.00	4.630	0.041
		8. Large gullies, diversions, and low flowing streams	3.10	364.00	11,728.00	5.280	0.617
#14	**3**	**Time of Concentration:**					**0.658**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	3.39	35.00	1,032.00	1.840	0.155
		8. Large gullies, diversions, and low flowing streams	2.97	103.00	3,470.00	5.160	0.186
#14	**4**	**Time of Concentration:**					**0.341**
#14	5	5. Nearly bare and untilled, and alluvial valley fans	28.15	125.00	444.00	5.300	0.023
		8. Large gullies, diversions, and low flowing streams	4.18	246.00	5,886.00	6.130	0.266
#14	**5**	**Time of Concentration:**					**0.289**
#14	6	5. Nearly bare and untilled, and alluvial valley fans	3.18	40.00	1,257.00	1.780	0.196
		8. Large gullies, diversions, and low flowing streams	2.29	228.00	9,963.00	4.530	0.610
#14	**6**	**Time of Concentration:**					**0.806**
#14	7	5. Nearly bare and untilled, and alluvial valley fans	16.72	100.00	598.00	4.080	0.040
		8. Large gullies, diversions, and low flowing streams	2.81	243.00	8,649.00	5.020	0.478
#14	**7**	**Time of Concentration:**					**0.518**
#14	8	5. Nearly bare and untilled, and alluvial valley fans	1.70	47.00	2,765.00	1.300	0.590
		8. Large gullies, diversions, and low flowing streams	2.44	274.00	11,208.00	4.690	0.663
#14	**8**	**Time of Concentration:**					**1.253**
#14	9	5. Nearly bare and untilled, and alluvial valley fans	2.87	105.00	3,657.00	1.690	0.601
		8. Large gullies, diversions, and low flowing streams	2.43	194.00	7,991.00	4.670	0.475

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	**9**	**Time of Concentration:**					**1.076**
#14	10	5. Nearly bare and untilled, and alluvial valley fans	2.75	80.00	2,907.00	1.650	0.489
		8. Large gullies, diversions, and low flowing streams	2.41	172.00	7,149.00	4.650	0.427
#14	**10**	**Time of Concentration:**					**0.916**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	12.80	54.00	422.00	3.570	0.032
		8. Large gullies, diversions, and low flowing streams	1.68	181.00	10,781.00	3.880	0.771
#15	**1**	**Time of Concentration:**					**0.803**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	44.22	260.00	588.00	6.640	0.024
		8. Large gullies, diversions, and low flowing streams	2.45	254.00	10,354.24	4.690	0.613
#15	**2**	**Time of Concentration:**					**0.637**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	10.04	85.00	847.00	3.160	0.074
		8. Large gullies, diversions, and low flowing streams	2.34	366.00	15,663.00	4.580	0.949
#15	**3**	**Time of Concentration:**					**1.023**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	2.26	117.00	5,179.00	1.500	0.959
		8. Large gullies, diversions, and low flowing streams	0.46	26.00	5,601.00	2.040	0.762
#16	**1**	**Time of Concentration:**					**1.721**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	8.70	62.00	713.00	2.940	0.067
		8. Large gullies, diversions, and low flowing streams	1.99	144.00	7,241.00	4.230	0.475
#16	**2**	**Time of Concentration:**					**0.542**
#16	3	5. Nearly bare and untilled, and alluvial valley fans	6.88	32.00	465.00	2.620	0.049
		8. Large gullies, diversions, and low flowing streams	2.29	81.00	3,543.00	4.530	0.217
#16	**3**	**Time of Concentration:**					**0.266**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	9.37	65.00	694.00	3.060	0.062
		8. Large gullies, diversions, and low flowing streams	1.19	56.00	4,712.00	3.270	0.400
#17	**1**	**Time of Concentration:**					**0.462**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	9.00	60.00	667.00	2.990	0.061
		8. Large gullies, diversions, and low flowing streams	0.97	61.00	6,287.00	2.950	0.591
#18	**1**	**Time of Concentration:**					**0.652**
#18	2	5. Nearly bare and untilled, and alluvial valley fans	2.47	33.00	1,336.00	1.570	0.236

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.01	164.00	8,154.00	4.250	0.532
#18	**2**	**Time of Concentration:**					**0.768**
#20	1	5. Nearly bare and untilled, and alluvial valley fans	2.64	47.00	1,783.00	1.620	0.305
		8. Large gullies, diversions, and low flowing streams	0.56	30.00	5,405.00	2.230	0.673
#20	**1**	**Time of Concentration:**					**0.978**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	4.09	60.00	1,467.02	2.020	0.201
		8. Large gullies, diversions, and low flowing streams	0.93	60.00	6,433.62	2.890	0.618
#21	**1**	**Time of Concentration:**					**0.819**
#21	2	5. Nearly bare and untilled, and alluvial valley fans	3.50	50.00	1,430.00	1.860	0.213
		8. Large gullies, diversions, and low flowing streams	2.15	60.00	2,785.12	4.400	0.175
#21	**2**	**Time of Concentration:**					**0.388**
#21	3	5. Nearly bare and untilled, and alluvial valley fans	1.70	15.00	881.00	1.300	0.188
		9. Small streams flowing bankfull	1.49	60.00	4,014.18	11.000	0.101
#21	**3**	**Time of Concentration:**					**0.289**
#21	4	5. Nearly bare and untilled, and alluvial valley fans	2.21	40.00	1,811.02	1.480	0.339
		8. Large gullies, diversions, and low flowing streams	0.84	50.00	5,949.54	2.750	0.600
#21	**4**	**Time of Concentration:**					**0.939**
#24	1	5. Nearly bare and untilled, and alluvial valley fans	1.71	430.00	25,118.00	1.300	5.367
#24	**1**	**Time of Concentration:**					**5.367**
#24	2	5. Nearly bare and untilled, and alluvial valley fans	1.84	430.00	23,393.00	1.350	4.813
#24	**2**	**Time of Concentration:**					**4.813**
#24	3	5. Nearly bare and untilled, and alluvial valley fans	1.82	155.00	8,498.00	1.350	1.748
		8. Large gullies, diversions, and low flowing streams	0.84	40.00	4,771.00	2.740	0.483
#24	**3**	**Time of Concentration:**					**2.231**
#24	4	5. Nearly bare and untilled, and alluvial valley fans	1.24	50.00	4,042.00	1.110	1.011
		8. Large gullies, diversions, and low flowing streams	0.49	60.00	12,150.00	2.100	1.607
#24	**4**	**Time of Concentration:**					**2.618**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	0.51	10.00	1,950.00	0.710	0.762
		8. Large gullies, diversions, and low flowing streams	1.81	60.00	3,322.00	4.030	0.228
#25	**1**	**Time of Concentration:**					**0.990**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#25	2	5. Nearly bare and untilled, and alluvial valley fans	1.11	25.00	2,254.00	1.050	0.596
		8. Large gullies, diversions, and low flowing streams	2.36	75.00	3,178.00	4.600	0.191
#25	**2**	**Time of Concentration:**					**0.787**
#25	3	5. Nearly bare and untilled, and alluvial valley fans	3.23	30.00	929.00	1.790	0.144
		8. Large gullies, diversions, and low flowing streams	2.45	154.00	6,297.00	4.690	0.372
#25	**3**	**Time of Concentration:**					**0.516**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	1.20	103.00	8,602.00	1.090	2.192
#26	**1**	**Time of Concentration:**					**2.192**
#26	2	5. Nearly bare and untilled, and alluvial valley fans	1.23	120.00	9,780.00	1.100	2.469
		8. Large gullies, diversions, and low flowing streams	2.18	184.00	8,454.00	4.420	0.531
#26	**2**	**Time of Concentration:**					**3.000**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.32	50.00	1,158.02	2.070	0.155
		8. Large gullies, diversions, and low flowing streams	2.53	198.00	7,838.16	4.760	0.457
#27	**1**	**Time of Concentration:**					**0.612**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	5.26	30.00	570.00	2.290	0.069
		8. Large gullies, diversions, and low flowing streams	3.15	278.00	8,822.00	5.320	0.460
#27	**2**	**Time of Concentration:**					**0.529**
#27	3	5. Nearly bare and untilled, and alluvial valley fans	16.33	80.00	490.00	4.040	0.033
		8. Large gullies, diversions, and low flowing streams	2.15	225.00	10,443.00	4.400	0.659
#27	**3**	**Time of Concentration:**					**0.692**
#27	4	5. Nearly bare and untilled, and alluvial valley fans	12.43	65.00	523.00	3.520	0.041
		8. Large gullies, diversions, and low flowing streams	3.49	225.00	6,454.00	5.600	0.320
#27	**4**	**Time of Concentration:**					**0.361**
#27	5	5. Nearly bare and untilled, and alluvial valley fans	9.40	25.00	266.00	3.060	0.024
		8. Large gullies, diversions, and low flowing streams	2.32	364.00	15,700.00	4.560	0.956
#27	**5**	**Time of Concentration:**					**0.980**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	40.00	762.00	2.290	0.092
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**1**	**Time of Concentration:**					**0.657**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	2	5. Nearly bare and untilled, and alluvial valley fans	25.86	105.00	406.00	5.080	0.022
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**2**	**Time of Concentration:**					**0.587**
#29	1	5. Nearly bare and untilled, and alluvial valley fans	11.58	30.00	259.00	3.400	0.021
		8. Large gullies, diversions, and low flowing streams	3.61	288.00	7,976.00	5.700	0.388
#29	**1**	**Time of Concentration:**					**0.409**
#29	2	5. Nearly bare and untilled, and alluvial valley fans	8.06	40.00	496.00	2.830	0.048
		8. Large gullies, diversions, and low flowing streams	2.90	252.00	8,693.55	5.100	0.473
#29	**2**	**Time of Concentration:**					**0.521**
#29	3	5. Nearly bare and untilled, and alluvial valley fans	7.25	25.00	345.00	2.690	0.035
		8. Large gullies, diversions, and low flowing streams	2.26	158.00	7,001.00	4.500	0.432
#29	**3**	**Time of Concentration:**					**0.467**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	35.00	710.00	2.220	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	243.00	14,540.00	3.870	1.043
#30	**1**	**Time of Concentration:**					**1.131**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.91	15.00	515.00	1.700	0.084
		8. Large gullies, diversions, and low flowing streams	2.74	247.00	9,006.00	4.960	0.504
#31	**1**	**Time of Concentration:**					**0.588**
#31	2	5. Nearly bare and untilled, and alluvial valley fans	7.46	25.00	335.00	2.730	0.034
		8. Large gullies, diversions, and low flowing streams	2.18	138.00	6,335.00	4.420	0.398
#31	**2**	**Time of Concentration:**					**0.432**
#31	3	5. Nearly bare and untilled, and alluvial valley fans	3.84	20.00	521.00	1.950	0.074
		8. Large gullies, diversions, and low flowing streams	2.24	108.00	4,826.00	4.480	0.299
#31	**3**	**Time of Concentration:**					**0.373**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	22.00	632.00	1.860	0.094
		8. Large gullies, diversions, and low flowing streams	1.56	101.00	6,494.00	3.740	0.482
#32	**1**	**Time of Concentration:**					**0.576**
#34	1	5. Nearly bare and untilled, and alluvial valley fans	2.28	35.00	1,538.00	1.500	0.284
		8. Large gullies, diversions, and low flowing streams	2.89	74.00	2,560.00	5.100	0.139

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#34	**1**	**Time of Concentration:**					**0.423**
#34	2	5. Nearly bare and untilled, and alluvial valley fans	2.69	38.00	1,415.00	1.630	0.241
		8. Large gullies, diversions, and low flowing streams	1.60	81.00	5,052.00	3.790	0.370
#34	**2**	**Time of Concentration:**					**0.611**
#34	3	5. Nearly bare and untilled, and alluvial valley fans	3.80	56.00	1,474.00	1.940	0.211
		8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,293.00	2.500	0.477
#34	**3**	**Time of Concentration:**					**0.688**
#34	4	5. Nearly bare and untilled, and alluvial valley fans	4.17	35.00	840.00	2.040	0.114
		8. Large gullies, diversions, and low flowing streams	1.89	72.00	3,807.00	4.120	0.256
#34	**4**	**Time of Concentration:**					**0.370**
#35	1	5. Nearly bare and untilled, and alluvial valley fans	2.34	113.00	4,831.12	1.520	0.882
		8. Large gullies, diversions, and low flowing streams	1.11	20.00	1,794.00	3.160	0.157
#35	**1**	**Time of Concentration:**					**1.039**
#36	1	5. Nearly bare and untilled, and alluvial valley fans	3.35	20.00	596.46	1.830	0.090
		8. Large gullies, diversions, and low flowing streams	1.29	60.00	4,641.80	3.410	0.378
#36	**1**	**Time of Concentration:**					**0.468**
#36	2	5. Nearly bare and untilled, and alluvial valley fans	3.33	40.00	1,200.57	1.820	0.183
		8. Large gullies, diversions, and low flowing streams	1.51	90.00	5,956.33	3.680	0.449
#36	**2**	**Time of Concentration:**					**0.632**
#36	3	5. Nearly bare and untilled, and alluvial valley fans	3.77	77.00	2,043.74	1.940	0.292
		8. Large gullies, diversions, and low flowing streams	1.12	53.00	4,712.61	3.180	0.411
#36	**3**	**Time of Concentration:**					**0.703**
#36	4	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	937.44	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.76	80.00	4,538.27	3.980	0.316
#36	**4**	**Time of Concentration:**					**0.419**
#36	5	5. Nearly bare and untilled, and alluvial valley fans	1.68	10.00	596.48	1.290	0.128
		8. Large gullies, diversions, and low flowing streams	2.50	125.00	5,007.21	4.740	0.293
#36	**5**	**Time of Concentration:**					**0.421**
#36	6	5. Nearly bare and untilled, and alluvial valley fans	1.57	10.00	638.43	1.250	0.141

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.06	123.00	5,966.63	4.300	0.385
#36	**6**	**Time of Concentration:**					**0.526**
#37	1	5. Nearly bare and untilled, and alluvial valley fans	4.68	129.00	2,754.05	2.160	0.354
		8. Large gullies, diversions, and low flowing streams	0.16	10.00	6,108.73	1.210	1.402
#37	**1**	**Time of Concentration:**					**1.756**
#37	2	5. Nearly bare and untilled, and alluvial valley fans	5.17	45.00	870.00	2.270	0.106
		8. Large gullies, diversions, and low flowing streams	2.01	95.00	4,737.20	4.240	0.310
#37	**2**	**Time of Concentration:**					**0.416**
#37	3	5. Nearly bare and untilled, and alluvial valley fans	3.52	30.00	852.93	1.870	0.126
		8. Large gullies, diversions, and low flowing streams	4.02	180.00	4,473.94	6.010	0.206
#37	**3**	**Time of Concentration:**					**0.703**
#37	4	5. Nearly bare and untilled, and alluvial valley fans	3.18	35.00	1,099.00	1.780	0.171
		8. Large gullies, diversions, and low flowing streams	1.49	38.00	2,544.00	3.660	0.193
#37	**4**	**Time of Concentration:**					**0.419**
#37	5	5. Nearly bare and untilled, and alluvial valley fans	2.59	40.00	1,542.81	1.610	0.266
		8. Large gullies, diversions, and low flowing streams	1.48	67.00	4,528.71	3.640	0.345
#37	**5**	**Time of Concentration:**					**0.421**
#37	6	5. Nearly bare and untilled, and alluvial valley fans	1.55	10.00	646.96	1.240	0.144
		8. Large gullies, diversions, and low flowing streams	6.34	157.00	2,475.12	7.550	0.091
#37	**6**	**Time of Concentration:**					**0.526**
#37	7	5. Nearly bare and untilled, and alluvial valley fans	7.23	80.00	1,106.00	2.680	0.114
		8. Large gullies, diversions, and low flowing streams	1.05	52.00	4,950.00	3.070	0.447
#37	**7**	**Time of Concentration:**					**0.561**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	1.29	107.00	8,294.00	3.400	0.677
#1	**2**	**Muskingum K:**					**0.677**
#1	3	8. Large gullies, diversions, and low flowing streams	1.27	113.00	8,880.00	3.380	0.729

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**3**	**Muskingum K:**					**0.729**
#1	4	8. Large gullies, diversions, and low flowing streams	1.35	171.00	12,634.00	3.490	1.005
#1	**4**	**Muskingum K:**					**1.005**
#1	5	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**5**	**Muskingum K:**					**1.392**
#1	6	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**6**	**Muskingum K:**					**1.392**
#2	2	8. Large gullies, diversions, and low flowing streams	0.53	20.00	3,756.00	2.180	0.478
#2	**2**	**Muskingum K:**					**0.478**
#2	3	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**3**	**Muskingum K:**					**0.574**
#2	4	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**4**	**Muskingum K:**					**0.574**
#2	5	8. Large gullies, diversions, and low flowing streams	0.65	45.00	6,955.00	2.410	0.801
#2	**5**	**Muskingum K:**					**0.801**
#3	3	8. Large gullies, diversions, and low flowing streams	0.92	20.00	2,168.00	2.880	0.209
#3	**3**	**Muskingum K:**					**0.209**
#5	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#5	**1**	**Muskingum K:**					**0.000**
#5	2	8. Large gullies, diversions, and low flowing streams	1.75	125.00	7,149.00	3.960	0.501
#5	**2**	**Muskingum K:**					**0.501**
#5	3	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**3**	**Muskingum K:**					**0.681**
#5	4	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**4**	**Muskingum K:**					**0.681**
#5	5	8. Large gullies, diversions, and low flowing streams	1.67	239.00	14,273.00	3.880	1.021
#5	**5**	**Muskingum K:**					**1.021**
#5	6	8. Large gullies, diversions, and low flowing streams	1.68	239.00	14,223.00	3.880	1.018
#5	**6**	**Muskingum K:**					**1.018**
#7	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**1**	**Muskingum K:**					**0.000**
#7	2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	**2**	**Muskingum K:**					**0.000**
#7	4	8. Large gullies, diversions, and low flowing streams	1.16	140.00	12,037.00	3.230	1.035
#7	**4**	**Muskingum K:**					**1.035**
#7	5	8. Large gullies, diversions, and low flowing streams	1.14	140.00	12,307.69	3.190	1.071
#7	**5**	**Muskingum K:**					**1.071**
#7	6	8. Large gullies, diversions, and low flowing streams	1.17	158.00	13,546.00	3.230	1.164
#7	**6**	**Muskingum K:**					**1.164**
#7	7	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**7**	**Muskingum K:**					**1.344**
#7	8	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**8**	**Muskingum K:**					**1.344**
#10	3	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**3**	**Muskingum K:**					**0.517**
#10	4	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**4**	**Muskingum K:**					**0.517**
#10	5	8. Large gullies, diversions, and low flowing streams	0.79	47.00	5,956.00	2.660	0.621
#10	**5**	**Muskingum K:**					**0.621**
#12	2	8. Large gullies, diversions, and low flowing streams	8.24	111.00	1,347.00	8.610	0.043
#12	**2**	**Muskingum K:**					**0.043**
#12	3	8. Large gullies, diversions, and low flowing streams	8.01	109.00	1,360.00	8.490	0.044
#12	**3**	**Muskingum K:**					**0.044**
#12	4	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**4**	**Muskingum K:**					**0.487**
#12	5	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**5**	**Muskingum K:**					**0.487**
#13	2	8. Large gullies, diversions, and low flowing streams	1.34	54.00	4,025.00	3.470	0.322
#13	**2**	**Muskingum K:**					**0.322**
#13	3	8. Large gullies, diversions, and low flowing streams	0.98	72.00	7,333.00	2.970	0.685
#13	**3**	**Muskingum K:**					**0.685**
#13	4	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**4**	**Muskingum K:**					**0.923**
#13	5	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	**5**	**Muskingum K:**					**0.923**
#14	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#14	**1**	**Muskingum K:**					**0.000**
#14	2	8. Large gullies, diversions, and low flowing streams	0.83	58.00	6,957.00	2.730	0.707
#14	**2**	**Muskingum K:**					**0.707**
#14	3	8. Large gullies, diversions, and low flowing streams	0.81	77.00	9,480.00	2.700	0.975
#14	**3**	**Muskingum K:**					**0.975**
#14	4	8. Large gullies, diversions, and low flowing streams	0.86	147.00	17,117.00	2.770	1.716
#14	**4**	**Muskingum K:**					**1.716**
#14	5	8. Large gullies, diversions, and low flowing streams	0.88	175.00	19,934.00	2.810	1.970
#14	**5**	**Muskingum K:**					**1.970**
#14	6	8. Large gullies, diversions, and low flowing streams	0.95	211.00	22,155.00	2.920	2.107
#14	**6**	**Muskingum K:**					**2.107**
#14	7	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**7**	**Muskingum K:**					**2.544**
#14	8	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**8**	**Muskingum K:**					**2.544**
#14	9	8. Large gullies, diversions, and low flowing streams	0.95	307.00	32,146.59	2.930	3.047
#14	**9**	**Muskingum K:**					**3.047**
#14	10	8. Large gullies, diversions, and low flowing streams	0.96	339.00	35,382.00	2.930	3.354
#14	**10**	**Muskingum K:**					**3.354**
#15	2	8. Large gullies, diversions, and low flowing streams	1.14	86.00	7,535.26	3.200	0.654
#15	**2**	**Muskingum K:**					**0.654**
#15	3	8. Large gullies, diversions, and low flowing streams	1.25	115.00	9,236.00	3.340	0.768
#15	**3**	**Muskingum K:**					**0.768**
#16	2	8. Large gullies, diversions, and low flowing streams	0.55	42.00	7,608.00	2.220	0.951
#16	**2**	**Muskingum K:**					**0.951**
#16	3	8. Large gullies, diversions, and low flowing streams	0.51	54.00	10,615.00	2.130	1.384
#16	**3**	**Muskingum K:**					**1.384**
#17	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#17	**1**	**Muskingum K:**					**0.000**
#18	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#18	**1**	**Muskingum K:**					**0.000**
#18	2	8. Large gullies, diversions, and low flowing streams	1.02	62.00	6,103.00	3.020	0.561
#18	**2**	**Muskingum K:**					**0.561**
#21	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#21	**1**	**Muskingum K:**					**0.000**
#21	2	8. Large gullies, diversions, and low flowing streams	0.41	20.00	4,825.09	1.930	0.694
#21	**2**	**Muskingum K:**					**0.694**
#21	3	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,627.46	1.780	0.878
#21	**3**	**Muskingum K:**					**0.878**
#21	4	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,627.46	1.780	0.878
#21	**4**	**Muskingum K:**					**0.878**
#24	1	8. Large gullies, diversions, and low flowing streams	0.79	180.00	22,769.00	2.660	2.377
#24	**1**	**Muskingum K:**					**2.377**
#24	2	8. Large gullies, diversions, and low flowing streams	0.78	180.00	23,111.00	2.640	2.431
#24	**2**	**Muskingum K:**					**2.431**
#24	4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#24	**4**	**Muskingum K:**					**0.000**
#25	1	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**1**	**Muskingum K:**					**0.342**
#25	2	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**2**	**Muskingum K:**					**0.342**
#25	3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#25	**3**	**Muskingum K:**					**0.000**
#27	1	8. Large gullies, diversions, and low flowing streams	1.38	216.00	15,629.00	3.520	1.233
#27	**1**	**Muskingum K:**					**1.233**
#27	2	8. Large gullies, diversions, and low flowing streams	1.17	144.00	12,301.00	3.240	1.054
#27	**2**	**Muskingum K:**					**1.054**
#27	3	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**3**	**Muskingum K:**					**0.551**
#27	4	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**4**	**Muskingum K:**					**0.551**
#28	1	8. Large gullies, diversions, and low flowing streams	1.30	84.00	6,445.17	3.420	0.523

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	**1**	**Muskingum K:**					**0.523**
#29	1	8. Large gullies, diversions, and low flowing streams	0.88	37.00	4,210.00	2.810	0.416
#29	**1**	**Muskingum K:**					**0.416**
#29	2	8. Large gullies, diversions, and low flowing streams	0.88	26.00	2,949.00	2.810	0.291
#29	**2**	**Muskingum K:**					**0.291**
#31	1	8. Large gullies, diversions, and low flowing streams	1.35	76.00	5,639.00	3.480	0.450
#31	**1**	**Muskingum K:**					**0.450**
#31	2	8. Large gullies, diversions, and low flowing streams	1.15	20.00	1,734.00	3.220	0.149
#31	**2**	**Muskingum K:**					**0.149**
#34	1	8. Large gullies, diversions, and low flowing streams	0.64	56.00	8,773.00	2.390	1.019
#34	**1**	**Muskingum K:**					**1.019**
#34	2	8. Large gullies, diversions, and low flowing streams	1.05	31.00	2,957.00	3.070	0.267
#34	**2**	**Muskingum K:**					**0.267**
#34	3	8. Large gullies, diversions, and low flowing streams	0.64	26.00	4,031.00	2.400	0.466
#34	**3**	**Muskingum K:**					**0.466**
#36	1	8. Large gullies, diversions, and low flowing streams	0.79	110.00	13,954.41	2.660	1.457
#36	**1**	**Muskingum K:**					**1.457**
#36	2	8. Large gullies, diversions, and low flowing streams	0.58	50.00	8,630.15	2.280	1.051
#36	**2**	**Muskingum K:**					**1.051**
#36	3	8. Large gullies, diversions, and low flowing streams	0.58	50.00	8,630.15	2.280	1.051
#36	**3**	**Muskingum K:**					**1.051**
#36	4	8. Large gullies, diversions, and low flowing streams	0.23	10.00	4,329.90	1.440	0.835
#36	**4**	**Muskingum K:**					**0.835**
#36	5	8. Large gullies, diversions, and low flowing streams	0.21	5.00	2,359.95	1.380	0.475
#36	**5**	**Muskingum K:**					**0.475**
#37	2	8. Large gullies, diversions, and low flowing streams	0.28	30.00	10,642.07	1.590	1.859
#37	**2**	**Muskingum K:**					**1.859**
#37	3	8. Large gullies, diversions, and low flowing streams	0.45	38.00	8,493.51	2.000	1.179
#37	**3**	**Muskingum K:**					**1.179**
#37	4	8. Large gullies, diversions, and low flowing streams	0.66	104.00	15,664.00	2.440	1.783
#37	**4**	**Muskingum K:**					**0.835**
#37	5	8. Large gullies, diversions, and low flowing streams	0.33	41.00	12,388.68	1.720	2.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#37	**5**	**Muskingum K:**					**0.475**
#37	6	8. Large gullies, diversions, and low flowing streams	0.33	41.00	12,388.68	1.720	2.000
#37	**6**	**Muskingum K:**					**0.000**
#37	7	8. Large gullies, diversions, and low flowing streams	0.33	31.00	9,267.00	1.730	1.487
#37	**7**	**Muskingum K:**					**1.487**

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Cottonwood Arroyo Post-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is shown on Exhibit 11-77.

Revised January 31, 2011

AAY/LR/RY

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

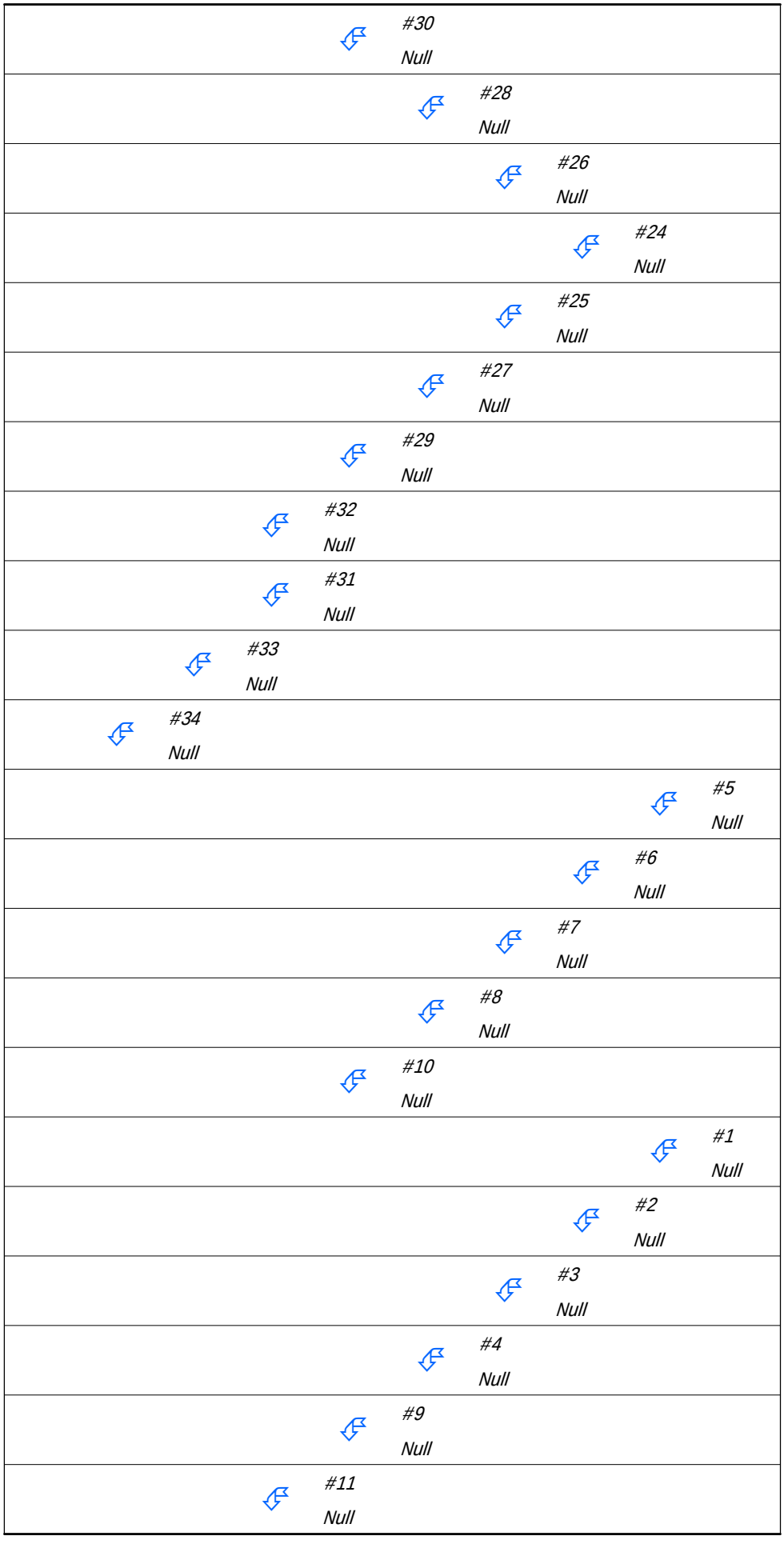
Storm Type:	NRCS Type II - 60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.961	0.307	
Null	#2	==>	#3	0.068	0.331	
Null	#3	==>	#4	0.000	0.000	
Null	#4	==>	#9	0.718	0.281	
Null	#5	==>	#6	1.205	0.328	
Null	#6	==>	#7	0.189	0.304	
Null	#7	==>	#8	0.000	0.000	
Null	#8	==>	#10	0.989	0.300	
Null	#9	==>	#11	0.000	0.000	
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#21	0.495	0.453	
Null	#12	==>	#13	0.076	0.330	
Null	#13	==>	#14	3.790	0.314	
Null	#14	==>	#16	1.579	0.287	
Null	#15	==>	#16	1.579	0.287	
Null	#16	==>	#23	0.000	0.000	
Null	#17	==>	#19	0.000	0.000	
Null	#18	==>	#19	0.000	0.000	
Null	#19	==>	#20	0.915	0.252	
Null	#20	==>	#22	0.000	0.000	End of Middle Fork
Null	#21	==>	#22	0.000	0.000	End of South Fork
Null	#22	==>	#36	1.315	0.260	
Null	#23	==>	#20	0.593	0.281	
Null	#24	==>	#25	0.964	0.340	
Null	#25	==>	#27	1.454	0.333	
Null	#26	==>	#27	1.454	0.333	
Null	#27	==>	#29	0.800	0.323	
Null	#28	==>	#29	0.800	0.323	
Null	#29	==>	#32	0.479	0.298	
Null	#30	==>	#32	0.479	0.298	
Null	#31	==>	#33	0.000	0.000	
Null	#32	==>	#33	0.000	0.000	
Null	#33	==>	#34	1.348	0.294	Inlet to North Fork Diversion
Null	#34	==>	#36	0.825	0.261	End of North Fork
Null	#35	==>	#23	0.203	0.259	
Null	#36	==>	#37	3.388	0.246	
Null	#37	==>	End	0.000	0.000	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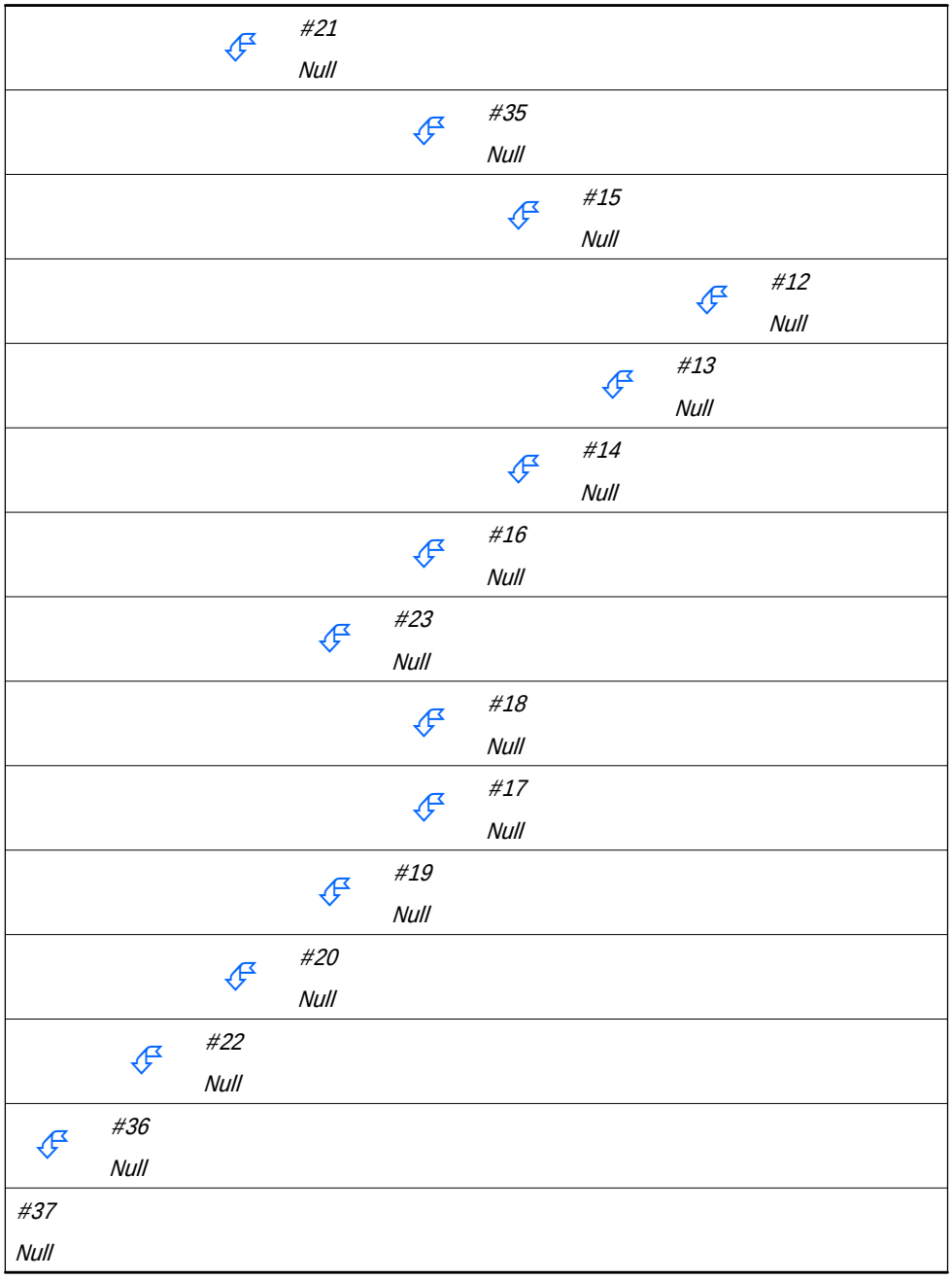

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.81	76.00	9,347.00	2.70	0.961
#1	**Muskingum K:**					**0.961**
#2	8. Large gullies, diversions, and low flowing streams	1.23	10.00	814.00	3.32	0.068
#2	**Muskingum K:**					**0.068**
#3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.53	30.00	5,637.00	2.18	0.718
#4	**Muskingum K:**					**0.718**
#5	8. Large gullies, diversions, and low flowing streams	1.17	165.00	14,065.00	3.24	1.205
#5	**Muskingum K:**					**1.205**
#6	8. Large gullies, diversions, and low flowing streams	0.78	14.00	1,799.25	2.64	0.189
#6	**Muskingum K:**					**0.189**
#8	8. Large gullies, diversions, and low flowing streams	0.72	65.00	9,046.00	2.54	0.989
#8	**Muskingum K:**					**0.989**
#11	8. Large gullies, diversions, and low flowing streams	30.00	8,801.00	29,336.66	16.43	0.495
#11	**Muskingum K:**					**0.495**
#12	8. Large gullies, diversions, and low flowing streams	1.21	11.00	906.00	3.30	0.076
#12	**Muskingum K:**					**0.076**
#13	8. Large gullies, diversions, and low flowing streams	0.92	363.00	39,301.00	2.88	3.790
#13	**Muskingum K:**					**3.790**
#14	8. Large gullies, diversions, and low flowing streams	0.59	77.00	13,075.22	2.30	1.579
#14	**Muskingum K:**					**1.579**
#15	8. Large gullies, diversions, and low flowing streams	0.59	77.00	13,075.00	2.30	1.579
#15	**Muskingum K:**					**1.579**
#16	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#16	**Muskingum K:**					**0.000**
#19	8. Large gullies, diversions, and low flowing streams	0.33	19.00	5,699.00	1.73	0.915
#19	**Muskingum K:**					**0.915**
#22	8. Large gullies, diversions, and low flowing streams	0.38	33.00	8,713.00	1.84	1.315
#22	**Muskingum K:**					**1.315**
#23	8. Large gullies, diversions, and low flowing streams	0.53	25.00	4,680.00	2.19	0.593
#23	**Muskingum K:**					**0.593**
#24	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,568.00	3.62	0.964
#24	**Muskingum K:**					**0.964**
#25	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.00	3.39	1.454
#25	**Muskingum K:**					**1.454**
#26	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.62	3.39	1.454

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#26	**Muskingum K:**					**1.454**
#27	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#27	**Muskingum K:**					**0.800**
#28	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#28	**Muskingum K:**					**0.800**
#29	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#29	**Muskingum K:**					**0.479**
#30	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#30	**Muskingum K:**					**0.479**
#33	8. Large gullies, diversions, and low flowing streams	0.66	77.00	11,748.55	2.42	1.348
#33	**Muskingum K:**					**1.348**
#34	8. Large gullies, diversions, and low flowing streams	0.38	21.00	5,497.38	1.85	0.825
#34	**Muskingum K:**					**0.825**
#35	8. Large gullies, diversions, and low flowing streams	0.37	5.00	1,338.00	1.83	0.203
#35	**Muskingum K:**					**0.203**
#36	8. Large gullies, diversions, and low flowing streams	0.30	60.00	20,005.00	1.64	3.388
#36	**Muskingum K:**					**3.388**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	12.85	2.37	14.2	5,823	2.63	1.99
#28	1,217.900	1,217.900	348.89	44.53	2,235.4	51,499	0.14	0.10
#26	2,486.400	2,486.400	65.87	20.75	120.8	5,583	1.83	1.40
#24	8,061.800	8,061.800	94.58	59.06	203.0	3,780	0.64	0.43
#25	1,015.700	9,077.500	103.41	74.45	286.7	13,375	3.76	0.80
#27	1,783.700	13,347.600	236.67	122.48	960.5	24,353	10.74	2.54
#29	966.000	15,531.500	535.73	201.59	5,382.3	61,965	5.75	1.80
#32	293.700	16,301.600	553.89	217.52	5,815.1	55,468	2.48	0.87
#31	957.100	957.100	333.75	41.62	1,654.1	37,577	0.51	0.39
#33	0.000	17,258.700	646.50	259.13	7,469.2	47,241	1.78	0.79
#34	1,020.000	18,278.700	664.99	278.20	7,299.7	42,342	0.84	0.38
#5	2,023.000	2,023.000	506.93	59.77	1,630.2	37,031	3.51	1.88
#6	1,743.200	3,766.200	630.69	115.88	3,138.3	32,912	0.18	0.11
#7	2,395.300	6,161.500	1,047.30	222.75	8,489.7	41,428	0.00	0.00
#8	0.000	6,161.500	1,047.30	222.75	8,489.7	41,428	0.00	0.00
#10	1,053.200	7,214.700	1,090.14	261.44	8,415.3	37,733	0.09	0.06
#1	2,411.100	2,411.100	349.94	55.56	1,695.8	33,350	4.70	3.13
#2	1,497.000	3,908.100	424.36	116.70	2,361.2	21,959	0.16	0.11
#3	862.700	4,770.800	559.86	145.57	2,728.8	17,946	0.05	0.04
#4	0.000	4,770.800	559.86	145.57	2,728.8	17,946	0.05	0.04
#9	445.600	5,216.400	573.82	156.14	2,828.2	17,278	0.56	0.43
#11	0.000	12,431.100	1,503.28	417.59	11,243.4	31,250	0.31	0.20
#21	1,100.460	13,531.560	1,545.90	449.75	11,526.3	30,603	0.70	0.43
#35	160.400	160.400	58.34	7.39	72.9	10,039	0.00	0.00
#15	1,992.700	1,992.700	386.36	60.50	2,083.2	40,738	1.65	1.01
#12	3,494.500	3,494.500	193.05	40.14	518.1	13,885	6.21	4.23
#13	2,720.700	6,215.200	371.99	71.83	1,125.3	16,885	8.41	5.71
#14	5,096.800	11,312.000	509.48	208.73	4,412.1	73,888	1.32	0.27
#16	1,022.000	14,326.700	833.40	314.54	7,808.9	45,918	1.28	0.50
#23	0.000	14,487.100	843.93	321.93	7,881.8	44,645	1.23	0.49
#18	848.500	848.500	169.02	27.56	312.0	12,741	0.08	0.05
#17	182.200	182.200	108.99	8.41	110.0	13,892	0.66	0.46
#19	0.000	1,030.700	255.08	35.96	422.0	11,926	0.20	0.14
#20	271.100	15,788.900	889.57	366.93	8,390.8	38,245	1.02	0.44
#22	0.000	29,320.460	2,319.36	816.68	19,917.2	31,426	0.77	0.44
#36	1,584.680	49,183.840	2,902.61	1,115.45	27,481.1	31,166	0.76	0.44
#37	2,292.810	51,476.650	2,854.56	1,150.46	27,065.2	30,513	0.30	0.17

Particle Size Distribution(s) at Each Structure

Structure #30:

Size (mm)	In/Out
2.0000	100.000%
0.1000	91.173%
0.0500	51.665%
0.0020	33.430%
0.0010	0.000%

Structure #28:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.240%
0.0010	0.000%

Structure #26:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	70.263%
0.0020	45.464%
0.0010	0.000%

Structure #24:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	90.403%
0.0020	65.131%

Size (mm)	In/Out
0.0010	0.000%

Structure #25:

Size (mm)	In/Out
2.0000	100.000%
0.1000	80.442%
0.0500	69.554%
0.0020	58.985%
0.0010	0.000%

Structure #27:

Size (mm)	In/Out
2.0000	100.000%
0.1000	74.421%
0.0500	51.045%
0.0020	37.202%
0.0010	0.000%

Structure #29:

Size (mm)	In/Out
2.0000	100.000%
0.1000	95.473%
0.0500	91.301%
0.0020	84.762%
0.0010	0.000%

Structure #32:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.545%
0.0020	90.499%
0.0010	0.000%

Structure #31:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	96.182%
0.0010	0.000%

Structure #33 (Inlet to North Fork Diversion):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.089%
0.0020	91.757%
0.0010	0.000%

Structure #34 (End of North Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.141%
0.0500	98.582%
0.0020	96.173%
0.0010	0.000%

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.202%
0.0500	90.662%
0.0020	85.006%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.494%

Size (mm)	In/Out
0.0010	0.000%

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #8:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #10:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.750%
0.0020	99.617%
0.0010	0.000%

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	94.096%
0.0500	84.449%
0.0020	79.797%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.916%
0.0010	0.000%

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.231%
0.0010	0.000%

Structure #4:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.231%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.135%
0.0500	96.306%
0.0020	95.462%
0.0010	0.000%

Structure #11:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.531%
0.0500	98.883%
0.0020	98.572%

Size (mm)	In/Out
0.0010	0.000%

Structure #21 (End of South Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.524%
0.0500	97.337%
0.0020	96.858%
0.0010	0.000%

Structure #35:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #15:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	96.466%
0.0020	93.034%
0.0010	0.000%

Structure #12:

Size (mm)	In/Out
2.0000	100.000%
0.1000	81.344%
0.0500	52.324%
0.0020	33.857%
0.0010	0.000%

Structure #13:

Size (mm)	In/Out
2.0000	100.000%
0.1000	73.909%
0.0500	44.750%
0.0020	28.956%
0.0010	0.000%

Structure #14:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	94.965%
0.0010	0.000%

Structure #16:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.073%
0.0020	93.302%
0.0010	0.000%

Structure #23:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.082%
0.0020	93.364%
0.0010	0.000%

Structure #18:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.314%

Size (mm)	In/Out
0.0010	0.000%

Structure #17:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	86.607%
0.0010	0.000%

Structure #19:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	95.262%
0.0010	0.000%

Structure #20 (End of Middle Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.159%
0.0020	93.551%
0.0010	0.000%

Structure #22:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.146%
0.0500	98.105%
0.0020	95.464%
0.0010	0.000%

Structure #36:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.070%
0.0500	98.081%
0.0020	95.504%
0.0010	0.000%

Structure #37:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.829%
0.0500	99.589%
0.0020	97.771%
0.0010	0.000%

Structure Detail:

Structure #30 (Null)

Structure #28 (Null)

Structure #26 (Null)

Structure #24 (Null)

Structure #25 (Null)

Structure #27 (Null)

Structure #29 (Null)

Structure #32 (Null)

Structure #31 (Null)

Structure #33 (Null)

Inlet to North Fork Diversion

Structure #34 (Null)

End of North Fork

Structure #5 (Null)

Structure #6 (Null)

Structure #7 (Null)

Structure #8 (Null)

Structure #10 (Null)

Structure #1 (Null)

Structure #2 (Null)

Structure #3 (Null)

Structure #4 (Null)

Structure #9 (Null)

Structure #11 (Null)

Structure #21 (Null)

End of South Fork

Structure #35 (Null)

Structure #15 (Null)

Structure #12 (Null)

Structure #13 (Null)

Structure #14 (Null)

Structure #16 (Null)

Structure #23 (Null)

Structure #18 (Null)

Structure #17 (Null)

Structure #19 (Null)

Structure #20 (Null)

End of Middle Fork

Structure #22 (Null)

Structure #36 (Null)

Structure #37 (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)
#30	1	476.400	1.131	0.000	0.000	73.100	M	12.85	2.369
	Σ	**476.400**						**12.85**	**2.369**
#28	1	772.300	0.657	0.523	0.334	90.400	M	294.08	28.234
	2	445.600	0.587	0.000	0.000	90.400	M	181.58	16.298
	Σ	**1,217.900**						**348.89**	**44.532**
#26	1	447.600	2.192	0.000	0.000	74.200	M	9.95	2.658
	2	2,038.800	3.000	0.000	0.000	77.000	M	56.53	18.090
	Σ	**2,486.400**						**65.87**	**20.749**
#24	1	2,607.500	5.367	2.377	0.305	75.200	M	36.40	18.008
	2	2,331.900	4.813	2.431	0.304	74.700	M	32.79	14.952
	3	1,758.500	2.231	1.788	0.297	76.200	M	53.22	14.003
	4	1,363.900	2.618	0.000	0.000	77.000	M	41.60	12.102
	Σ	**8,061.800**						**94.58**	**59.064**
#25	1	515.200	0.990	0.342	0.357	78.200	M	35.51	5.338
	2	130.500	0.787	0.342	0.357	78.100	M	10.20	1.335
	3	370.000	0.516	0.000	0.000	85.700	M	100.68	8.714
	Σ	**9,077.500**						**103.41**	**74.451**
#27	1	354.400	0.612	1.233	0.337	83.100	M	64.12	6.415
	2	305.200	0.529	1.054	0.328	84.000	M	67.36	6.066
	3	289.800	0.692	0.551	0.328	75.500	M	15.73	2.092
	4	253.000	0.361	0.551	0.328	79.400	M	38.72	3.045
	5	581.300	0.980	0.000	0.000	82.300	M	70.74	9.662
	Σ	**13,347.600**						**236.67**	**122.480**
#29	1	508.800	0.409	0.416	0.312	89.500	M	231.71	17.181
	2	233.200	0.521	0.291	0.312	91.600	M	114.51	9.503
	3	224.000	0.467	0.000	0.000	90.000	M	99.86	7.898
	Σ	**15,531.500**						**535.73**	**201.594**
#32	1	293.700	0.576	0.000	0.000	93.000	M	155.77	13.555
	Σ	**16,301.600**						**553.89**	**217.518**
#31	1	431.100	0.588	0.450	0.336	91.500	M	195.23	17.409
	2	325.800	0.432	0.149	0.327	93.000	M	201.53	15.054
	3	200.200	0.373	0.000	0.000	92.900	M	130.94	9.154
	Σ	**957.100**						**333.75**	**41.617**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#33	**∑**	**17,258.700**						**646.50**	**259.135**
#34	1	251.500	0.423	1.019	0.292	90.500	M	124.24	9.297
	2	219.100	0.611	0.267	0.322	80.000	M	26.64	2.822
	3	246.200	0.688	0.466	0.293	80.000	M	27.79	3.169
	4	303.200	0.370	0.000	0.000	79.700	M	47.70	3.774
	∑	**18,278.700**						**664.99**	**278.197**
#5	1	503.600	0.618	0.000	0.000	87.600	M	150.18	14.208
	2	406.500	0.388	0.501	0.350	84.800	M	118.13	8.756
	3	439.600	0.342	0.681	0.347	87.800	M	185.10	12.703
	4	162.600	0.280	0.681	0.347	86.000	M	62.76	3.956
	5	294.100	0.375	1.021	0.348	92.000	M	177.00	12.404
	6	216.600	0.272	1.018	0.348	90.100	M	124.31	7.741
	∑	**2,023.000**						**506.93**	**59.768**
#6	1	149.100	0.331	0.000	0.000	92.600	M	99.69	6.664
	2	245.000	0.529	0.192	0.328	88.100	M	84.56	7.253
	3	276.200	0.450	0.461	0.319	89.500	M	119.60	9.300
	4	158.400	0.380	1.385	0.185	93.000	M	103.69	7.303
	5	206.200	0.402	0.796	0.320	89.400	M	93.79	6.898
	6	414.000	0.430	1.066	0.323	87.200	M	146.68	11.277
	7	294.300	0.535	1.066	0.323	86.400	M	84.49	7.413
	∑	**3,766.200**						**630.69**	**115.877**
#7	1	731.700	1.274	0.000	0.000	93.000	M	230.24	33.718
	2	445.800	1.043	0.000	0.000	93.000	M	161.73	20.536
	3	270.800	0.804	0.000	0.000	93.000	M	116.60	12.479
	4	78.900	0.267	1.035	0.328	93.000	M	58.83	3.657
	5	154.900	0.310	1.071	0.326	93.000	M	109.87	7.170
	6	101.400	0.288	1.164	0.328	92.900	M	73.18	4.649
	7	117.700	0.298	1.344	0.329	92.200	M	79.02	5.069
	8	494.100	0.518	1.344	0.329	91.300	M	236.39	19.599
	∑	**6,161.500**						**1,047.30**	**222.753**
#8	1	0.000	0.000	0.000	0.000	1.000	0.00	0.000	
	∑	**6,161.500**						**1,047.30**	**222.753**
#10	1	355.500	1.286	0.000	0.000	93.000	M	111.10	16.378
	2	307.100	1.282	0.668	0.305	83.200	M	34.57	5.611
	3	147.300	1.245	0.517	0.303	90.600	M	37.29	5.476
	4	126.400	0.585	0.517	0.303	93.000	M	66.43	5.835
	5	116.900	1.179	0.621	0.305	93.000	M	38.91	5.387
	∑	**7,214.700**						**1,090.14**	**261.441**

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	557.400	0.941	0.000	0.000	83.600	M	81.52	10.620
	2	169.600	1.616	0.677	0.333	93.000	M	44.67	7.814
	3	636.400	1.842	0.729	0.333	81.000	M	42.22	9.173
	4	223.400	0.846	1.005	0.336	84.100	M	37.12	4.481
	5	77.700	0.330	1.392	0.341	81.400	M	16.45	1.177
	6	746.600	0.678	1.392	0.341	88.200	M	223.56	22.294
	Σ	**2,411.100**						**349.94**	**55.559**
#2	1	257.000	0.423	0.000	0.000	93.000	M	160.57	11.884
	2	180.500	0.562	0.478	0.281	91.800	M	86.49	7.480
	3	200.700	0.687	0.574	0.283	93.000	M	95.62	9.253
	4	438.600	0.811	0.574	0.283	93.000	M	187.82	20.217
	5	420.200	1.247	0.801	0.293	88.000	M	81.68	12.305
	Σ	**3,908.100**						**424.36**	**116.699**
#3	1	172.600	0.443	0.000	0.000	93.000	M	105.46	7.962
	2	311.200	0.890	0.000	0.000	88.900	M	83.85	9.910
	3	378.900	0.632	0.209	0.314	87.900	M	114.95	10.994
	Σ	**4,770.800**						**559.86**	**145.565**
#4	**Σ**	**4,770.800**						**559.86**	**145.565**
#9	1	445.600	0.987	0.000	0.000	85.800	M	80.88	10.579
	Σ	**5,216.400**						**573.82**	**156.145**
#11	**Σ**	**12,431.100**						**1,503.28**	**417.585**
#21	1	292.400	0.819	0.000	0.000	86.900	M	67.48	7.722
	2	230.540	0.388	0.694	0.266	89.200	M	104.60	7.555
	3	181.120	0.289	0.878	0.256	91.300	M	113.49	7.196
	4	396.400	0.939	0.878	0.256	86.100	M	76.84	9.691
	Σ	**13,531.560**						**1,545.90**	**449.749**
#35	1	160.400	1.039	0.000	0.000	93.000	M	58.34	7.390
	Σ	**160.400**						**58.34**	**7.390**
#15	1	437.400	0.803	0.000	0.000	91.300	M	160.17	17.318
	2	549.000	0.637	0.654	0.327	91.300	M	232.24	21.748
	3	1,006.300	1.023	0.768	0.331	84.700	M	157.84	21.436
	Σ	**1,992.700**						**386.36**	**60.502**
#12	1	517.800	0.791	0.000	0.000	81.900	M	68.85	8.243
	2	229.000	0.571	0.043	0.418	80.100	M	29.46	2.985
	3	592.700	0.706	0.044	0.417	81.500	M	80.46	9.035
	4	1,806.900	1.542	0.487	0.362	76.700	M	75.15	15.402
	5	348.100	0.618	0.487	0.362	80.000	42.02	4.480	

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**3,494.500**						**193.05**	**40.145**
#13	1	411.600	0.725	0.000	0.000	79.700	M	43.08	5.117
	2	636.400	0.774	0.322	0.336	80.700	M	73.39	8.877
	3	319.000	0.575	0.685	0.318	85.500	M	79.39	7.365
	4	231.700	0.314	0.923	0.328	80.400	M	44.09	3.134
	5	1,122.000	1.308	0.923	0.328	74.700	M	37.39	7.196
	Σ	**6,215.200**						**371.99**	**71.835**
#14	1	405.900	0.384	0.000	0.000	90.800	M	216.25	15.375
	2	411.100	0.452	0.707	0.308	90.700	M	199.92	15.437
	3	787.400	0.658	0.975	0.307	91.400	M	329.86	31.500
	4	144.200	0.341	1.716	0.310	86.200	M	51.96	3.578
	5	343.800	0.289	1.970	0.312	86.500	M	137.47	8.764
	6	392.800	0.806	2.107	0.316	81.900	M	51.63	6.253
	7	528.200	0.518	2.544	0.316	87.200	M	168.32	14.371
	8	890.900	1.253	2.544	0.316	83.500	M	105.62	16.798
	9	741.400	1.076	3.047	0.316	84.800	M	113.59	15.952
	10	451.100	0.916	3.354	0.316	83.900	M	69.56	8.865
	Σ	**11,312.000**						**509.48**	**208.729**
#16	1	475.100	1.721	0.000	0.000	92.400	M	112.52	20.749
	2	348.400	0.542	0.951	0.283	92.500	M	182.39	15.361
	3	198.500	0.266	1.384	0.278	93.000	M	148.18	9.199
	Σ	**14,326.700**						**833.40**	**314.541**
#23	**Σ**	**14,487.100**						**843.93**	**321.931**
#18	1	301.700	0.652	0.000	0.000	93.000	M	148.51	13.922
	2	546.800	0.768	0.561	0.320	86.300	M	123.34	13.636
	Σ	**848.500**						**169.02**	**27.558**
#17	1	182.200	0.462	0.000	0.000	93.000	M	108.99	8.406
	Σ	**182.200**						**108.99**	**8.406**
#19	**Σ**	**1,030.700**						**255.08**	**35.964**
#20	1	271.100	0.978	0.000	0.000	89.400	M	72.16	9.037
	Σ	**15,788.900**						**889.57**	**366.932**
#22	**Σ**	**29,320.460**						**2,319.36**	**816.681**
#36	1	283.020	0.468	1.457	0.305	77.100	M	25.98	2.550
	2	301.840	0.632	1.051	0.286	90.100	M	114.26	10.726
	3	223.850	0.703	1.051	0.286	74.300	M	9.65	1.351
	4	262.400	0.419	0.835	0.229	78.000	M	29.92	2.661

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	222.760	0.421	0.475	0.224	74.500	M	13.21	1.391
	6	290.810	0.526	0.000	0.000	74.800	M	16.02	1.897
	Σ	**49,183.840**						**2,902.61**	**1,115.454**
#37	1	744.000	1.756	0.000	0.000	84.800	M	79.95	16.001
	2	303.330	0.416	1.859	0.242	87.800	M	116.15	8.752
	3	223.850	0.703	1.179	0.270	74.300	M	9.65	1.351
	4	262.400	0.419	0.835	0.229	78.000	M	29.92	2.661
	5	222.760	0.421	0.475	0.224	74.500	M	13.21	1.391
	6	290.810	0.526	0.000	0.000	74.800	M	16.02	1.897
	7	245.660	0.561	1.487	0.252	79.400	M	28.93	2.948
	Σ	**51,476.650**						**2,854.56**	**1,150.456**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#30	1	0.095	200.00	3.80	0.3720	1.0000	2	14.2	5,823	2.63	1.99
	Σ							**14.2**	**5,823**	**2.63**	**1.99**
#28	1	0.187	100.00	10.10	0.3750	1.0000	3	1,691.3	60,778	0.00	0.00
	2	0.196	100.00	10.20	0.3930	1.0000	3	1,057.3	66,779	0.38	0.27
	Σ							**2,235.4**	**51,499**	**0.14**	**0.10**
#26	1	0.155	400.00	1.40	0.3480	1.0000	2	10.2	3,675	1.35	1.03
	2	0.155	300.00	2.40	0.3340	1.0000	2	110.7	5,916	1.92	1.46
	Σ							**120.8**	**5,583**	**1.83**	**1.40**
#24	1	0.128	300.00	2.30	0.3360	1.0000	2	69.0	3,751	0.72	0.55
	2	0.136	300.00	2.70	0.3440	1.0000	2	73.7	4,806	1.05	0.79
	3	0.107	300.00	2.30	0.3330	1.0000	2	61.4	4,240	1.58	1.20
	4	0.163	400.00	1.60	0.3210	1.0000	2	57.4	4,592	1.60	1.22
	Σ							**203.0**	**3,780**	**0.64**	**0.43**
#25	1	0.125	400.00	1.90	0.3440	1.0000	2	31.7	5,921	2.90	2.13
	2	0.124	300.00	2.60	0.3280	1.0000	2	8.3	6,299	3.23	2.34
	3	0.122	175.00	4.90	0.2660	1.0000	2	124.8	15,325	9.03	6.18
	Σ							**286.7**	**13,375**	**3.76**	**0.80**
#27	1	0.127	175.00	5.90	0.3160	1.0000	2	120.5	19,245	10.86	7.75
	2	0.122	150.00	7.50	0.2920	1.0000	2	124.1	21,150	12.27	8.67
	3	0.070	125.00	8.40	0.3270	1.0000	2	20.4	9,772	4.95	3.62

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.097	125.00	9.60	0.3170	1.0000	2	68.7	24,070	14.12	9.66
	5	0.126	125.00	8.90	0.3290	1.0000	2	221.3	23,130	11.96	8.64
	Σ							**960.5**	**24,353**	**10.74**	**2.54**
#29	1	0.190	125.00	9.80	0.3930	1.0000	3	1,234.6	74,373	2.77	1.92
	2	0.203	125.00	8.90	0.3940	1.0000	3	553.5	59,967	1.62	1.13
	3	0.193	125.00	8.40	0.3940	1.0000	3	401.2	53,399	1.47	1.01
	Σ							**5,382.3**	**61,965**	**5.75**	**1.80**
#32	1	0.210	150.00	7.70	0.3990	1.0000	3	750.9	57,078	1.49	1.04
	Σ							**5,815.1**	**55,468**	**2.48**	**0.87**
#31	1	0.204	125.00	8.70	0.3620	1.0000	3	933.4	54,844	0.71	0.50
	2	0.210	150.00	7.30	0.3990	1.0000	3	873.4	60,205	3.21	2.23
	3	0.210	175.00	4.50	0.3980	1.0000	3	353.4	40,877	2.61	1.79
	Σ							**1,654.1**	**37,577**	**0.51**	**0.39**
#33	**Σ**							**7,469.2**	**47,241**	**1.78**	**0.79**
#34	1	0.193	200.00	3.84	0.2460	1.0000	3	147.7	16,426	0.66	0.47
	2	0.214	200.00	3.66	0.3150	1.0000	1	43.5	15,928	9.21	6.52
	3	0.214	300.00	2.54	0.3150	1.0000	1	38.4	12,389	7.04	5.04
	4	0.242	200.00	3.50	0.3150	1.0000	1	76.9	22,467	13.73	9.09
	Σ							**7,299.7**	**42,342**	**0.84**	**0.38**
#5	1	0.149	75.00	12.50	0.3230	1.0000	3	613.6	44,895	0.00	0.00
	2	0.133	75.00	15.80	0.3190	1.0000	2	485.8	58,586	35.43	24.22
	3	0.103	100.00	11.00	0.2030	1.0000	3	280.3	23,416	1.03	0.71
	4	0.093	75.00	13.80	0.2130	1.0000	2	85.9	23,252	14.53	9.90
	5	0.123	100.00	11.00	0.1370	1.0000	3	218.0	18,255	1.07	0.75
	6	0.149	75.00	14.70	0.1990	1.0000	3	297.4	39,951	2.82	1.97
	Σ							**1,630.2**	**37,031**	**3.51**	**1.88**
#6	1	0.208	175.00	4.30	0.3980	1.0000	3	240.5	38,407	2.71	1.85
	2	0.183	175.00	5.40	0.3910	1.0000	3	246.9	35,623	0.11	0.08
	3	0.188	150.00	7.60	0.3900	1.0000	3	453.3	50,708	1.43	0.99
	4	0.210	150.00	6.30	0.3990	1.0000	3	349.1	47,409	2.99	2.18
	5	0.185	125.00	8.10	0.3860	1.0000	3	317.5	47,503	1.82	1.27
	6	0.104	100.00	11.30	0.2240	1.0000	3	266.6	24,541	0.50	0.35
	7	0.164	100.00	11.20	0.3740	1.0000	3	402.9	55,318	0.00	0.00
	Σ							**3,138.3**	**32,912**	**0.18**	**0.11**
#7	1	0.208	150.00	7.80	0.3780	1.0000	3	1,480.3	43,754	0.00	0.00
	2	0.209	100.00	10.20	0.3940	1.0000	3	1,207.2	58,657	0.00	0.00
	3	0.210	150.00	6.70	0.3990	1.0000	3	533.9	43,426	0.00	0.00

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.210	100.00	11.50	0.3990	1.0000	3	313.0	85,954	7.31	5.20
	5	0.210	150.00	7.10	0.3990	1.0000	3	399.3	56,568	4.34	3.08
	6	0.209	150.00	7.90	0.3990	1.0000	3	275.2	60,002	4.83	3.44
	7	0.206	75.00	15.50	0.3990	1.0000	3	539.7	105,636	7.94	5.68
	8	0.202	75.00	14.50	0.3980	1.0000	3	1,915.2	96,942	2.47	1.78
	Σ							**8,489.7**	**41,428**	**0.00**	**0.00**
#8	1	0.000	0.00	0.00	0.0000	1.0000	0	0.0	1	0.00	0.00
	Σ							**8,489.7**	**41,428**	**0.00**	**0.00**
#10	1	0.190	300.00	2.70	0.1930	1.0000	3	120.4	7,432	0.00	0.00
	2	0.153	200.00	3.50	0.3610	1.0000	2	58.2	10,318	5.07	3.73
	3	0.189	200.00	3.70	0.3190	1.0000	3	68.8	12,613	0.00	0.00
	4	0.190	300.00	2.10	0.1940	1.0000	3	40.6	7,208	0.18	0.12
	5	0.201	300.00	2.00	0.3030	1.0000	3	45.6	8,515	0.00	0.00
	Σ							**8,415.3**	**37,733**	**0.09**	**0.06**
#1	1	0.157	150.00	6.80	0.3830	1.0000	2	290.5	27,721	14.65	10.54
	2	0.210	150.00	6.60	0.3990	1.0000	3	236.6	29,984	0.00	0.00
	3	0.149	200.00	3.90	0.3870	1.0000	2	98.9	10,566	4.53	3.39
	4	0.169	175.00	4.70	0.3950	1.0000	2	97.3	21,927	11.87	8.58
	5	0.157	100.00	10.10	0.3940	1.0000	2	50.0	43,848	26.38	18.53
	6	0.175	75.00	12.60	0.2840	1.0000	3	1,029.5	46,570	0.00	0.00
	Σ							**1,695.8**	**33,350**	**4.70**	**3.13**
#2	1	0.190	150.00	7.90	0.1930	1.0000	3	317.9	28,327	1.56	1.07
	2	0.184	175.00	4.80	0.2010	1.0000	3	117.7	16,320	0.33	0.23
	3	0.202	200.00	3.90	0.3220	1.0000	3	177.2	19,601	0.11	0.08
	4	0.203	150.00	7.40	0.3220	1.0000	3	783.8	39,103	0.00	0.00
	5	0.181	175.00	5.10	0.3710	1.0000	3	289.7	23,447	0.00	0.00
	Σ							**2,361.2**	**21,959**	**0.16**	**0.11**
#3	1	0.190	175.00	5.20	0.1930	1.0000	3	145.6	19,412	1.00	0.69
	2	0.177	175.00	4.20	0.2560	1.0000	3	146.3	15,131	0.00	0.00
	3	0.166	175.00	4.30	0.2290	1.0000	3	158.7	15,066	0.00	0.00
	Σ							**2,728.8**	**17,946**	**0.05**	**0.04**
#4	**Σ**							**2,728.8**	**17,946**	**0.05**	**0.04**
#9	1	0.212	175.00	4.17	0.2490	1.0000	2	172.1	16,552	8.85	6.36
	Σ							**2,828.2**	**17,278**	**0.56**	**0.43**
#11	**Σ**							**11,243.4**	**31,250**	**0.31**	**0.20**
#21	1	0.206	175.00	4.44	0.2760	1.0000	2	148.9	19,811	11.04	7.85

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	2	0.241	175.00	5.81	0.3130	1.0000	1	321.7	43,913	28.08	19.74
	3	0.185	300.00	2.70	0.2180	1.0000	3	84.4	12,142	0.88	0.62
	4	0.220	200.00	2.66	0.2980	1.0000	1	114.0	11,859	6.77	4.92
	Σ							**11,526.3**	**30,603**	**0.70**	**0.43**
#35	1	0.194	200.00	3.42	0.2330	1.0000	3	72.9	10,039	0.00	0.00
	Σ							**72.9**	**10,039**	**0.00**	**0.00**
#15	1	0.201	125.00	8.20	0.3960	1.0000	3	817.5	47,967	0.00	0.00
	2	0.161	100.00	11.40	0.3060	1.0000	3	1,067.8	49,947	0.10	0.07
	3	0.118	100.00	10.20	0.2850	1.0000	2	498.0	23,281	12.24	8.91
	Σ							**2,083.2**	**40,738**	**1.65**	**1.01**
#12	1	0.124	150.00	6.30	0.3070	1.0000	2	135.0	16,811	9.01	6.42
	2	0.132	200.00	3.60	0.3500	1.0000	2	32.0	11,340	6.30	4.37
	3	0.136	175.00	5.00	0.3330	1.0000	2	159.9	18,316	9.97	7.04
	4	0.188	200.00	3.40	0.3570	1.0000	2	187.1	11,816	5.06	3.81
	5	0.228	175.00	4.10	0.3640	1.0000	2	114.1	26,144	14.32	10.17
	Σ							**518.1**	**13,885**	**6.21**	**4.23**
#13	1	0.128	150.00	6.90	0.3390	1.0000	2	98.8	19,801	10.52	7.50
	2	0.130	175.00	5.70	0.3300	1.0000	2	161.3	18,474	9.82	7.06
	3	0.191	175.00	6.00	0.2890	1.0000	2	205.0	28,748	16.69	11.77
	4	0.122	175.00	5.10	0.3460	1.0000	2	59.8	20,201	12.12	8.37
	5	0.137	175.00	4.20	0.3530	1.0000	2	83.1	11,197	4.92	3.72
	Σ							**1,125.3**	**16,885**	**8.41**	**5.71**
#14	1	0.196	100.00	10.20	0.3980	1.0000	3	1,143.6	78,218	3.93	2.68
	2	0.193	150.00	6.70	0.4020	1.0000	3	752.8	50,128	1.77	1.24
	3	0.169	75.00	13.80	0.3240	1.0000	3	1,926.0	61,423	0.00	0.00
	4	0.114	100.00	11.00	0.2980	1.0000	3	110.0	31,352	1.15	0.82
	5	0.078	100.00	10.10	0.1830	1.0000	3	116.7	13,621	0.69	0.50
	6	0.084	150.00	7.10	0.2700	1.0000	2	65.7	10,554	5.64	4.12
	7	0.087	100.00	10.00	0.1840	1.0000	3	184.7	12,978	0.00	0.00
	8	0.126	150.00	6.70	0.2740	1.0000	2	245.8	14,467	7.18	5.31
	9	0.117	150.00	7.30	0.2600	1.0000	2	237.9	14,783	7.70	5.68
	10	0.115	125.00	8.50	0.2610	1.0000	2	140.7	15,749	8.39	6.18
	Σ							**4,412.1**	**73,888**	**1.32**	**0.27**
#16	1	0.201	300.00	2.78	0.3030	1.0000	3	236.1	11,383	0.00	0.00
	2	0.204	150.00	6.00	0.3630	1.0000	3	612.8	40,528	1.17	0.84
	3	0.210	150.00	6.10	0.3990	1.0000	3	469.1	51,076	4.35	3.14
	Σ							**7,808.9**	**45,918**	**1.28**	**0.50**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#23	Σ							**7,881.8**	**44,645**	**1.23**	**0.49**
#18	1	0.193	300.00	2.80	0.2200	1.0000	3	154.6	11,569	0.14	0.10
	2	0.173	175.00	4.70	0.3880	1.0000	3	357.5	26,716	0.00	0.00
	Σ							**312.0**	**12,741**	**0.08**	**0.05**
#17	1	0.196	300.00	2.60	0.2600	1.0000	3	110.0	13,892	0.66	0.46
	Σ							**110.0**	**13,892**	**0.66**	**0.46**
#19	Σ							**422.0**	**11,926**	**0.20**	**0.14**
#20	1	0.192	200.00	3.19	0.2430	1.0000	3	88.9	10,055	0.00	0.00
	Σ							**8,390.8**	**38,245**	**1.02**	**0.44**
#22	Σ							**19,917.2**	**31,426**	**0.77**	**0.44**
#36	1	0.172	200.00	3.14	0.1950	1.0000	2	17.5	6,975	3.86	2.79
	2	0.195	150.00	6.18	0.1680	1.0000	3	175.5	16,743	0.00	0.00
	3	0.166	150.00	7.47	0.1830	1.0000	3	15.3	11,215	0.00	0.00
	4	0.187	175.00	5.07	0.1810	1.0000	1	35.0	13,496	8.04	5.74
	5	0.173	175.00	4.89	0.1800	1.0000	1	13.7	10,011	5.74	4.14
	6	0.177	175.00	5.15	0.1840	1.0000	1	20.0	10,748	5.99	4.30
	Σ							**27,481.1**	**31,166**	**0.76**	**0.44**
#37	1	0.172	200.00	3.14	0.1950	1.0000	2	91.9	5,704	2.62	1.94
	2	0.195	150.00	6.18	0.1680	1.0000	3	157.7	18,148	0.49	0.35
	3	0.166	150.00	7.47	0.1830	1.0000	3	15.3	11,183	0.00	0.00
	4	0.187	175.00	5.07	0.1810	1.0000	1	35.0	13,496	8.04	5.74
	5	0.173	175.00	4.89	0.1800	1.0000	2	13.7	10,011	5.44	3.92
	6	0.177	175.00	5.15	0.1840	1.0000	1	20.0	10,748	5.99	4.30
	7	0.175	175.00	4.90	0.2080	1.0000	2	38.0	13,002	7.19	5.21
	Σ							**27,065.2**	**30,513**	**0.30**	**0.17**

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	3.65	50.00	1,369.00	1.910	0.199
		8. Large gullies, diversions, and low flowing streams	1.57	157.00	10,030.00	3.750	0.742
#1	**1**	**Time of Concentration:**					**0.941**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	6.63	70.00	1,056.00	2.570	0.114

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	1.98	150.00	7,573.00	1.400	1.502
#1	**2**	**Time of Concentration:**					**1.616**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	1.65	117.00	7,070.00	1.280	1.534
		8. Large gullies, diversions, and low flowing streams	2.43	126.00	5,188.00	4.670	0.308
#1	**3**	**Time of Concentration:**					**1.842**
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.77	260.00	4,506.00	2.400	0.521
		8. Large gullies, diversions, and low flowing streams	2.84	168.00	5,924.00	5.050	0.325
#1	**4**	**Time of Concentration:**					**0.846**
#1	5	5. Nearly bare and untilled, and alluvial valley fans	19.93	180.00	903.00	4.460	0.056
		8. Large gullies, diversions, and low flowing streams	3.30	178.00	5,393.00	5.450	0.274
#1	**5**	**Time of Concentration:**					**0.330**
#1	6	5. Nearly bare and untilled, and alluvial valley fans	13.43	105.00	782.00	3.660	0.059
		8. Large gullies, diversions, and low flowing streams	2.62	283.00	10,822.00	4.850	0.619
#1	**6**	**Time of Concentration:**					**0.678**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.84	70.00	1,024.00	2.610	0.108
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,325.00	3.810	0.315
#2	**1**	**Time of Concentration:**					**0.423**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	5.56	45.00	810.00	2.350	0.095
		8. Large gullies, diversions, and low flowing streams	0.86	40.00	4,663.00	2.770	0.467
#2	**2**	**Time of Concentration:**					**0.562**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	5.89	50.00	849.00	2.420	0.097
		8. Large gullies, diversions, and low flowing streams	1.17	80.00	6,862.00	3.230	0.590
#2	**3**	**Time of Concentration:**					**0.687**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	12.63	95.00	752.00	3.550	0.058
		8. Large gullies, diversions, and low flowing streams	1.40	135.00	9,630.00	3.550	0.753
#2	**4**	**Time of Concentration:**					**0.811**
#2	5	5. Nearly bare and untilled, and alluvial valley fans	11.02	70.00	635.00	3.320	0.053
		8. Large gullies, diversions, and low flowing streams	0.46	40.00	8,732.00	2.030	1.194
#2	**5**	**Time of Concentration:**					**1.247**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	10.00	805.00	1.110	0.201
		8. Large gullies, diversions, and low flowing streams	1.33	40.00	3,017.00	3.450	0.242
#3	**1**	**Time of Concentration:**					**0.443**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.68	10.00	1,478.00	0.820	0.500
		8. Large gullies, diversions, and low flowing streams	1.78	100.00	5,622.00	4.000	0.390
#3	**2**	**Time of Concentration:**					**0.890**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	4.66	70.00	1,501.00	2.150	0.193
		8. Large gullies, diversions, and low flowing streams	1.17	60.00	5,126.00	3.240	0.439
#3	**3**	**Time of Concentration:**					**0.632**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	19.06	285.00	1,495.00	4.360	0.095
		8. Large gullies, diversions, and low flowing streams	2.64	242.00	9,174.00	4.870	0.523
#5	**1**	**Time of Concentration:**					**0.618**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	14.27	105.00	736.00	3.770	0.054
		8. Large gullies, diversions, and low flowing streams	4.08	297.00	7,279.00	6.050	0.334
#5	**2**	**Time of Concentration:**					**0.388**
#5	3	5. Nearly bare and untilled, and alluvial valley fans	8.27	35.00	423.00	2.870	0.040
		8. Large gullies, diversions, and low flowing streams	3.44	208.00	6,049.00	5.560	0.302
#5	**3**	**Time of Concentration:**					**0.342**
#5	4	5. Nearly bare and untilled, and alluvial valley fans	14.58	85.00	583.00	3.810	0.042
		8. Large gullies, diversions, and low flowing streams	4.53	248.00	5,473.00	6.380	0.238
#5	**4**	**Time of Concentration:**					**0.280**
#5	5	5. Nearly bare and untilled, and alluvial valley fans	5.07	70.00	1,382.00	2.250	0.170
		8. Large gullies, diversions, and low flowing streams	3.89	170.00	4,375.00	5.910	0.205
#5	**5**	**Time of Concentration:**					**0.375**
#5	6	5. Nearly bare and untilled, and alluvial valley fans	12.48	90.00	721.00	3.530	0.056
		8. Large gullies, diversions, and low flowing streams	5.16	274.00	5,308.02	6.810	0.216
#5	**6**	**Time of Concentration:**					**0.272**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	5.36	75.00	1,399.00	2.310	0.168
		8. Large gullies, diversions, and low flowing streams	2.41	66.00	2,742.00	4.650	0.163

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	**1**	**Time of Concentration:**					**0.331**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.39	80.00	2,359.00	1.840	0.356
		8. Large gullies, diversions, and low flowing streams	2.63	80.00	3,039.00	4.860	0.173
#6	**2**	**Time of Concentration:**					**0.529**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	4.60	34.00	739.00	2.140	0.095
		8. Large gullies, diversions, and low flowing streams	2.33	136.00	5,845.00	4.570	0.355
#6	**3**	**Time of Concentration:**					**0.450**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	6.06	85.00	1,402.00	2.460	0.158
		8. Large gullies, diversions, and low flowing streams	2.52	96.00	3,810.00	4.760	0.222
#6	**4**	**Time of Concentration:**					**0.380**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	7.24	70.00	967.00	2.690	0.099
		8. Large gullies, diversions, and low flowing streams	2.34	117.00	5,003.00	4.580	0.303
#6	**5**	**Time of Concentration:**					**0.402**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	31.83	183.00	575.00	5.640	0.028
		8. Large gullies, diversions, and low flowing streams	3.38	270.00	7,990.00	5.510	0.402
#6	**6**	**Time of Concentration:**					**0.430**
#6	7	5. Nearly bare and untilled, and alluvial valley fans	23.08	325.00	1,408.00	4.800	0.081
		8. Large gullies, diversions, and low flowing streams	2.88	240.00	8,327.00	5.090	0.454
#6	**7**	**Time of Concentration:**					**0.535**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	11.42	90.00	788.00	3.370	0.064
		8. Large gullies, diversions, and low flowing streams	1.46	230.00	15,769.00	3.620	1.210
#7	**1**	**Time of Concentration:**					**1.274**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	10.97	60.00	547.00	3.310	0.045
		8. Large gullies, diversions, and low flowing streams	1.61	220.00	13,660.00	3.800	0.998
#7	**2**	**Time of Concentration:**					**1.043**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	938.00	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.72	171.00	9,931.00	3.930	0.701
#7	**3**	**Time of Concentration:**					**0.804**
#7	4	5. Nearly bare and untilled, and alluvial valley fans	19.23	80.00	416.00	4.380	0.026

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.45	100.00	4,083.00	4.690	0.241
#7	**4**	**Time of Concentration:**					**0.267**
#7	5	5. Nearly bare and untilled, and alluvial valley fans	6.09	67.00	1,101.00	2.460	0.124
		8. Large gullies, diversions, and low flowing streams	2.51	80.00	3,184.00	4.750	0.186
#7	**5**	**Time of Concentration:**					**0.310**
#7	6	5. Nearly bare and untilled, and alluvial valley fans	5.93	63.00	1,062.00	2.430	0.121
		8. Large gullies, diversions, and low flowing streams	2.74	82.00	2,993.00	4.960	0.167
#7	**6**	**Time of Concentration:**					**0.288**
#7	7	5. Nearly bare and untilled, and alluvial valley fans	7.97	65.00	816.00	2.820	0.080
		8. Large gullies, diversions, and low flowing streams	3.48	153.00	4,400.00	5.590	0.218
#7	**7**	**Time of Concentration:**					**0.298**
#7	8	5. Nearly bare and untilled, and alluvial valley fans	6.60	50.00	758.00	2.560	0.082
		8. Large gullies, diversions, and low flowing streams	4.66	473.00	10,157.00	6.470	0.436
#7	**8**	**Time of Concentration:**					**0.518**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	3.01	55.00	1,829.00	1.730	0.293
		8. Large gullies, diversions, and low flowing streams	0.76	50.00	6,548.00	2.620	0.694
#9	**1**	**Time of Concentration:**					**0.987**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	41.00	3,317.00	1.110	0.830
		8. Large gullies, diversions, and low flowing streams	0.70	29.00	4,125.00	2.510	0.456
#10	**1**	**Time of Concentration:**					**1.286**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	2.25	125.00	5,554.00	1.500	1.028
		8. Large gullies, diversions, and low flowing streams	2.13	85.00	3,997.00	4.370	0.254
#10	**2**	**Time of Concentration:**					**1.282**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.39	68.00	4,904.00	1.170	1.164
		8. Large gullies, diversions, and low flowing streams	4.73	90.00	1,904.00	6.520	0.081
#10	**3**	**Time of Concentration:**					**1.245**
#10	4	5. Nearly bare and untilled, and alluvial valley fans	3.76	51.00	1,357.00	1.930	0.195
		8. Large gullies, diversions, and low flowing streams	0.65	22.00	3,385.00	2.410	0.390
#10	**4**	**Time of Concentration:**					**0.585**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	5	5. Nearly bare and untilled, and alluvial valley fans	1.63	88.00	5,391.16	1.270	1.179
#10	**5**	**Time of Concentration:**					**1.179**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	4.50	75.00	1,667.00	2.120	0.218
		8. Large gullies, diversions, and low flowing streams	1.85	155.00	8,400.00	4.070	0.573
#12	**1**	**Time of Concentration:**					**0.791**
#12	2	5. Nearly bare and untilled, and alluvial valley fans	2.99	50.00	1,674.03	1.720	0.270
		8. Large gullies, diversions, and low flowing streams	1.67	70.00	4,201.17	3.870	0.301
#12	**2**	**Time of Concentration:**					**0.571**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	4.04	57.00	1,411.00	2.000	0.195
		8. Large gullies, diversions, and low flowing streams	1.55	107.00	6,884.00	3.740	0.511
#12	**3**	**Time of Concentration:**					**0.706**
#12	4	5. Nearly bare and untilled, and alluvial valley fans	2.23	84.00	3,771.04	1.490	0.703
		8. Large gullies, diversions, and low flowing streams	1.62	186.00	11,515.60	3.810	0.839
#12	**4**	**Time of Concentration:**					**1.542**
#12	5	5. Nearly bare and untilled, and alluvial valley fans	3.68	53.00	1,442.00	1.910	0.209
		8. Large gullies, diversions, and low flowing streams	1.95	120.00	6,155.00	4.180	0.409
#12	**5**	**Time of Concentration:**					**0.618**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	4.62	62.00	1,342.00	2.140	0.174
		8. Large gullies, diversions, and low flowing streams	1.91	157.00	8,225.00	4.140	0.551
#13	**1**	**Time of Concentration:**					**0.725**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	2.91	50.00	1,717.00	1.700	0.280
		8. Large gullies, diversions, and low flowing streams	2.28	183.00	8,039.00	4.520	0.494
#13	**2**	**Time of Concentration:**					**0.774**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	6.18	95.00	1,537.00	2.480	0.172
		8. Large gullies, diversions, and low flowing streams	2.13	135.00	6,347.00	4.370	0.403
#13	**3**	**Time of Concentration:**					**0.575**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.17	10.00	315.00	1.780	0.049
		8. Large gullies, diversions, and low flowing streams	2.30	100.00	4,344.00	4.550	0.265
#13	**4**	**Time of Concentration:**					**0.314**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	5	5. Nearly bare and untilled, and alluvial valley fans	3.10	70.00	2,255.00	1.760	0.355
		8. Large gullies, diversions, and low flowing streams	1.23	140.00	11,392.00	3.320	0.953
#13	**5**	**Time of Concentration:**					**1.308**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	10.59	63.00	595.00	3.250	0.050
		8. Large gullies, diversions, and low flowing streams	2.60	151.00	5,808.00	4.830	0.334
#14	**1**	**Time of Concentration:**					**0.384**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	7.28	67.00	920.00	2.690	0.095
		8. Large gullies, diversions, and low flowing streams	2.17	123.00	5,670.00	4.410	0.357
#14	**2**	**Time of Concentration:**					**0.452**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	21.46	150.00	699.00	4.630	0.041
		8. Large gullies, diversions, and low flowing streams	3.10	364.00	11,728.00	5.280	0.617
#14	**3**	**Time of Concentration:**					**0.658**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	3.39	35.00	1,032.00	1.840	0.155
		8. Large gullies, diversions, and low flowing streams	2.97	103.00	3,470.00	5.160	0.186
#14	**4**	**Time of Concentration:**					**0.341**
#14	5	5. Nearly bare and untilled, and alluvial valley fans	28.15	125.00	444.00	5.300	0.023
		8. Large gullies, diversions, and low flowing streams	4.18	246.00	5,886.00	6.130	0.266
#14	**5**	**Time of Concentration:**					**0.289**
#14	6	5. Nearly bare and untilled, and alluvial valley fans	3.18	40.00	1,257.00	1.780	0.196
		8. Large gullies, diversions, and low flowing streams	2.29	228.00	9,963.00	4.530	0.610
#14	**6**	**Time of Concentration:**					**0.806**
#14	7	5. Nearly bare and untilled, and alluvial valley fans	16.72	100.00	598.00	4.080	0.040
		8. Large gullies, diversions, and low flowing streams	2.81	243.00	8,649.00	5.020	0.478
#14	**7**	**Time of Concentration:**					**0.518**
#14	8	5. Nearly bare and untilled, and alluvial valley fans	1.70	47.00	2,765.00	1.300	0.590
		8. Large gullies, diversions, and low flowing streams	2.44	274.00	11,208.00	4.690	0.663
#14	**8**	**Time of Concentration:**					**1.253**
#14	9	5. Nearly bare and untilled, and alluvial valley fans	2.87	105.00	3,657.00	1.690	0.601
		8. Large gullies, diversions, and low flowing streams	2.43	194.00	7,991.00	4.670	0.475

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	**9**	**Time of Concentration:**					**1.076**
#14	10	5. Nearly bare and untilled, and alluvial valley fans	2.75	80.00	2,907.00	1.650	0.489
		8. Large gullies, diversions, and low flowing streams	2.41	172.00	7,149.00	4.650	0.427
#14	**10**	**Time of Concentration:**					**0.916**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	12.80	54.00	422.00	3.570	0.032
		8. Large gullies, diversions, and low flowing streams	1.68	181.00	10,781.00	3.880	0.771
#15	**1**	**Time of Concentration:**					**0.803**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	44.22	260.00	588.00	6.640	0.024
		8. Large gullies, diversions, and low flowing streams	2.45	254.00	10,354.24	4.690	0.613
#15	**2**	**Time of Concentration:**					**0.637**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	10.04	85.00	847.00	3.160	0.074
		8. Large gullies, diversions, and low flowing streams	2.34	366.00	15,663.00	4.580	0.949
#15	**3**	**Time of Concentration:**					**1.023**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	2.26	117.00	5,179.00	1.500	0.959
		8. Large gullies, diversions, and low flowing streams	0.46	26.00	5,601.00	2.040	0.762
#16	**1**	**Time of Concentration:**					**1.721**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	8.70	62.00	713.00	2.940	0.067
		8. Large gullies, diversions, and low flowing streams	1.99	144.00	7,241.00	4.230	0.475
#16	**2**	**Time of Concentration:**					**0.542**
#16	3	5. Nearly bare and untilled, and alluvial valley fans	6.88	32.00	465.00	2.620	0.049
		8. Large gullies, diversions, and low flowing streams	2.29	81.00	3,543.00	4.530	0.217
#16	**3**	**Time of Concentration:**					**0.266**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	9.37	65.00	694.00	3.060	0.062
		8. Large gullies, diversions, and low flowing streams	1.19	56.00	4,712.00	3.270	0.400
#17	**1**	**Time of Concentration:**					**0.462**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	9.00	60.00	667.00	2.990	0.061
		8. Large gullies, diversions, and low flowing streams	0.97	61.00	6,287.00	2.950	0.591
#18	**1**	**Time of Concentration:**					**0.652**
#18	2	5. Nearly bare and untilled, and alluvial valley fans	2.47	33.00	1,336.00	1.570	0.236

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.01	164.00	8,154.00	4.250	0.532
#18	**2**	**Time of Concentration:**					**0.768**
#20	1	5. Nearly bare and untilled, and alluvial valley fans	2.64	47.00	1,783.00	1.620	0.305
		8. Large gullies, diversions, and low flowing streams	0.56	30.00	5,405.00	2.230	0.673
#20	**1**	**Time of Concentration:**					**0.978**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	4.09	60.00	1,467.02	2.020	0.201
		8. Large gullies, diversions, and low flowing streams	0.93	60.00	6,433.62	2.890	0.618
#21	**1**	**Time of Concentration:**					**0.819**
#21	2	5. Nearly bare and untilled, and alluvial valley fans	3.50	50.00	1,430.00	1.860	0.213
		8. Large gullies, diversions, and low flowing streams	2.15	60.00	2,785.12	4.400	0.175
#21	**2**	**Time of Concentration:**					**0.388**
#21	3	5. Nearly bare and untilled, and alluvial valley fans	1.70	15.00	881.00	1.300	0.188
		9. Small streams flowing bankfull	1.49	60.00	4,014.18	11.000	0.101
#21	**3**	**Time of Concentration:**					**0.289**
#21	4	5. Nearly bare and untilled, and alluvial valley fans	2.21	40.00	1,811.02	1.480	0.339
		8. Large gullies, diversions, and low flowing streams	0.84	50.00	5,949.54	2.750	0.600
#21	**4**	**Time of Concentration:**					**0.939**
#24	1	5. Nearly bare and untilled, and alluvial valley fans	1.71	430.00	25,118.00	1.300	5.367
#24	**1**	**Time of Concentration:**					**5.367**
#24	2	5. Nearly bare and untilled, and alluvial valley fans	1.84	430.00	23,393.00	1.350	4.813
#24	**2**	**Time of Concentration:**					**4.813**
#24	3	5. Nearly bare and untilled, and alluvial valley fans	1.82	155.00	8,498.00	1.350	1.748
		8. Large gullies, diversions, and low flowing streams	0.84	40.00	4,771.00	2.740	0.483
#24	**3**	**Time of Concentration:**					**2.231**
#24	4	5. Nearly bare and untilled, and alluvial valley fans	1.24	50.00	4,042.00	1.110	1.011
		8. Large gullies, diversions, and low flowing streams	0.49	60.00	12,150.00	2.100	1.607
#24	**4**	**Time of Concentration:**					**2.618**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	0.51	10.00	1,950.00	0.710	0.762
		8. Large gullies, diversions, and low flowing streams	1.81	60.00	3,322.00	4.030	0.228
#25	**1**	**Time of Concentration:**					**0.990**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#25	2	5. Nearly bare and untilled, and alluvial valley fans	1.11	25.00	2,254.00	1.050	0.596
		8. Large gullies, diversions, and low flowing streams	2.36	75.00	3,178.00	4.600	0.191
#25	**2**	**Time of Concentration:**					**0.787**
#25	3	5. Nearly bare and untilled, and alluvial valley fans	3.23	30.00	929.00	1.790	0.144
		8. Large gullies, diversions, and low flowing streams	2.45	154.00	6,297.00	4.690	0.372
#25	**3**	**Time of Concentration:**					**0.516**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	1.20	103.00	8,602.00	1.090	2.192
#26	**1**	**Time of Concentration:**					**2.192**
#26	2	5. Nearly bare and untilled, and alluvial valley fans	1.23	120.00	9,780.00	1.100	2.469
		8. Large gullies, diversions, and low flowing streams	2.18	184.00	8,454.00	4.420	0.531
#26	**2**	**Time of Concentration:**					**3.000**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.32	50.00	1,158.02	2.070	0.155
		8. Large gullies, diversions, and low flowing streams	2.53	198.00	7,838.16	4.760	0.457
#27	**1**	**Time of Concentration:**					**0.612**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	5.26	30.00	570.00	2.290	0.069
		8. Large gullies, diversions, and low flowing streams	3.15	278.00	8,822.00	5.320	0.460
#27	**2**	**Time of Concentration:**					**0.529**
#27	3	5. Nearly bare and untilled, and alluvial valley fans	16.33	80.00	490.00	4.040	0.033
		8. Large gullies, diversions, and low flowing streams	2.15	225.00	10,443.00	4.400	0.659
#27	**3**	**Time of Concentration:**					**0.692**
#27	4	5. Nearly bare and untilled, and alluvial valley fans	12.43	65.00	523.00	3.520	0.041
		8. Large gullies, diversions, and low flowing streams	3.49	225.00	6,454.00	5.600	0.320
#27	**4**	**Time of Concentration:**					**0.361**
#27	5	5. Nearly bare and untilled, and alluvial valley fans	9.40	25.00	266.00	3.060	0.024
		8. Large gullies, diversions, and low flowing streams	2.32	364.00	15,700.00	4.560	0.956
#27	**5**	**Time of Concentration:**					**0.980**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	40.00	762.00	2.290	0.092
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**1**	**Time of Concentration:**					**0.657**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	2	5. Nearly bare and untilled, and alluvial valley fans	25.86	105.00	406.00	5.080	0.022
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**2**	**Time of Concentration:**					**0.587**
#29	1	5. Nearly bare and untilled, and alluvial valley fans	11.58	30.00	259.00	3.400	0.021
		8. Large gullies, diversions, and low flowing streams	3.61	288.00	7,976.00	5.700	0.388
#29	**1**	**Time of Concentration:**					**0.409**
#29	2	5. Nearly bare and untilled, and alluvial valley fans	8.06	40.00	496.00	2.830	0.048
		8. Large gullies, diversions, and low flowing streams	2.90	252.00	8,693.55	5.100	0.473
#29	**2**	**Time of Concentration:**					**0.521**
#29	3	5. Nearly bare and untilled, and alluvial valley fans	7.25	25.00	345.00	2.690	0.035
		8. Large gullies, diversions, and low flowing streams	2.26	158.00	7,001.00	4.500	0.432
#29	**3**	**Time of Concentration:**					**0.467**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	35.00	710.00	2.220	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	243.00	14,540.00	3.870	1.043
#30	**1**	**Time of Concentration:**					**1.131**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.91	15.00	515.00	1.700	0.084
		8. Large gullies, diversions, and low flowing streams	2.74	247.00	9,006.00	4.960	0.504
#31	**1**	**Time of Concentration:**					**0.588**
#31	2	5. Nearly bare and untilled, and alluvial valley fans	7.46	25.00	335.00	2.730	0.034
		8. Large gullies, diversions, and low flowing streams	2.18	138.00	6,335.00	4.420	0.398
#31	**2**	**Time of Concentration:**					**0.432**
#31	3	5. Nearly bare and untilled, and alluvial valley fans	3.84	20.00	521.00	1.950	0.074
		8. Large gullies, diversions, and low flowing streams	2.24	108.00	4,826.00	4.480	0.299
#31	**3**	**Time of Concentration:**					**0.373**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	22.00	632.00	1.860	0.094
		8. Large gullies, diversions, and low flowing streams	1.56	101.00	6,494.00	3.740	0.482
#32	**1**	**Time of Concentration:**					**0.576**
#34	1	5. Nearly bare and untilled, and alluvial valley fans	2.28	35.00	1,538.00	1.500	0.284
		8. Large gullies, diversions, and low flowing streams	2.89	74.00	2,560.00	5.100	0.139

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#34	**1**	**Time of Concentration:**					**0.423**
#34	2	5. Nearly bare and untilled, and alluvial valley fans	2.69	38.00	1,415.00	1.630	0.241
		8. Large gullies, diversions, and low flowing streams	1.60	81.00	5,052.00	3.790	0.370
#34	**2**	**Time of Concentration:**					**0.611**
#34	3	5. Nearly bare and untilled, and alluvial valley fans	3.80	56.00	1,474.00	1.940	0.211
		8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,293.00	2.500	0.477
#34	**3**	**Time of Concentration:**					**0.688**
#34	4	5. Nearly bare and untilled, and alluvial valley fans	4.17	35.00	840.00	2.040	0.114
		8. Large gullies, diversions, and low flowing streams	1.89	72.00	3,807.00	4.120	0.256
#34	**4**	**Time of Concentration:**					**0.370**
#35	1	5. Nearly bare and untilled, and alluvial valley fans	2.34	113.00	4,831.12	1.520	0.882
		8. Large gullies, diversions, and low flowing streams	1.11	20.00	1,794.00	3.160	0.157
#35	**1**	**Time of Concentration:**					**1.039**
#36	1	5. Nearly bare and untilled, and alluvial valley fans	3.35	20.00	596.46	1.830	0.090
		8. Large gullies, diversions, and low flowing streams	1.29	60.00	4,641.80	3.410	0.378
#36	**1**	**Time of Concentration:**					**0.468**
#36	2	5. Nearly bare and untilled, and alluvial valley fans	3.33	40.00	1,200.57	1.820	0.183
		8. Large gullies, diversions, and low flowing streams	1.51	90.00	5,956.33	3.680	0.449
#36	**2**	**Time of Concentration:**					**0.632**
#36	3	5. Nearly bare and untilled, and alluvial valley fans	3.77	77.00	2,043.74	1.940	0.292
		8. Large gullies, diversions, and low flowing streams	1.12	53.00	4,712.61	3.180	0.411
#36	**3**	**Time of Concentration:**					**0.703**
#36	4	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	937.44	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.76	80.00	4,538.27	3.980	0.316
#36	**4**	**Time of Concentration:**					**0.419**
#36	5	5. Nearly bare and untilled, and alluvial valley fans	1.68	10.00	596.48	1.290	0.128
		8. Large gullies, diversions, and low flowing streams	2.50	125.00	5,007.21	4.740	0.293
#36	**5**	**Time of Concentration:**					**0.421**
#36	6	5. Nearly bare and untilled, and alluvial valley fans	1.57	10.00	638.43	1.250	0.141

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.06	123.00	5,966.63	4.300	0.385
#36	**6**	**Time of Concentration:**					**0.526**
#37	1	5. Nearly bare and untilled, and alluvial valley fans	4.68	129.00	2,754.05	2.160	0.354
		8. Large gullies, diversions, and low flowing streams	0.16	10.00	6,108.73	1.210	1.402
#37	**1**	**Time of Concentration:**					**1.756**
#37	2	5. Nearly bare and untilled, and alluvial valley fans	5.17	45.00	870.00	2.270	0.106
		8. Large gullies, diversions, and low flowing streams	2.01	95.00	4,737.20	4.240	0.310
#37	**2**	**Time of Concentration:**					**0.416**
#37	3	5. Nearly bare and untilled, and alluvial valley fans	3.52	30.00	852.93	1.870	0.126
		8. Large gullies, diversions, and low flowing streams	4.02	180.00	4,473.94	6.010	0.206
#37	**3**	**Time of Concentration:**					**0.703**
#37	4	5. Nearly bare and untilled, and alluvial valley fans	3.18	35.00	1,099.00	1.780	0.171
		8. Large gullies, diversions, and low flowing streams	1.49	38.00	2,544.00	3.660	0.193
#37	**4**	**Time of Concentration:**					**0.419**
#37	5	5. Nearly bare and untilled, and alluvial valley fans	2.59	40.00	1,542.81	1.610	0.266
		8. Large gullies, diversions, and low flowing streams	1.48	67.00	4,528.71	3.640	0.345
#37	**5**	**Time of Concentration:**					**0.421**
#37	6	5. Nearly bare and untilled, and alluvial valley fans	1.55	10.00	646.96	1.240	0.144
		8. Large gullies, diversions, and low flowing streams	6.34	157.00	2,475.12	7.550	0.091
#37	**6**	**Time of Concentration:**					**0.526**
#37	7	5. Nearly bare and untilled, and alluvial valley fans	7.23	80.00	1,106.00	2.680	0.114
		8. Large gullies, diversions, and low flowing streams	1.05	52.00	4,950.00	3.070	0.447
#37	**7**	**Time of Concentration:**					**0.561**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	1.29	107.00	8,294.00	3.400	0.677
#1	**2**	**Muskingum K:**					**0.677**
#1	3	8. Large gullies, diversions, and low flowing streams	1.27	113.00	8,880.00	3.380	0.729

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**3**	**Muskingum K:**					**0.729**
#1	4	8. Large gullies, diversions, and low flowing streams	1.35	171.00	12,634.00	3.490	1.005
#1	**4**	**Muskingum K:**					**1.005**
#1	5	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**5**	**Muskingum K:**					**1.392**
#1	6	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**6**	**Muskingum K:**					**1.392**
#2	2	8. Large gullies, diversions, and low flowing streams	0.53	20.00	3,756.00	2.180	0.478
#2	**2**	**Muskingum K:**					**0.478**
#2	3	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**3**	**Muskingum K:**					**0.574**
#2	4	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**4**	**Muskingum K:**					**0.574**
#2	5	8. Large gullies, diversions, and low flowing streams	0.65	45.00	6,955.00	2.410	0.801
#2	**5**	**Muskingum K:**					**0.801**
#3	3	8. Large gullies, diversions, and low flowing streams	0.92	20.00	2,168.00	2.880	0.209
#3	**3**	**Muskingum K:**					**0.209**
#5	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#5	**1**	**Muskingum K:**					**0.000**
#5	2	8. Large gullies, diversions, and low flowing streams	1.75	125.00	7,149.00	3.960	0.501
#5	**2**	**Muskingum K:**					**0.501**
#5	3	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**3**	**Muskingum K:**					**0.681**
#5	4	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**4**	**Muskingum K:**					**0.681**
#5	5	8. Large gullies, diversions, and low flowing streams	1.67	239.00	14,273.00	3.880	1.021
#5	**5**	**Muskingum K:**					**1.021**
#5	6	8. Large gullies, diversions, and low flowing streams	1.68	239.00	14,223.00	3.880	1.018
#5	**6**	**Muskingum K:**					**1.018**
#7	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**1**	**Muskingum K:**					**0.000**
#7	2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	**2**	**Muskingum K:**					**0.000**
#7	4	8. Large gullies, diversions, and low flowing streams	1.16	140.00	12,037.00	3.230	1.035
#7	**4**	**Muskingum K:**					**1.035**
#7	5	8. Large gullies, diversions, and low flowing streams	1.14	140.00	12,307.69	3.190	1.071
#7	**5**	**Muskingum K:**					**1.071**
#7	6	8. Large gullies, diversions, and low flowing streams	1.17	158.00	13,546.00	3.230	1.164
#7	**6**	**Muskingum K:**					**1.164**
#7	7	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**7**	**Muskingum K:**					**1.344**
#7	8	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**8**	**Muskingum K:**					**1.344**
#10	3	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**3**	**Muskingum K:**					**0.517**
#10	4	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**4**	**Muskingum K:**					**0.517**
#10	5	8. Large gullies, diversions, and low flowing streams	0.79	47.00	5,956.00	2.660	0.621
#10	**5**	**Muskingum K:**					**0.621**
#12	2	8. Large gullies, diversions, and low flowing streams	8.24	111.00	1,347.00	8.610	0.043
#12	**2**	**Muskingum K:**					**0.043**
#12	3	8. Large gullies, diversions, and low flowing streams	8.01	109.00	1,360.00	8.490	0.044
#12	**3**	**Muskingum K:**					**0.044**
#12	4	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**4**	**Muskingum K:**					**0.487**
#12	5	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**5**	**Muskingum K:**					**0.487**
#13	2	8. Large gullies, diversions, and low flowing streams	1.34	54.00	4,025.00	3.470	0.322
#13	**2**	**Muskingum K:**					**0.322**
#13	3	8. Large gullies, diversions, and low flowing streams	0.98	72.00	7,333.00	2.970	0.685
#13	**3**	**Muskingum K:**					**0.685**
#13	4	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**4**	**Muskingum K:**					**0.923**
#13	5	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	**5**	**Muskingum K:**					**0.923**
#14	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#14	**1**	**Muskingum K:**					**0.000**
#14	2	8. Large gullies, diversions, and low flowing streams	0.83	58.00	6,957.00	2.730	0.707
#14	**2**	**Muskingum K:**					**0.707**
#14	3	8. Large gullies, diversions, and low flowing streams	0.81	77.00	9,480.00	2.700	0.975
#14	**3**	**Muskingum K:**					**0.975**
#14	4	8. Large gullies, diversions, and low flowing streams	0.86	147.00	17,117.00	2.770	1.716
#14	**4**	**Muskingum K:**					**1.716**
#14	5	8. Large gullies, diversions, and low flowing streams	0.88	175.00	19,934.00	2.810	1.970
#14	**5**	**Muskingum K:**					**1.970**
#14	6	8. Large gullies, diversions, and low flowing streams	0.95	211.00	22,155.00	2.920	2.107
#14	**6**	**Muskingum K:**					**2.107**
#14	7	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**7**	**Muskingum K:**					**2.544**
#14	8	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**8**	**Muskingum K:**					**2.544**
#14	9	8. Large gullies, diversions, and low flowing streams	0.95	307.00	32,146.59	2.930	3.047
#14	**9**	**Muskingum K:**					**3.047**
#14	10	8. Large gullies, diversions, and low flowing streams	0.96	339.00	35,382.00	2.930	3.354
#14	**10**	**Muskingum K:**					**3.354**
#15	2	8. Large gullies, diversions, and low flowing streams	1.14	86.00	7,535.26	3.200	0.654
#15	**2**	**Muskingum K:**					**0.654**
#15	3	8. Large gullies, diversions, and low flowing streams	1.25	115.00	9,236.00	3.340	0.768
#15	**3**	**Muskingum K:**					**0.768**
#16	2	8. Large gullies, diversions, and low flowing streams	0.55	42.00	7,608.00	2.220	0.951
#16	**2**	**Muskingum K:**					**0.951**
#16	3	8. Large gullies, diversions, and low flowing streams	0.51	54.00	10,615.00	2.130	1.384
#16	**3**	**Muskingum K:**					**1.384**
#17	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#17	**1**	**Muskingum K:**					**0.000**
#18	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#18	**1**	**Muskingum K:**					**0.000**
#18	2	8. Large gullies, diversions, and low flowing streams	1.02	62.00	6,103.00	3.020	0.561
#18	**2**	**Muskingum K:**					**0.561**
#21	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#21	**1**	**Muskingum K:**					**0.000**
#21	2	8. Large gullies, diversions, and low flowing streams	0.41	20.00	4,825.09	1.930	0.694
#21	**2**	**Muskingum K:**					**0.694**
#21	3	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,627.46	1.780	0.878
#21	**3**	**Muskingum K:**					**0.878**
#21	4	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,627.46	1.780	0.878
#21	**4**	**Muskingum K:**					**0.878**
#24	1	8. Large gullies, diversions, and low flowing streams	0.79	180.00	22,769.00	2.660	2.377
#24	**1**	**Muskingum K:**					**2.377**
#24	2	8. Large gullies, diversions, and low flowing streams	0.78	180.00	23,111.00	2.640	2.431
#24	**2**	**Muskingum K:**					**2.431**
#24	4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#24	**4**	**Muskingum K:**					**0.000**
#25	1	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**1**	**Muskingum K:**					**0.342**
#25	2	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**2**	**Muskingum K:**					**0.342**
#25	3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#25	**3**	**Muskingum K:**					**0.000**
#27	1	8. Large gullies, diversions, and low flowing streams	1.38	216.00	15,629.00	3.520	1.233
#27	**1**	**Muskingum K:**					**1.233**
#27	2	8. Large gullies, diversions, and low flowing streams	1.17	144.00	12,301.00	3.240	1.054
#27	**2**	**Muskingum K:**					**1.054**
#27	3	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**3**	**Muskingum K:**					**0.551**
#27	4	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**4**	**Muskingum K:**					**0.551**
#28	1	8. Large gullies, diversions, and low flowing streams	1.30	84.00	6,445.17	3.420	0.523

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	**1**	**Muskingum K:**					**0.523**
#29	1	8. Large gullies, diversions, and low flowing streams	0.88	37.00	4,210.00	2.810	0.416
#29	**1**	**Muskingum K:**					**0.416**
#29	2	8. Large gullies, diversions, and low flowing streams	0.88	26.00	2,949.00	2.810	0.291
#29	**2**	**Muskingum K:**					**0.291**
#31	1	8. Large gullies, diversions, and low flowing streams	1.35	76.00	5,639.00	3.480	0.450
#31	**1**	**Muskingum K:**					**0.450**
#31	2	8. Large gullies, diversions, and low flowing streams	1.15	20.00	1,734.00	3.220	0.149
#31	**2**	**Muskingum K:**					**0.149**
#34	1	8. Large gullies, diversions, and low flowing streams	0.64	56.00	8,773.00	2.390	1.019
#34	**1**	**Muskingum K:**					**1.019**
#34	2	8. Large gullies, diversions, and low flowing streams	1.05	31.00	2,957.00	3.070	0.267
#34	**2**	**Muskingum K:**					**0.267**
#34	3	8. Large gullies, diversions, and low flowing streams	0.64	26.00	4,031.00	2.400	0.466
#34	**3**	**Muskingum K:**					**0.466**
#36	1	8. Large gullies, diversions, and low flowing streams	0.79	110.00	13,954.41	2.660	1.457
#36	**1**	**Muskingum K:**					**1.457**
#36	2	8. Large gullies, diversions, and low flowing streams	0.58	50.00	8,630.15	2.280	1.051
#36	**2**	**Muskingum K:**					**1.051**
#36	3	8. Large gullies, diversions, and low flowing streams	0.58	50.00	8,630.15	2.280	1.051
#36	**3**	**Muskingum K:**					**1.051**
#36	4	8. Large gullies, diversions, and low flowing streams	0.23	10.00	4,329.90	1.440	0.835
#36	**4**	**Muskingum K:**					**0.835**
#36	5	8. Large gullies, diversions, and low flowing streams	0.21	5.00	2,359.95	1.380	0.475
#36	**5**	**Muskingum K:**					**0.475**
#37	2	8. Large gullies, diversions, and low flowing streams	0.28	30.00	10,642.07	1.590	1.859
#37	**2**	**Muskingum K:**					**1.859**
#37	3	8. Large gullies, diversions, and low flowing streams	0.45	38.00	8,493.51	2.000	1.179
#37	**3**	**Muskingum K:**					**1.179**
#37	4	8. Large gullies, diversions, and low flowing streams	0.66	104.00	15,664.00	2.440	1.783
#37	**4**	**Muskingum K:**					**0.835**
#37	5	8. Large gullies, diversions, and low flowing streams	0.33	41.00	12,388.68	1.720	2.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#37	**5**	**Muskingum K:**					**0.475**
#37	6	8. Large gullies, diversions, and low flowing streams	0.33	41.00	12,388.68	1.720	2.000
#37	**6**	**Muskingum K:**					**0.000**
#37	7	8. Large gullies, diversions, and low flowing streams	0.33	31.00	9,267.00	1.730	1.487
#37	**7**	**Muskingum K:**					**1.487**

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Cottonwood Arroyo Post-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is shown on Exhibit 11-77.

Revised January 31, 2011

AAY/LR/RY

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

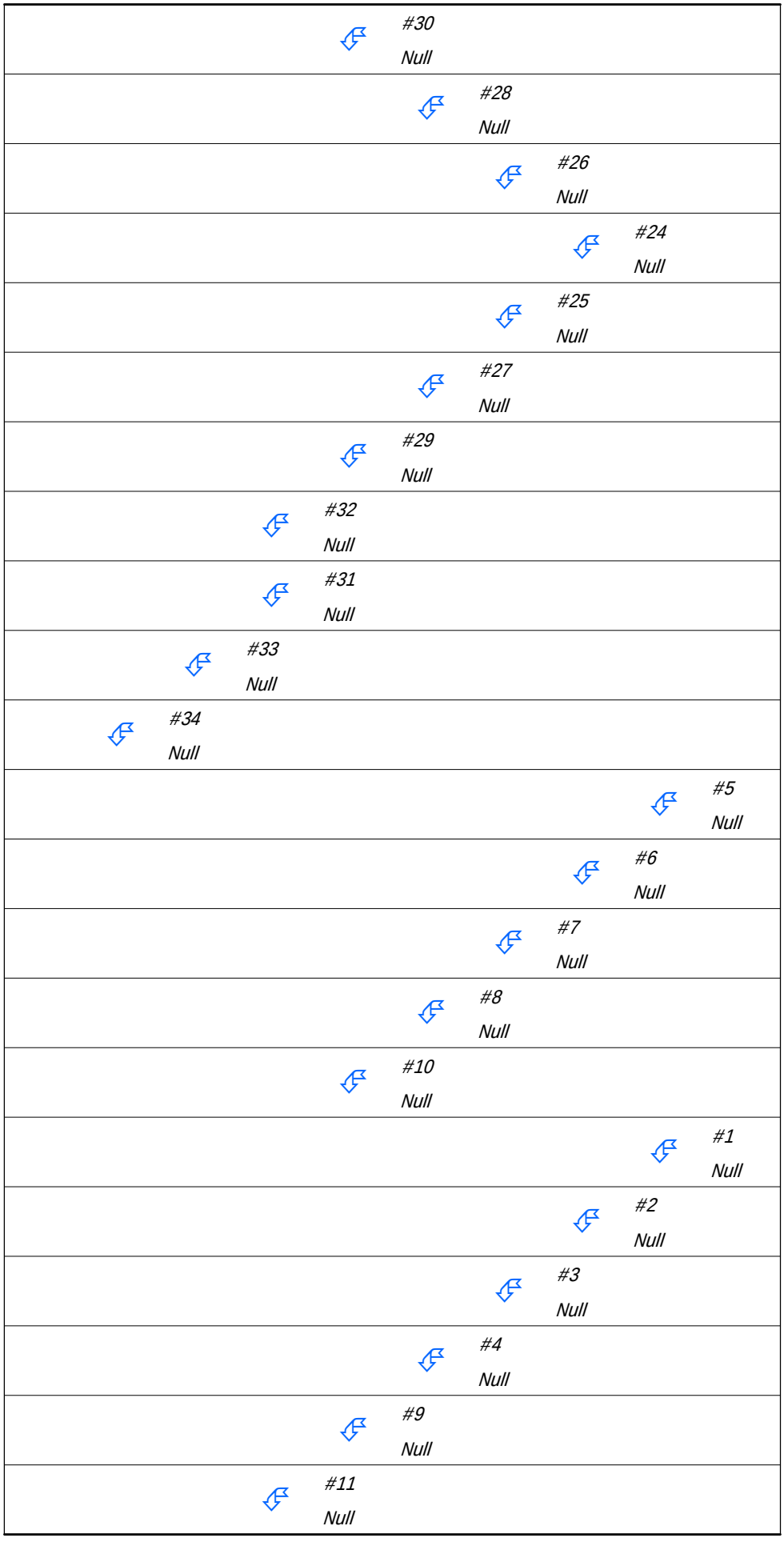
Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.961	0.307	
Null	#2	==>	#3	0.068	0.331	
Null	#3	==>	#4	0.000	0.000	
Null	#4	==>	#9	0.718	0.281	
Null	#5	==>	#6	1.205	0.328	
Null	#6	==>	#7	0.189	0.304	
Null	#7	==>	#8	0.000	0.000	
Null	#8	==>	#10	0.989	0.300	
Null	#9	==>	#11	0.000	0.000	
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#21	0.495	0.453	
Null	#12	==>	#13	0.076	0.330	
Null	#13	==>	#14	3.790	0.314	
Null	#14	==>	#16	1.579	0.287	
Null	#15	==>	#16	1.579	0.287	
Null	#16	==>	#23	0.000	0.000	
Null	#17	==>	#19	0.000	0.000	
Null	#18	==>	#19	0.000	0.000	
Null	#19	==>	#20	0.915	0.252	
Null	#20	==>	#22	0.000	0.000	End of Middle Fork
Null	#21	==>	#22	0.000	0.000	End of South Fork
Null	#22	==>	#36	1.315	0.260	
Null	#23	==>	#20	0.593	0.281	
Null	#24	==>	#25	0.964	0.340	
Null	#25	==>	#27	1.454	0.333	
Null	#26	==>	#27	1.454	0.333	
Null	#27	==>	#29	0.800	0.323	
Null	#28	==>	#29	0.800	0.323	
Null	#29	==>	#32	0.479	0.298	
Null	#30	==>	#32	0.479	0.298	
Null	#31	==>	#33	0.000	0.000	
Null	#32	==>	#33	0.000	0.000	
Null	#33	==>	#34	1.348	0.294	Inlet to North Fork Diversion
Null	#34	==>	#36	0.825	0.261	End of North Fork
Null	#35	==>	#23	0.203	0.259	
Null	#36	==>	#37	3.388	0.246	
Null	#37	==>	End	0.000	0.000	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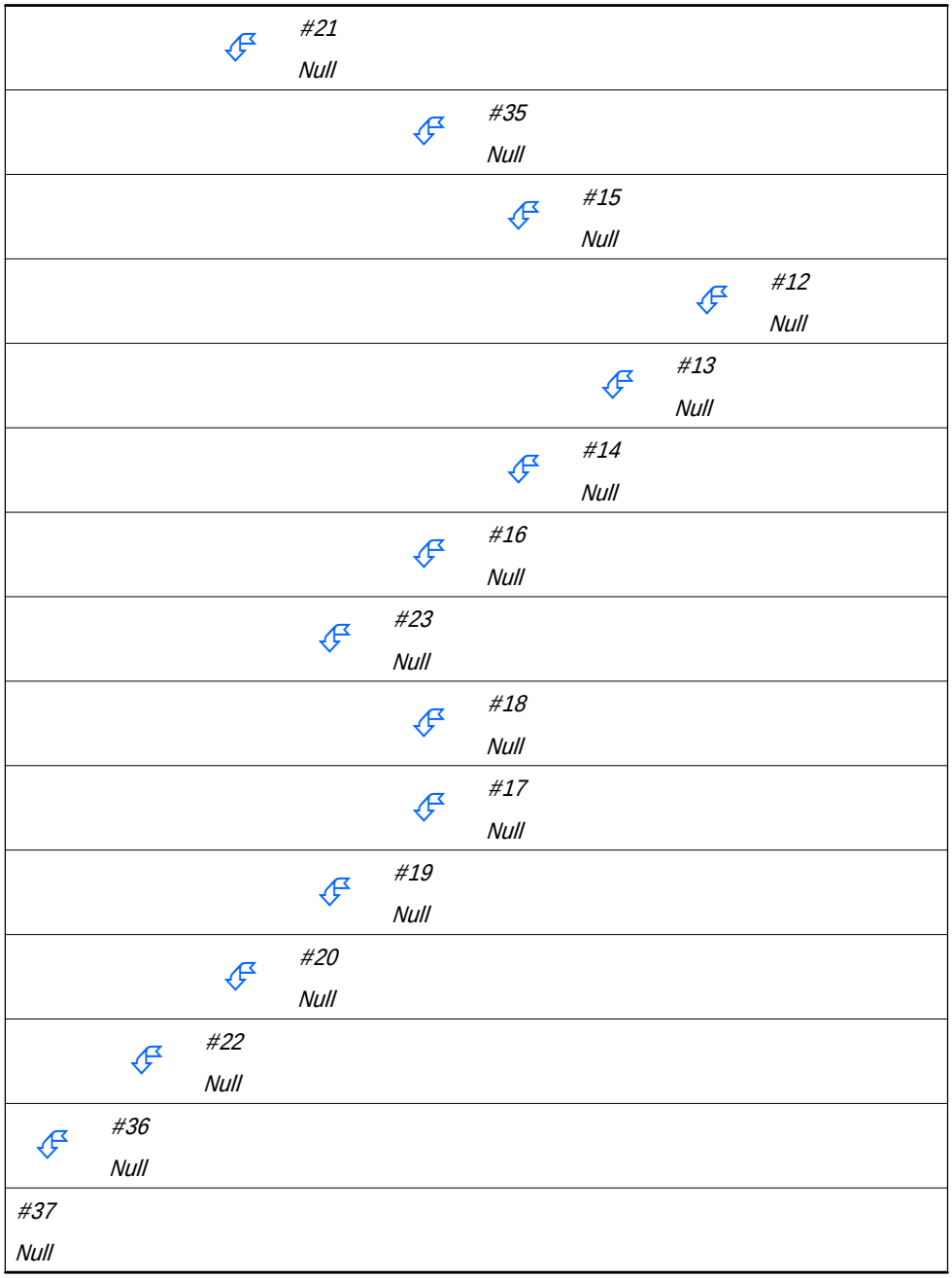

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.81	76.00	9,347.00	2.70	0.961
#1	**Muskingum K:**					**0.961**
#2	8. Large gullies, diversions, and low flowing streams	1.23	10.00	814.00	3.32	0.068
#2	**Muskingum K:**					**0.068**
#3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.53	30.00	5,637.00	2.18	0.718
#4	**Muskingum K:**					**0.718**
#5	8. Large gullies, diversions, and low flowing streams	1.17	165.00	14,065.00	3.24	1.205
#5	**Muskingum K:**					**1.205**
#6	8. Large gullies, diversions, and low flowing streams	0.78	14.00	1,799.25	2.64	0.189
#6	**Muskingum K:**					**0.189**
#8	8. Large gullies, diversions, and low flowing streams	0.72	65.00	9,046.00	2.54	0.989
#8	**Muskingum K:**					**0.989**
#11	8. Large gullies, diversions, and low flowing streams	30.00	8,801.00	29,336.66	16.43	0.495
#11	**Muskingum K:**					**0.495**
#12	8. Large gullies, diversions, and low flowing streams	1.21	11.00	906.00	3.30	0.076
#12	**Muskingum K:**					**0.076**
#13	8. Large gullies, diversions, and low flowing streams	0.92	363.00	39,301.00	2.88	3.790
#13	**Muskingum K:**					**3.790**
#14	8. Large gullies, diversions, and low flowing streams	0.59	77.00	13,075.22	2.30	1.579
#14	**Muskingum K:**					**1.579**
#15	8. Large gullies, diversions, and low flowing streams	0.59	77.00	13,075.00	2.30	1.579
#15	**Muskingum K:**					**1.579**
#16	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#16	**Muskingum K:**					**0.000**
#19	8. Large gullies, diversions, and low flowing streams	0.33	19.00	5,699.00	1.73	0.915
#19	**Muskingum K:**					**0.915**
#22	8. Large gullies, diversions, and low flowing streams	0.38	33.00	8,713.00	1.84	1.315
#22	**Muskingum K:**					**1.315**
#23	8. Large gullies, diversions, and low flowing streams	0.53	25.00	4,680.00	2.19	0.593
#23	**Muskingum K:**					**0.593**
#24	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,568.00	3.62	0.964
#24	**Muskingum K:**					**0.964**
#25	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.00	3.39	1.454
#25	**Muskingum K:**					**1.454**
#26	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.62	3.39	1.454

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#26	**Muskingum K:**					**1.454**
#27	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#27	**Muskingum K:**					**0.800**
#28	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#28	**Muskingum K:**					**0.800**
#29	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#29	**Muskingum K:**					**0.479**
#30	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#30	**Muskingum K:**					**0.479**
#33	8. Large gullies, diversions, and low flowing streams	0.66	77.00	11,748.55	2.42	1.348
#33	**Muskingum K:**					**1.348**
#34	8. Large gullies, diversions, and low flowing streams	0.38	21.00	5,497.38	1.85	0.825
#34	**Muskingum K:**					**0.825**
#35	8. Large gullies, diversions, and low flowing streams	0.37	5.00	1,338.00	1.83	0.203
#35	**Muskingum K:**					**0.203**
#36	8. Large gullies, diversions, and low flowing streams	0.30	60.00	20,005.00	1.64	3.388
#36	**Muskingum K:**					**3.388**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	30.89	5.19	36.1	6,848	3.20	2.38
#28	1,217.900	1,217.900	503.94	63.61	3,353.7	53,603	0.44	0.31
#26	2,486.400	2,486.400	129.71	39.61	252.2	6,132	2.13	1.63
#24	8,061.800	8,061.800	187.84	116.49	438.7	4,231	0.75	0.49
#25	1,015.700	9,077.500	192.60	142.05	565.2	13,913	3.62	0.76
#27	1,783.700	13,347.600	390.94	227.10	1,814.3	26,321	11.54	2.57
#29	966.000	15,531.500	811.81	340.27	8,464.1	64,471	7.33	2.05
#32	293.700	16,301.600	841.49	364.08	9,178.5	57,790	4.40	1.40
#31	957.100	957.100	468.62	57.72	2,405.5	38,963	0.70	0.54
#33	0.000	17,258.700	933.80	421.80	11,584.0	49,667	3.18	1.28
#34	1,020.000	18,278.700	961.80	452.03	11,315.2	44,295	1.67	0.69
#5	2,023.000	2,023.000	759.22	88.30	2,575.9	39,084	4.33	2.35
#6	1,743.200	3,766.200	937.84	170.00	4,873.0	34,451	0.20	0.12
#7	2,395.300	6,161.500	1,511.91	317.58	12,625.5	43,159	0.00	0.00
#8	0.000	6,161.500	1,511.91	317.58	12,625.5	43,159	0.00	0.00
#10	1,053.200	7,214.700	1,570.05	372.35	12,524.8	39,453	0.12	0.07
#1	2,411.100	2,411.100	539.70	85.33	2,707.2	34,591	5.44	3.63
#2	1,497.000	3,908.100	639.70	170.84	3,692.2	22,950	0.17	0.12
#3	862.700	4,770.800	796.58	212.60	4,101.8	17,905	0.05	0.04
#4	0.000	4,770.800	796.58	212.60	4,101.8	17,905	0.05	0.04
#9	445.600	5,216.400	819.55	228.88	4,230.5	17,092	0.62	0.49
#11	0.000	12,431.100	2,170.49	601.23	16,755.3	32,567	0.37	0.23
#21	1,100.460	13,531.560	2,229.67	648.87	17,196.2	31,736	0.77	0.47
#35	160.400	160.400	80.69	10.15	104.4	10,453	0.00	0.00
#15	1,992.700	1,992.700	573.85	88.69	3,170.2	42,664	2.31	1.40
#12	3,494.500	3,494.500	342.58	71.01	983.8	14,979	6.87	4.65
#13	2,720.700	6,215.200	652.52	126.55	2,108.3	17,849	9.04	6.17
#14	5,096.800	11,312.000	855.51	331.51	7,120.7	78,733	2.33	0.46
#16	1,022.000	14,326.700	1,207.11	482.85	12,177.5	48,723	1.88	0.71
#23	0.000	14,487.100	1,221.18	493.00	12,281.9	47,445	1.81	0.69
#18	848.500	848.500	254.46	39.93	510.1	14,524	0.14	0.09
#17	182.200	182.200	150.01	11.54	157.1	14,384	0.80	0.55
#19	0.000	1,030.700	355.05	51.47	667.3	13,576	0.27	0.19
#20	271.100	15,788.900	1,283.67	557.58	13,082.3	40,910	1.50	0.63
#22	0.000	29,320.460	3,353.12	1,206.45	30,278.5	32,934	0.98	0.54
#36	1,584.680	49,183.840	4,226.44	1,693.05	42,067.8	32,600	1.10	0.62
#37	2,292.810	51,476.650	4,149.05	1,750.73	41,307.5	31,893	0.53	0.30

Particle Size Distribution(s) at Each Structure

Structure #30:

Size (mm)	In/Out
2.0000	100.000%
0.1000	87.139%
0.0500	49.379%
0.0020	31.951%
0.0010	0.000%

Structure #28:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.707%
0.0010	0.000%

Structure #26:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	67.267%
0.0020	43.526%
0.0010	0.000%

Structure #24:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	90.057%
0.0020	63.480%

Size (mm)	In/Out
0.0010	0.000%

Structure #25:

Size (mm)	In/Out
2.0000	100.000%
0.1000	82.821%
0.0500	73.204%
0.0020	60.225%
0.0010	0.000%

Structure #27:

Size (mm)	In/Out
2.0000	100.000%
0.1000	73.827%
0.0500	51.501%
0.0020	37.330%
0.0010	0.000%

Structure #29:

Size (mm)	In/Out
2.0000	100.000%
0.1000	94.436%
0.0500	89.651%
0.0020	80.945%
0.0010	0.000%

Structure #32:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.096%
0.0500	94.578%
0.0020	85.330%
0.0010	0.000%

Structure #31:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	94.937%
0.0010	0.000%

Structure #33 (Inlet to North Fork Diversion):

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.284%
0.0500	95.704%
0.0020	87.325%
0.0010	0.000%

Structure #34 (End of North Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.853%
0.0500	98.205%
0.0020	91.648%
0.0010	0.000%

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	96.991%
0.0500	89.266%
0.0020	82.245%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.356%

Size (mm)	In/Out
0.0010	0.000%

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #8:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #10:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.690%
0.0020	99.533%
0.0010	0.000%

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	92.734%
0.0500	82.507%
0.0020	77.639%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.854%
0.0010	0.000%

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.165%
0.0010	0.000%

Structure #4:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.165%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.753%
0.0500	95.830%
0.0020	94.943%
0.0010	0.000%

Structure #11:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.433%
0.0500	98.715%
0.0020	98.374%

Size (mm)	In/Out
0.0010	0.000%

Structure #21 (End of South Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.391%
0.0500	97.183%
0.0020	96.685%
0.0010	0.000%

Structure #35:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #15:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	94.848%
0.0020	91.226%
0.0010	0.000%

Structure #12:

Size (mm)	In/Out
2.0000	100.000%
0.1000	79.629%
0.0500	50.680%
0.0020	32.793%
0.0010	0.000%

Structure #13:

Size (mm)	In/Out
2.0000	100.000%
0.1000	72.181%
0.0500	43.496%
0.0020	28.144%
0.0010	0.000%

Structure #14:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.707%
0.0020	92.016%
0.0010	0.000%

Structure #16:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.539%
0.0020	90.959%
0.0010	0.000%

Structure #23:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.551%
0.0020	91.036%
0.0010	0.000%

Structure #18:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.364%

Size (mm)	In/Out
0.0010	0.000%

Structure #17:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	84.471%
0.0010	0.000%

Structure #19:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	94.327%
0.0010	0.000%

Structure #20 (End of Middle Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.661%
0.0020	91.318%
0.0010	0.000%

Structure #22:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.086%
0.0500	97.822%
0.0020	94.366%
0.0010	0.000%

Structure #36:

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.871%
0.0500	97.672%
0.0020	93.378%
0.0010	0.000%

Structure #37:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.734%
0.0500	99.455%
0.0020	95.959%
0.0010	0.000%

Structure Detail:

Structure #30 (Null)

Structure #28 (Null)

Structure #26 (Null)

Structure #24 (Null)

Structure #25 (Null)

Structure #27 (Null)

Structure #29 (Null)

Structure #32 (Null)

Structure #31 (Null)

Structure #33 (Null)

Inlet to North Fork Diversion

Structure #34 (Null)

End of North Fork

Structure #5 (Null)

Structure #6 (Null)

Structure #7 (Null)

Structure #8 (Null)

Structure #10 (Null)

Structure #1 (Null)

Structure #2 (Null)

Structure #3 (Null)

Structure #4 (Null)

Structure #9 (Null)

Structure #11 (Null)

Structure #21 (Null)

End of South Fork

Structure #35 (Null)

Structure #15 (Null)

Structure #12 (Null)

Structure #13 (Null)

Structure #14 (Null)

Structure #16 (Null)

Structure #23 (Null)

Structure #18 (Null)

Structure #17 (Null)

Structure #19 (Null)

Structure #20 (Null)

End of Middle Fork

Structure #22 (Null)

Structure #36 (Null)

Structure #37 (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)
#30	1	476.400	1.131	0.000	0.000	73.100	M	30.89	5.192
	Σ	**476.400**						**30.89**	**5.192**
#28	1	772.300	0.657	0.523	0.334	90.400	M	424.73	40.330
	2	445.600	0.587	0.000	0.000	90.400	M	262.61	23.280
	Σ	**1,217.900**						**503.94**	**63.609**
#26	1	447.600	2.192	0.000	0.000	74.200	M	21.78	5.544
	2	2,038.800	3.000	0.000	0.000	77.000	M	109.45	34.068
	Σ	**2,486.400**						**129.71**	**39.611**
#24	1	2,607.500	5.367	2.377	0.305	75.200	M	73.98	36.082
	2	2,331.900	4.813	2.431	0.304	74.700	M	68.12	30.546
	3	1,758.500	2.231	1.788	0.297	76.200	M	107.12	27.069
	4	1,363.900	2.618	0.000	0.000	77.000	M	80.91	22.789
	Σ	**8,061.800**						**187.84**	**116.486**
#25	1	515.200	0.990	0.342	0.357	78.200	M	69.57	9.699
	2	130.500	0.787	0.342	0.357	78.100	M	20.21	2.433
	3	370.000	0.516	0.000	0.000	85.700	M	158.89	13.436
	Σ	**9,077.500**						**192.60**	**142.054**
#27	1	354.400	0.612	1.233	0.337	83.100	M	108.10	10.383
	2	305.200	0.529	1.054	0.328	84.000	M	110.92	9.647
	3	289.800	0.692	0.551	0.328	75.500	M	35.41	4.146
	4	253.000	0.361	0.551	0.328	79.400	M	72.85	5.356
	5	581.300	0.980	0.000	0.000	82.300	M	121.16	15.897
	Σ	**13,347.600**						**390.94**	**227.095**
#29	1	508.800	0.409	0.416	0.312	89.500	M	339.58	24.884
	2	233.200	0.521	0.291	0.312	91.600	M	162.15	13.329
	3	224.000	0.467	0.000	0.000	90.000	M	145.43	11.352
	Σ	**15,531.500**						**811.81**	**340.269**
#32	1	293.700	0.576	0.000	0.000	93.000	M	215.21	18.618
	Σ	**16,301.600**						**841.49**	**364.079**
#31	1	431.100	0.588	0.450	0.336	91.500	M	277.55	24.455
	2	325.800	0.432	0.149	0.327	93.000	M	276.96	20.677
	3	200.200	0.373	0.000	0.000	92.900	M	179.64	12.591
	Σ	**957.100**						**468.62**	**57.723**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#33	**∑**	**17,258.700**						**933.80**	**421.802**
#34	1	251.500	0.423	1.019	0.292	90.500	M	178.74	13.260
	2	219.100	0.611	0.267	0.322	80.000	M	48.94	4.890
	3	246.200	0.688	0.466	0.293	80.000	M	51.11	5.493
	4	303.200	0.370	0.000	0.000	79.700	M	88.88	6.589
	∑	**18,278.700**						**961.80**	**452.034**
#5	1	503.600	0.618	0.000	0.000	87.600	M	228.36	21.212
	2	406.500	0.388	0.501	0.350	84.800	M	188.61	13.719
	3	439.600	0.342	0.681	0.347	87.800	M	277.69	18.903
	4	162.600	0.280	0.681	0.347	86.000	M	96.25	6.067
	5	294.100	0.375	1.021	0.348	92.000	M	246.80	17.294
	6	216.600	0.272	1.018	0.348	90.100	M	178.36	11.109
	∑	**2,023.000**						**759.22**	**88.303**
#6	1	149.100	0.331	0.000	0.000	92.600	M	137.19	9.208
	2	245.000	0.529	0.192	0.328	88.100	M	126.84	10.740
	3	276.200	0.450	0.461	0.319	89.500	M	175.59	13.471
	4	158.400	0.380	1.385	0.185	93.000	M	142.04	10.031
	5	206.200	0.402	0.796	0.320	89.400	M	137.65	10.007
	6	414.000	0.430	1.066	0.323	87.200	M	222.61	16.947
	7	294.300	0.535	1.066	0.323	86.400	M	131.38	11.292
	∑	**3,766.200**						**937.84**	**169.999**
#7	1	731.700	1.274	0.000	0.000	93.000	M	318.74	46.311
	2	445.800	1.043	0.000	0.000	93.000	M	223.68	28.206
	3	270.800	0.804	0.000	0.000	93.000	M	161.64	17.139
	4	78.900	0.267	1.035	0.328	93.000	M	80.17	5.022
	5	154.900	0.310	1.071	0.326	93.000	M	150.00	9.847
	6	101.400	0.288	1.164	0.328	92.900	M	100.00	6.395
	7	117.700	0.298	1.344	0.329	92.200	M	109.34	7.047
	8	494.100	0.518	1.344	0.329	91.300	M	336.62	27.615
	∑	**6,161.500**						**1,511.91**	**317.580**
#8	1	0.000	0.000	0.000	0.000	1.000	0.00	0.000	
	∑	**6,161.500**						**1,511.91**	**317.580**
#10	1	355.500	1.286	0.000	0.000	93.000	M	153.80	22.495
	2	307.100	1.282	0.668	0.305	83.200	M	57.78	9.064
	3	147.300	1.245	0.517	0.303	90.600	M	53.83	7.798
	4	126.400	0.585	0.517	0.303	93.000	M	91.80	8.015
	5	116.900	1.179	0.621	0.305	93.000	M	53.85	7.399
	∑	**7,214.700**						**1,570.05**	**372.352**

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	557.400	0.941	0.000	0.000	83.600	M	134.99	17.020
	2	169.600	1.616	0.677	0.333	93.000	M	61.86	10.732
	3	636.400	1.842	0.729	0.333	81.000	M	74.17	15.527
	4	223.400	0.846	1.005	0.336	84.100	M	60.69	7.114
	5	77.700	0.330	1.392	0.341	81.400	M	28.79	1.974
	6	746.600	0.678	1.392	0.341	88.200	M	336.35	32.961
	Σ	**2,411.100**						**539.70**	**85.329**
#2	1	257.000	0.423	0.000	0.000	93.000	M	220.56	16.323
	2	180.500	0.562	0.478	0.281	91.800	M	122.18	10.460
	3	200.700	0.687	0.574	0.283	93.000	M	132.40	12.709
	4	438.600	0.811	0.574	0.283	93.000	M	260.34	27.767
	5	420.200	1.247	0.801	0.293	88.000	M	123.48	18.251
	Σ	**3,908.100**						**639.70**	**170.840**
#3	1	172.600	0.443	0.000	0.000	93.000	M	145.01	10.936
	2	311.200	0.890	0.000	0.000	88.900	M	124.77	14.489
	3	378.900	0.632	0.209	0.314	87.900	M	173.80	16.333
	Σ	**4,770.800**						**796.58**	**212.599**
#4	**Σ**	**4,770.800**						**796.58**	**212.599**
#9	1	445.600	0.987	0.000	0.000	85.800	M	127.52	16.283
	Σ	**5,216.400**						**819.55**	**228.881**
#11	**Σ**	**12,431.100**						**2,170.49**	**601.233**
#21	1	292.400	0.819	0.000	0.000	86.900	M	104.45	11.663
	2	230.540	0.388	0.694	0.266	89.200	M	153.97	10.993
	3	181.120	0.289	0.878	0.256	91.300	M	159.50	10.140
	4	396.400	0.939	0.878	0.256	86.100	M	120.52	14.838
	Σ	**13,531.560**						**2,229.67**	**648.867**
#35	1	160.400	1.039	0.000	0.000	93.000	M	80.69	10.150
	Σ	**160.400**						**80.69**	**10.150**
#15	1	437.400	0.803	0.000	0.000	91.300	M	227.94	24.401
	2	549.000	0.637	0.654	0.327	91.300	M	331.35	30.643
	3	1,006.300	1.023	0.768	0.331	84.700	M	254.66	33.649
	Σ	**1,992.700**						**573.85**	**88.693**
#12	1	517.800	0.791	0.000	0.000	81.900	M	119.27	13.677
	2	229.000	0.571	0.043	0.418	80.100	M	53.86	5.160
	3	592.700	0.706	0.044	0.417	81.500	M	140.95	15.122
	4	1,806.900	1.542	0.487	0.362	76.700	M	151.04	29.284
	5	348.100	0.618	0.487	0.362	80.000	77.20	7.765	

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	∑	**3,494.500**						**342.58**	**71.008**
#13	1	411.600	0.725	0.000	0.000	79.700	M	80.11	8.935
	2	636.400	0.774	0.322	0.336	80.700	M	131.90	15.131
	3	319.000	0.575	0.685	0.318	85.500	M	126.20	11.395
	4	231.700	0.314	0.923	0.328	80.400	M	79.79	5.380
	5	1,122.000	1.308	0.923	0.328	74.700	M	82.11	14.702
	∑	**6,215.200**						**652.52**	**126.551**
#14	1	405.900	0.384	0.000	0.000	90.800	M	308.41	21.828
	2	411.100	0.452	0.707	0.308	90.700	M	287.06	21.949
	3	787.400	0.658	0.975	0.307	91.400	M	469.71	44.317
	4	144.200	0.341	1.716	0.310	86.200	M	79.84	5.469
	5	343.800	0.289	1.970	0.312	86.500	M	208.84	13.327
	6	392.800	0.806	2.107	0.316	81.900	M	89.44	10.376
	7	528.200	0.518	2.544	0.316	87.200	M	257.06	21.597
	8	890.900	1.253	2.544	0.316	83.500	M	175.26	26.974
	9	741.400	1.076	3.047	0.316	84.800	M	182.87	24.995
	10	451.100	0.916	3.354	0.316	83.900	M	114.32	14.126
	∑	**11,312.000**						**855.51**	**331.509**
#16	1	475.100	1.721	0.000	0.000	92.400	M	157.45	28.756
	2	348.400	0.542	0.951	0.283	92.500	M	254.12	21.257
	3	198.500	0.266	1.384	0.278	93.000	M	201.91	12.635
	∑	**14,326.700**						**1,207.11**	**482.850**
#23	**∑**	**14,487.100**						**1,221.18**	**493.000**
#18	1	301.700	0.652	0.000	0.000	93.000	M	205.51	19.122
	2	546.800	0.768	0.561	0.320	86.300	M	193.28	20.806
	∑	**848.500**						**254.46**	**39.928**
#17	1	182.200	0.462	0.000	0.000	93.000	M	150.01	11.545
	∑	**182.200**						**150.01**	**11.545**
#19	**∑**	**1,030.700**						**355.05**	**51.472**
#20	1	271.100	0.978	0.000	0.000	89.400	M	106.40	13.110
	∑	**15,788.900**						**1,283.67**	**557.582**
#22	**∑**	**29,320.460**						**3,353.12**	**1,206.449**
#36	1	283.020	0.468	1.457	0.305	77.100	M	53.81	4.786
	2	301.840	0.632	1.051	0.286	90.100	M	165.82	15.392
	3	223.850	0.703	1.051	0.286	74.300	M	22.98	2.806
	4	262.400	0.419	0.835	0.229	78.000	M	59.12	4.863

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	222.760	0.421	0.475	0.224	74.500	M	32.36	2.865
	6	290.810	0.526	0.000	0.000	74.800	M	38.41	3.860
	Σ	**49,183.840**						**4,226.44**	**1,693.054**
#37	1	744.000	1.756	0.000	0.000	84.800	M	128.48	25.072
	2	303.330	0.416	1.859	0.242	87.800	M	174.61	13.024
	3	223.850	0.703	1.179	0.270	74.300	M	22.98	2.806
	4	262.400	0.419	0.835	0.229	78.000	M	59.12	4.863
	5	222.760	0.421	0.475	0.224	74.500	M	32.36	2.865
	6	290.810	0.526	0.000	0.000	74.800	M	38.41	3.860
	7	245.660	0.561	1.487	0.252	79.400	M	54.26	5.187
	Σ	**51,476.650**						**4,149.05**	**1,750.730**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#30	1	0.095	200.00	3.80	0.3720	1.0000	2	36.1	6,848	3.20	2.38
	Σ							**36.1**	**6,848**	**3.20**	**2.38**
#28	1	0.187	100.00	10.10	0.3750	1.0000	3	2,537.1	63,668	0.25	0.17
	2	0.196	100.00	10.20	0.3930	1.0000	3	1,587.2	69,899	1.20	0.84
	Σ							**3,353.7**	**53,603**	**0.44**	**0.31**
#26	1	0.155	400.00	1.40	0.3480	1.0000	2	23.8	4,165	1.60	1.21
	2	0.155	300.00	2.40	0.3340	1.0000	2	228.4	6,522	2.25	1.69
	Σ							**252.2**	**6,132**	**2.13**	**1.63**
#24	1	0.128	300.00	2.30	0.3360	1.0000	2	151.5	4,123	0.86	0.65
	2	0.136	300.00	2.70	0.3440	1.0000	2	165.6	5,304	1.23	0.93
	3	0.107	300.00	2.30	0.3330	1.0000	2	131.4	4,733	1.85	1.39
	4	0.163	400.00	1.60	0.3210	1.0000	2	118.8	5,079	1.87	1.41
	Σ							**438.7**	**4,231**	**0.75**	**0.49**
#25	1	0.125	400.00	1.90	0.3440	1.0000	2	64.5	6,703	3.43	2.50
	2	0.124	300.00	2.60	0.3280	1.0000	2	17.1	7,171	3.83	2.75
	3	0.122	175.00	4.90	0.2660	1.0000	2	205.3	16,296	9.75	6.69
	Σ							**565.2**	**13,913**	**3.62**	**0.76**
#27	1	0.127	175.00	5.90	0.3160	1.0000	2	211.4	20,868	12.04	8.58
	2	0.122	150.00	7.50	0.2920	1.0000	2	212.7	22,773	13.46	9.52
	3	0.070	125.00	8.40	0.3270	1.0000	2	47.1	11,600	6.17	4.43

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.097	125.00	9.60	0.3170	1.0000	2	134.3	26,781	16.09	10.99
	5	0.126	125.00	8.90	0.3290	1.0000	2	395.4	25,212	13.42	9.65
	Σ							**1,814.3**	**26,321**	**11.54**	**2.57**
#29	1	0.190	125.00	9.80	0.3930	1.0000	3	1,881.8	77,632	3.72	2.60
	2	0.203	125.00	8.90	0.3940	1.0000	3	812.9	62,510	2.30	1.62
	3	0.193	125.00	8.40	0.3940	1.0000	3	606.8	55,957	2.16	1.49
	Σ							**8,464.1**	**64,471**	**7.33**	**2.05**
#32	1	0.210	150.00	7.70	0.3990	1.0000	3	1,074.9	59,290	2.07	1.45
	Σ							**9,178.5**	**57,790**	**4.40**	**1.40**
#31	1	0.204	125.00	8.70	0.3620	1.0000	3	1,375.0	57,378	1.36	0.96
	2	0.210	150.00	7.30	0.3990	1.0000	3	1,246.5	62,208	3.78	2.64
	3	0.210	175.00	4.50	0.3980	1.0000	3	504.3	42,105	2.98	2.05
	Σ							**2,405.5**	**38,963**	**0.70**	**0.54**
#33	**Σ**							**11,584.0**	**49,667**	**3.18**	**1.28**
#34	1	0.193	200.00	3.84	0.2460	1.0000	3	220.9	17,143	0.86	0.61
	2	0.214	200.00	3.66	0.3150	1.0000	1	83.2	17,720	10.49	7.36
	3	0.214	300.00	2.54	0.3150	1.0000	1	73.5	13,754	8.02	5.71
	4	0.242	200.00	3.50	0.3150	1.0000	1	148.9	24,937	15.55	10.28
	Σ							**11,315.2**	**44,295**	**1.67**	**0.69**
#5	1	0.149	75.00	12.50	0.3230	1.0000	3	971.1	47,419	0.00	0.00
	2	0.133	75.00	15.80	0.3190	1.0000	2	811.8	62,098	38.05	26.14
	3	0.103	100.00	11.00	0.2030	1.0000	3	439.5	24,540	1.33	0.92
	4	0.093	75.00	13.80	0.2130	1.0000	2	138.7	24,353	15.34	10.51
	5	0.123	100.00	11.00	0.1370	1.0000	3	316.3	18,929	1.25	0.89
	6	0.149	75.00	14.70	0.1990	1.0000	3	445.6	41,387	3.25	2.29
	Σ							**2,575.9**	**39,084**	**4.33**	**2.35**
#6	1	0.208	175.00	4.30	0.3980	1.0000	3	344.6	39,498	3.05	2.10
	2	0.183	175.00	5.40	0.3910	1.0000	3	386.1	37,504	0.58	0.40
	3	0.188	150.00	7.60	0.3900	1.0000	3	691.6	53,090	2.09	1.46
	4	0.210	150.00	6.30	0.3990	1.0000	3	497.4	49,017	3.42	2.51
	5	0.185	125.00	8.10	0.3860	1.0000	3	484.7	49,832	2.44	1.71
	6	0.104	100.00	11.30	0.2240	1.0000	3	423.0	25,849	0.82	0.58
	7	0.164	100.00	11.20	0.3740	1.0000	3	653.0	58,720	0.31	0.22
	Σ							**4,873.0**	**34,451**	**0.20**	**0.12**
#7	1	0.208	150.00	7.80	0.3780	1.0000	3	2,121.4	45,599	0.00	0.00
	2	0.209	100.00	10.20	0.3940	1.0000	3	1,729.1	61,032	0.00	0.00
	3	0.210	150.00	6.70	0.3990	1.0000	3	765.7	45,290	0.00	0.00

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.210	100.00	11.50	0.3990	1.0000	3	444.6	88,428	8.02	5.74
	5	0.210	150.00	7.10	0.3990	1.0000	3	567.8	58,355	4.83	3.44
	6	0.209	150.00	7.90	0.3990	1.0000	3	391.9	61,848	5.35	3.82
	7	0.206	75.00	15.50	0.3990	1.0000	3	778.4	108,944	8.91	6.41
	8	0.202	75.00	14.50	0.3980	1.0000	3	2,828.6	101,302	3.62	2.60
	Σ							**12,625.5**	**43,159**	**0.00**	**0.00**
#8	1	0.000	0.00	0.00	0.0000	1.0000	0	0.0	1	0.00	0.00
	Σ							**12,625.5**	**43,159**	**0.00**	**0.00**
#10	1	0.190	300.00	2.70	0.1930	1.0000	3	172.5	7,751	0.00	0.00
	2	0.153	200.00	3.50	0.3610	1.0000	2	101.5	11,181	5.67	4.16
	3	0.189	200.00	3.70	0.3190	1.0000	3	103.0	13,257	0.00	0.00
	4	0.190	300.00	2.10	0.1940	1.0000	3	58.1	7,508	0.25	0.18
	5	0.201	300.00	2.00	0.3030	1.0000	3	65.3	8,886	0.00	0.00
	Σ							**12,524.8**	**39,453**	**0.12**	**0.07**
#1	1	0.157	150.00	6.80	0.3830	1.0000	2	501.8	29,917	16.21	11.63
	2	0.210	150.00	6.60	0.3990	1.0000	3	339.2	31,285	0.00	0.00
	3	0.149	200.00	3.90	0.3870	1.0000	2	182.1	11,553	5.17	3.85
	4	0.169	175.00	4.70	0.3950	1.0000	2	166.0	23,610	13.07	9.43
	5	0.157	100.00	10.10	0.3940	1.0000	2	91.3	47,747	29.24	20.52
	6	0.175	75.00	12.60	0.2840	1.0000	3	1,610.8	49,221	0.00	0.00
	Σ							**2,707.2**	**34,591**	**5.44**	**3.63**
#2	1	0.190	150.00	7.90	0.1930	1.0000	3	453.6	29,264	1.83	1.26
	2	0.184	175.00	4.80	0.2010	1.0000	3	172.3	17,027	0.52	0.37
	3	0.202	200.00	3.90	0.3220	1.0000	3	253.9	20,410	0.32	0.23
	4	0.203	150.00	7.40	0.3220	1.0000	3	1,124.0	40,767	0.00	0.00
	5	0.181	175.00	5.10	0.3710	1.0000	3	455.3	24,864	0.00	0.00
	Σ							**3,692.2**	**22,950**	**0.17**	**0.12**
#3	1	0.190	175.00	5.20	0.1930	1.0000	3	207.9	20,078	1.18	0.82
	2	0.177	175.00	4.20	0.2560	1.0000	3	226.1	15,982	0.00	0.00
	3	0.166	175.00	4.30	0.2290	1.0000	3	249.7	15,930	0.00	0.00
	Σ							**4,101.8**	**17,905**	**0.05**	**0.04**
#4	**Σ**							**4,101.8**	**17,905**	**0.05**	**0.04**
#9	1	0.212	175.00	4.17	0.2490	1.0000	2	282.8	17,673	9.65	6.94
	Σ							**4,230.5**	**17,092**	**0.62**	**0.49**
#11	**Σ**							**16,755.3**	**32,567**	**0.37**	**0.23**
#21	1	0.206	175.00	4.44	0.2760	1.0000	2	239.6	21,111	11.98	8.52

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	2	0.241	175.00	5.81	0.3130	1.0000	1	492.8	46,077	29.71	20.94
	3	0.185	300.00	2.70	0.2180	1.0000	3	123.7	12,551	1.00	0.71
	4	0.220	200.00	2.66	0.2980	1.0000	1	186.2	12,653	7.35	5.34
	Σ							**17,196.2**	**31,736**	**0.77**	**0.47**
#35	1	0.194	200.00	3.42	0.2330	1.0000	3	104.4	10,453	0.00	0.00
	Σ							**104.4**	**10,453**	**0.00**	**0.00**
#15	1	0.201	125.00	8.20	0.3960	1.0000	3	1,207.0	50,092	0.00	0.00
	2	0.161	100.00	11.40	0.3060	1.0000	3	1,578.7	52,259	0.70	0.50
	3	0.118	100.00	10.20	0.2850	1.0000	2	838.0	24,987	13.44	9.77
	Σ							**3,170.2**	**42,664**	**2.31**	**1.40**
#12	1	0.124	150.00	6.30	0.3070	1.0000	2	243.8	18,353	10.10	7.17
	2	0.132	200.00	3.60	0.3500	1.0000	2	61.0	12,522	7.14	4.94
	3	0.136	175.00	5.00	0.3330	1.0000	2	292.1	20,029	11.19	7.88
	4	0.188	200.00	3.40	0.3570	1.0000	2	396.4	13,294	5.96	4.45
	5	0.228	175.00	4.10	0.3640	1.0000	2	218.2	28,979	16.34	11.54
	Σ							**983.8**	**14,979**	**6.87**	**4.65**
#13	1	0.128	150.00	6.90	0.3390	1.0000	2	191.1	22,097	12.13	8.57
	2	0.130	175.00	5.70	0.3300	1.0000	2	301.9	20,384	11.16	7.98
	3	0.191	175.00	6.00	0.2890	1.0000	2	339.4	30,713	18.13	12.80
	4	0.122	175.00	5.10	0.3460	1.0000	2	112.8	22,191	13.59	9.38
	5	0.137	175.00	4.20	0.3530	1.0000	2	192.5	12,866	5.90	4.40
	Σ							**2,108.3**	**17,849**	**9.04**	**6.17**
#14	1	0.196	100.00	10.20	0.3980	1.0000	3	1,697.6	81,141	4.79	3.29
	2	0.193	150.00	6.70	0.4020	1.0000	3	1,122.7	52,409	2.37	1.67
	3	0.169	75.00	13.80	0.3240	1.0000	3	2,842.1	64,277	0.66	0.47
	4	0.114	100.00	11.00	0.2980	1.0000	3	177.4	33,008	1.55	1.11
	5	0.078	100.00	10.10	0.1830	1.0000	3	186.4	14,274	0.86	0.61
	6	0.084	150.00	7.10	0.2700	1.0000	2	118.7	11,524	6.33	4.60
	7	0.087	100.00	10.00	0.1840	1.0000	3	294.1	13,740	0.18	0.13
	8	0.126	150.00	6.70	0.2740	1.0000	2	425.5	15,628	7.99	5.90
	9	0.117	150.00	7.30	0.2600	1.0000	2	399.4	15,866	8.46	6.23
	10	0.115	125.00	8.50	0.2610	1.0000	2	241.2	16,973	9.26	6.81
	Σ							**7,120.7**	**78,733**	**2.33**	**0.46**
#16	1	0.201	300.00	2.78	0.3030	1.0000	3	342.1	11,907	0.00	0.00
	2	0.204	150.00	6.00	0.3630	1.0000	3	885.0	42,217	1.60	1.15
	3	0.210	150.00	6.10	0.3990	1.0000	3	666.4	52,593	4.78	3.46
	Σ							**12,177.5**	**48,723**	**1.88**	**0.71**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#23	Σ							**12,281.9**	**47,445**	**1.81**	**0.69**
#18	1	0.193	300.00	2.80	0.2200	1.0000	3	221.6	12,047	0.26	0.18
	2	0.173	175.00	4.70	0.3880	1.0000	3	582.5	28,492	0.00	0.00
	Σ							**510.1**	**14,524**	**0.14**	**0.09**
#17	1	0.196	300.00	2.60	0.2600	1.0000	3	157.1	14,384	0.80	0.55
	Σ							**157.1**	**14,384**	**0.80**	**0.55**
#19	Σ							**667.3**	**13,576**	**0.27**	**0.19**
#20	1	0.192	200.00	3.19	0.2430	1.0000	3	136.1	10,607	0.00	0.00
	Σ							**13,082.3**	**40,910**	**1.50**	**0.63**
#22	Σ							**30,278.5**	**32,934**	**0.98**	**0.54**
#36	1	0.172	200.00	3.14	0.1950	1.0000	2	37.4	8,033	4.61	3.29
	2	0.195	150.00	6.18	0.1680	1.0000	3	264.7	17,556	0.12	0.08
	3	0.166	150.00	7.47	0.1830	1.0000	3	37.5	13,463	0.00	0.00
	4	0.187	175.00	5.07	0.1810	1.0000	1	71.9	15,298	9.34	6.60
	5	0.173	175.00	4.89	0.1800	1.0000	1	33.9	12,362	7.37	5.17
	6	0.177	175.00	5.15	0.1840	1.0000	1	48.5	13,310	7.74	5.35
	Σ							**42,067.8**	**32,600**	**1.10**	**0.62**
#37	1	0.172	200.00	3.14	0.1950	1.0000	2	154.1	6,132	2.91	2.14
	2	0.195	150.00	6.18	0.1680	1.0000	3	247.6	19,118	0.72	0.53
	3	0.166	150.00	7.47	0.1830	1.0000	3	37.5	13,418	0.00	0.00
	4	0.187	175.00	5.07	0.1810	1.0000	1	71.9	15,298	9.34	6.60
	5	0.173	175.00	4.89	0.1800	1.0000	2	33.9	12,362	7.04	4.94
	6	0.177	175.00	5.15	0.1840	1.0000	1	48.5	13,310	7.74	5.35
	7	0.175	175.00	4.90	0.2080	1.0000	2	74.1	14,484	8.24	5.95
	Σ							**41,307.5**	**31,893**	**0.53**	**0.30**

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	3.65	50.00	1,369.00	1.910	0.199
		8. Large gullies, diversions, and low flowing streams	1.57	157.00	10,030.00	3.750	0.742
#1	**1**	**Time of Concentration:**					**0.941**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	6.63	70.00	1,056.00	2.570	0.114

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	1.98	150.00	7,573.00	1.400	1.502
#1	**2**	**Time of Concentration:**					**1.616**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	1.65	117.00	7,070.00	1.280	1.534
		8. Large gullies, diversions, and low flowing streams	2.43	126.00	5,188.00	4.670	0.308
#1	**3**	**Time of Concentration:**					**1.842**
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.77	260.00	4,506.00	2.400	0.521
		8. Large gullies, diversions, and low flowing streams	2.84	168.00	5,924.00	5.050	0.325
#1	**4**	**Time of Concentration:**					**0.846**
#1	5	5. Nearly bare and untilled, and alluvial valley fans	19.93	180.00	903.00	4.460	0.056
		8. Large gullies, diversions, and low flowing streams	3.30	178.00	5,393.00	5.450	0.274
#1	**5**	**Time of Concentration:**					**0.330**
#1	6	5. Nearly bare and untilled, and alluvial valley fans	13.43	105.00	782.00	3.660	0.059
		8. Large gullies, diversions, and low flowing streams	2.62	283.00	10,822.00	4.850	0.619
#1	**6**	**Time of Concentration:**					**0.678**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.84	70.00	1,024.00	2.610	0.108
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,325.00	3.810	0.315
#2	**1**	**Time of Concentration:**					**0.423**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	5.56	45.00	810.00	2.350	0.095
		8. Large gullies, diversions, and low flowing streams	0.86	40.00	4,663.00	2.770	0.467
#2	**2**	**Time of Concentration:**					**0.562**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	5.89	50.00	849.00	2.420	0.097
		8. Large gullies, diversions, and low flowing streams	1.17	80.00	6,862.00	3.230	0.590
#2	**3**	**Time of Concentration:**					**0.687**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	12.63	95.00	752.00	3.550	0.058
		8. Large gullies, diversions, and low flowing streams	1.40	135.00	9,630.00	3.550	0.753
#2	**4**	**Time of Concentration:**					**0.811**
#2	5	5. Nearly bare and untilled, and alluvial valley fans	11.02	70.00	635.00	3.320	0.053
		8. Large gullies, diversions, and low flowing streams	0.46	40.00	8,732.00	2.030	1.194
#2	**5**	**Time of Concentration:**					**1.247**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	10.00	805.00	1.110	0.201
		8. Large gullies, diversions, and low flowing streams	1.33	40.00	3,017.00	3.450	0.242
#3	**1**	**Time of Concentration:**					**0.443**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.68	10.00	1,478.00	0.820	0.500
		8. Large gullies, diversions, and low flowing streams	1.78	100.00	5,622.00	4.000	0.390
#3	**2**	**Time of Concentration:**					**0.890**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	4.66	70.00	1,501.00	2.150	0.193
		8. Large gullies, diversions, and low flowing streams	1.17	60.00	5,126.00	3.240	0.439
#3	**3**	**Time of Concentration:**					**0.632**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	19.06	285.00	1,495.00	4.360	0.095
		8. Large gullies, diversions, and low flowing streams	2.64	242.00	9,174.00	4.870	0.523
#5	**1**	**Time of Concentration:**					**0.618**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	14.27	105.00	736.00	3.770	0.054
		8. Large gullies, diversions, and low flowing streams	4.08	297.00	7,279.00	6.050	0.334
#5	**2**	**Time of Concentration:**					**0.388**
#5	3	5. Nearly bare and untilled, and alluvial valley fans	8.27	35.00	423.00	2.870	0.040
		8. Large gullies, diversions, and low flowing streams	3.44	208.00	6,049.00	5.560	0.302
#5	**3**	**Time of Concentration:**					**0.342**
#5	4	5. Nearly bare and untilled, and alluvial valley fans	14.58	85.00	583.00	3.810	0.042
		8. Large gullies, diversions, and low flowing streams	4.53	248.00	5,473.00	6.380	0.238
#5	**4**	**Time of Concentration:**					**0.280**
#5	5	5. Nearly bare and untilled, and alluvial valley fans	5.07	70.00	1,382.00	2.250	0.170
		8. Large gullies, diversions, and low flowing streams	3.89	170.00	4,375.00	5.910	0.205
#5	**5**	**Time of Concentration:**					**0.375**
#5	6	5. Nearly bare and untilled, and alluvial valley fans	12.48	90.00	721.00	3.530	0.056
		8. Large gullies, diversions, and low flowing streams	5.16	274.00	5,308.02	6.810	0.216
#5	**6**	**Time of Concentration:**					**0.272**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	5.36	75.00	1,399.00	2.310	0.168
		8. Large gullies, diversions, and low flowing streams	2.41	66.00	2,742.00	4.650	0.163

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	**1**	**Time of Concentration:**					**0.331**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.39	80.00	2,359.00	1.840	0.356
		8. Large gullies, diversions, and low flowing streams	2.63	80.00	3,039.00	4.860	0.173
#6	**2**	**Time of Concentration:**					**0.529**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	4.60	34.00	739.00	2.140	0.095
		8. Large gullies, diversions, and low flowing streams	2.33	136.00	5,845.00	4.570	0.355
#6	**3**	**Time of Concentration:**					**0.450**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	6.06	85.00	1,402.00	2.460	0.158
		8. Large gullies, diversions, and low flowing streams	2.52	96.00	3,810.00	4.760	0.222
#6	**4**	**Time of Concentration:**					**0.380**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	7.24	70.00	967.00	2.690	0.099
		8. Large gullies, diversions, and low flowing streams	2.34	117.00	5,003.00	4.580	0.303
#6	**5**	**Time of Concentration:**					**0.402**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	31.83	183.00	575.00	5.640	0.028
		8. Large gullies, diversions, and low flowing streams	3.38	270.00	7,990.00	5.510	0.402
#6	**6**	**Time of Concentration:**					**0.430**
#6	7	5. Nearly bare and untilled, and alluvial valley fans	23.08	325.00	1,408.00	4.800	0.081
		8. Large gullies, diversions, and low flowing streams	2.88	240.00	8,327.00	5.090	0.454
#6	**7**	**Time of Concentration:**					**0.535**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	11.42	90.00	788.00	3.370	0.064
		8. Large gullies, diversions, and low flowing streams	1.46	230.00	15,769.00	3.620	1.210
#7	**1**	**Time of Concentration:**					**1.274**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	10.97	60.00	547.00	3.310	0.045
		8. Large gullies, diversions, and low flowing streams	1.61	220.00	13,660.00	3.800	0.998
#7	**2**	**Time of Concentration:**					**1.043**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	938.00	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.72	171.00	9,931.00	3.930	0.701
#7	**3**	**Time of Concentration:**					**0.804**
#7	4	5. Nearly bare and untilled, and alluvial valley fans	19.23	80.00	416.00	4.380	0.026

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.45	100.00	4,083.00	4.690	0.241
#7	**4**	**Time of Concentration:**					**0.267**
#7	5	5. Nearly bare and untilled, and alluvial valley fans	6.09	67.00	1,101.00	2.460	0.124
		8. Large gullies, diversions, and low flowing streams	2.51	80.00	3,184.00	4.750	0.186
#7	**5**	**Time of Concentration:**					**0.310**
#7	6	5. Nearly bare and untilled, and alluvial valley fans	5.93	63.00	1,062.00	2.430	0.121
		8. Large gullies, diversions, and low flowing streams	2.74	82.00	2,993.00	4.960	0.167
#7	**6**	**Time of Concentration:**					**0.288**
#7	7	5. Nearly bare and untilled, and alluvial valley fans	7.97	65.00	816.00	2.820	0.080
		8. Large gullies, diversions, and low flowing streams	3.48	153.00	4,400.00	5.590	0.218
#7	**7**	**Time of Concentration:**					**0.298**
#7	8	5. Nearly bare and untilled, and alluvial valley fans	6.60	50.00	758.00	2.560	0.082
		8. Large gullies, diversions, and low flowing streams	4.66	473.00	10,157.00	6.470	0.436
#7	**8**	**Time of Concentration:**					**0.518**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	3.01	55.00	1,829.00	1.730	0.293
		8. Large gullies, diversions, and low flowing streams	0.76	50.00	6,548.00	2.620	0.694
#9	**1**	**Time of Concentration:**					**0.987**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	41.00	3,317.00	1.110	0.830
		8. Large gullies, diversions, and low flowing streams	0.70	29.00	4,125.00	2.510	0.456
#10	**1**	**Time of Concentration:**					**1.286**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	2.25	125.00	5,554.00	1.500	1.028
		8. Large gullies, diversions, and low flowing streams	2.13	85.00	3,997.00	4.370	0.254
#10	**2**	**Time of Concentration:**					**1.282**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.39	68.00	4,904.00	1.170	1.164
		8. Large gullies, diversions, and low flowing streams	4.73	90.00	1,904.00	6.520	0.081
#10	**3**	**Time of Concentration:**					**1.245**
#10	4	5. Nearly bare and untilled, and alluvial valley fans	3.76	51.00	1,357.00	1.930	0.195
		8. Large gullies, diversions, and low flowing streams	0.65	22.00	3,385.00	2.410	0.390
#10	**4**	**Time of Concentration:**					**0.585**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	5	5. Nearly bare and untilled, and alluvial valley fans	1.63	88.00	5,391.16	1.270	1.179
#10	**5**	**Time of Concentration:**					**1.179**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	4.50	75.00	1,667.00	2.120	0.218
		8. Large gullies, diversions, and low flowing streams	1.85	155.00	8,400.00	4.070	0.573
#12	**1**	**Time of Concentration:**					**0.791**
#12	2	5. Nearly bare and untilled, and alluvial valley fans	2.99	50.00	1,674.03	1.720	0.270
		8. Large gullies, diversions, and low flowing streams	1.67	70.00	4,201.17	3.870	0.301
#12	**2**	**Time of Concentration:**					**0.571**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	4.04	57.00	1,411.00	2.000	0.195
		8. Large gullies, diversions, and low flowing streams	1.55	107.00	6,884.00	3.740	0.511
#12	**3**	**Time of Concentration:**					**0.706**
#12	4	5. Nearly bare and untilled, and alluvial valley fans	2.23	84.00	3,771.04	1.490	0.703
		8. Large gullies, diversions, and low flowing streams	1.62	186.00	11,515.60	3.810	0.839
#12	**4**	**Time of Concentration:**					**1.542**
#12	5	5. Nearly bare and untilled, and alluvial valley fans	3.68	53.00	1,442.00	1.910	0.209
		8. Large gullies, diversions, and low flowing streams	1.95	120.00	6,155.00	4.180	0.409
#12	**5**	**Time of Concentration:**					**0.618**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	4.62	62.00	1,342.00	2.140	0.174
		8. Large gullies, diversions, and low flowing streams	1.91	157.00	8,225.00	4.140	0.551
#13	**1**	**Time of Concentration:**					**0.725**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	2.91	50.00	1,717.00	1.700	0.280
		8. Large gullies, diversions, and low flowing streams	2.28	183.00	8,039.00	4.520	0.494
#13	**2**	**Time of Concentration:**					**0.774**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	6.18	95.00	1,537.00	2.480	0.172
		8. Large gullies, diversions, and low flowing streams	2.13	135.00	6,347.00	4.370	0.403
#13	**3**	**Time of Concentration:**					**0.575**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.17	10.00	315.00	1.780	0.049
		8. Large gullies, diversions, and low flowing streams	2.30	100.00	4,344.00	4.550	0.265
#13	**4**	**Time of Concentration:**					**0.314**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	5	5. Nearly bare and untilled, and alluvial valley fans	3.10	70.00	2,255.00	1.760	0.355
		8. Large gullies, diversions, and low flowing streams	1.23	140.00	11,392.00	3.320	0.953
#13	**5**	**Time of Concentration:**					**1.308**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	10.59	63.00	595.00	3.250	0.050
		8. Large gullies, diversions, and low flowing streams	2.60	151.00	5,808.00	4.830	0.334
#14	**1**	**Time of Concentration:**					**0.384**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	7.28	67.00	920.00	2.690	0.095
		8. Large gullies, diversions, and low flowing streams	2.17	123.00	5,670.00	4.410	0.357
#14	**2**	**Time of Concentration:**					**0.452**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	21.46	150.00	699.00	4.630	0.041
		8. Large gullies, diversions, and low flowing streams	3.10	364.00	11,728.00	5.280	0.617
#14	**3**	**Time of Concentration:**					**0.658**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	3.39	35.00	1,032.00	1.840	0.155
		8. Large gullies, diversions, and low flowing streams	2.97	103.00	3,470.00	5.160	0.186
#14	**4**	**Time of Concentration:**					**0.341**
#14	5	5. Nearly bare and untilled, and alluvial valley fans	28.15	125.00	444.00	5.300	0.023
		8. Large gullies, diversions, and low flowing streams	4.18	246.00	5,886.00	6.130	0.266
#14	**5**	**Time of Concentration:**					**0.289**
#14	6	5. Nearly bare and untilled, and alluvial valley fans	3.18	40.00	1,257.00	1.780	0.196
		8. Large gullies, diversions, and low flowing streams	2.29	228.00	9,963.00	4.530	0.610
#14	**6**	**Time of Concentration:**					**0.806**
#14	7	5. Nearly bare and untilled, and alluvial valley fans	16.72	100.00	598.00	4.080	0.040
		8. Large gullies, diversions, and low flowing streams	2.81	243.00	8,649.00	5.020	0.478
#14	**7**	**Time of Concentration:**					**0.518**
#14	8	5. Nearly bare and untilled, and alluvial valley fans	1.70	47.00	2,765.00	1.300	0.590
		8. Large gullies, diversions, and low flowing streams	2.44	274.00	11,208.00	4.690	0.663
#14	**8**	**Time of Concentration:**					**1.253**
#14	9	5. Nearly bare and untilled, and alluvial valley fans	2.87	105.00	3,657.00	1.690	0.601
		8. Large gullies, diversions, and low flowing streams	2.43	194.00	7,991.00	4.670	0.475

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	**9**	**Time of Concentration:**					**1.076**
#14	10	5. Nearly bare and untilled, and alluvial valley fans	2.75	80.00	2,907.00	1.650	0.489
		8. Large gullies, diversions, and low flowing streams	2.41	172.00	7,149.00	4.650	0.427
#14	**10**	**Time of Concentration:**					**0.916**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	12.80	54.00	422.00	3.570	0.032
		8. Large gullies, diversions, and low flowing streams	1.68	181.00	10,781.00	3.880	0.771
#15	**1**	**Time of Concentration:**					**0.803**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	44.22	260.00	588.00	6.640	0.024
		8. Large gullies, diversions, and low flowing streams	2.45	254.00	10,354.24	4.690	0.613
#15	**2**	**Time of Concentration:**					**0.637**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	10.04	85.00	847.00	3.160	0.074
		8. Large gullies, diversions, and low flowing streams	2.34	366.00	15,663.00	4.580	0.949
#15	**3**	**Time of Concentration:**					**1.023**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	2.26	117.00	5,179.00	1.500	0.959
		8. Large gullies, diversions, and low flowing streams	0.46	26.00	5,601.00	2.040	0.762
#16	**1**	**Time of Concentration:**					**1.721**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	8.70	62.00	713.00	2.940	0.067
		8. Large gullies, diversions, and low flowing streams	1.99	144.00	7,241.00	4.230	0.475
#16	**2**	**Time of Concentration:**					**0.542**
#16	3	5. Nearly bare and untilled, and alluvial valley fans	6.88	32.00	465.00	2.620	0.049
		8. Large gullies, diversions, and low flowing streams	2.29	81.00	3,543.00	4.530	0.217
#16	**3**	**Time of Concentration:**					**0.266**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	9.37	65.00	694.00	3.060	0.062
		8. Large gullies, diversions, and low flowing streams	1.19	56.00	4,712.00	3.270	0.400
#17	**1**	**Time of Concentration:**					**0.462**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	9.00	60.00	667.00	2.990	0.061
		8. Large gullies, diversions, and low flowing streams	0.97	61.00	6,287.00	2.950	0.591
#18	**1**	**Time of Concentration:**					**0.652**
#18	2	5. Nearly bare and untilled, and alluvial valley fans	2.47	33.00	1,336.00	1.570	0.236

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.01	164.00	8,154.00	4.250	0.532
#18	**2**	**Time of Concentration:**					**0.768**
#20	1	5. Nearly bare and untilled, and alluvial valley fans	2.64	47.00	1,783.00	1.620	0.305
		8. Large gullies, diversions, and low flowing streams	0.56	30.00	5,405.00	2.230	0.673
#20	**1**	**Time of Concentration:**					**0.978**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	4.09	60.00	1,467.02	2.020	0.201
		8. Large gullies, diversions, and low flowing streams	0.93	60.00	6,433.62	2.890	0.618
#21	**1**	**Time of Concentration:**					**0.819**
#21	2	5. Nearly bare and untilled, and alluvial valley fans	3.50	50.00	1,430.00	1.860	0.213
		8. Large gullies, diversions, and low flowing streams	2.15	60.00	2,785.12	4.400	0.175
#21	**2**	**Time of Concentration:**					**0.388**
#21	3	5. Nearly bare and untilled, and alluvial valley fans	1.70	15.00	881.00	1.300	0.188
		9. Small streams flowing bankfull	1.49	60.00	4,014.18	11.000	0.101
#21	**3**	**Time of Concentration:**					**0.289**
#21	4	5. Nearly bare and untilled, and alluvial valley fans	2.21	40.00	1,811.02	1.480	0.339
		8. Large gullies, diversions, and low flowing streams	0.84	50.00	5,949.54	2.750	0.600
#21	**4**	**Time of Concentration:**					**0.939**
#24	1	5. Nearly bare and untilled, and alluvial valley fans	1.71	430.00	25,118.00	1.300	5.367
#24	**1**	**Time of Concentration:**					**5.367**
#24	2	5. Nearly bare and untilled, and alluvial valley fans	1.84	430.00	23,393.00	1.350	4.813
#24	**2**	**Time of Concentration:**					**4.813**
#24	3	5. Nearly bare and untilled, and alluvial valley fans	1.82	155.00	8,498.00	1.350	1.748
		8. Large gullies, diversions, and low flowing streams	0.84	40.00	4,771.00	2.740	0.483
#24	**3**	**Time of Concentration:**					**2.231**
#24	4	5. Nearly bare and untilled, and alluvial valley fans	1.24	50.00	4,042.00	1.110	1.011
		8. Large gullies, diversions, and low flowing streams	0.49	60.00	12,150.00	2.100	1.607
#24	**4**	**Time of Concentration:**					**2.618**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	0.51	10.00	1,950.00	0.710	0.762
		8. Large gullies, diversions, and low flowing streams	1.81	60.00	3,322.00	4.030	0.228
#25	**1**	**Time of Concentration:**					**0.990**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#25	2	5. Nearly bare and untilled, and alluvial valley fans	1.11	25.00	2,254.00	1.050	0.596
		8. Large gullies, diversions, and low flowing streams	2.36	75.00	3,178.00	4.600	0.191
#25	**2**	**Time of Concentration:**					**0.787**
#25	3	5. Nearly bare and untilled, and alluvial valley fans	3.23	30.00	929.00	1.790	0.144
		8. Large gullies, diversions, and low flowing streams	2.45	154.00	6,297.00	4.690	0.372
#25	**3**	**Time of Concentration:**					**0.516**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	1.20	103.00	8,602.00	1.090	2.192
#26	**1**	**Time of Concentration:**					**2.192**
#26	2	5. Nearly bare and untilled, and alluvial valley fans	1.23	120.00	9,780.00	1.100	2.469
		8. Large gullies, diversions, and low flowing streams	2.18	184.00	8,454.00	4.420	0.531
#26	**2**	**Time of Concentration:**					**3.000**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.32	50.00	1,158.02	2.070	0.155
		8. Large gullies, diversions, and low flowing streams	2.53	198.00	7,838.16	4.760	0.457
#27	**1**	**Time of Concentration:**					**0.612**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	5.26	30.00	570.00	2.290	0.069
		8. Large gullies, diversions, and low flowing streams	3.15	278.00	8,822.00	5.320	0.460
#27	**2**	**Time of Concentration:**					**0.529**
#27	3	5. Nearly bare and untilled, and alluvial valley fans	16.33	80.00	490.00	4.040	0.033
		8. Large gullies, diversions, and low flowing streams	2.15	225.00	10,443.00	4.400	0.659
#27	**3**	**Time of Concentration:**					**0.692**
#27	4	5. Nearly bare and untilled, and alluvial valley fans	12.43	65.00	523.00	3.520	0.041
		8. Large gullies, diversions, and low flowing streams	3.49	225.00	6,454.00	5.600	0.320
#27	**4**	**Time of Concentration:**					**0.361**
#27	5	5. Nearly bare and untilled, and alluvial valley fans	9.40	25.00	266.00	3.060	0.024
		8. Large gullies, diversions, and low flowing streams	2.32	364.00	15,700.00	4.560	0.956
#27	**5**	**Time of Concentration:**					**0.980**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	40.00	762.00	2.290	0.092
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**1**	**Time of Concentration:**					**0.657**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	2	5. Nearly bare and untilled, and alluvial valley fans	25.86	105.00	406.00	5.080	0.022
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**2**	**Time of Concentration:**					**0.587**
#29	1	5. Nearly bare and untilled, and alluvial valley fans	11.58	30.00	259.00	3.400	0.021
		8. Large gullies, diversions, and low flowing streams	3.61	288.00	7,976.00	5.700	0.388
#29	**1**	**Time of Concentration:**					**0.409**
#29	2	5. Nearly bare and untilled, and alluvial valley fans	8.06	40.00	496.00	2.830	0.048
		8. Large gullies, diversions, and low flowing streams	2.90	252.00	8,693.55	5.100	0.473
#29	**2**	**Time of Concentration:**					**0.521**
#29	3	5. Nearly bare and untilled, and alluvial valley fans	7.25	25.00	345.00	2.690	0.035
		8. Large gullies, diversions, and low flowing streams	2.26	158.00	7,001.00	4.500	0.432
#29	**3**	**Time of Concentration:**					**0.467**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	35.00	710.00	2.220	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	243.00	14,540.00	3.870	1.043
#30	**1**	**Time of Concentration:**					**1.131**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.91	15.00	515.00	1.700	0.084
		8. Large gullies, diversions, and low flowing streams	2.74	247.00	9,006.00	4.960	0.504
#31	**1**	**Time of Concentration:**					**0.588**
#31	2	5. Nearly bare and untilled, and alluvial valley fans	7.46	25.00	335.00	2.730	0.034
		8. Large gullies, diversions, and low flowing streams	2.18	138.00	6,335.00	4.420	0.398
#31	**2**	**Time of Concentration:**					**0.432**
#31	3	5. Nearly bare and untilled, and alluvial valley fans	3.84	20.00	521.00	1.950	0.074
		8. Large gullies, diversions, and low flowing streams	2.24	108.00	4,826.00	4.480	0.299
#31	**3**	**Time of Concentration:**					**0.373**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	22.00	632.00	1.860	0.094
		8. Large gullies, diversions, and low flowing streams	1.56	101.00	6,494.00	3.740	0.482
#32	**1**	**Time of Concentration:**					**0.576**
#34	1	5. Nearly bare and untilled, and alluvial valley fans	2.28	35.00	1,538.00	1.500	0.284
		8. Large gullies, diversions, and low flowing streams	2.89	74.00	2,560.00	5.100	0.139

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#34	**1**	**Time of Concentration:**					**0.423**
#34	2	5. Nearly bare and untilled, and alluvial valley fans	2.69	38.00	1,415.00	1.630	0.241
		8. Large gullies, diversions, and low flowing streams	1.60	81.00	5,052.00	3.790	0.370
#34	**2**	**Time of Concentration:**					**0.611**
#34	3	5. Nearly bare and untilled, and alluvial valley fans	3.80	56.00	1,474.00	1.940	0.211
		8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,293.00	2.500	0.477
#34	**3**	**Time of Concentration:**					**0.688**
#34	4	5. Nearly bare and untilled, and alluvial valley fans	4.17	35.00	840.00	2.040	0.114
		8. Large gullies, diversions, and low flowing streams	1.89	72.00	3,807.00	4.120	0.256
#34	**4**	**Time of Concentration:**					**0.370**
#35	1	5. Nearly bare and untilled, and alluvial valley fans	2.34	113.00	4,831.12	1.520	0.882
		8. Large gullies, diversions, and low flowing streams	1.11	20.00	1,794.00	3.160	0.157
#35	**1**	**Time of Concentration:**					**1.039**
#36	1	5. Nearly bare and untilled, and alluvial valley fans	3.35	20.00	596.46	1.830	0.090
		8. Large gullies, diversions, and low flowing streams	1.29	60.00	4,641.80	3.410	0.378
#36	**1**	**Time of Concentration:**					**0.468**
#36	2	5. Nearly bare and untilled, and alluvial valley fans	3.33	40.00	1,200.57	1.820	0.183
		8. Large gullies, diversions, and low flowing streams	1.51	90.00	5,956.33	3.680	0.449
#36	**2**	**Time of Concentration:**					**0.632**
#36	3	5. Nearly bare and untilled, and alluvial valley fans	3.77	77.00	2,043.74	1.940	0.292
		8. Large gullies, diversions, and low flowing streams	1.12	53.00	4,712.61	3.180	0.411
#36	**3**	**Time of Concentration:**					**0.703**
#36	4	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	937.44	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.76	80.00	4,538.27	3.980	0.316
#36	**4**	**Time of Concentration:**					**0.419**
#36	5	5. Nearly bare and untilled, and alluvial valley fans	1.68	10.00	596.48	1.290	0.128
		8. Large gullies, diversions, and low flowing streams	2.50	125.00	5,007.21	4.740	0.293
#36	**5**	**Time of Concentration:**					**0.421**
#36	6	5. Nearly bare and untilled, and alluvial valley fans	1.57	10.00	638.43	1.250	0.141

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.06	123.00	5,966.63	4.300	0.385
#36	**6**	**Time of Concentration:**					**0.526**
#37	1	5. Nearly bare and untilled, and alluvial valley fans	4.68	129.00	2,754.05	2.160	0.354
		8. Large gullies, diversions, and low flowing streams	0.16	10.00	6,108.73	1.210	1.402
#37	**1**	**Time of Concentration:**					**1.756**
#37	2	5. Nearly bare and untilled, and alluvial valley fans	5.17	45.00	870.00	2.270	0.106
		8. Large gullies, diversions, and low flowing streams	2.01	95.00	4,737.20	4.240	0.310
#37	**2**	**Time of Concentration:**					**0.416**
#37	3	5. Nearly bare and untilled, and alluvial valley fans	3.52	30.00	852.93	1.870	0.126
		8. Large gullies, diversions, and low flowing streams	4.02	180.00	4,473.94	6.010	0.206
#37	**3**	**Time of Concentration:**					**0.703**
#37	4	5. Nearly bare and untilled, and alluvial valley fans	3.18	35.00	1,099.00	1.780	0.171
		8. Large gullies, diversions, and low flowing streams	1.49	38.00	2,544.00	3.660	0.193
#37	**4**	**Time of Concentration:**					**0.419**
#37	5	5. Nearly bare and untilled, and alluvial valley fans	2.59	40.00	1,542.81	1.610	0.266
		8. Large gullies, diversions, and low flowing streams	1.48	67.00	4,528.71	3.640	0.345
#37	**5**	**Time of Concentration:**					**0.421**
#37	6	5. Nearly bare and untilled, and alluvial valley fans	1.55	10.00	646.96	1.240	0.144
		8. Large gullies, diversions, and low flowing streams	6.34	157.00	2,475.12	7.550	0.091
#37	**6**	**Time of Concentration:**					**0.526**
#37	7	5. Nearly bare and untilled, and alluvial valley fans	7.23	80.00	1,106.00	2.680	0.114
		8. Large gullies, diversions, and low flowing streams	1.05	52.00	4,950.00	3.070	0.447
#37	**7**	**Time of Concentration:**					**0.561**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	1.29	107.00	8,294.00	3.400	0.677
#1	**2**	**Muskingum K:**					**0.677**
#1	3	8. Large gullies, diversions, and low flowing streams	1.27	113.00	8,880.00	3.380	0.729

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**3**	**Muskingum K:**					**0.729**
#1	4	8. Large gullies, diversions, and low flowing streams	1.35	171.00	12,634.00	3.490	1.005
#1	**4**	**Muskingum K:**					**1.005**
#1	5	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**5**	**Muskingum K:**					**1.392**
#1	6	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**6**	**Muskingum K:**					**1.392**
#2	2	8. Large gullies, diversions, and low flowing streams	0.53	20.00	3,756.00	2.180	0.478
#2	**2**	**Muskingum K:**					**0.478**
#2	3	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**3**	**Muskingum K:**					**0.574**
#2	4	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**4**	**Muskingum K:**					**0.574**
#2	5	8. Large gullies, diversions, and low flowing streams	0.65	45.00	6,955.00	2.410	0.801
#2	**5**	**Muskingum K:**					**0.801**
#3	3	8. Large gullies, diversions, and low flowing streams	0.92	20.00	2,168.00	2.880	0.209
#3	**3**	**Muskingum K:**					**0.209**
#5	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#5	**1**	**Muskingum K:**					**0.000**
#5	2	8. Large gullies, diversions, and low flowing streams	1.75	125.00	7,149.00	3.960	0.501
#5	**2**	**Muskingum K:**					**0.501**
#5	3	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**3**	**Muskingum K:**					**0.681**
#5	4	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**4**	**Muskingum K:**					**0.681**
#5	5	8. Large gullies, diversions, and low flowing streams	1.67	239.00	14,273.00	3.880	1.021
#5	**5**	**Muskingum K:**					**1.021**
#5	6	8. Large gullies, diversions, and low flowing streams	1.68	239.00	14,223.00	3.880	1.018
#5	**6**	**Muskingum K:**					**1.018**
#7	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**1**	**Muskingum K:**					**0.000**
#7	2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	**2**	**Muskingum K:**					**0.000**
#7	4	8. Large gullies, diversions, and low flowing streams	1.16	140.00	12,037.00	3.230	1.035
#7	**4**	**Muskingum K:**					**1.035**
#7	5	8. Large gullies, diversions, and low flowing streams	1.14	140.00	12,307.69	3.190	1.071
#7	**5**	**Muskingum K:**					**1.071**
#7	6	8. Large gullies, diversions, and low flowing streams	1.17	158.00	13,546.00	3.230	1.164
#7	**6**	**Muskingum K:**					**1.164**
#7	7	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**7**	**Muskingum K:**					**1.344**
#7	8	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**8**	**Muskingum K:**					**1.344**
#10	3	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**3**	**Muskingum K:**					**0.517**
#10	4	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**4**	**Muskingum K:**					**0.517**
#10	5	8. Large gullies, diversions, and low flowing streams	0.79	47.00	5,956.00	2.660	0.621
#10	**5**	**Muskingum K:**					**0.621**
#12	2	8. Large gullies, diversions, and low flowing streams	8.24	111.00	1,347.00	8.610	0.043
#12	**2**	**Muskingum K:**					**0.043**
#12	3	8. Large gullies, diversions, and low flowing streams	8.01	109.00	1,360.00	8.490	0.044
#12	**3**	**Muskingum K:**					**0.044**
#12	4	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**4**	**Muskingum K:**					**0.487**
#12	5	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**5**	**Muskingum K:**					**0.487**
#13	2	8. Large gullies, diversions, and low flowing streams	1.34	54.00	4,025.00	3.470	0.322
#13	**2**	**Muskingum K:**					**0.322**
#13	3	8. Large gullies, diversions, and low flowing streams	0.98	72.00	7,333.00	2.970	0.685
#13	**3**	**Muskingum K:**					**0.685**
#13	4	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**4**	**Muskingum K:**					**0.923**
#13	5	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	**5**	**Muskingum K:**					**0.923**
#14	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#14	**1**	**Muskingum K:**					**0.000**
#14	2	8. Large gullies, diversions, and low flowing streams	0.83	58.00	6,957.00	2.730	0.707
#14	**2**	**Muskingum K:**					**0.707**
#14	3	8. Large gullies, diversions, and low flowing streams	0.81	77.00	9,480.00	2.700	0.975
#14	**3**	**Muskingum K:**					**0.975**
#14	4	8. Large gullies, diversions, and low flowing streams	0.86	147.00	17,117.00	2.770	1.716
#14	**4**	**Muskingum K:**					**1.716**
#14	5	8. Large gullies, diversions, and low flowing streams	0.88	175.00	19,934.00	2.810	1.970
#14	**5**	**Muskingum K:**					**1.970**
#14	6	8. Large gullies, diversions, and low flowing streams	0.95	211.00	22,155.00	2.920	2.107
#14	**6**	**Muskingum K:**					**2.107**
#14	7	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**7**	**Muskingum K:**					**2.544**
#14	8	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**8**	**Muskingum K:**					**2.544**
#14	9	8. Large gullies, diversions, and low flowing streams	0.95	307.00	32,146.59	2.930	3.047
#14	**9**	**Muskingum K:**					**3.047**
#14	10	8. Large gullies, diversions, and low flowing streams	0.96	339.00	35,382.00	2.930	3.354
#14	**10**	**Muskingum K:**					**3.354**
#15	2	8. Large gullies, diversions, and low flowing streams	1.14	86.00	7,535.26	3.200	0.654
#15	**2**	**Muskingum K:**					**0.654**
#15	3	8. Large gullies, diversions, and low flowing streams	1.25	115.00	9,236.00	3.340	0.768
#15	**3**	**Muskingum K:**					**0.768**
#16	2	8. Large gullies, diversions, and low flowing streams	0.55	42.00	7,608.00	2.220	0.951
#16	**2**	**Muskingum K:**					**0.951**
#16	3	8. Large gullies, diversions, and low flowing streams	0.51	54.00	10,615.00	2.130	1.384
#16	**3**	**Muskingum K:**					**1.384**
#17	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#17	**1**	**Muskingum K:**					**0.000**
#18	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#18	**1**	**Muskingum K:**					**0.000**
#18	2	8. Large gullies, diversions, and low flowing streams	1.02	62.00	6,103.00	3.020	0.561
#18	**2**	**Muskingum K:**					**0.561**
#21	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#21	**1**	**Muskingum K:**					**0.000**
#21	2	8. Large gullies, diversions, and low flowing streams	0.41	20.00	4,825.09	1.930	0.694
#21	**2**	**Muskingum K:**					**0.694**
#21	3	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,627.46	1.780	0.878
#21	**3**	**Muskingum K:**					**0.878**
#21	4	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,627.46	1.780	0.878
#21	**4**	**Muskingum K:**					**0.878**
#24	1	8. Large gullies, diversions, and low flowing streams	0.79	180.00	22,769.00	2.660	2.377
#24	**1**	**Muskingum K:**					**2.377**
#24	2	8. Large gullies, diversions, and low flowing streams	0.78	180.00	23,111.00	2.640	2.431
#24	**2**	**Muskingum K:**					**2.431**
#24	4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#24	**4**	**Muskingum K:**					**0.000**
#25	1	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**1**	**Muskingum K:**					**0.342**
#25	2	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**2**	**Muskingum K:**					**0.342**
#25	3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#25	**3**	**Muskingum K:**					**0.000**
#27	1	8. Large gullies, diversions, and low flowing streams	1.38	216.00	15,629.00	3.520	1.233
#27	**1**	**Muskingum K:**					**1.233**
#27	2	8. Large gullies, diversions, and low flowing streams	1.17	144.00	12,301.00	3.240	1.054
#27	**2**	**Muskingum K:**					**1.054**
#27	3	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**3**	**Muskingum K:**					**0.551**
#27	4	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**4**	**Muskingum K:**					**0.551**
#28	1	8. Large gullies, diversions, and low flowing streams	1.30	84.00	6,445.17	3.420	0.523

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	**1**	**Muskingum K:**					**0.523**
#29	1	8. Large gullies, diversions, and low flowing streams	0.88	37.00	4,210.00	2.810	0.416
#29	**1**	**Muskingum K:**					**0.416**
#29	2	8. Large gullies, diversions, and low flowing streams	0.88	26.00	2,949.00	2.810	0.291
#29	**2**	**Muskingum K:**					**0.291**
#31	1	8. Large gullies, diversions, and low flowing streams	1.35	76.00	5,639.00	3.480	0.450
#31	**1**	**Muskingum K:**					**0.450**
#31	2	8. Large gullies, diversions, and low flowing streams	1.15	20.00	1,734.00	3.220	0.149
#31	**2**	**Muskingum K:**					**0.149**
#34	1	8. Large gullies, diversions, and low flowing streams	0.64	56.00	8,773.00	2.390	1.019
#34	**1**	**Muskingum K:**					**1.019**
#34	2	8. Large gullies, diversions, and low flowing streams	1.05	31.00	2,957.00	3.070	0.267
#34	**2**	**Muskingum K:**					**0.267**
#34	3	8. Large gullies, diversions, and low flowing streams	0.64	26.00	4,031.00	2.400	0.466
#34	**3**	**Muskingum K:**					**0.466**
#36	1	8. Large gullies, diversions, and low flowing streams	0.79	110.00	13,954.41	2.660	1.457
#36	**1**	**Muskingum K:**					**1.457**
#36	2	8. Large gullies, diversions, and low flowing streams	0.58	50.00	8,630.15	2.280	1.051
#36	**2**	**Muskingum K:**					**1.051**
#36	3	8. Large gullies, diversions, and low flowing streams	0.58	50.00	8,630.15	2.280	1.051
#36	**3**	**Muskingum K:**					**1.051**
#36	4	8. Large gullies, diversions, and low flowing streams	0.23	10.00	4,329.90	1.440	0.835
#36	**4**	**Muskingum K:**					**0.835**
#36	5	8. Large gullies, diversions, and low flowing streams	0.21	5.00	2,359.95	1.380	0.475
#36	**5**	**Muskingum K:**					**0.475**
#37	2	8. Large gullies, diversions, and low flowing streams	0.28	30.00	10,642.07	1.590	1.859
#37	**2**	**Muskingum K:**					**1.859**
#37	3	8. Large gullies, diversions, and low flowing streams	0.45	38.00	8,493.51	2.000	1.179
#37	**3**	**Muskingum K:**					**1.179**
#37	4	8. Large gullies, diversions, and low flowing streams	0.66	104.00	15,664.00	2.440	1.783
#37	**4**	**Muskingum K:**					**0.835**
#37	5	8. Large gullies, diversions, and low flowing streams	0.33	41.00	12,388.68	1.720	2.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#37	**5**	**Muskingum K:**					**0.475**
#37	6	8. Large gullies, diversions, and low flowing streams	0.33	41.00	12,388.68	1.720	2.000
#37	**6**	**Muskingum K:**					**0.000**
#37	7	8. Large gullies, diversions, and low flowing streams	0.33	31.00	9,267.00	1.730	1.487
#37	**7**	**Muskingum K:**					**1.487**

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Cottonwood Arroyo Post-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is shown on Exhibit 11-77.

Revised January 31, 2011

AAY/LR/RY

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

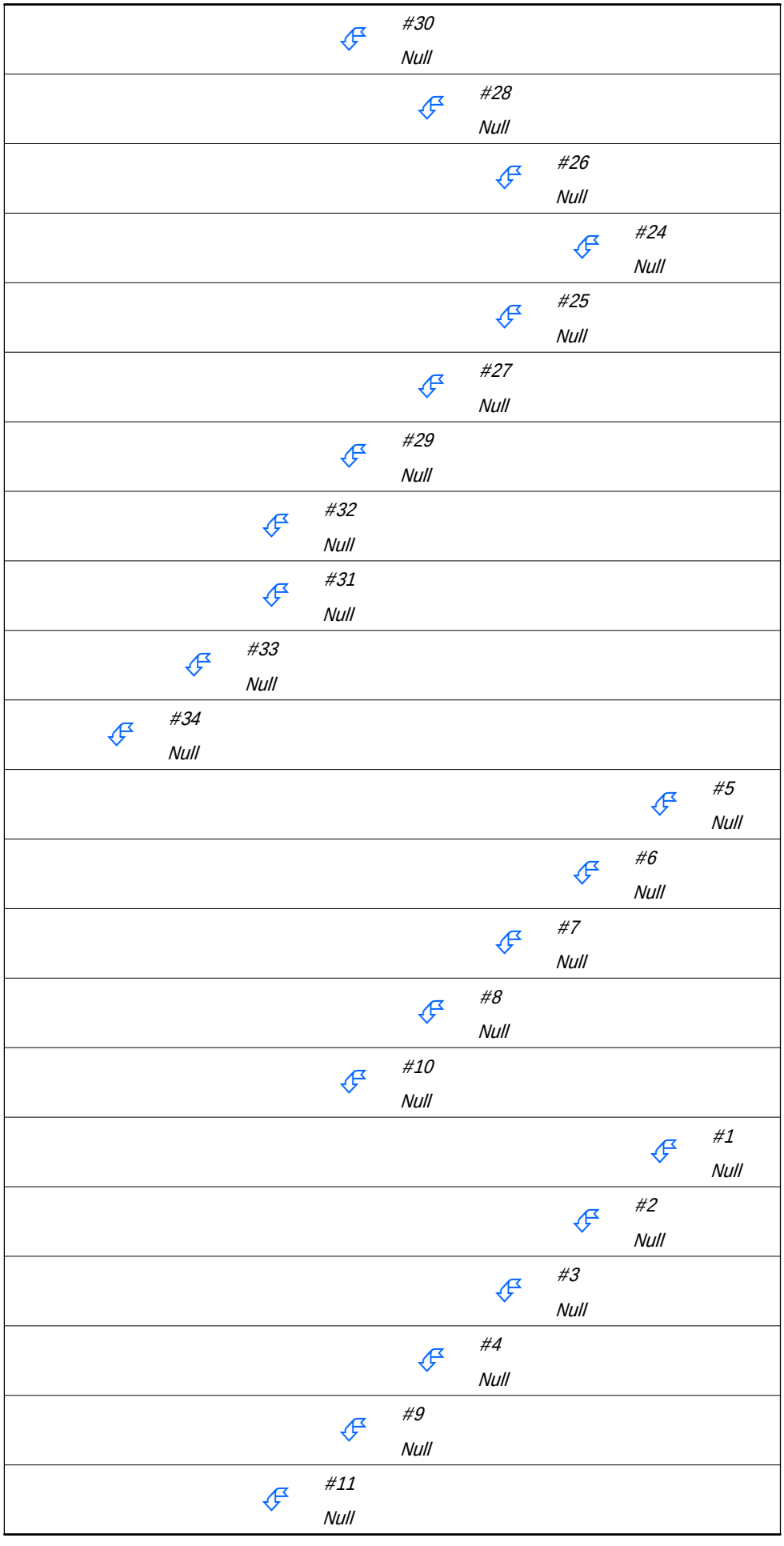
Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.961	0.307	
Null	#2	==>	#3	0.068	0.331	
Null	#3	==>	#4	0.000	0.000	
Null	#4	==>	#9	0.718	0.281	
Null	#5	==>	#6	1.205	0.328	
Null	#6	==>	#7	0.189	0.304	
Null	#7	==>	#8	0.000	0.000	
Null	#8	==>	#10	0.989	0.300	
Null	#9	==>	#11	0.000	0.000	
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#21	0.495	0.453	
Null	#12	==>	#13	0.076	0.330	
Null	#13	==>	#14	3.790	0.314	
Null	#14	==>	#16	1.579	0.287	
Null	#15	==>	#16	1.579	0.287	
Null	#16	==>	#23	0.000	0.000	
Null	#17	==>	#19	0.000	0.000	
Null	#18	==>	#19	0.000	0.000	
Null	#19	==>	#20	0.915	0.252	
Null	#20	==>	#22	0.000	0.000	End of Middle Fork
Null	#21	==>	#22	0.000	0.000	End of South Fork
Null	#22	==>	#36	1.315	0.260	
Null	#23	==>	#20	0.593	0.281	
Null	#24	==>	#25	0.964	0.340	
Null	#25	==>	#27	1.454	0.333	
Null	#26	==>	#27	1.454	0.333	
Null	#27	==>	#29	0.800	0.323	
Null	#28	==>	#29	0.800	0.323	
Null	#29	==>	#32	0.479	0.298	
Null	#30	==>	#32	0.479	0.298	
Null	#31	==>	#33	0.000	0.000	
Null	#32	==>	#33	0.000	0.000	
Null	#33	==>	#34	1.348	0.294	Inlet to North Fork Diversion
Null	#34	==>	#36	0.825	0.261	End of North Fork
Null	#35	==>	#23	0.203	0.259	
Null	#36	==>	#37	3.388	0.246	
Null	#37	==>	End	0.000	0.000	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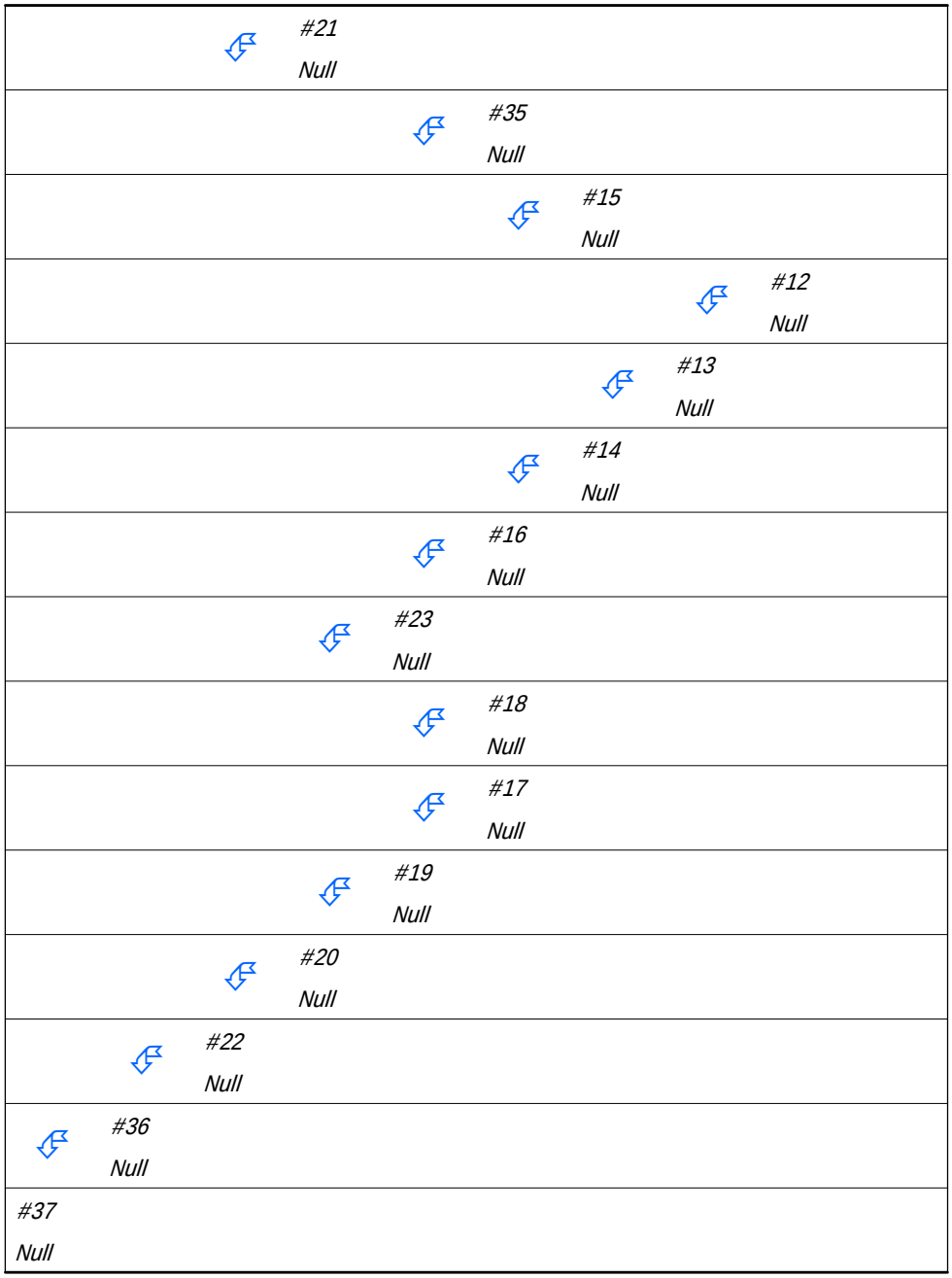

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.81	76.00	9,347.00	2.70	0.961
#1	**Muskingum K:**					**0.961**
#2	8. Large gullies, diversions, and low flowing streams	1.23	10.00	814.00	3.32	0.068
#2	**Muskingum K:**					**0.068**
#3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.53	30.00	5,637.00	2.18	0.718
#4	**Muskingum K:**					**0.718**
#5	8. Large gullies, diversions, and low flowing streams	1.17	165.00	14,065.00	3.24	1.205
#5	**Muskingum K:**					**1.205**
#6	8. Large gullies, diversions, and low flowing streams	0.78	14.00	1,799.25	2.64	0.189
#6	**Muskingum K:**					**0.189**
#8	8. Large gullies, diversions, and low flowing streams	0.72	65.00	9,046.00	2.54	0.989
#8	**Muskingum K:**					**0.989**
#11	8. Large gullies, diversions, and low flowing streams	30.00	8,801.00	29,336.66	16.43	0.495
#11	**Muskingum K:**					**0.495**
#12	8. Large gullies, diversions, and low flowing streams	1.21	11.00	906.00	3.30	0.076
#12	**Muskingum K:**					**0.076**
#13	8. Large gullies, diversions, and low flowing streams	0.92	363.00	39,301.00	2.88	3.790
#13	**Muskingum K:**					**3.790**
#14	8. Large gullies, diversions, and low flowing streams	0.59	77.00	13,075.22	2.30	1.579
#14	**Muskingum K:**					**1.579**
#15	8. Large gullies, diversions, and low flowing streams	0.59	77.00	13,075.00	2.30	1.579
#15	**Muskingum K:**					**1.579**
#16	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#16	**Muskingum K:**					**0.000**
#19	8. Large gullies, diversions, and low flowing streams	0.33	19.00	5,699.00	1.73	0.915
#19	**Muskingum K:**					**0.915**
#22	8. Large gullies, diversions, and low flowing streams	0.38	33.00	8,713.00	1.84	1.315
#22	**Muskingum K:**					**1.315**
#23	8. Large gullies, diversions, and low flowing streams	0.53	25.00	4,680.00	2.19	0.593
#23	**Muskingum K:**					**0.593**
#24	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,568.00	3.62	0.964
#24	**Muskingum K:**					**0.964**
#25	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.00	3.39	1.454
#25	**Muskingum K:**					**1.454**
#26	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.62	3.39	1.454

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#26	**Muskingum K:**					**1.454**
#27	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#27	**Muskingum K:**					**0.800**
#28	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#28	**Muskingum K:**					**0.800**
#29	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#29	**Muskingum K:**					**0.479**
#30	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#30	**Muskingum K:**					**0.479**
#33	8. Large gullies, diversions, and low flowing streams	0.66	77.00	11,748.55	2.42	1.348
#33	**Muskingum K:**					**1.348**
#34	8. Large gullies, diversions, and low flowing streams	0.38	21.00	5,497.38	1.85	0.825
#34	**Muskingum K:**					**0.825**
#35	8. Large gullies, diversions, and low flowing streams	0.37	5.00	1,338.00	1.83	0.203
#35	**Muskingum K:**					**0.203**
#36	8. Large gullies, diversions, and low flowing streams	0.30	60.00	20,005.00	1.64	3.388
#36	**Muskingum K:**					**3.388**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	65.84	10.21	80.6	7,897	3.88	2.84
#28	1,217.900	1,217.900	724.22	90.75	5,014.7	55,579	0.74	0.53
#26	2,486.400	2,486.400	239.85	71.16	491.1	6,676	2.47	1.87
#24	8,061.800	8,061.800	347.67	214.00	875.6	4,680	0.88	0.57
#25	1,015.700	9,077.500	355.36	255.52	1,084.6	14,498	3.70	0.80
#27	1,783.700	13,347.600	632.57	400.49	3,310.4	27,999	12.29	2.66
#29	966.000	15,531.500	1,224.41	562.17	13,267.6	67,394	9.00	2.29
#32	293.700	16,301.600	1,271.84	598.03	14,429.8	60,085	6.29	1.84
#31	957.100	957.100	658.11	80.24	3,502.4	40,447	0.93	0.73
#33	0.000	17,258.700	1,380.10	678.27	17,932.2	51,948	4.61	1.71
#34	1,020.000	18,278.700	1,392.62	725.63	17,342.7	46,245	2.37	0.90
#5	2,023.000	2,023.000	1,134.33	129.85	4,047.1	40,903	5.32	2.95
#6	1,743.200	3,766.200	1,388.71	248.47	7,527.5	36,069	0.30	0.18
#7	2,395.300	6,161.500	2,178.26	452.80	18,760.6	44,925	0.00	0.00
#8	0.000	6,161.500	2,178.26	452.80	18,760.6	44,925	0.00	0.00
#10	1,053.200	7,214.700	2,258.75	530.48	18,793.8	41,539	0.16	0.10
#1	2,411.100	2,411.100	823.47	129.88	4,276.8	35,752	6.14	4.11
#2	1,497.000	3,908.100	957.23	249.69	5,734.6	23,757	0.18	0.13
#3	862.700	4,770.800	1,132.66	309.97	6,206.0	18,918	0.06	0.05
#4	0.000	4,770.800	1,132.66	309.97	6,206.0	18,918	0.06	0.05
#9	445.600	5,216.400	1,170.08	334.75	6,411.8	17,954	0.71	0.56
#11	0.000	12,431.100	3,131.48	865.23	25,205.6	34,177	0.44	0.27
#21	1,100.460	13,531.560	3,214.63	935.41	25,885.2	33,042	0.83	0.51
#35	160.400	160.400	111.85	13.99	150.0	10,899	0.00	0.00
#15	1,992.700	1,992.700	849.14	129.64	4,812.3	44,608	3.06	1.85
#12	3,494.500	3,494.500	584.36	120.82	1,787.9	16,061	7.55	5.09
#13	2,720.700	6,215.200	1,103.87	214.86	3,780.1	18,686	9.62	6.62
#14	5,096.800	11,312.000	1,402.27	519.98	11,403.3	82,900	4.66	0.89
#16	1,022.000	14,326.700	1,744.40	736.45	18,927.4	51,539	3.02	1.09
#23	0.000	14,487.100	1,763.29	750.44	19,077.4	50,202	2.92	1.07
#18	848.500	848.500	380.92	57.77	823.4	16,272	0.19	0.12
#17	182.200	182.200	206.29	15.91	224.8	14,878	0.93	0.64
#19	0.000	1,030.700	494.85	73.68	1,048.2	15,219	0.34	0.23
#20	271.100	15,788.900	1,850.79	843.08	20,328.1	43,387	2.41	0.97
#22	0.000	29,320.460	4,843.52	1,778.49	46,213.3	34,526	1.33	0.73
#36	1,584.680	49,183.840	6,148.59	2,561.11	64,386.1	33,979	1.52	0.83
#37	2,292.810	51,476.650	6,029.39	2,654.33	63,065.5	33,144	0.83	0.44

Particle Size Distribution(s) at Each Structure

Structure #30:

Size (mm)	In/Out
2.0000	100.000%
0.1000	80.843%
0.0500	45.811%
0.0020	29.642%
0.0010	0.000%

Structure #28:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	96.265%
0.0010	0.000%

Structure #26:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	64.010%
0.0020	41.418%
0.0010	0.000%

Structure #24:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	89.673%
0.0020	60.935%

Size (mm)	In/Out
0.0010	0.000%

Structure #25:

Size (mm)	In/Out
2.0000	100.000%
0.1000	84.948%
0.0500	75.885%
0.0020	58.545%
0.0010	0.000%

Structure #27:

Size (mm)	In/Out
2.0000	100.000%
0.1000	73.662%
0.0500	51.933%
0.0020	36.697%
0.0010	0.000%

Structure #29:

Size (mm)	In/Out
2.0000	100.000%
0.1000	93.484%
0.0500	88.062%
0.0020	77.327%
0.0010	0.000%

Structure #32:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.081%
0.0500	91.901%
0.0020	80.656%
0.0010	0.000%

Structure #31:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	93.526%
0.0010	0.000%

Structure #33 (Inlet to North Fork Diversion):

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.651%
0.0500	93.482%
0.0020	83.169%
0.0010	0.000%

Structure #34 (End of North Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.593%
0.0500	97.864%
0.0020	88.223%
0.0010	0.000%

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	95.462%
0.0500	87.728%
0.0020	78.733%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.681%

Size (mm)	In/Out
0.0010	0.000%

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #8:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #10:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.893%
0.0500	99.603%
0.0020	99.426%
0.0010	0.000%

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	91.430%
0.0500	80.755%
0.0020	75.730%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.826%
0.0010	0.000%

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.123%
0.0010	0.000%

Structure #4:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.123%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.401%
0.0500	95.432%
0.0020	94.523%
0.0010	0.000%

Structure #11:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.259%
0.0500	98.542%
0.0020	98.179%

Size (mm)	In/Out
0.0010	0.000%

Structure #21 (End of South Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.281%
0.0500	97.071%
0.0020	96.564%
0.0010	0.000%

Structure #35:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #15:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	93.226%
0.0020	89.143%
0.0010	0.000%

Structure #12:

Size (mm)	In/Out
2.0000	100.000%
0.1000	77.729%
0.0500	48.910%
0.0020	31.647%
0.0010	0.000%

Structure #13:

Size (mm)	In/Out
2.0000	100.000%
0.1000	70.563%
0.0500	42.286%
0.0020	27.361%
0.0010	0.000%

Structure #14:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.406%
0.0020	86.152%
0.0010	0.000%

Structure #16:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.370%
0.0020	86.762%
0.0010	0.000%

Structure #23:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.390%
0.0020	86.866%
0.0010	0.000%

Structure #18:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	96.744%

Size (mm)	In/Out
0.0010	0.000%

Structure #17:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	82.575%
0.0010	0.000%

Structure #19:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	93.706%
0.0010	0.000%

Structure #20 (End of Middle Fork):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.572%
0.0020	87.373%
0.0010	0.000%

Structure #22:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.037%
0.0500	97.292%
0.0020	92.521%
0.0010	0.000%

Structure #36:

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.687%
0.0500	97.098%
0.0020	91.006%
0.0010	0.000%

Structure #37:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.632%
0.0500	99.320%
0.0020	93.833%
0.0010	0.000%

Structure Detail:

Structure #30 (Null)

Structure #28 (Null)

Structure #26 (Null)

Structure #24 (Null)

Structure #25 (Null)

Structure #27 (Null)

Structure #29 (Null)

Structure #32 (Null)

Structure #31 (Null)

Structure #33 (Null)

Inlet to North Fork Diversion

Structure #34 (Null)

End of North Fork

Structure #5 (Null)

Structure #6 (Null)

Structure #7 (Null)

Structure #8 (Null)

Structure #10 (Null)

Structure #1 (Null)

Structure #2 (Null)

Structure #3 (Null)

Structure #4 (Null)

Structure #9 (Null)

Structure #11 (Null)

Structure #21 (Null)

End of South Fork

Structure #35 (Null)

Structure #15 (Null)

Structure #12 (Null)

Structure #13 (Null)

Structure #14 (Null)

Structure #16 (Null)

Structure #23 (Null)

Structure #18 (Null)

Structure #17 (Null)

Structure #19 (Null)

Structure #20 (Null)

End of Middle Fork

Structure #22 (Null)

Structure #36 (Null)

Structure #37 (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)
#30	1	476.400	1.131	0.000	0.000	73.100	M	65.84	10.213
	Σ	**476.400**						**65.84**	**10.213**
#28	1	772.300	0.657	0.523	0.334	90.400	M	613.21	57.537
	2	445.600	0.587	0.000	0.000	90.400	M	378.55	33.212
	Σ	**1,217.900**						**724.22**	**90.749**
#26	1	447.600	2.192	0.000	0.000	74.200	M	43.15	10.566
	2	2,038.800	3.000	0.000	0.000	77.000	M	199.35	60.598
	Σ	**2,486.400**						**239.85**	**71.164**
#24	1	2,607.500	5.367	2.377	0.305	75.200	M	138.94	66.983
	2	2,331.900	4.813	2.431	0.304	74.700	M	129.86	57.441
	3	1,758.500	2.231	1.788	0.297	76.200	M	200.87	49.039
	4	1,363.900	2.618	0.000	0.000	77.000	M	148.03	40.537
	Σ	**8,061.800**						**347.67**	**214.000**
#25	1	515.200	0.990	0.342	0.357	78.200	M	126.55	16.814
	2	130.500	0.787	0.342	0.357	78.100	M	36.89	4.227
	3	370.000	0.516	0.000	0.000	85.700	M	245.27	20.475
	Σ	**9,077.500**						**355.36**	**255.515**
#27	1	354.400	0.612	1.233	0.337	83.100	M	176.32	16.470
	2	305.200	0.529	1.054	0.328	84.000	M	177.03	15.085
	3	289.800	0.692	0.551	0.328	75.500	M	70.23	7.639
	4	253.000	0.361	0.551	0.328	79.400	M	127.70	9.067
	5	581.300	0.980	0.000	0.000	82.300	M	200.12	25.549
	Σ	**13,347.600**						**632.57**	**400.488**
#29	1	508.800	0.409	0.416	0.312	89.500	M	492.86	35.938
	2	233.200	0.521	0.291	0.312	91.600	M	228.60	18.711
	3	224.000	0.467	0.000	0.000	90.000	M	210.10	16.283
	Σ	**15,531.500**						**1,224.41**	**562.169**
#32	1	293.700	0.576	0.000	0.000	93.000	M	296.99	25.652
	Σ	**16,301.600**						**1,271.84**	**598.034**
#31	1	431.100	0.588	0.450	0.336	91.500	M	392.70	34.378
	2	325.800	0.432	0.149	0.327	93.000	M	380.33	28.489
	3	200.200	0.373	0.000	0.000	92.900	M	246.26	17.371
	Σ	**957.100**						**658.11**	**80.238**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#33	**∑**	**17,258.700**						**1,380.10**	**678.272**
#34	1	251.500	0.423	1.019	0.292	90.500	M	255.40	18.892
	2	219.100	0.611	0.267	0.322	80.000	M	85.51	8.184
	3	246.200	0.688	0.466	0.293	80.000	M	89.04	9.192
	4	303.200	0.370	0.000	0.000	79.700	M	154.70	11.089
	∑	**18,278.700**						**1,392.62**	**725.629**
#5	1	503.600	0.618	0.000	0.000	87.600	M	342.75	31.451
	2	406.500	0.388	0.501	0.350	84.800	M	294.23	21.190
	3	439.600	0.342	0.681	0.347	87.800	M	412.79	27.948
	4	162.600	0.280	0.681	0.347	86.000	M	146.53	9.205
	5	294.100	0.375	1.021	0.348	92.000	M	343.13	24.148
	6	216.600	0.272	1.018	0.348	90.100	M	254.15	15.913
	∑	**2,023.000**						**1,134.33**	**129.855**
#6	1	149.100	0.331	0.000	0.000	92.600	M	188.54	12.755
	2	245.000	0.529	0.192	0.328	88.100	M	189.41	15.813
	3	276.200	0.450	0.461	0.319	89.500	M	255.58	19.454
	4	158.400	0.380	1.385	0.185	93.000	M	194.47	13.821
	5	206.200	0.402	0.796	0.320	89.400	M	200.01	14.472
	6	414.000	0.430	1.066	0.323	87.200	M	336.68	25.270
	7	294.300	0.535	1.066	0.323	86.400	M	200.65	17.032
	∑	**3,766.200**						**1,388.71**	**248.471**
#7	1	731.700	1.274	0.000	0.000	93.000	M	441.55	63.807
	2	445.800	1.043	0.000	0.000	93.000	M	310.05	38.863
	3	270.800	0.804	0.000	0.000	93.000	M	223.84	23.615
	4	78.900	0.267	1.035	0.328	93.000	M	109.23	6.920
	5	154.900	0.310	1.071	0.326	93.000	M	204.71	13.568
	6	101.400	0.288	1.164	0.328	92.900	M	136.58	8.822
	7	117.700	0.298	1.344	0.329	92.200	M	151.00	9.813
	8	494.100	0.518	1.344	0.329	91.300	M	476.86	38.923
	∑	**6,161.500**						**2,178.26**	**452.802**
#8	1	0.000	0.000	0.000	0.000	1.000	0.00	0.000	
	∑	**6,161.500**						**2,178.26**	**452.802**
#10	1	355.500	1.286	0.000	0.000	93.000	M	213.06	30.994
	2	307.100	1.282	0.668	0.305	83.200	M	93.75	14.354
	3	147.300	1.245	0.517	0.303	90.600	M	77.40	11.095
	4	126.400	0.585	0.517	0.303	93.000	M	126.71	11.043
	5	116.900	1.179	0.621	0.305	93.000	M	74.61	10.195
	∑	**7,214.700**						**2,258.75**	**530.483**

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	557.400	0.941	0.000	0.000	83.600	M	217.91	26.782
	2	169.600	1.616	0.677	0.333	93.000	M	85.71	14.787
	3	636.400	1.842	0.729	0.333	81.000	M	125.52	25.518
	4	223.400	0.846	1.005	0.336	84.100	M	97.32	11.107
	5	77.700	0.330	1.392	0.341	81.400	M	47.66	3.222
	6	746.600	0.678	1.392	0.341	88.200	M	500.31	48.463
	Σ	**2,411.100**						**823.47**	**129.878**
#2	1	257.000	0.423	0.000	0.000	93.000	M	302.74	22.490
	2	180.500	0.562	0.478	0.281	91.800	M	171.89	14.645
	3	200.700	0.687	0.574	0.283	93.000	M	183.08	17.511
	4	438.600	0.811	0.574	0.283	93.000	M	360.54	38.258
	5	420.200	1.247	0.801	0.293	88.000	M	185.00	26.910
	Σ	**3,908.100**						**957.23**	**249.692**
#3	1	172.600	0.443	0.000	0.000	93.000	M	199.24	15.068
	2	311.200	0.890	0.000	0.000	88.900	M	184.03	21.098
	3	378.900	0.632	0.209	0.314	87.900	M	259.75	24.115
	Σ	**4,770.800**						**1,132.66**	**309.974**
#4	**Σ**	**4,770.800**						**1,132.66**	**309.974**
#9	1	445.600	0.987	0.000	0.000	85.800	M	198.26	24.776
	Σ	**5,216.400**						**1,170.08**	**334.750**
#11	**Σ**	**12,431.100**						**3,131.48**	**865.233**
#21	1	292.400	0.819	0.000	0.000	86.900	M	159.15	17.466
	2	230.540	0.388	0.694	0.266	89.200	M	224.19	15.942
	3	181.120	0.289	0.878	0.256	91.300	M	223.26	14.292
	4	396.400	0.939	0.878	0.256	86.100	M	186.37	22.478
	Σ	**13,531.560**						**3,214.63**	**935.411**
#35	1	160.400	1.039	0.000	0.000	93.000	M	111.85	13.985
	Σ	**160.400**						**111.85**	**13.985**
#15	1	437.400	0.803	0.000	0.000	91.300	M	324.47	34.393
	2	549.000	0.637	0.654	0.327	91.300	M	470.93	43.191
	3	1,006.300	1.023	0.768	0.331	84.700	M	403.29	52.052
	Σ	**1,992.700**						**849.14**	**129.636**
#12	1	517.800	0.791	0.000	0.000	81.900	M	199.22	22.130
	2	229.000	0.571	0.043	0.418	80.100	M	94.06	8.620
	3	592.700	0.706	0.044	0.417	81.500	M	237.99	24.636
	4	1,806.900	1.542	0.487	0.362	76.700	M	283.93	52.443
	5	348.100	0.618	0.487	0.362	80.000	134.86	12.995	

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**3,494.500**						**584.36**	**120.823**
#13	1	411.600	0.725	0.000	0.000	79.700	M	140.29	15.038
	2	636.400	0.774	0.322	0.336	80.700	M	225.71	25.000
	3	319.000	0.575	0.685	0.318	85.500	M	196.10	17.417
	4	231.700	0.314	0.923	0.328	80.400	M	135.08	8.937
	5	1,122.000	1.308	0.923	0.328	74.700	M	164.68	27.647
	Σ	**6,215.200**						**1,103.87**	**214.861**
#14	1	405.900	0.384	0.000	0.000	90.800	M	437.25	30.973
	2	411.100	0.452	0.707	0.308	90.700	M	409.53	31.187
	3	787.400	0.658	0.975	0.307	91.400	M	666.73	62.380
	4	144.200	0.341	1.716	0.310	86.200	M	122.05	8.274
	5	343.800	0.289	1.970	0.312	86.500	M	316.48	20.073
	6	392.800	0.806	2.107	0.316	81.900	M	149.31	16.789
	7	528.200	0.518	2.544	0.316	87.200	M	388.39	32.204
	8	890.900	1.253	2.544	0.316	83.500	M	282.74	42.513
	9	741.400	1.076	3.047	0.316	84.800	M	288.96	38.606
	10	451.100	0.916	3.354	0.316	83.900	M	183.66	22.123
	Σ	**11,312.000**						**1,402.27**	**519.982**
#16	1	475.100	1.721	0.000	0.000	92.400	M	220.23	39.939
	2	348.400	0.542	0.951	0.283	92.500	M	353.24	29.484
	3	198.500	0.266	1.384	0.278	93.000	M	275.07	17.409
	Σ	**14,326.700**						**1,744.40**	**736.450**
#23	**Σ**	**14,487.100**						**1,763.29**	**750.435**
#18	1	301.700	0.652	0.000	0.000	93.000	M	284.03	26.346
	2	546.800	0.768	0.561	0.320	86.300	M	297.45	31.428
	Σ	**848.500**						**380.92**	**57.774**
#17	1	182.200	0.462	0.000	0.000	93.000	M	206.29	15.907
	Σ	**182.200**						**206.29**	**15.907**
#19	**Σ**	**1,030.700**						**494.85**	**73.681**
#20	1	271.100	0.978	0.000	0.000	89.400	M	155.77	18.959
	Σ	**15,788.900**						**1,850.79**	**843.075**
#22	**Σ**	**29,320.460**						**4,843.52**	**1,778.486**
#36	1	283.020	0.468	1.457	0.305	77.100	M	101.43	8.495
	2	301.840	0.632	1.051	0.286	90.100	M	240.51	22.048
	3	223.850	0.703	1.051	0.286	74.300	M	47.76	5.333
	4	262.400	0.419	0.835	0.229	78.000	M	108.79	8.465

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	222.760	0.421	0.475	0.224	74.500	M	66.34	5.417
	6	290.810	0.526	0.000	0.000	74.800	M	77.96	7.239
	Σ	**49,183.840**						**6,148.59**	**2,561.112**
#37	1	744.000	1.756	0.000	0.000	84.800	M	202.26	38.725
	2	303.330	0.416	1.859	0.242	87.800	M	261.09	19.256
	3	223.850	0.703	1.179	0.270	74.300	M	47.76	5.333
	4	262.400	0.419	0.835	0.229	78.000	M	108.79	8.465
	5	222.760	0.421	0.475	0.224	74.500	M	66.34	5.417
	6	290.810	0.526	0.000	0.000	74.800	M	77.96	7.239
	7	245.660	0.561	1.487	0.252	79.400	M	96.26	8.780
	Σ	**51,476.650**						**6,029.39**	**2,654.327**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#30	1	0.095	200.00	3.80	0.3720	1.0000	2	80.6	7,897	3.88	2.84
	Σ							**80.6**	**7,897**	**3.88**	**2.84**
#28	1	0.187	100.00	10.10	0.3750	1.0000	3	3,802.6	66,635	1.02	0.73
	2	0.196	100.00	10.20	0.3930	1.0000	3	2,376.8	73,091	2.04	1.44
	Σ							**5,014.7**	**55,579**	**0.74**	**0.53**
#26	1	0.155	400.00	1.40	0.3480	1.0000	2	50.0	4,636	1.88	1.41
	2	0.155	300.00	2.40	0.3340	1.0000	2	441.1	7,119	2.60	1.95
	Σ							**491.1**	**6,676**	**2.47**	**1.87**
#24	1	0.128	300.00	2.30	0.3360	1.0000	2	304.8	4,482	1.04	0.79
	2	0.136	300.00	2.70	0.3440	1.0000	2	338.5	5,783	1.48	1.10
	3	0.107	300.00	2.30	0.3330	1.0000	2	260.7	5,211	2.15	1.61
	4	0.163	400.00	1.60	0.3210	1.0000	2	230.1	5,563	2.17	1.62
	Σ							**875.6**	**4,680**	**0.88**	**0.57**
#25	1	0.125	400.00	1.90	0.3440	1.0000	2	122.7	7,401	3.91	2.83
	2	0.124	300.00	2.60	0.3280	1.0000	2	32.6	7,915	4.35	3.11
	3	0.122	175.00	4.90	0.2660	1.0000	2	331.5	17,153	10.39	7.17
	Σ							**1,084.6**	**14,498**	**3.70**	**0.80**
#27	1	0.127	175.00	5.90	0.3160	1.0000	2	360.0	22,398	13.16	9.38
	2	0.122	150.00	7.50	0.2920	1.0000	2	355.0	24,279	14.57	10.30
	3	0.070	125.00	8.40	0.3270	1.0000	2	97.4	13,109	7.23	5.15

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.097	125.00	9.60	0.3170	1.0000	2	247.0	29,035	17.75	12.14
	5	0.126	125.00	8.90	0.3290	1.0000	2	683.0	27,101	14.77	10.62
	Σ							**3,310.4**	**27,999**	**12.29**	**2.66**
#29	1	0.190	125.00	9.80	0.3930	1.0000	3	2,848.1	80,980	4.64	3.25
	2	0.203	125.00	8.90	0.3940	1.0000	3	1,191.4	64,960	2.96	2.09
	3	0.193	125.00	8.40	0.3940	1.0000	3	912.5	58,330	2.82	1.95
	Σ							**13,267.6**	**67,394**	**9.00**	**2.29**
#32	1	0.210	150.00	7.70	0.3990	1.0000	3	1,540.4	61,498	2.63	1.85
	Σ							**14,429.8**	**60,085**	**6.29**	**1.84**
#31	1	0.204	125.00	8.70	0.3620	1.0000	3	2,020.9	59,817	1.99	1.41
	2	0.210	150.00	7.30	0.3990	1.0000	3	1,781.5	64,222	4.33	3.04
	3	0.210	175.00	4.50	0.3980	1.0000	3	720.6	43,341	3.33	2.31
	Σ							**3,502.4**	**40,447**	**0.93**	**0.73**
#33	**Σ**							**17,932.2**	**51,948**	**4.61**	**1.71**
#34	1	0.193	200.00	3.84	0.2460	1.0000	3	329.0	17,859	1.05	0.75
	2	0.214	200.00	3.66	0.3150	1.0000	1	151.7	19,311	11.66	8.18
	3	0.214	300.00	2.54	0.3150	1.0000	1	133.8	15,005	8.93	6.34
	4	0.242	200.00	3.50	0.3150	1.0000	1	271.8	26,868	17.00	11.31
	Σ							**17,342.7**	**46,245**	**2.37**	**0.90**
#5	1	0.149	75.00	12.50	0.3230	1.0000	3	1,519.9	49,802	0.38	0.26
	2	0.133	75.00	15.80	0.3190	1.0000	2	1,328.4	65,257	40.43	27.97
	3	0.103	100.00	11.00	0.2030	1.0000	3	683.1	25,601	1.64	1.14
	4	0.093	75.00	13.80	0.2130	1.0000	2	221.6	25,442	16.16	11.16
	5	0.123	100.00	11.00	0.1370	1.0000	3	458.6	19,605	1.43	1.01
	6	0.149	75.00	14.70	0.1990	1.0000	3	664.4	42,859	3.67	2.59
	Σ							**4,047.1**	**40,903**	**5.32**	**2.95**
#6	1	0.208	175.00	4.30	0.3980	1.0000	3	494.2	40,595	3.37	2.34
	2	0.183	175.00	5.40	0.3910	1.0000	3	600.1	39,469	1.09	0.76
	3	0.188	150.00	7.60	0.3900	1.0000	3	1,048.5	55,521	2.74	1.92
	4	0.210	150.00	6.30	0.3990	1.0000	3	709.6	50,644	3.85	2.82
	5	0.185	125.00	8.10	0.3860	1.0000	3	734.7	51,956	3.02	2.14
	6	0.104	100.00	11.30	0.2240	1.0000	3	667.1	27,199	1.18	0.84
	7	0.164	100.00	11.20	0.3740	1.0000	3	1,042.0	61,946	1.11	0.79
	Σ							**7,527.5**	**36,069**	**0.30**	**0.18**
#7	1	0.208	150.00	7.80	0.3780	1.0000	3	3,046.7	47,486	0.00	0.00
	2	0.209	100.00	10.20	0.3940	1.0000	3	2,484.2	63,579	0.00	0.00
	3	0.210	150.00	6.70	0.3990	1.0000	3	1,099.5	47,148	0.25	0.18

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.210	100.00	11.50	0.3990	1.0000	3	632.6	91,073	8.73	6.25
	5	0.210	150.00	7.10	0.3990	1.0000	3	808.6	60,147	5.31	3.79
	6	0.209	150.00	7.90	0.3990	1.0000	3	558.7	63,697	5.85	4.19
	7	0.206	75.00	15.50	0.3990	1.0000	3	1,122.7	112,192	9.84	7.11
	8	0.202	75.00	14.50	0.3980	1.0000	3	4,166.3	105,464	4.72	3.40
	Σ							**18,760.6**	**44,925**	**0.00**	**0.00**
#8	1	0.000	0.00	0.00	0.0000	1.0000	0	0.0	1	0.00	0.00
	Σ							**18,760.6**	**44,925**	**0.00**	**0.00**
#10	1	0.190	300.00	2.70	0.1930	1.0000	3	247.8	8,076	0.00	0.00
	2	0.153	200.00	3.50	0.3610	1.0000	2	172.1	11,995	6.24	4.57
	3	0.189	200.00	3.70	0.3190	1.0000	3	153.8	13,918	0.00	0.00
	4	0.190	300.00	2.10	0.1940	1.0000	3	83.3	7,807	0.32	0.23
	5	0.201	300.00	2.00	0.3030	1.0000	3	93.8	9,265	0.00	0.00
	Σ							**18,793.8**	**41,539**	**0.16**	**0.10**
#1	1	0.157	150.00	6.80	0.3830	1.0000	2	845.8	32,046	17.74	12.72
	2	0.210	150.00	6.60	0.3990	1.0000	3	487.2	32,623	0.00	0.00
	3	0.149	200.00	3.90	0.3870	1.0000	2	322.9	12,509	5.82	4.31
	4	0.169	175.00	4.70	0.3950	1.0000	2	277.6	25,266	14.27	10.29
	5	0.157	100.00	10.10	0.3940	1.0000	2	159.4	50,816	31.51	22.19
	6	0.175	75.00	12.60	0.2840	1.0000	3	2,496.7	51,727	0.00	0.00
	Σ							**4,276.8**	**35,752**	**6.14**	**4.11**
#2	1	0.190	150.00	7.90	0.1930	1.0000	3	648.1	30,207	2.08	1.45
	2	0.184	175.00	4.80	0.2010	1.0000	3	251.8	17,735	0.70	0.49
	3	0.202	200.00	3.90	0.3220	1.0000	3	364.3	21,239	0.51	0.37
	4	0.203	150.00	7.40	0.3220	1.0000	3	1,614.1	42,423	0.18	0.13
	5	0.181	175.00	5.10	0.3710	1.0000	3	709.7	26,277	0.00	0.00
	Σ							**5,734.6**	**23,757**	**0.18**	**0.13**
#3	1	0.190	175.00	5.20	0.1930	1.0000	3	297.2	20,748	1.36	0.94
	2	0.177	175.00	4.20	0.2560	1.0000	3	346.9	16,807	0.00	0.00
	3	0.166	175.00	4.30	0.2290	1.0000	3	389.0	16,748	0.11	0.08
	Σ							**6,206.0**	**18,918**	**0.06**	**0.05**
#4	**Σ**							**6,206.0**	**18,918**	**0.06**	**0.05**
#9	1	0.212	175.00	4.17	0.2490	1.0000	2	458.0	18,821	10.48	7.52
	Σ							**6,411.8**	**17,954**	**0.71**	**0.56**
#11	**Σ**							**25,205.6**	**34,177**	**0.44**	**0.27**
#21	1	0.206	175.00	4.44	0.2760	1.0000	2	380.3	22,339	12.88	9.17

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	2	0.241	175.00	5.81	0.3130	1.0000	1	748.9	48,037	31.20	22.09
	3	0.185	300.00	2.70	0.2180	1.0000	3	181.0	12,991	1.12	0.80
	4	0.220	200.00	2.66	0.2980	1.0000	1	299.9	13,463	7.94	5.76
	Σ							**25,885.2**	**33,042**	**0.83**	**0.51**
#35	1	0.194	200.00	3.42	0.2330	1.0000	3	150.0	10,899	0.00	0.00
	Σ							**150.0**	**10,899**	**0.00**	**0.00**
#15	1	0.201	125.00	8.20	0.3960	1.0000	3	1,782.6	52,395	0.00	0.00
	2	0.161	100.00	11.40	0.3060	1.0000	3	2,329.6	54,616	1.29	0.92
	3	0.118	100.00	10.20	0.2850	1.0000	2	1,384.0	26,700	14.67	10.65
	Σ							**4,812.3**	**44,608**	**3.06**	**1.85**
#12	1	0.124	150.00	6.30	0.3070	1.0000	2	425.5	19,804	11.15	7.91
	2	0.132	200.00	3.60	0.3500	1.0000	2	111.2	13,682	7.99	5.51
	3	0.136	175.00	5.00	0.3330	1.0000	2	514.7	21,691	12.39	8.72
	4	0.188	200.00	3.40	0.3570	1.0000	2	782.3	14,751	6.93	5.13
	5	0.228	175.00	4.10	0.3640	1.0000	2	397.9	31,665	18.28	12.86
	Σ							**1,787.9**	**16,061**	**7.55**	**5.09**
#13	1	0.128	150.00	6.90	0.3390	1.0000	2	350.0	24,065	13.55	9.56
	2	0.130	175.00	5.70	0.3300	1.0000	2	540.3	22,139	12.41	8.85
	3	0.191	175.00	6.00	0.2890	1.0000	2	550.9	32,526	19.47	13.78
	4	0.122	175.00	5.10	0.3460	1.0000	2	201.3	23,731	14.73	10.20
	5	0.137	175.00	4.20	0.3530	1.0000	2	404.9	14,501	6.98	5.16
	Σ							**3,780.1**	**18,686**	**9.62**	**6.62**
#14	1	0.196	100.00	10.20	0.3980	1.0000	3	2,511.0	83,864	5.61	3.88
	2	0.193	150.00	6.70	0.4020	1.0000	3	1,667.6	54,585	2.95	2.09
	3	0.169	75.00	13.80	0.3240	1.0000	3	4,187.7	67,081	1.37	0.99
	4	0.114	100.00	11.00	0.2980	1.0000	3	283.7	34,754	2.02	1.45
	5	0.078	100.00	10.10	0.1830	1.0000	3	296.0	14,991	1.05	0.76
	6	0.084	150.00	7.10	0.2700	1.0000	2	207.2	12,432	6.98	5.07
	7	0.087	100.00	10.00	0.1840	1.0000	3	463.5	14,493	0.37	0.27
	8	0.126	150.00	6.70	0.2740	1.0000	2	717.6	16,744	8.77	6.46
	9	0.117	150.00	7.30	0.2600	1.0000	2	658.3	16,932	9.23	6.79
	10	0.115	125.00	8.50	0.2610	1.0000	2	404.4	18,166	10.12	7.44
	Σ							**11,403.3**	**82,900**	**4.66**	**0.89**
#16	1	0.201	300.00	2.78	0.3030	1.0000	3	496.2	12,436	0.00	0.00
	2	0.204	150.00	6.00	0.3630	1.0000	3	1,278.3	43,876	2.02	1.45
	3	0.210	150.00	6.10	0.3990	1.0000	3	948.1	54,231	5.21	3.78
	Σ							**18,927.4**	**51,539**	**3.02**	**1.09**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#23	Σ							**19,077.4**	**50,202**	**2.92**	**1.07**
#18	1	0.193	300.00	2.80	0.2200	1.0000	3	317.8	12,523	0.37	0.26
	2	0.173	175.00	4.70	0.3880	1.0000	3	934.2	30,254	0.00	0.00
	Σ							**823.4**	**16,272**	**0.19**	**0.12**
#17	1	0.196	300.00	2.60	0.2600	1.0000	3	224.8	14,878	0.93	0.64
	Σ							**224.8**	**14,878**	**0.93**	**0.64**
#19	Σ							**1,048.2**	**15,219**	**0.34**	**0.23**
#20	1	0.192	200.00	3.19	0.2430	1.0000	3	207.2	11,147	0.00	0.00
	Σ							**20,328.1**	**43,387**	**2.41**	**0.97**
#22	Σ							**46,213.3**	**34,526**	**1.33**	**0.73**
#36	1	0.172	200.00	3.14	0.1950	1.0000	2	73.6	8,932	5.26	3.74
	2	0.195	150.00	6.18	0.1680	1.0000	3	398.6	18,418	0.34	0.24
	3	0.166	150.00	7.47	0.1830	1.0000	3	80.9	15,414	0.00	0.00
	4	0.187	175.00	5.07	0.1810	1.0000	1	138.0	16,893	10.51	7.42
	5	0.173	175.00	4.89	0.1800	1.0000	1	72.4	14,081	8.62	5.99
	6	0.177	175.00	5.15	0.1840	1.0000	1	102.5	15,096	9.03	6.20
	Σ							**64,386.1**	**33,979**	**1.52**	**0.83**
#37	1	0.172	200.00	3.14	0.1950	1.0000	2	253.5	6,544	3.19	2.34
	2	0.195	150.00	6.18	0.1680	1.0000	3	386.1	20,108	0.98	0.72
	3	0.166	150.00	7.47	0.1830	1.0000	3	80.9	15,354	0.00	0.00
	4	0.187	175.00	5.07	0.1810	1.0000	1	138.0	16,893	10.51	7.42
	5	0.173	175.00	4.89	0.1800	1.0000	2	72.4	14,081	8.27	5.75
	6	0.177	175.00	5.15	0.1840	1.0000	1	102.5	15,096	9.03	6.20
	7	0.175	175.00	4.90	0.2080	1.0000	2	137.1	15,855	9.24	6.66
	Σ							**63,065.5**	**33,144**	**0.83**	**0.44**

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	3.65	50.00	1,369.00	1.910	0.199
		8. Large gullies, diversions, and low flowing streams	1.57	157.00	10,030.00	3.750	0.742
#1	**1**	**Time of Concentration:**					**0.941**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	6.63	70.00	1,056.00	2.570	0.114

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	1.98	150.00	7,573.00	1.400	1.502
#1	**2**	**Time of Concentration:**					**1.616**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	1.65	117.00	7,070.00	1.280	1.534
		8. Large gullies, diversions, and low flowing streams	2.43	126.00	5,188.00	4.670	0.308
#1	**3**	**Time of Concentration:**					**1.842**
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.77	260.00	4,506.00	2.400	0.521
		8. Large gullies, diversions, and low flowing streams	2.84	168.00	5,924.00	5.050	0.325
#1	**4**	**Time of Concentration:**					**0.846**
#1	5	5. Nearly bare and untilled, and alluvial valley fans	19.93	180.00	903.00	4.460	0.056
		8. Large gullies, diversions, and low flowing streams	3.30	178.00	5,393.00	5.450	0.274
#1	**5**	**Time of Concentration:**					**0.330**
#1	6	5. Nearly bare and untilled, and alluvial valley fans	13.43	105.00	782.00	3.660	0.059
		8. Large gullies, diversions, and low flowing streams	2.62	283.00	10,822.00	4.850	0.619
#1	**6**	**Time of Concentration:**					**0.678**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.84	70.00	1,024.00	2.610	0.108
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,325.00	3.810	0.315
#2	**1**	**Time of Concentration:**					**0.423**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	5.56	45.00	810.00	2.350	0.095
		8. Large gullies, diversions, and low flowing streams	0.86	40.00	4,663.00	2.770	0.467
#2	**2**	**Time of Concentration:**					**0.562**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	5.89	50.00	849.00	2.420	0.097
		8. Large gullies, diversions, and low flowing streams	1.17	80.00	6,862.00	3.230	0.590
#2	**3**	**Time of Concentration:**					**0.687**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	12.63	95.00	752.00	3.550	0.058
		8. Large gullies, diversions, and low flowing streams	1.40	135.00	9,630.00	3.550	0.753
#2	**4**	**Time of Concentration:**					**0.811**
#2	5	5. Nearly bare and untilled, and alluvial valley fans	11.02	70.00	635.00	3.320	0.053
		8. Large gullies, diversions, and low flowing streams	0.46	40.00	8,732.00	2.030	1.194
#2	**5**	**Time of Concentration:**					**1.247**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	10.00	805.00	1.110	0.201
		8. Large gullies, diversions, and low flowing streams	1.33	40.00	3,017.00	3.450	0.242
#3	**1**	**Time of Concentration:**					**0.443**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.68	10.00	1,478.00	0.820	0.500
		8. Large gullies, diversions, and low flowing streams	1.78	100.00	5,622.00	4.000	0.390
#3	**2**	**Time of Concentration:**					**0.890**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	4.66	70.00	1,501.00	2.150	0.193
		8. Large gullies, diversions, and low flowing streams	1.17	60.00	5,126.00	3.240	0.439
#3	**3**	**Time of Concentration:**					**0.632**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	19.06	285.00	1,495.00	4.360	0.095
		8. Large gullies, diversions, and low flowing streams	2.64	242.00	9,174.00	4.870	0.523
#5	**1**	**Time of Concentration:**					**0.618**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	14.27	105.00	736.00	3.770	0.054
		8. Large gullies, diversions, and low flowing streams	4.08	297.00	7,279.00	6.050	0.334
#5	**2**	**Time of Concentration:**					**0.388**
#5	3	5. Nearly bare and untilled, and alluvial valley fans	8.27	35.00	423.00	2.870	0.040
		8. Large gullies, diversions, and low flowing streams	3.44	208.00	6,049.00	5.560	0.302
#5	**3**	**Time of Concentration:**					**0.342**
#5	4	5. Nearly bare and untilled, and alluvial valley fans	14.58	85.00	583.00	3.810	0.042
		8. Large gullies, diversions, and low flowing streams	4.53	248.00	5,473.00	6.380	0.238
#5	**4**	**Time of Concentration:**					**0.280**
#5	5	5. Nearly bare and untilled, and alluvial valley fans	5.07	70.00	1,382.00	2.250	0.170
		8. Large gullies, diversions, and low flowing streams	3.89	170.00	4,375.00	5.910	0.205
#5	**5**	**Time of Concentration:**					**0.375**
#5	6	5. Nearly bare and untilled, and alluvial valley fans	12.48	90.00	721.00	3.530	0.056
		8. Large gullies, diversions, and low flowing streams	5.16	274.00	5,308.02	6.810	0.216
#5	**6**	**Time of Concentration:**					**0.272**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	5.36	75.00	1,399.00	2.310	0.168
		8. Large gullies, diversions, and low flowing streams	2.41	66.00	2,742.00	4.650	0.163

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	**1**	**Time of Concentration:**					**0.331**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.39	80.00	2,359.00	1.840	0.356
		8. Large gullies, diversions, and low flowing streams	2.63	80.00	3,039.00	4.860	0.173
#6	**2**	**Time of Concentration:**					**0.529**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	4.60	34.00	739.00	2.140	0.095
		8. Large gullies, diversions, and low flowing streams	2.33	136.00	5,845.00	4.570	0.355
#6	**3**	**Time of Concentration:**					**0.450**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	6.06	85.00	1,402.00	2.460	0.158
		8. Large gullies, diversions, and low flowing streams	2.52	96.00	3,810.00	4.760	0.222
#6	**4**	**Time of Concentration:**					**0.380**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	7.24	70.00	967.00	2.690	0.099
		8. Large gullies, diversions, and low flowing streams	2.34	117.00	5,003.00	4.580	0.303
#6	**5**	**Time of Concentration:**					**0.402**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	31.83	183.00	575.00	5.640	0.028
		8. Large gullies, diversions, and low flowing streams	3.38	270.00	7,990.00	5.510	0.402
#6	**6**	**Time of Concentration:**					**0.430**
#6	7	5. Nearly bare and untilled, and alluvial valley fans	23.08	325.00	1,408.00	4.800	0.081
		8. Large gullies, diversions, and low flowing streams	2.88	240.00	8,327.00	5.090	0.454
#6	**7**	**Time of Concentration:**					**0.535**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	11.42	90.00	788.00	3.370	0.064
		8. Large gullies, diversions, and low flowing streams	1.46	230.00	15,769.00	3.620	1.210
#7	**1**	**Time of Concentration:**					**1.274**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	10.97	60.00	547.00	3.310	0.045
		8. Large gullies, diversions, and low flowing streams	1.61	220.00	13,660.00	3.800	0.998
#7	**2**	**Time of Concentration:**					**1.043**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	938.00	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.72	171.00	9,931.00	3.930	0.701
#7	**3**	**Time of Concentration:**					**0.804**
#7	4	5. Nearly bare and untilled, and alluvial valley fans	19.23	80.00	416.00	4.380	0.026

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.45	100.00	4,083.00	4.690	0.241
#7	**4**	**Time of Concentration:**					**0.267**
#7	5	5. Nearly bare and untilled, and alluvial valley fans	6.09	67.00	1,101.00	2.460	0.124
		8. Large gullies, diversions, and low flowing streams	2.51	80.00	3,184.00	4.750	0.186
#7	**5**	**Time of Concentration:**					**0.310**
#7	6	5. Nearly bare and untilled, and alluvial valley fans	5.93	63.00	1,062.00	2.430	0.121
		8. Large gullies, diversions, and low flowing streams	2.74	82.00	2,993.00	4.960	0.167
#7	**6**	**Time of Concentration:**					**0.288**
#7	7	5. Nearly bare and untilled, and alluvial valley fans	7.97	65.00	816.00	2.820	0.080
		8. Large gullies, diversions, and low flowing streams	3.48	153.00	4,400.00	5.590	0.218
#7	**7**	**Time of Concentration:**					**0.298**
#7	8	5. Nearly bare and untilled, and alluvial valley fans	6.60	50.00	758.00	2.560	0.082
		8. Large gullies, diversions, and low flowing streams	4.66	473.00	10,157.00	6.470	0.436
#7	**8**	**Time of Concentration:**					**0.518**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	3.01	55.00	1,829.00	1.730	0.293
		8. Large gullies, diversions, and low flowing streams	0.76	50.00	6,548.00	2.620	0.694
#9	**1**	**Time of Concentration:**					**0.987**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	41.00	3,317.00	1.110	0.830
		8. Large gullies, diversions, and low flowing streams	0.70	29.00	4,125.00	2.510	0.456
#10	**1**	**Time of Concentration:**					**1.286**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	2.25	125.00	5,554.00	1.500	1.028
		8. Large gullies, diversions, and low flowing streams	2.13	85.00	3,997.00	4.370	0.254
#10	**2**	**Time of Concentration:**					**1.282**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.39	68.00	4,904.00	1.170	1.164
		8. Large gullies, diversions, and low flowing streams	4.73	90.00	1,904.00	6.520	0.081
#10	**3**	**Time of Concentration:**					**1.245**
#10	4	5. Nearly bare and untilled, and alluvial valley fans	3.76	51.00	1,357.00	1.930	0.195
		8. Large gullies, diversions, and low flowing streams	0.65	22.00	3,385.00	2.410	0.390
#10	**4**	**Time of Concentration:**					**0.585**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	5	5. Nearly bare and untilled, and alluvial valley fans	1.63	88.00	5,391.16	1.270	1.179
#10	**5**	**Time of Concentration:**					**1.179**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	4.50	75.00	1,667.00	2.120	0.218
		8. Large gullies, diversions, and low flowing streams	1.85	155.00	8,400.00	4.070	0.573
#12	**1**	**Time of Concentration:**					**0.791**
#12	2	5. Nearly bare and untilled, and alluvial valley fans	2.99	50.00	1,674.03	1.720	0.270
		8. Large gullies, diversions, and low flowing streams	1.67	70.00	4,201.17	3.870	0.301
#12	**2**	**Time of Concentration:**					**0.571**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	4.04	57.00	1,411.00	2.000	0.195
		8. Large gullies, diversions, and low flowing streams	1.55	107.00	6,884.00	3.740	0.511
#12	**3**	**Time of Concentration:**					**0.706**
#12	4	5. Nearly bare and untilled, and alluvial valley fans	2.23	84.00	3,771.04	1.490	0.703
		8. Large gullies, diversions, and low flowing streams	1.62	186.00	11,515.60	3.810	0.839
#12	**4**	**Time of Concentration:**					**1.542**
#12	5	5. Nearly bare and untilled, and alluvial valley fans	3.68	53.00	1,442.00	1.910	0.209
		8. Large gullies, diversions, and low flowing streams	1.95	120.00	6,155.00	4.180	0.409
#12	**5**	**Time of Concentration:**					**0.618**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	4.62	62.00	1,342.00	2.140	0.174
		8. Large gullies, diversions, and low flowing streams	1.91	157.00	8,225.00	4.140	0.551
#13	**1**	**Time of Concentration:**					**0.725**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	2.91	50.00	1,717.00	1.700	0.280
		8. Large gullies, diversions, and low flowing streams	2.28	183.00	8,039.00	4.520	0.494
#13	**2**	**Time of Concentration:**					**0.774**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	6.18	95.00	1,537.00	2.480	0.172
		8. Large gullies, diversions, and low flowing streams	2.13	135.00	6,347.00	4.370	0.403
#13	**3**	**Time of Concentration:**					**0.575**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.17	10.00	315.00	1.780	0.049
		8. Large gullies, diversions, and low flowing streams	2.30	100.00	4,344.00	4.550	0.265
#13	**4**	**Time of Concentration:**					**0.314**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	5	5. Nearly bare and untilled, and alluvial valley fans	3.10	70.00	2,255.00	1.760	0.355
		8. Large gullies, diversions, and low flowing streams	1.23	140.00	11,392.00	3.320	0.953
#13	**5**	**Time of Concentration:**					**1.308**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	10.59	63.00	595.00	3.250	0.050
		8. Large gullies, diversions, and low flowing streams	2.60	151.00	5,808.00	4.830	0.334
#14	**1**	**Time of Concentration:**					**0.384**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	7.28	67.00	920.00	2.690	0.095
		8. Large gullies, diversions, and low flowing streams	2.17	123.00	5,670.00	4.410	0.357
#14	**2**	**Time of Concentration:**					**0.452**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	21.46	150.00	699.00	4.630	0.041
		8. Large gullies, diversions, and low flowing streams	3.10	364.00	11,728.00	5.280	0.617
#14	**3**	**Time of Concentration:**					**0.658**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	3.39	35.00	1,032.00	1.840	0.155
		8. Large gullies, diversions, and low flowing streams	2.97	103.00	3,470.00	5.160	0.186
#14	**4**	**Time of Concentration:**					**0.341**
#14	5	5. Nearly bare and untilled, and alluvial valley fans	28.15	125.00	444.00	5.300	0.023
		8. Large gullies, diversions, and low flowing streams	4.18	246.00	5,886.00	6.130	0.266
#14	**5**	**Time of Concentration:**					**0.289**
#14	6	5. Nearly bare and untilled, and alluvial valley fans	3.18	40.00	1,257.00	1.780	0.196
		8. Large gullies, diversions, and low flowing streams	2.29	228.00	9,963.00	4.530	0.610
#14	**6**	**Time of Concentration:**					**0.806**
#14	7	5. Nearly bare and untilled, and alluvial valley fans	16.72	100.00	598.00	4.080	0.040
		8. Large gullies, diversions, and low flowing streams	2.81	243.00	8,649.00	5.020	0.478
#14	**7**	**Time of Concentration:**					**0.518**
#14	8	5. Nearly bare and untilled, and alluvial valley fans	1.70	47.00	2,765.00	1.300	0.590
		8. Large gullies, diversions, and low flowing streams	2.44	274.00	11,208.00	4.690	0.663
#14	**8**	**Time of Concentration:**					**1.253**
#14	9	5. Nearly bare and untilled, and alluvial valley fans	2.87	105.00	3,657.00	1.690	0.601
		8. Large gullies, diversions, and low flowing streams	2.43	194.00	7,991.00	4.670	0.475

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	**9**	**Time of Concentration:**					**1.076**
#14	10	5. Nearly bare and untilled, and alluvial valley fans	2.75	80.00	2,907.00	1.650	0.489
		8. Large gullies, diversions, and low flowing streams	2.41	172.00	7,149.00	4.650	0.427
#14	**10**	**Time of Concentration:**					**0.916**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	12.80	54.00	422.00	3.570	0.032
		8. Large gullies, diversions, and low flowing streams	1.68	181.00	10,781.00	3.880	0.771
#15	**1**	**Time of Concentration:**					**0.803**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	44.22	260.00	588.00	6.640	0.024
		8. Large gullies, diversions, and low flowing streams	2.45	254.00	10,354.24	4.690	0.613
#15	**2**	**Time of Concentration:**					**0.637**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	10.04	85.00	847.00	3.160	0.074
		8. Large gullies, diversions, and low flowing streams	2.34	366.00	15,663.00	4.580	0.949
#15	**3**	**Time of Concentration:**					**1.023**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	2.26	117.00	5,179.00	1.500	0.959
		8. Large gullies, diversions, and low flowing streams	0.46	26.00	5,601.00	2.040	0.762
#16	**1**	**Time of Concentration:**					**1.721**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	8.70	62.00	713.00	2.940	0.067
		8. Large gullies, diversions, and low flowing streams	1.99	144.00	7,241.00	4.230	0.475
#16	**2**	**Time of Concentration:**					**0.542**
#16	3	5. Nearly bare and untilled, and alluvial valley fans	6.88	32.00	465.00	2.620	0.049
		8. Large gullies, diversions, and low flowing streams	2.29	81.00	3,543.00	4.530	0.217
#16	**3**	**Time of Concentration:**					**0.266**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	9.37	65.00	694.00	3.060	0.062
		8. Large gullies, diversions, and low flowing streams	1.19	56.00	4,712.00	3.270	0.400
#17	**1**	**Time of Concentration:**					**0.462**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	9.00	60.00	667.00	2.990	0.061
		8. Large gullies, diversions, and low flowing streams	0.97	61.00	6,287.00	2.950	0.591
#18	**1**	**Time of Concentration:**					**0.652**
#18	2	5. Nearly bare and untilled, and alluvial valley fans	2.47	33.00	1,336.00	1.570	0.236

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.01	164.00	8,154.00	4.250	0.532
#18	**2**	**Time of Concentration:**					**0.768**
#20	1	5. Nearly bare and untilled, and alluvial valley fans	2.64	47.00	1,783.00	1.620	0.305
		8. Large gullies, diversions, and low flowing streams	0.56	30.00	5,405.00	2.230	0.673
#20	**1**	**Time of Concentration:**					**0.978**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	4.09	60.00	1,467.02	2.020	0.201
		8. Large gullies, diversions, and low flowing streams	0.93	60.00	6,433.62	2.890	0.618
#21	**1**	**Time of Concentration:**					**0.819**
#21	2	5. Nearly bare and untilled, and alluvial valley fans	3.50	50.00	1,430.00	1.860	0.213
		8. Large gullies, diversions, and low flowing streams	2.15	60.00	2,785.12	4.400	0.175
#21	**2**	**Time of Concentration:**					**0.388**
#21	3	5. Nearly bare and untilled, and alluvial valley fans	1.70	15.00	881.00	1.300	0.188
		9. Small streams flowing bankfull	1.49	60.00	4,014.18	11.000	0.101
#21	**3**	**Time of Concentration:**					**0.289**
#21	4	5. Nearly bare and untilled, and alluvial valley fans	2.21	40.00	1,811.02	1.480	0.339
		8. Large gullies, diversions, and low flowing streams	0.84	50.00	5,949.54	2.750	0.600
#21	**4**	**Time of Concentration:**					**0.939**
#24	1	5. Nearly bare and untilled, and alluvial valley fans	1.71	430.00	25,118.00	1.300	5.367
#24	**1**	**Time of Concentration:**					**5.367**
#24	2	5. Nearly bare and untilled, and alluvial valley fans	1.84	430.00	23,393.00	1.350	4.813
#24	**2**	**Time of Concentration:**					**4.813**
#24	3	5. Nearly bare and untilled, and alluvial valley fans	1.82	155.00	8,498.00	1.350	1.748
		8. Large gullies, diversions, and low flowing streams	0.84	40.00	4,771.00	2.740	0.483
#24	**3**	**Time of Concentration:**					**2.231**
#24	4	5. Nearly bare and untilled, and alluvial valley fans	1.24	50.00	4,042.00	1.110	1.011
		8. Large gullies, diversions, and low flowing streams	0.49	60.00	12,150.00	2.100	1.607
#24	**4**	**Time of Concentration:**					**2.618**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	0.51	10.00	1,950.00	0.710	0.762
		8. Large gullies, diversions, and low flowing streams	1.81	60.00	3,322.00	4.030	0.228
#25	**1**	**Time of Concentration:**					**0.990**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#25	2	5. Nearly bare and untilled, and alluvial valley fans	1.11	25.00	2,254.00	1.050	0.596
		8. Large gullies, diversions, and low flowing streams	2.36	75.00	3,178.00	4.600	0.191
#25	**2**	**Time of Concentration:**					**0.787**
#25	3	5. Nearly bare and untilled, and alluvial valley fans	3.23	30.00	929.00	1.790	0.144
		8. Large gullies, diversions, and low flowing streams	2.45	154.00	6,297.00	4.690	0.372
#25	**3**	**Time of Concentration:**					**0.516**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	1.20	103.00	8,602.00	1.090	2.192
#26	**1**	**Time of Concentration:**					**2.192**
#26	2	5. Nearly bare and untilled, and alluvial valley fans	1.23	120.00	9,780.00	1.100	2.469
		8. Large gullies, diversions, and low flowing streams	2.18	184.00	8,454.00	4.420	0.531
#26	**2**	**Time of Concentration:**					**3.000**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.32	50.00	1,158.02	2.070	0.155
		8. Large gullies, diversions, and low flowing streams	2.53	198.00	7,838.16	4.760	0.457
#27	**1**	**Time of Concentration:**					**0.612**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	5.26	30.00	570.00	2.290	0.069
		8. Large gullies, diversions, and low flowing streams	3.15	278.00	8,822.00	5.320	0.460
#27	**2**	**Time of Concentration:**					**0.529**
#27	3	5. Nearly bare and untilled, and alluvial valley fans	16.33	80.00	490.00	4.040	0.033
		8. Large gullies, diversions, and low flowing streams	2.15	225.00	10,443.00	4.400	0.659
#27	**3**	**Time of Concentration:**					**0.692**
#27	4	5. Nearly bare and untilled, and alluvial valley fans	12.43	65.00	523.00	3.520	0.041
		8. Large gullies, diversions, and low flowing streams	3.49	225.00	6,454.00	5.600	0.320
#27	**4**	**Time of Concentration:**					**0.361**
#27	5	5. Nearly bare and untilled, and alluvial valley fans	9.40	25.00	266.00	3.060	0.024
		8. Large gullies, diversions, and low flowing streams	2.32	364.00	15,700.00	4.560	0.956
#27	**5**	**Time of Concentration:**					**0.980**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	40.00	762.00	2.290	0.092
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**1**	**Time of Concentration:**					**0.657**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	2	5. Nearly bare and untilled, and alluvial valley fans	25.86	105.00	406.00	5.080	0.022
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**2**	**Time of Concentration:**					**0.587**
#29	1	5. Nearly bare and untilled, and alluvial valley fans	11.58	30.00	259.00	3.400	0.021
		8. Large gullies, diversions, and low flowing streams	3.61	288.00	7,976.00	5.700	0.388
#29	**1**	**Time of Concentration:**					**0.409**
#29	2	5. Nearly bare and untilled, and alluvial valley fans	8.06	40.00	496.00	2.830	0.048
		8. Large gullies, diversions, and low flowing streams	2.90	252.00	8,693.55	5.100	0.473
#29	**2**	**Time of Concentration:**					**0.521**
#29	3	5. Nearly bare and untilled, and alluvial valley fans	7.25	25.00	345.00	2.690	0.035
		8. Large gullies, diversions, and low flowing streams	2.26	158.00	7,001.00	4.500	0.432
#29	**3**	**Time of Concentration:**					**0.467**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	35.00	710.00	2.220	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	243.00	14,540.00	3.870	1.043
#30	**1**	**Time of Concentration:**					**1.131**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.91	15.00	515.00	1.700	0.084
		8. Large gullies, diversions, and low flowing streams	2.74	247.00	9,006.00	4.960	0.504
#31	**1**	**Time of Concentration:**					**0.588**
#31	2	5. Nearly bare and untilled, and alluvial valley fans	7.46	25.00	335.00	2.730	0.034
		8. Large gullies, diversions, and low flowing streams	2.18	138.00	6,335.00	4.420	0.398
#31	**2**	**Time of Concentration:**					**0.432**
#31	3	5. Nearly bare and untilled, and alluvial valley fans	3.84	20.00	521.00	1.950	0.074
		8. Large gullies, diversions, and low flowing streams	2.24	108.00	4,826.00	4.480	0.299
#31	**3**	**Time of Concentration:**					**0.373**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	22.00	632.00	1.860	0.094
		8. Large gullies, diversions, and low flowing streams	1.56	101.00	6,494.00	3.740	0.482
#32	**1**	**Time of Concentration:**					**0.576**
#34	1	5. Nearly bare and untilled, and alluvial valley fans	2.28	35.00	1,538.00	1.500	0.284
		8. Large gullies, diversions, and low flowing streams	2.89	74.00	2,560.00	5.100	0.139

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#34	**1**	**Time of Concentration:**					**0.423**
#34	2	5. Nearly bare and untilled, and alluvial valley fans	2.69	38.00	1,415.00	1.630	0.241
		8. Large gullies, diversions, and low flowing streams	1.60	81.00	5,052.00	3.790	0.370
#34	**2**	**Time of Concentration:**					**0.611**
#34	3	5. Nearly bare and untilled, and alluvial valley fans	3.80	56.00	1,474.00	1.940	0.211
		8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,293.00	2.500	0.477
#34	**3**	**Time of Concentration:**					**0.688**
#34	4	5. Nearly bare and untilled, and alluvial valley fans	4.17	35.00	840.00	2.040	0.114
		8. Large gullies, diversions, and low flowing streams	1.89	72.00	3,807.00	4.120	0.256
#34	**4**	**Time of Concentration:**					**0.370**
#35	1	5. Nearly bare and untilled, and alluvial valley fans	2.34	113.00	4,831.12	1.520	0.882
		8. Large gullies, diversions, and low flowing streams	1.11	20.00	1,794.00	3.160	0.157
#35	**1**	**Time of Concentration:**					**1.039**
#36	1	5. Nearly bare and untilled, and alluvial valley fans	3.35	20.00	596.46	1.830	0.090
		8. Large gullies, diversions, and low flowing streams	1.29	60.00	4,641.80	3.410	0.378
#36	**1**	**Time of Concentration:**					**0.468**
#36	2	5. Nearly bare and untilled, and alluvial valley fans	3.33	40.00	1,200.57	1.820	0.183
		8. Large gullies, diversions, and low flowing streams	1.51	90.00	5,956.33	3.680	0.449
#36	**2**	**Time of Concentration:**					**0.632**
#36	3	5. Nearly bare and untilled, and alluvial valley fans	3.77	77.00	2,043.74	1.940	0.292
		8. Large gullies, diversions, and low flowing streams	1.12	53.00	4,712.61	3.180	0.411
#36	**3**	**Time of Concentration:**					**0.703**
#36	4	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	937.44	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.76	80.00	4,538.27	3.980	0.316
#36	**4**	**Time of Concentration:**					**0.419**
#36	5	5. Nearly bare and untilled, and alluvial valley fans	1.68	10.00	596.48	1.290	0.128
		8. Large gullies, diversions, and low flowing streams	2.50	125.00	5,007.21	4.740	0.293
#36	**5**	**Time of Concentration:**					**0.421**
#36	6	5. Nearly bare and untilled, and alluvial valley fans	1.57	10.00	638.43	1.250	0.141

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.06	123.00	5,966.63	4.300	0.385
#36	**6**	**Time of Concentration:**					**0.526**
#37	1	5. Nearly bare and untilled, and alluvial valley fans	4.68	129.00	2,754.05	2.160	0.354
		8. Large gullies, diversions, and low flowing streams	0.16	10.00	6,108.73	1.210	1.402
#37	**1**	**Time of Concentration:**					**1.756**
#37	2	5. Nearly bare and untilled, and alluvial valley fans	5.17	45.00	870.00	2.270	0.106
		8. Large gullies, diversions, and low flowing streams	2.01	95.00	4,737.20	4.240	0.310
#37	**2**	**Time of Concentration:**					**0.416**
#37	3	5. Nearly bare and untilled, and alluvial valley fans	3.52	30.00	852.93	1.870	0.126
		8. Large gullies, diversions, and low flowing streams	4.02	180.00	4,473.94	6.010	0.206
#37	**3**	**Time of Concentration:**					**0.703**
#37	4	5. Nearly bare and untilled, and alluvial valley fans	3.18	35.00	1,099.00	1.780	0.171
		8. Large gullies, diversions, and low flowing streams	1.49	38.00	2,544.00	3.660	0.193
#37	**4**	**Time of Concentration:**					**0.419**
#37	5	5. Nearly bare and untilled, and alluvial valley fans	2.59	40.00	1,542.81	1.610	0.266
		8. Large gullies, diversions, and low flowing streams	1.48	67.00	4,528.71	3.640	0.345
#37	**5**	**Time of Concentration:**					**0.421**
#37	6	5. Nearly bare and untilled, and alluvial valley fans	1.55	10.00	646.96	1.240	0.144
		8. Large gullies, diversions, and low flowing streams	6.34	157.00	2,475.12	7.550	0.091
#37	**6**	**Time of Concentration:**					**0.526**
#37	7	5. Nearly bare and untilled, and alluvial valley fans	7.23	80.00	1,106.00	2.680	0.114
		8. Large gullies, diversions, and low flowing streams	1.05	52.00	4,950.00	3.070	0.447
#37	**7**	**Time of Concentration:**					**0.561**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	1.29	107.00	8,294.00	3.400	0.677
#1	**2**	**Muskingum K:**					**0.677**
#1	3	8. Large gullies, diversions, and low flowing streams	1.27	113.00	8,880.00	3.380	0.729

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**3**	**Muskingum K:**					**0.729**
#1	4	8. Large gullies, diversions, and low flowing streams	1.35	171.00	12,634.00	3.490	1.005
#1	**4**	**Muskingum K:**					**1.005**
#1	5	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**5**	**Muskingum K:**					**1.392**
#1	6	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**6**	**Muskingum K:**					**1.392**
#2	2	8. Large gullies, diversions, and low flowing streams	0.53	20.00	3,756.00	2.180	0.478
#2	**2**	**Muskingum K:**					**0.478**
#2	3	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**3**	**Muskingum K:**					**0.574**
#2	4	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**4**	**Muskingum K:**					**0.574**
#2	5	8. Large gullies, diversions, and low flowing streams	0.65	45.00	6,955.00	2.410	0.801
#2	**5**	**Muskingum K:**					**0.801**
#3	3	8. Large gullies, diversions, and low flowing streams	0.92	20.00	2,168.00	2.880	0.209
#3	**3**	**Muskingum K:**					**0.209**
#5	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#5	**1**	**Muskingum K:**					**0.000**
#5	2	8. Large gullies, diversions, and low flowing streams	1.75	125.00	7,149.00	3.960	0.501
#5	**2**	**Muskingum K:**					**0.501**
#5	3	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**3**	**Muskingum K:**					**0.681**
#5	4	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**4**	**Muskingum K:**					**0.681**
#5	5	8. Large gullies, diversions, and low flowing streams	1.67	239.00	14,273.00	3.880	1.021
#5	**5**	**Muskingum K:**					**1.021**
#5	6	8. Large gullies, diversions, and low flowing streams	1.68	239.00	14,223.00	3.880	1.018
#5	**6**	**Muskingum K:**					**1.018**
#7	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**1**	**Muskingum K:**					**0.000**
#7	2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	**2**	**Muskingum K:**					**0.000**
#7	4	8. Large gullies, diversions, and low flowing streams	1.16	140.00	12,037.00	3.230	1.035
#7	**4**	**Muskingum K:**					**1.035**
#7	5	8. Large gullies, diversions, and low flowing streams	1.14	140.00	12,307.69	3.190	1.071
#7	**5**	**Muskingum K:**					**1.071**
#7	6	8. Large gullies, diversions, and low flowing streams	1.17	158.00	13,546.00	3.230	1.164
#7	**6**	**Muskingum K:**					**1.164**
#7	7	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**7**	**Muskingum K:**					**1.344**
#7	8	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**8**	**Muskingum K:**					**1.344**
#10	3	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**3**	**Muskingum K:**					**0.517**
#10	4	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**4**	**Muskingum K:**					**0.517**
#10	5	8. Large gullies, diversions, and low flowing streams	0.79	47.00	5,956.00	2.660	0.621
#10	**5**	**Muskingum K:**					**0.621**
#12	2	8. Large gullies, diversions, and low flowing streams	8.24	111.00	1,347.00	8.610	0.043
#12	**2**	**Muskingum K:**					**0.043**
#12	3	8. Large gullies, diversions, and low flowing streams	8.01	109.00	1,360.00	8.490	0.044
#12	**3**	**Muskingum K:**					**0.044**
#12	4	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**4**	**Muskingum K:**					**0.487**
#12	5	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**5**	**Muskingum K:**					**0.487**
#13	2	8. Large gullies, diversions, and low flowing streams	1.34	54.00	4,025.00	3.470	0.322
#13	**2**	**Muskingum K:**					**0.322**
#13	3	8. Large gullies, diversions, and low flowing streams	0.98	72.00	7,333.00	2.970	0.685
#13	**3**	**Muskingum K:**					**0.685**
#13	4	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**4**	**Muskingum K:**					**0.923**
#13	5	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	**5**	**Muskingum K:**					**0.923**
#14	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#14	**1**	**Muskingum K:**					**0.000**
#14	2	8. Large gullies, diversions, and low flowing streams	0.83	58.00	6,957.00	2.730	0.707
#14	**2**	**Muskingum K:**					**0.707**
#14	3	8. Large gullies, diversions, and low flowing streams	0.81	77.00	9,480.00	2.700	0.975
#14	**3**	**Muskingum K:**					**0.975**
#14	4	8. Large gullies, diversions, and low flowing streams	0.86	147.00	17,117.00	2.770	1.716
#14	**4**	**Muskingum K:**					**1.716**
#14	5	8. Large gullies, diversions, and low flowing streams	0.88	175.00	19,934.00	2.810	1.970
#14	**5**	**Muskingum K:**					**1.970**
#14	6	8. Large gullies, diversions, and low flowing streams	0.95	211.00	22,155.00	2.920	2.107
#14	**6**	**Muskingum K:**					**2.107**
#14	7	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**7**	**Muskingum K:**					**2.544**
#14	8	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**8**	**Muskingum K:**					**2.544**
#14	9	8. Large gullies, diversions, and low flowing streams	0.95	307.00	32,146.59	2.930	3.047
#14	**9**	**Muskingum K:**					**3.047**
#14	10	8. Large gullies, diversions, and low flowing streams	0.96	339.00	35,382.00	2.930	3.354
#14	**10**	**Muskingum K:**					**3.354**
#15	2	8. Large gullies, diversions, and low flowing streams	1.14	86.00	7,535.26	3.200	0.654
#15	**2**	**Muskingum K:**					**0.654**
#15	3	8. Large gullies, diversions, and low flowing streams	1.25	115.00	9,236.00	3.340	0.768
#15	**3**	**Muskingum K:**					**0.768**
#16	2	8. Large gullies, diversions, and low flowing streams	0.55	42.00	7,608.00	2.220	0.951
#16	**2**	**Muskingum K:**					**0.951**
#16	3	8. Large gullies, diversions, and low flowing streams	0.51	54.00	10,615.00	2.130	1.384
#16	**3**	**Muskingum K:**					**1.384**
#17	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#17	**1**	**Muskingum K:**					**0.000**
#18	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#18	**1**	**Muskingum K:**					**0.000**
#18	2	8. Large gullies, diversions, and low flowing streams	1.02	62.00	6,103.00	3.020	0.561
#18	**2**	**Muskingum K:**					**0.561**
#21	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#21	**1**	**Muskingum K:**					**0.000**
#21	2	8. Large gullies, diversions, and low flowing streams	0.41	20.00	4,825.09	1.930	0.694
#21	**2**	**Muskingum K:**					**0.694**
#21	3	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,627.46	1.780	0.878
#21	**3**	**Muskingum K:**					**0.878**
#21	4	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,627.46	1.780	0.878
#21	**4**	**Muskingum K:**					**0.878**
#24	1	8. Large gullies, diversions, and low flowing streams	0.79	180.00	22,769.00	2.660	2.377
#24	**1**	**Muskingum K:**					**2.377**
#24	2	8. Large gullies, diversions, and low flowing streams	0.78	180.00	23,111.00	2.640	2.431
#24	**2**	**Muskingum K:**					**2.431**
#24	4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#24	**4**	**Muskingum K:**					**0.000**
#25	1	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**1**	**Muskingum K:**					**0.342**
#25	2	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**2**	**Muskingum K:**					**0.342**
#25	3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#25	**3**	**Muskingum K:**					**0.000**
#27	1	8. Large gullies, diversions, and low flowing streams	1.38	216.00	15,629.00	3.520	1.233
#27	**1**	**Muskingum K:**					**1.233**
#27	2	8. Large gullies, diversions, and low flowing streams	1.17	144.00	12,301.00	3.240	1.054
#27	**2**	**Muskingum K:**					**1.054**
#27	3	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**3**	**Muskingum K:**					**0.551**
#27	4	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**4**	**Muskingum K:**					**0.551**
#28	1	8. Large gullies, diversions, and low flowing streams	1.30	84.00	6,445.17	3.420	0.523

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#28	**1**	**Muskingum K:**					**0.523**
#29	1	8. Large gullies, diversions, and low flowing streams	0.88	37.00	4,210.00	2.810	0.416
#29	**1**	**Muskingum K:**					**0.416**
#29	2	8. Large gullies, diversions, and low flowing streams	0.88	26.00	2,949.00	2.810	0.291
#29	**2**	**Muskingum K:**					**0.291**
#31	1	8. Large gullies, diversions, and low flowing streams	1.35	76.00	5,639.00	3.480	0.450
#31	**1**	**Muskingum K:**					**0.450**
#31	2	8. Large gullies, diversions, and low flowing streams	1.15	20.00	1,734.00	3.220	0.149
#31	**2**	**Muskingum K:**					**0.149**
#34	1	8. Large gullies, diversions, and low flowing streams	0.64	56.00	8,773.00	2.390	1.019
#34	**1**	**Muskingum K:**					**1.019**
#34	2	8. Large gullies, diversions, and low flowing streams	1.05	31.00	2,957.00	3.070	0.267
#34	**2**	**Muskingum K:**					**0.267**
#34	3	8. Large gullies, diversions, and low flowing streams	0.64	26.00	4,031.00	2.400	0.466
#34	**3**	**Muskingum K:**					**0.466**
#36	1	8. Large gullies, diversions, and low flowing streams	0.79	110.00	13,954.41	2.660	1.457
#36	**1**	**Muskingum K:**					**1.457**
#36	2	8. Large gullies, diversions, and low flowing streams	0.58	50.00	8,630.15	2.280	1.051
#36	**2**	**Muskingum K:**					**1.051**
#36	3	8. Large gullies, diversions, and low flowing streams	0.58	50.00	8,630.15	2.280	1.051
#36	**3**	**Muskingum K:**					**1.051**
#36	4	8. Large gullies, diversions, and low flowing streams	0.23	10.00	4,329.90	1.440	0.835
#36	**4**	**Muskingum K:**					**0.835**
#36	5	8. Large gullies, diversions, and low flowing streams	0.21	5.00	2,359.95	1.380	0.475
#36	**5**	**Muskingum K:**					**0.475**
#37	2	8. Large gullies, diversions, and low flowing streams	0.28	30.00	10,642.07	1.590	1.859
#37	**2**	**Muskingum K:**					**1.859**
#37	3	8. Large gullies, diversions, and low flowing streams	0.45	38.00	8,493.51	2.000	1.179
#37	**3**	**Muskingum K:**					**1.179**
#37	4	8. Large gullies, diversions, and low flowing streams	0.66	104.00	15,664.00	2.440	1.783
#37	**4**	**Muskingum K:**					**0.835**
#37	5	8. Large gullies, diversions, and low flowing streams	0.33	41.00	12,388.68	1.720	2.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#37	**5**	**Muskingum K:**					**0.475**
#37	6	8. Large gullies, diversions, and low flowing streams	0.33	41.00	12,388.68	1.720	2.000
#37	**6**	**Muskingum K:**					**0.000**
#37	7	8. Large gullies, diversions, and low flowing streams	0.33	31.00	9,267.00	1.730	1.487
#37	**7**	**Muskingum K:**					**1.487**

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Area 4 North Pond 3

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-115.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

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Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Area 4 North Pond 3

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	8.600	8.600	21.09	0.83

Structure Detail:

Structure #1 (Null)

Area 4 North Pond 3

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	0.019	0.000	0.000	91.000	M	21.09	0.833
	Σ	**8.600**						**21.09**	**0.833**

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	6.00	6.00	100.00	2.440	0.011
		8. Large gullies, diversions, and low flowing streams	20.95	88.00	420.00	13.730	0.008
#1	**1**	**Time of Concentration:**					**0.019**

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Area 4 North Pond 4

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-118.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

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Phone: 505 598 2007

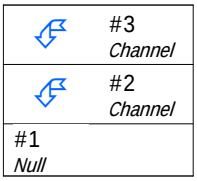
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 4
Channel	#2	==>	#1	0.013	0.443	Southwest Berm to Pond 4
Channel	#3	==>	#1	0.006	0.452	Northeast Berm to Pond 4



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	19.68	124.00	630.00	13.30	0.013
#2	**Muskingum K:**					**0.013**
#3	8. Large gullies, diversions, and low flowing streams	28.57	100.00	350.00	16.03	0.006
#3	**Muskingum K:**					**0.006**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	0.200	0.200	0.49	0.02
#2	6.600	6.600	16.19	0.64
#1	39.500	46.300	75.64	4.49

Structure Detail:

Structure #3 (Erodible Channel)

Northeast Berm to Pond 4

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	1.3	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.35 ft	1.35 ft
Top Width:	1.41 ft	5.41 ft
Velocity:	1.98 fps	
X-Section Area:	0.25 sq ft	
Hydraulic Radius:	0.157	
Froude Number:	0.83	

Structure #2 (Erodible Channel)

Southwest Berm to Pond 4

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

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)
6.00	1.5:1	3.0:1	0.2	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.94 ft	1.94 ft
Top Width:	10.21 ft	14.71 ft
Velocity:	2.13 fps	
X-Section Area:	7.59 sq ft	
Hydraulic Radius:	0.715	
Froude Number:	0.44	

Structure #1 (Null) Area 4N Pond

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)
#3	1	0.200	0.033	0.000	0.000	91.000	M	0.49	0.02
	S	**0.200**						**0.49**	**0.02**
#2	1	6.600	0.084	0.000	0.000	91.000	M	16.19	0.64
	S	**6.600**						**16.19**	**0.64**
#1	1	39.500	0.133	0.000	0.000	91.000	M	63.76	3.83
	S	**46.300**						**75.64**	**4.49**

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	2.62	15.00	572.01	1.610	0.098
		8. Large gullies, diversions, and low flowing streams	9.89	120.00	1,213.00	9.430	0.035
#1	**1**	**Time of Concentration:**					**0.133**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.45	10.00	155.00	2.540	0.016
		8. Large gullies, diversions, and low flowing streams	2.25	25.00	1,110.00	4.500	0.068
#2	**1**	**Time of Concentration:**					**0.084**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.22	4.00	180.00	1.490	0.033
#3	**1**	**Time of Concentration:**					**0.033**

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Area 4 North Pond 4

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-118.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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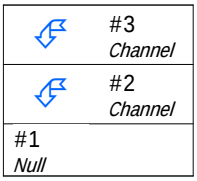
General Information

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
Null	#1	==>	End	0.000	0.000	A4N Pond 4
Channel	#2	==>	#1	0.013	0.443	Southwest Berm to Pond 4
Channel	#3	==>	#1	0.006	0.452	Northeast Berm to Pond 4



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	19.68	124.00	630.00	13.30	0.013
#2	**Muskingum K:**					**0.013**
#3	8. Large gullies, diversions, and low flowing streams	28.57	100.00	350.00	16.03	0.006
#3	**Muskingum K:**					**0.006**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	0.200	0.200	0.27	0.01
#2	6.600	6.600	8.98	0.32
#1	39.500	46.300	38.57	2.57

Structure Detail:

Structure #3 (Erodible Channel)

Northeast Berm to Pond 4

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	1.3	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.28 ft	1.28 ft
Top Width:	1.13 ft	5.13 ft
Velocity:	1.72 fps	
X-Section Area:	0.16 sq ft	
Hydraulic Radius:	0.127	
Froude Number:	0.80	

Structure #2 (Erodible Channel)

Southwest Berm to Pond 4

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

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)
6.00	1.5:1	3.0:1	0.2	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	0.67 ft	1.67 ft
Top Width:	9.03 ft	13.53 ft
Velocity:	1.77 fps	
X-Section Area:	5.06 sq ft	
Hydraulic Radius:	0.543	
Froude Number:	0.42	

Structure #1 (Null) Area 4N Pond

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)
#3	1	0.200	0.033	0.000	0.000	91.000	M	0.27	0.01
	S	**0.200**						**0.27**	**0.01**
#2	1	6.600	0.084	0.000	0.000	91.000	M	8.98	0.32
	S	**6.600**						**8.98**	**0.32**
#1	1	39.500	0.133	0.000	0.000	91.000	M	33.48	1.91
	S	**46.300**						**38.57**	**2.57**

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	2.62	15.00	572.01	1.610	0.098
		8. Large gullies, diversions, and low flowing streams	9.89	120.00	1,213.00	9.430	0.035
#1	**1**	**Time of Concentration:**					**0.133**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.45	10.00	155.00	2.540	0.016
		8. Large gullies, diversions, and low flowing streams	2.25	25.00	1,110.00	4.500	0.068
#2	**1**	**Time of Concentration:**					**0.084**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.22	4.00	180.00	1.490	0.033
#3	**1**	**Time of Concentration:**					**0.033**

Area 4 North

Perimeter Road Pond 401

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-01.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

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PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

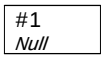
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 401



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	21.400	21.400	42.07	1.45

Structure Detail:

Structure #1 (Null)

Perimeter Road Pond 401

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	21.400	0.059	0.000	0.000	85.300	M	42.07	1.45
	S	**21.400**						**42.07**	**1.45**

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	4.56	62.00	1,360.00	6.400	0.059
#1	**1**	**Time of Concentration:**					**0.059**

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Area 4 North
Perimeter Road Pond 402

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-02.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

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Fruitland, NM 87416

Phone: 505 598 2007

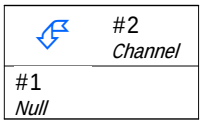
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 402
Channel	#2	==>	#1	0.000	0.000	Road Channel-East



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	60.800	60.800	88.97	5.21
#1	17.900	78.700	121.10	1.53

Structure Detail:

Structure #2 (Erodible Channel)

Road Channel-East

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)
8.00	3.0:1	1.5:1	0.8	0.0250	1.00			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.43 ft	2.43 ft
Top Width:	14.42 ft	18.92 ft
Velocity:	5.56 fps	
X-Section Area:	16.00 sq ft	
Hydraulic Radius:	1.065	
Froude Number:	0.93	

Structure #1 (Null)

Perimeter Road Pond 402

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)
#2	1	60.800	0.139	0.000	0.000	89.000	M	88.97	5.21
	S	**60.800**						**88.97**	**5.21**
#1	1	17.900	0.015	0.000	0.000	89.000	M	40.87	1.53
	S	**78.700**						**121.10**	**1.53**

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	15.00	6.00	40.00	3.870	0.002
		8. Large gullies, diversions, and low flowing streams	15.00	84.00	560.00	11.610	0.013
#1	**1**	**Time of Concentration:**					**0.015**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	10.00	150.00	2.580	0.016
		8. Large gullies, diversions, and low flowing streams	3.90	103.00	2,640.01	5.920	0.123
#2	**1**	**Time of Concentration:**					**0.139**

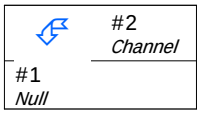
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 402
Channel	#2	==>	#1	0.000	0.000	Road Channel-East



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	60.800	60.800	50.91	3.58
#1	17.900	78.700	68.56	6.26

Structure Detail:

Structure #2 (Erodible Channel)

Road Channel-East

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)
8.00	3.0:1	1.5:1	0.8	0.0250	1.00			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.05 ft	2.05 ft
Top Width:	12.72 ft	17.22 ft
Velocity:	4.69 fps	
X-Section Area:	10.86 sq ft	
Hydraulic Radius:	0.825	
Froude Number:	0.89	

Structure #1 (Null)

Perimeter Road Pond 402

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)
#2	1	60.800	0.139	0.000	0.000	89.000	M	50.91	3.58
	S	**60.800**						**50.91**	**3.58**
#1	1	17.900	0.015	0.000	0.000	89.000	M	24.18	1.05
	S	**78.700**						**68.56**	**6.26**

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	15.00	6.00	40.00	3.870	0.002
		8. Large gullies, diversions, and low flowing streams	15.00	84.00	560.00	11.610	0.013
#1	**1**	**Time of Concentration:**					**0.015**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	10.00	150.00	2.580	0.016
		8. Large gullies, diversions, and low flowing streams	3.90	103.00	2,640.01	5.920	0.123
#2	**1**	**Time of Concentration:**					**0.139**

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	12.0	1.00		

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.48 ft	1.48 ft
Top Width:	10.86 ft	16.86 ft
Velocity*:		
X-Section Area:	4.49 sq ft	
Hydraulic Radius:	0.408	
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.

Area 4 North

Perimeter Road Pond 404

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-04.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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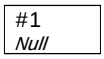
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 404



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	9.800	9.800	22.38	0.84

Structure Detail:

Structure #1 (Null)

Perimeter Road Pond 404

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	0.012	0.000	0.000	89.000	M	22.38	0.84
	S	**9.800**						**22.38**	**0.84**

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	10.48	44.00	420.00	9.710	0.012
#1	**1**	**Time of Concentration:**					**0.012**

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Area 4 North Pond 405

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-5.

The pond is design to retain the 100 yr-6 hr storm event. No spillway is required.

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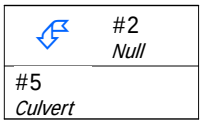
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#2	==>	#5	0.000	0.000	A4N Pond 405
Culvert	#5	==>	End	0.000	0.000	CP-189 Culvert under road



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	89.700	89.700	131.26	7.68
#5	0.000	89.700	131.26	7.68

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)
#2	1	89.700	0.146	0.000	0.000	89.000	M	131.26	7.68
	S	**89.700**						**131.26**	**7.68**
#5	**S**	**89.700**						**131.26**	**7.68**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	4.59	155.00	3,380.07	6.420	0.146
#2	**1**	**Time of Concentration:**					**0.146**

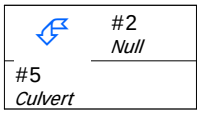
General Information

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
Null	#2	==>	#5	0.000	0.000	A4N Pond 405
Culvert	#5	==>	End	0.000	0.000	CP-189 Culvert under road



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	89.700	89.700	84.63	3.62
#5	0.000	89.700	84.63	3.62

Structure Detail:

Structure #2 (Null)

A4N Pond 405

Structure #5 (Culvert)

CP-189 Culvert under road

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
280.00	5.70	0.0150	23.00	0.00	0.90

Culvert Results:

Minimum pipe diameter required: 30 inches

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)
#2	1	89.700	0.146	0.000	0.000	89.000	F	84.63	3.62
	S	**89.700**						**84.63**	**3.62**
#5	**S**	**89.700**						**84.63**	**3.62**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	4.59	155.00	3,380.07	6.420	0.146
#2	**1**	**Time of Concentration:**					**0.146**

Area 4 North Pond 406

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-156.

The pond is designed to retain the 100-yr 6-hr storm event, therefore a spillway is not required.

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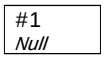
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 406



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	238.100	238.100	97.07	9.83

Structure Detail:

Structure #1 (Null)

A4N Pond 406

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	238.100	0.578	0.000	0.000	78.300	M	97.07	9.83
	S	**238.100**						**97.07**	**9.83**

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	1.87	20.00	1,070.03	1.360	0.218
		8. Large gullies, diversions, and low flowing streams	1.00	39.00	3,890.00	3.000	0.360
#1	**1**	**Time of Concentration:**					**0.578**

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Area 4 North Pond 407

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-157.

The pond is designed to retain the 100-yr 6-hr storm event, therefore a spillway is not required.

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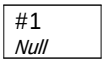
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 407



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	124.800	124.800	142.00	9.98

Structure Detail:

Structure #1 (Null)

A4N Pond 407

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	124.800	0.306	0.000	0.000	87.900	M	142.00	9.98
	S	**124.800**						**142.00**	**9.98**

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	0.79	6.00	760.00	0.880	0.239
		8. Large gullies, diversions, and low flowing streams	6.41	118.00	1,840.00	7.590	0.067
#1	**1**	**Time of Concentration:**					**0.306**

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Area 4 North Pond 408

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-158.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

RYazzie

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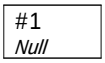
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 408



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.180	6.180	12.52	0.44

Structure Detail:

Structure #1 (Null)

A4N Pond 408

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	6.180	0.105	0.000	0.000	86.000	M	12.52	0.44
	S	**6.180**						**12.52**	**0.44**

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	1.33	1.00	75.00	1.150	0.018
		8. Large gullies, diversions, and low flowing streams	0.66	5.10	767.60	2.440	0.087
#1	**1**	**Time of Concentration:**					**0.105**

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Area 4 North Pond 409

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-159

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

RYazzie

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Phone: 505 598 2007

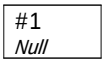
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 409



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	2.830	2.830	5.73	0.20

Structure Detail:

Structure #1 (Null)

A4N Pond 409

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	2.830	0.044	0.000	0.000	86.000	M	5.73	0.20
	S	**2.830**						**5.73**	**0.20**

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	5.12	2.90	56.60	2.260	0.006
		8. Large gullies, diversions, and low flowing streams	2.24	13.80	614.75	4.490	0.038
#1	**1**	**Time of Concentration:**					**0.044**

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Area 4 North Pond 410

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-159

The pond is design to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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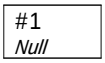
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 410



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	2.370	2.370	4.80	0.17

Structure Detail:

Structure #1 (Null)

A4N Pond 410

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	2.370	0.059	0.000	0.000	86.000	M	4.80	0.17
	S	**2.370**						**4.80**	**0.17**

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	1.67	1.90	113.50	1.290	0.024
		8. Large gullies, diversions, and low flowing streams	1.76	9.00	510.00	3.980	0.035
#1	**1**	**Time of Concentration:**					**0.059**

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Area 4 North Pond 411

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-161

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 411

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.500	12.500	30.66	1.21

Structure Detail:

Structure #1 (Null)

A4N Pond 411

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	12.500	0.077	0.000	0.000	91.000	M	30.66	1.210
	Σ	**12.500**						**30.66**	**1.210**

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	1.79	5.00	280.00	1.330	0.058
		8. Large gullies, diversions, and low flowing streams	9.85	65.00	660.00	9.410	0.019
#1	**1**	**Time of Concentration:**					**0.077**

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Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

Ron Van Valkenburg, PE

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Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

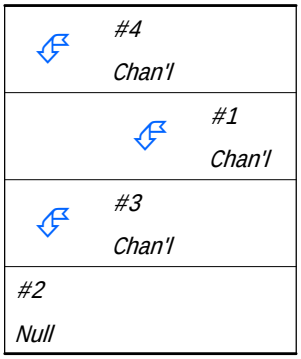
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



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	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	26.73	1.06
#1	5.300	5.300	13.00	0.51
#3	3.400	8.700	21.34	0.84
#2	11.000	30.600	75.05	2.96

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

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	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	26.73 cfs	
Depth:	0.21 ft	1.21 ft
Top Width:	11.26 ft	17.26 ft
Velocity*:		
X-Section Area:	2.24 sq ft	
Hydraulic Radius:	0.197 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.

Structure #1 (Erodible Channel)

Drainage Ditch

Trapezoidal Erodible Channel Inputs:

Material: Stiff clay very colloidal

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)
4.00	3.0:1	3.0:1	3.2	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.00 cfs	
Depth:	0.48 ft	1.48 ft
Top Width:	6.90 ft	12.90 ft
Velocity:	4.94 fps	
X-Section Area:	2.63 sq ft	
Hydraulic Radius:	0.373 ft	
Froude Number:	1.41	

Structure #3 (Riprap Channel)

Inlet B (West)

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	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	21.34 cfs	
Depth:	0.30 ft	1.30 ft
Top Width:	7.81 ft	13.81 ft
Velocity*:		
X-Section Area:	2.08 sq ft	
Hydraulic Radius:	0.263 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.

Structure #2 (Null)

A4N Pond 412

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)
#4	1	10.900	0.108	0.000	0.000	91.000	M	26.73	1.055
	Σ	**10.900**						**26.73**	**1.055**
#1	1	5.300	0.064	0.000	0.000	91.000	M	13.00	0.513
	Σ	**5.300**						**13.00**	**0.513**
#3	1	3.400	0.031	0.000	0.000	91.000	M	8.34	0.329
	Σ	**8.700**						**21.34**	**0.842**
#2	1	11.000	0.082	0.000	0.000	91.000	M	26.98	1.065
	Σ	**30.600**						**75.05**	**2.963**

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	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr-6 hr storm events, respectively.

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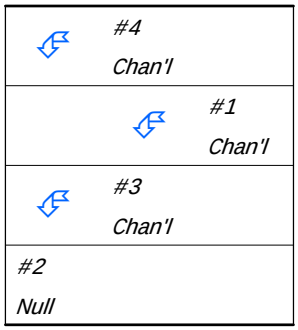
General Information

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	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



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	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	14.83	0.53
#1	5.300	5.300	7.21	0.26
#3	3.400	8.700	11.84	0.42
#2	11.000	30.600	41.64	1.48

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

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	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	14.83 cfs	
Depth:	0.13 ft	1.13 ft
Top Width:	10.79 ft	16.79 ft
Velocity*:		
X-Section Area:	1.38 sq ft	
Hydraulic Radius:	0.127 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.

Structure #1 (Erodible Channel)

Drainage Ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.0:1	2.0:1	3.2	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.21 cfs	
Depth:	0.85 ft	1.85 ft
Top Width:	3.40 ft	7.40 ft

	w/o Freeboard	w/ Freeboard
Velocity:	4.99 fps	
X-Section Area:	1.44 sq ft	
Hydraulic Radius:	0.380 ft	
Froude Number:	1.35	

Structure #3 (Riprap Channel)

Inlet B (West)

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	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.84 cfs	
Depth:	0.19 ft	1.19 ft
Top Width:	7.15 ft	13.15 ft
Velocity*:		
X-Section Area:	1.26 sq ft	
Hydraulic Radius:	0.175 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.

Structure #2 (Null)

A4N Pond 412

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)
#4	1	10.900	0.108	0.000	0.000	91.000	M	14.83	0.527
	Σ	**10.900**						**14.83**	**0.527**
#1	1	5.300	0.064	0.000	0.000	91.000	M	7.21	0.256
	Σ	**5.300**						**7.21**	**0.256**
#3	1	3.400	0.031	0.000	0.000	91.000	M	4.63	0.164
	Σ	**8.700**						**11.84**	**0.420**
#2	1	11.000	0.082	0.000	0.000	91.000	M	14.97	0.532
	Σ	**30.600**						**41.64**	**1.479**

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	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

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Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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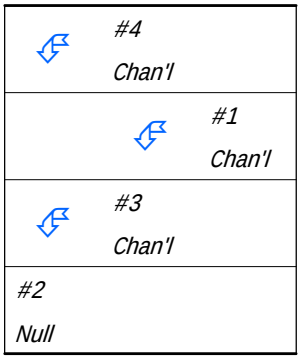
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



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	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	19.91	0.75
#1	5.300	5.300	9.68	0.36
#3	3.400	8.700	15.89	0.60
#2	11.000	30.600	55.89	2.09

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

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	18.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	19.91 cfs	
Depth:	0.17 ft	1.17 ft
Top Width:	11.00 ft	17.00 ft
Velocity*:		
X-Section Area:	1.75 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.

Structure #1 (Erodible Channel)

Drainage Ditch

Trapezoidal Erodible Channel Inputs:

Material: Stiff clay very colloidal

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)
4.00	3.0:1	3.0:1	3.2	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.68 cfs	
Depth:	0.41 ft	1.41 ft
Top Width:	6.46 ft	12.46 ft
Velocity:	4.50 fps	
X-Section Area:	2.15 sq ft	
Hydraulic Radius:	0.326 ft	
Froude Number:	1.38	

Structure #3 (Riprap Channel)

Inlet B (West)

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	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	15.89 cfs	
Depth:	0.24 ft	1.24 ft
Top Width:	7.44 ft	13.44 ft
Velocity*:		
X-Section Area:	1.61 sq ft	
Hydraulic Radius:	0.214 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.

Structure #2 (Null)

A4N Pond 412

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)
#4	1	10.900	0.108	0.000	0.000	91.000	M	19.91	0.746
	Σ	**10.900**						**19.91**	**0.746**
#1	1	5.300	0.064	0.000	0.000	91.000	M	9.68	0.363
	Σ	**5.300**						**9.68**	**0.363**
#3	1	3.400	0.031	0.000	0.000	91.000	M	6.21	0.233
	Σ	**8.700**						**15.89**	**0.595**
#2	1	11.000	0.082	0.000	0.000	91.000	M	20.09	0.753
	Σ	**30.600**						**55.89**	**2.093**

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	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

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Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

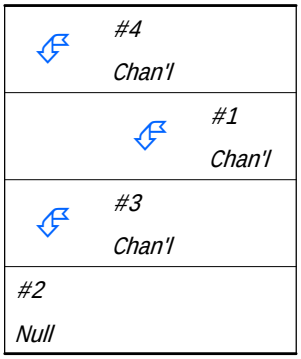
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Inlet B (West)
Channel	#4	==>	#2	0.000	0.000	Inlet A (East)



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	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**
#4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#4	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	5.500	5.500	13.49	0.53
#1	1.300	1.300	2.10	0.10
#3	0.500	1.800	3.17	0.15
#2	3.000	10.300	24.02	0.97

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (East)

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:	13.49 cfs	
Depth:	0.18 ft	1.18 ft
Top Width:	7.07 ft	13.07 ft
Velocity*:		
X-Section Area:	1.16 sq ft	
Hydraulic Radius:	0.163 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.

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	2.0	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.10 cfs	
Depth:	0.66 ft	1.66 ft
Top Width:	1.99 ft	4.99 ft
Velocity:	3.19 fps	
X-Section Area:	0.66 sq ft	
Hydraulic Radius:	0.276 ft	
Froude Number:	0.98	

Structure #3 (Riprap Channel)

Inlet B (West)

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	3.0:1	32.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.17 cfs	
Depth:	0.05 ft	1.05 ft
Top Width:	4.27 ft	10.27 ft
Velocity*:		
X-Section Area:	0.19 sq ft	
Hydraulic Radius:	0.044 ft	
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.

Structure #2 (Null)

A4N Pond 413

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)
#4	1	5.500	0.120	0.002	0.431	91.000	M	13.49	0.533
	Σ	**5.500**						**13.49**	**0.533**
#1	1	1.300	0.156	0.000	0.000	91.000	M	2.10	0.102
	Σ	**1.300**						**2.10**	**0.102**
#3	1	0.500	0.011	0.000	0.455	91.000	M	1.23	0.048
	Σ	**1.800**						**3.17**	**0.151**
#2	1	3.000	0.030	0.000	0.000	91.000	M	7.36	0.290
	Σ	**10.300**						**24.02**	**0.974**

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	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	4.00	360.00	1.050	0.095
		8. Large gullies, diversions, and low flowing streams	9.76	83.00	850.00	9.370	0.025
#4	**1**	**Time of Concentration:**					**0.120**

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	33.33	15.00	45.00	17.320	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**1**	**Muskingum K:**					**0.000**
#4	1	8. Large gullies, diversions, and low flowing streams	12.38	13.00	105.00	10.550	0.002
#4	**1**	**Muskingum K:**					**0.002**

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Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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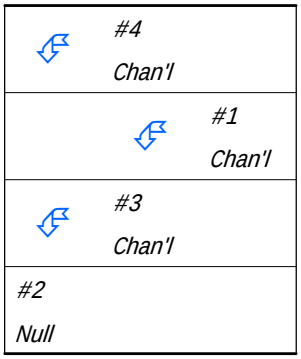
General Information

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	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Inlet B (West)
Channel	#4	==>	#2	0.000	0.000	Inlet A (East)



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	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**
#4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#4	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	5.500	5.500	7.49	0.27
#1	1.300	1.300	1.10	0.05
#3	0.500	1.800	1.65	0.08
#2	3.000	10.300	13.21	0.49

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (East)

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:	7.49 cfs	
Depth:	0.11 ft	1.11 ft
Top Width:	6.68 ft	12.68 ft
Velocity*:		
X-Section Area:	0.72 sq ft	
Hydraulic Radius:	0.107 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.

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	2.0	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.10 cfs	
Depth:	0.52 ft	1.52 ft
Top Width:	1.56 ft	4.56 ft
Velocity:	2.71 fps	
X-Section Area:	0.41 sq ft	
Hydraulic Radius:	0.216 ft	
Froude Number:	0.94	

Structure #3 (Riprap Channel)

Inlet B (West)

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	3.0:1	32.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.65 cfs	
Depth:	0.03 ft	1.03 ft
Top Width:	4.19 ft	10.19 ft
Velocity*:		
X-Section Area:	0.13 sq ft	
Hydraulic Radius:	0.031 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.

Structure #2 (Null)

A4N Pond 413

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)
#4	1	5.500	0.120	0.002	0.431	91.000	M	7.49	0.266
	Σ	**5.500**						**7.49**	**0.266**
#1	1	1.300	0.156	0.000	0.000	91.000	M	1.10	0.051
	Σ	**1.300**						**1.10**	**0.051**
#3	1	0.500	0.011	0.000	0.455	91.000	M	0.68	0.024
	Σ	**1.800**						**1.65**	**0.075**
#2	1	3.000	0.030	0.000	0.000	91.000	M	4.08	0.145
	Σ	**10.300**						**13.21**	**0.486**

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	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	4.00	360.00	1.050	0.095
		8. Large gullies, diversions, and low flowing streams	9.76	83.00	850.00	9.370	0.025
#4	**1**	**Time of Concentration:**					**0.120**

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	33.33	15.00	45.00	17.320	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**1**	**Muskingum K:**					**0.000**
#4	1	8. Large gullies, diversions, and low flowing streams	12.38	13.00	105.00	10.550	0.002
#4	**1**	**Muskingum K:**					**0.002**

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Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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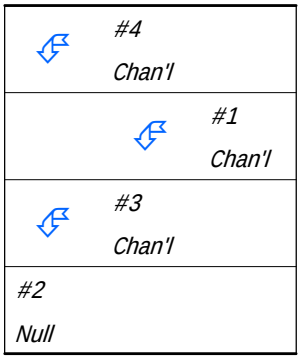
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Inlet B (West)
Channel	#4	==>	#2	0.000	0.000	Inlet A (East)



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	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**
#4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#4	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	5.500	5.500	10.05	0.38
#1	1.300	1.300	1.52	0.07
#3	0.500	1.800	2.29	0.11
#2	3.000	10.300	17.81	0.69

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (East)

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:	10.05 cfs	
Depth:	0.14 ft	1.14 ft
Top Width:	6.85 ft	12.85 ft
Velocity*:		
X-Section Area:	0.91 sq ft	
Hydraulic Radius:	0.132 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.

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	2.0	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.52 cfs	
Depth:	0.59 ft	1.59 ft
Top Width:	1.76 ft	4.76 ft
Velocity:	2.94 fps	
X-Section Area:	0.52 sq ft	
Hydraulic Radius:	0.244 ft	
Froude Number:	0.96	

Structure #3 (Riprap Channel)

Inlet B (West)

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	32.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.29 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	

Structure #2 (Null)

A4N Pond 413

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)
#4	1	5.500	0.120	0.002	0.431	91.000	M	10.05	0.376
	Σ	**5.500**						**10.05**	**0.376**
#1	1	1.300	0.156	0.000	0.000	91.000	M	1.52	0.072
	Σ	**1.300**						**1.52**	**0.072**
#3	1	0.500	0.011	0.000	0.455	91.000	M	0.91	0.034
	Σ	**1.800**						**2.29**	**0.107**
#2	1	3.000	0.030	0.000	0.000	91.000	M	5.48	0.205
	Σ	**10.300**						**17.81**	**0.688**

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	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	4.00	360.00	1.050	0.095
		8. Large gullies, diversions, and low flowing streams	9.76	83.00	850.00	9.370	0.025
#4	**1**	**Time of Concentration:**					**0.120**

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	33.33	15.00	45.00	17.320	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**1**	**Muskingum K:**					**0.000**
#4	1	8. Large gullies, diversions, and low flowing streams	12.38	13.00	105.00	10.550	0.002
#4	**1**	**Muskingum K:**					**0.002**

Cottonwood Arroyo Pre-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is shown on Exhibit 7-4.

Revised January 2007

AAY/LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

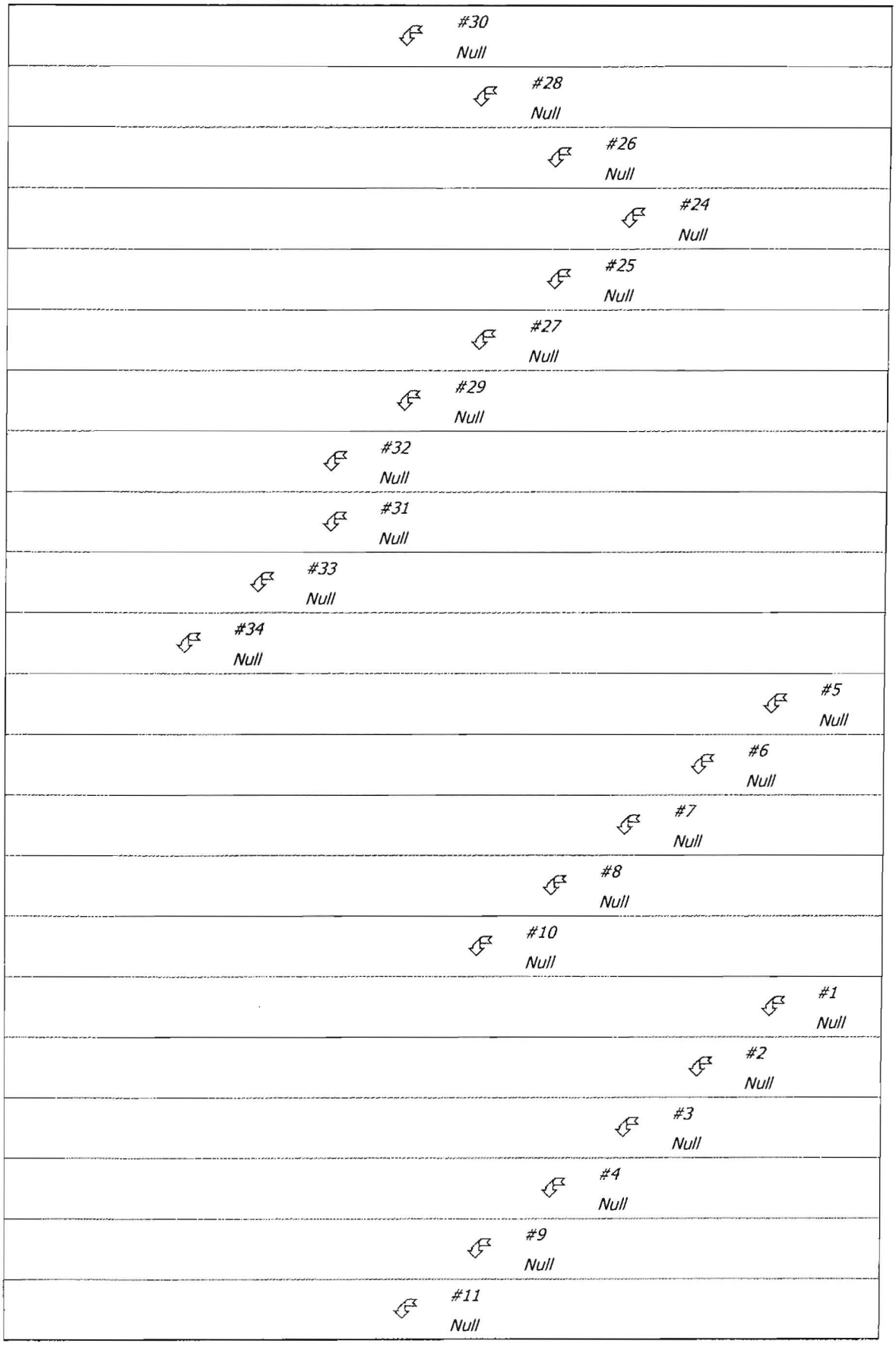
General Information

Storm Information:

Storm Type:	Type II-60
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	==>	#2	0.961	0.307	
Null	#2	==>	#3	0.068	0.331	
Null	#3	==>	#4	0.000	0.000	
Null	#4	==>	#9	0.718	0.281	
Null	#5	==>	#6	1.717	0.314	
Null	#6	==>	#7	0.222	0.298	
Null	#7	==>	#8	0.000	0.000	
Null	#8	==>	#10	1.278	0.289	
Null	#9	==>	#11	0.000	0.000	
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#21	0.495	0.453	
Null	#12	==>	#13	0.076	0.330	
Null	#13	==>	#14	3.790	0.314	
Null	#14	==>	#16	1.198	0.286	
Null	#15	==>	#16	1.198	0.286	
Null	#16	==>	#20	0.911	0.280	
Null	#17	==>	#19	0.000	0.000	
Null	#18	==>	#19	0.000	0.000	
Null	#19	==>	#20	0.915	0.252	
Null	#20	==>	#22	0.000	0.000	
Null	#21	==>	#22	0.000	0.000	
Null	#22	==>	#23	0.811	0.247	
Null	#23	==>	#35	0.000	0.000	
Null	#24	==>	#25	0.964	0.340	
Null	#25	==>	#27	1.454	0.333	
Null	#26	==>	#27	1.454	0.333	
Null	#27	==>	#29	0.800	0.323	
Null	#28	==>	#29	0.800	0.323	
Null	#29	==>	#32	0.479	0.298	
Null	#30	==>	#32	0.479	0.298	
Null	#31	==>	#33	0.000	0.000	
Null	#32	==>	#33	0.000	0.000	
Null	#33	==>	#34	1.372	0.293	Inlet to North Fork Diversion
Null	#34	==>	#35	0.000	0.000	
Null	#35	==>	#36	0.735	0.251	
Null	#36	==>	#37	3.388	0.246	
Null	#37	==>	End	0.000	0.000	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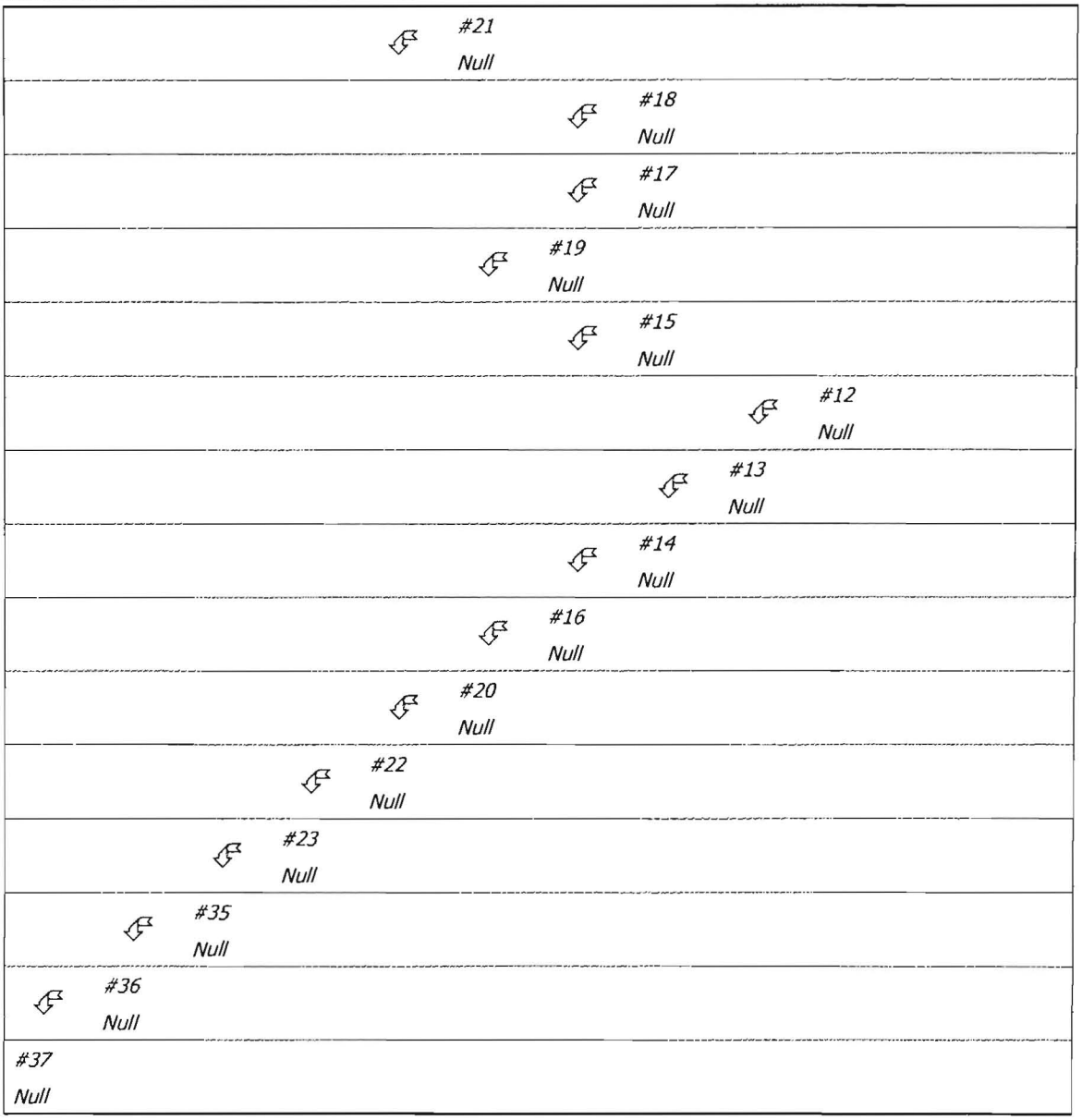


Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.81	76.00	9,347.00	2.70	0.961
#1	**Muskingum K:**					**0.961**
#2	8. Large gullies, diversions, and low flowing streams	1.23	10.00	814.00	3.32	0.068
#2	**Muskingum K:**					**0.068**
#3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.53	30.00	5,637.00	2.18	0.718
#4	**Muskingum K:**					**0.718**
#5	8. Large gullies, diversions, and low flowing streams	0.93	165.00	17,810.88	2.88	1.717
#5	**Muskingum K:**					**1.717**
#6	8. Large gullies, diversions, and low flowing streams	0.70	14.00	2,006.01	2.50	0.222
#6	**Muskingum K:**					**0.222**
#8	8. Large gullies, diversions, and low flowing streams	0.61	65.00	10,726.07	2.33	1.278
#8	**Muskingum K:**					**1.278**
#11	8. Large gullies, diversions, and low flowing streams	30.00	8,801.00	29,336.66	16.43	0.495
#11	**Muskingum K:**					**0.495**
#12	8. Large gullies, diversions, and low flowing streams	1.21	11.00	906.00	3.30	0.076
#12	**Muskingum K:**					**0.076**
#13	8. Large gullies, diversions, and low flowing streams	0.92	363.00	39,301.00	2.88	3.790
#13	**Muskingum K:**					**3.790**
#14	8. Large gullies, diversions, and low flowing streams	0.58	57.00	9,834.00	2.28	1.198
#14	**Muskingum K:**					**1.198**
#15	8. Large gullies, diversions, and low flowing streams	0.58	57.00	9,834.00	2.28	1.198
#15	**Muskingum K:**					**1.198**
#16	8. Large gullies, diversions, and low flowing streams	0.52	37.00	7,084.00	2.16	0.911
#16	**Muskingum K:**					**0.911**
#19	8. Large gullies, diversions, and low flowing streams	0.33	19.00	5,699.00	1.73	0.915
#19	**Muskingum K:**					**0.915**
#22	8. Large gullies, diversions, and low flowing streams	0.31	15.00	4,852.00	1.66	0.811
#22	**Muskingum K:**					**0.811**
#24	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,568.00	3.62	0.964
#24	**Muskingum K:**					**0.964**
#25	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.00	3.39	1.454
#25	**Muskingum K:**					**1.454**
#26	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.62	3.39	1.454
#26	**Muskingum K:**					**1.454**
#27	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#27	**Muskingum K:**					**0.800**
#28	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#28	**Muskingum K:**					**0.800**
#29	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#29	**Muskingum K:**					**0.479**
#30	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#30	**Muskingum K:**					**0.479**
#33	8. Large gullies, diversions, and low flowing streams	0.65	77.00	11,910.00	2.41	1.372
#33	**Muskingum K:**					**1.372**
#35	8. Large gullies, diversions, and low flowing streams	0.33	15.00	4,554.00	1.72	0.735
#35	**Muskingum K:**					**0.735**
#36	8. Large gullies, diversions, and low flowing streams	0.30	60.00	20,005.00	1.64	3.388
#36	**Muskingum K:**					**3.388**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#30	476.400	476.400	6.98	1.76
#28	1,217.900	1,217.900	283.47	46.07
#26	2,486.400	2,486.400	46.07	18.65
#24	8,061.800	8,061.800	65.88	51.67
#25	1,015.700	9,077.500	80.90	66.70
#27	1,783.700	13,347.600	183.29	111.80
#29	966.000	15,531.500	426.99	193.50
#32	293.700	16,301.600	441.67	209.47
#31	957.100	957.100	271.94	43.43
#33	0.000	17,258.700	525.37	252.90
#34	932.500	18,191.200	549.99	286.55
#5	2,023.000	2,023.000	353.61	61.88
#6	1,743.200	3,766.200	378.03	119.94
#7	2,395.300	6,161.500	660.04	232.04
#8	0.000	6,161.500	660.04	232.04
#10	1,053.200	7,214.700	695.02	272.19
#1	2,411.100	2,411.100	280.48	56.33
#2	1,497.000	3,908.100	345.41	120.02
#3	862.700	4,770.800	457.63	149.88
#4	0.000	4,770.800	457.63	149.88
#9	425.500	5,196.300	481.74	169.93
#11	0.000	12,411.000	1,064.62	442.12
#21	1,080.800	13,491.800	1,112.92	480.32
#18	848.500	848.500	134.32	28.24
#17	182.200	182.200	90.17	8.82
#19	0.000	1,030.700	209.51	37.06
#15	1,992.700	1,992.700	314.41	62.84
#12	3,494.500	3,494.500	146.72	38.48
#13	2,720.700	6,215.200	284.84	69.00
#14	5,096.800	11,312.000	400.59	209.40
#16	876.500	14,181.200	676.40	313.93
#20	681.900	15,893.800	724.23	382.40
#22	0.000	29,385.600	1,750.57	862.72
#23	752.900	30,138.500	1,749.20	888.40
#35	0.000	48,329.700	2,189.60	1,174.95
#36	891.700	49,221.400	2,186.29	1,195.57
#37	2,208.500	51,429.900	2,165.91	1,247.56

Structure Detail:

Structure #30 (Null)

Structure #28 (Null)

Structure #26 (Null)

Structure #24 (Null)

Structure #25 (Null)

Structure #27 (Null)

Structure #29 (Null)

Structure #32 (Null)

Structure #31 (Null)

Structure #33 (Null)

- *Inlet to North Fork Diversion*

Structure #34 (Null)

Structure #5 (Null)

Structure #6 (Null)

Structure #7 (Null)

Structure #8 (Null)

Structure #10 (Null)

Structure #1 (Null)

Structure #2 (Null)

Structure #3 (Null)

Structure #4 (Null)

Structure #9 (Null)

Structure #11 (Null)

Structure #21 (Null)

Structure #18 (Null)

Structure #17 (Null)

Structure #19 (Null)

Structure #15 (Null)

Structure #12 (Null)

Structure #13 (Null)

Structure #14 (Null)

Structure #16 (Null)

Structure #20 (Null)

Structure #22 (Null)

Structure #23 (Null)

Structure #35 (Null)

Structure #36 (Null)

Structure #37 (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)
#30	1	476.400	1.131	0.000	0.000	70.300	M	6.98	1.757
	Σ	**476.400**						**6.98**	**1.757**
#28	1	772.300	0.657	0.523	0.334	88.300	M	238.37	29.212
	2	445.600	0.587	0.000	0.000	88.300	M	147.51	16.855
	Σ	**1,217.900**						**283.47**	**46.067**
#26	1	447.600	2.192	0.000	0.000	71.800	M	6.36	2.223
	2	2,038.800	3.000	0.000	0.000	74.700	M	39.98	16.427
	Σ	**2,486.400**						**46.07**	**18.649**
#24	1	2,607.500	5.367	2.377	0.305	72.800	M	24.68	15.479
	2	2,331.900	4.813	2.431	0.304	72.300	M	21.92	12.683
	3	1,758.500	2.231	1.788	0.297	73.900	M	36.70	12.518
	4	1,363.900	2.618	0.000	0.000	74.700	M	29.33	10.989
	Σ	**8,061.800**						**65.88**	**51.669**
#25	1	515.200	0.990	0.342	0.357	75.900	M	24.69	4.943
	2	130.500	0.787	0.342	0.357	75.800	M	6.99	1.235
	3	370.000	0.516	0.000	0.000	83.600	M	79.10	8.853
	Σ	**9,077.500**						**80.90**	**66.700**
#27	1	354.400	0.612	1.233	0.337	81.000	M	49.31	6.418
	2	305.200	0.529	1.054	0.328	81.900	M	52.11	6.103
	3	289.800	0.692	0.551	0.328	72.900	M	9.52	1.750
	4	253.000	0.361	0.551	0.328	77.200	M	27.66	2.896
	5	581.300	0.980	0.000	0.000	79.900	M	51.62	9.286
	Σ	**13,347.600**						**183.29**	**111.802**
#29	1	508.800	0.409	0.416	0.312	87.300	M	187.01	17.522
	2	233.200	0.521	0.291	0.312	89.600	M	94.22	9.944
	3	224.000	0.467	0.000	0.000	87.900	M	81.36	8.162
	Σ	**15,531.500**						**426.99**	**193.497**
#32	1	293.700	0.576	0.000	0.000	91.000	M	128.15	14.218
	Σ	**16,301.600**						**441.67**	**209.472**
#31	1	431.100	0.588	0.450	0.336	89.400	M	159.20	18.049
	2	325.800	0.432	0.149	0.327	91.000	M	167.10	15.772
	3	200.200	0.373	0.000	0.000	90.900	M	109.10	9.605
	Σ	**957.100**						**271.94**	**43.426**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#33	**Σ**	**17,258.700**						**525.37**	**252.898**
#34	1	91.700	0.244	0.965	0.300	90.300	M	55.63	4.167
	2	105.200	0.256	0.965	0.300	91.000	M	66.86	5.093
	3	735.600	0.885	0.000	0.000	86.900	M	161.37	24.388
	Σ	**18,191.200**						**549.99**	**286.547**
#5	1	503.600	0.707	0.000	0.000	85.600	M	110.93	14.726
	2	406.500	0.492	0.747	0.336	82.800	M	81.19	8.949
	3	439.600	0.626	1.036	0.331	85.800	M	107.12	13.109
	4	162.600	0.332	1.036	0.331	84.000	M	46.98	4.053
	5	294.100	0.505	1.413	0.336	90.000	M	125.65	13.006
	6	216.600	0.341	1.413	0.336	88.100	M	93.95	8.042
	Σ	**2,023.000**						**353.61**	**61.884**
#6	1	149.100	0.331	0.000	0.000	90.600	M	83.23	6.962
	2	245.000	0.529	0.228	0.320	85.900	M	67.10	7.377
	3	276.200	0.450	0.605	0.306	87.400	M	97.37	9.602
	4	158.400	0.380	0.605	0.306	91.000	M	86.41	7.668
	5	206.200	0.402	1.110	0.307	87.400	M	77.23	7.169
	6	414.000	0.430	1.512	0.309	85.200	M	118.75	11.639
	7	294.300	0.535	1.512	0.309	84.400	M	67.58	7.639
	Σ	**3,766.200**						**378.03**	**119.941**
#7	1	731.700	1.274	0.000	0.000	91.000	M	189.49	35.422
	2	445.800	1.486	0.000	0.000	91.000	M	102.97	21.581
	3	270.800	1.110	0.000	0.000	91.000	M	77.45	13.110
	4	78.900	0.260	1.207	0.322	91.000	M	49.86	3.820
	5	154.900	0.320	1.207	0.322	91.000	M	90.90	7.499
	6	101.400	0.313	1.318	0.323	90.900	M	59.49	4.865
	7	117.700	0.300	1.547	0.323	90.200	M	65.80	5.301
	8	494.100	0.645	1.547	0.323	89.300	M	170.71	20.498
	Σ	**6,161.500**						**660.04**	**232.036**
#8	1	0.000	0.000	0.000	0.000	1.000	0.00	0.000	
	Σ	**6,161.500**						**660.04**	**232.036**
#10	1	355.500	1.046	0.000	0.000	91.000	M	106.00	17.210
	2	307.100	1.282	0.724	0.301	80.800	M	25.62	5.438
	3	147.300	1.245	0.587	0.297	88.600	M	30.47	5.729
	4	126.400	0.585	0.587	0.297	91.000	M	54.65	6.119
	5	116.900	1.179	0.716	0.297	91.000	M	32.03	5.659
	Σ	**7,214.700**						**695.02**	**272.191**
#1	1	557.400	0.941	0.000	0.000	81.200	M	60.60	10.322

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	2	169.600	1.616	0.677	0.333	91.000	M	36.76	8.210
	3	636.400	1.842	0.729	0.333	78.800	M	31.75	8.918
	4	223.400	0.846	1.005	0.336	82.100	M	29.20	4.565
	5	77.700	0.330	1.392	0.341	79.400	M	12.50	1.170
	6	746.600	0.678	1.392	0.341	86.200	M	180.72	23.145
	Σ	**2,411.100**						**280.48**	**56.330**
#2	1	257.000	0.423	0.000	0.000	91.000	M	133.24	12.442
	2	180.500	0.562	0.478	0.281	89.700	M	70.50	7.767
	3	200.700	0.687	0.574	0.283	91.000	M	78.80	9.716
	4	438.600	0.811	0.574	0.283	91.000	M	155.00	21.233
	5	420.200	1.247	0.801	0.293	85.800	M	64.79	12.530
	Σ	**3,908.100**						**345.41**	**120.018**
#3	1	172.600	0.443	0.000	0.000	91.000	M	87.36	8.356
	2	311.200	0.890	0.000	0.000	86.900	M	68.02	10.318
	3	378.900	0.632	0.209	0.314	85.700	M	90.77	11.189
	Σ	**4,770.800**						**457.63**	**149.880**
#4	**Σ**	**4,770.800**						**457.63**	**149.880**
#9	1	425.500	0.830	0.000	0.000	90.700	M	143.84	20.049
	Σ	**5,196.300**						**481.74**	**169.929**
#11	**Σ**	**12,411.000**						**1,064.62**	**442.120**
#21	1	272.800	0.819	0.000	0.000	86.900	M	62.96	9.044
	2	230.500	0.388	0.694	0.266	89.200	M	104.58	9.475
	3	181.100	0.289	0.877	0.256	89.300	M	94.29	7.513
	4	396.400	0.939	0.877	0.256	86.100	M	76.84	12.170
	Σ	**13,491.800**						**1,112.92**	**480.323**
#18	1	301.700	0.652	0.000	0.000	91.000	M	122.31	14.605
	2	546.800	0.768	0.561	0.320	84.000	M	95.48	13.630
	Σ	**848.500**						**134.32**	**28.235**
#17	1	182.200	0.462	0.000	0.000	91.000	M	90.17	8.820
	Σ	**182.200**						**90.17**	**8.820**
#19	**Σ**	**1,030.700**						**209.51**	**37.056**
#15	1	437.400	0.803	0.000	0.000	89.300	M	131.37	18.146
	2	549.000	0.637	0.654	0.327	89.300	M	191.13	22.775
	3	1,006.300	1.023	0.768	0.331	82.700	M	124.93	21.920
	Σ	**1,992.700**						**314.41**	**62.841**
#12	1	517.800	0.791	0.000	0.000	79.800	M	52.01	8.176

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	2	229.000	0.571	0.043	0.418	78.100	M	21.91	2.943
	3	592.700	0.706	0.044	0.417	79.500	M	61.27	9.034
	4	1,806.900	1.542	0.487	0.362	74.400	M	51.82	13.908
	5	348.100	0.618	0.487	0.362	78.000	M	31.17	4.417
	Σ	**3,494.500**						**146.72**	**38.478**
#13	1	411.600	0.725	0.000	0.000	77.600	M	31.27	4.963
	2	636.400	0.774	0.322	0.336	78.700	M	55.18	8.810
	3	319.000	0.575	0.685	0.318	83.500	M	62.92	7.554
	4	231.700	0.314	0.923	0.328	78.400	M	33.16	3.091
	5	1,122.000	1.308	0.923	0.328	72.300	M	23.88	6.102
	Σ	**6,215.200**						**284.84**	**68.999**
#14	1	405.900	0.384	0.000	0.000	88.700	M	176.21	15.934
	2	411.100	0.452	0.707	0.308	88.600	M	162.89	15.989
	3	787.400	0.658	0.975	0.307	89.300	M	268.72	32.665
	4	144.200	0.341	1.716	0.310	84.000	M	41.09	3.594
	5	343.800	0.289	1.970	0.312	84.500	M	112.09	9.014
	6	392.800	0.806	2.107	0.316	79.700	M	38.45	6.130
	7	528.200	0.518	2.544	0.316	85.200	M	135.63	14.850
	8	890.900	1.253	2.544	0.316	81.500	M	82.72	17.053
	9	741.400	1.076	3.047	0.316	82.700	M	88.91	16.150
	10	451.100	0.916	3.354	0.316	81.900	M	54.62	9.020
	Σ	**11,312.000**						**400.59**	**209.398**
#16	1	329.600	0.641	0.000	0.000	91.000	M	134.99	15.956
	2	348.400	0.542	0.509	0.286	90.500	M	149.98	16.122
	3	198.500	0.266	0.943	0.279	91.000	M	124.54	9.610
	Σ	**14,181.200**						**676.40**	**313.926**
#20	1	296.300	0.667	0.000	0.000	89.700	M	104.34	12.750
	2	385.600	0.713	0.476	0.440	91.000	M	147.90	18.667
	Σ	**15,893.800**						**724.23**	**382.399**
#22	**Σ**	**29,385.600**						**1,750.57**	**862.722**
#23	1	442.400	0.960	0.000	0.000	85.300	M	77.45	12.561
	2	310.500	0.538	0.559	0.291	89.500	M	121.94	13.119
	Σ	**30,138.500**						**1,749.20**	**888.402**
#35	**Σ**	**48,329.700**						**2,189.60**	**1,174.949**
#36	1	298.200	0.987	0.000	0.000	85.000	M	49.57	8.219
	2	196.800	0.441	0.000	0.000	87.900	M	73.77	7.171
	3	396.700	0.433	0.166	0.372	78.300	M	46.46	5.227

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	∑	**49,221.400**						**2,186.29**	**1,195.566**
#37	1	744.000	1.756	0.000	0.000	82.800	M	63.54	16.378
	2	296.000	0.439	1.780	0.243	85.800	M	89.55	8.827
	3	237.700	0.333	1.649	0.246	85.500	M	80.62	6.883
	4	561.400	1.502	1.780	0.243	84.100	M	62.58	14.137
	5	369.400	0.817	2.236	0.284	79.700	M	35.86	5.765
	∑	**51,429.900**						**2,165.91**	**1,247.556**

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	3.65	50.00	1,369.00	1.910	0.199
		8. Large gullies, diversions, and low flowing streams	1.57	157.00	10,030.00	3.750	0.742
#1	**1**	**Time of Concentration:**					**0.941**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	6.63	70.00	1,056.00	2.570	0.114
		5. Nearly bare and untilled, and alluvial valley fans	1.98	150.00	7,573.00	1.400	1.502
#1	**2**	**Time of Concentration:**					**1.616**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	1.65	117.00	7,070.00	1.280	1.534
		8. Large gullies, diversions, and low flowing streams	2.43	126.00	5,188.00	4.670	0.308
#1	**3**	**Time of Concentration:**					**1.842**
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.77	260.00	4,506.00	2.400	0.521
		8. Large gullies, diversions, and low flowing streams	2.84	168.00	5,924.00	5.050	0.325
#1	**4**	**Time of Concentration:**					**0.846**
#1	5	5. Nearly bare and untilled, and alluvial valley fans	19.93	180.00	903.00	4.460	0.056
		8. Large gullies, diversions, and low flowing streams	3.30	178.00	5,393.00	5.450	0.274
#1	**5**	**Time of Concentration:**					**0.330**
#1	6	5. Nearly bare and untilled, and alluvial valley fans	13.43	105.00	782.00	3.660	0.059
		8. Large gullies, diversions, and low flowing streams	2.62	283.00	10,822.00	4.850	0.619
#1	**6**	**Time of Concentration:**					**0.678**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.84	70.00	1,024.00	2.610	0.108

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,325.00	3.810	0.315
#2	**1**	**Time of Concentration:**					**0.423**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	5.56	45.00	810.00	2.350	0.095
		8. Large gullies, diversions, and low flowing streams	0.86	40.00	4,663.00	2.770	0.467
#2	**2**	**Time of Concentration:**					**0.562**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	5.89	50.00	849.00	2.420	0.097
		8. Large gullies, diversions, and low flowing streams	1.17	80.00	6,862.00	3.230	0.590
#2	**3**	**Time of Concentration:**					**0.687**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	12.63	95.00	752.00	3.550	0.058
		8. Large gullies, diversions, and low flowing streams	1.40	135.00	9,630.00	3.550	0.753
#2	**4**	**Time of Concentration:**					**0.811**
#2	5	5. Nearly bare and untilled, and alluvial valley fans	11.02	70.00	635.00	3.320	0.053
		8. Large gullies, diversions, and low flowing streams	0.46	40.00	8,732.00	2.030	1.194
#2	**5**	**Time of Concentration:**					**1.247**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	10.00	805.00	1.110	0.201
		8. Large gullies, diversions, and low flowing streams	1.33	40.00	3,017.00	3.450	0.242
#3	**1**	**Time of Concentration:**					**0.443**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.68	10.00	1,478.00	0.820	0.500
		8. Large gullies, diversions, and low flowing streams	1.78	100.00	5,622.00	4.000	0.390
#3	**2**	**Time of Concentration:**					**0.890**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	4.66	70.00	1,501.00	2.150	0.193
		8. Large gullies, diversions, and low flowing streams	1.17	60.00	5,126.00	3.240	0.439
#3	**3**	**Time of Concentration:**					**0.632**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	17.19	110.00	640.00	4.140	0.042
		8. Large gullies, diversions, and low flowing streams	2.72	322.00	11,831.00	4.940	0.665
#5	**1**	**Time of Concentration:**					**0.707**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	11.58	105.00	907.00	3.400	0.074
		8. Large gullies, diversions, and low flowing streams	3.52	298.00	8,475.00	5.620	0.418
#5	**2**	**Time of Concentration:**					**0.492**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	3	5. Nearly bare and untilled, and alluvial valley fans	1.53	25.00	1,638.00	1.230	0.369
		8. Large gullies, diversions, and low flowing streams	4.30	248.00	5,762.00	6.220	0.257
#5	**3**	**Time of Concentration:**					**0.626**
#5	4	5. Nearly bare and untilled, and alluvial valley fans	14.19	85.00	599.00	3.760	0.044
		8. Large gullies, diversions, and low flowing streams	3.99	248.00	6,219.00	5.990	0.288
#5	**4**	**Time of Concentration:**					**0.332**
#5	5	5. Nearly bare and untilled, and alluvial valley fans	4.15	85.00	2,049.00	2.030	0.280
		8. Large gullies, diversions, and low flowing streams	3.24	142.00	4,377.00	5.400	0.225
#5	**5**	**Time of Concentration:**					**0.505**
#5	6	5. Nearly bare and untilled, and alluvial valley fans	8.67	125.00	1,441.00	2.940	0.136
		8. Large gullies, diversions, and low flowing streams	4.81	234.00	4,865.00	6.570	0.205
#5	**6**	**Time of Concentration:**					**0.341**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	5.36	75.00	1,399.00	2.310	0.168
		8. Large gullies, diversions, and low flowing streams	2.41	66.00	2,742.00	4.650	0.163
#6	**1**	**Time of Concentration:**					**0.331**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.39	80.00	2,359.00	1.840	0.356
		8. Large gullies, diversions, and low flowing streams	2.63	80.00	3,039.00	4.860	0.173
#6	**2**	**Time of Concentration:**					**0.529**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	4.60	34.00	739.00	2.140	0.095
		8. Large gullies, diversions, and low flowing streams	2.33	136.00	5,845.00	4.570	0.355
#6	**3**	**Time of Concentration:**					**0.450**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	6.06	85.00	1,402.03	2.460	0.158
		8. Large gullies, diversions, and low flowing streams	2.52	96.00	3,810.12	4.760	0.222
#6	**4**	**Time of Concentration:**					**0.380**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	7.24	70.00	967.00	2.690	0.099
		8. Large gullies, diversions, and low flowing streams	2.34	117.00	5,003.00	4.580	0.303
#6	**5**	**Time of Concentration:**					**0.402**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	31.83	183.00	575.00	5.640	0.028
		8. Large gullies, diversions, and low flowing streams	3.38	270.00	7,990.00	5.510	0.402

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	**6**	**Time of Concentration:**					**0.430**
#6	7	5. Nearly bare and untilled, and alluvial valley fans	23.08	325.00	1,408.00	4.800	0.081
		8. Large gullies, diversions, and low flowing streams	2.88	240.00	8,327.00	5.090	0.454
#6	**7**	**Time of Concentration:**					**0.535**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	11.42	90.00	788.00	3.370	0.064
		8. Large gullies, diversions, and low flowing streams	1.46	230.00	15,769.62	3.620	1.210
#7	**1**	**Time of Concentration:**					**1.274**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	11.19	60.00	536.00	3.340	0.044
		8. Large gullies, diversions, and low flowing streams	1.26	220.00	17,444.00	3.360	1.442
#7	**2**	**Time of Concentration:**					**1.486**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	5.35	60.00	1,121.00	2.310	0.134
		8. Large gullies, diversions, and low flowing streams	1.43	180.00	12,585.00	3.580	0.976
#7	**3**	**Time of Concentration:**					**1.110**
#7	4	5. Nearly bare and untilled, and alluvial valley fans	14.29	35.00	245.00	3.770	0.018
		8. Large gullies, diversions, and low flowing streams	2.76	120.00	4,349.00	4.980	0.242
#7	**4**	**Time of Concentration:**					**0.260**
#7	5	5. Nearly bare and untilled, and alluvial valley fans	5.36	65.00	1,213.00	2.310	0.145
		8. Large gullies, diversions, and low flowing streams	2.57	78.00	3,034.00	4.810	0.175
#7	**5**	**Time of Concentration:**					**0.320**
#7	6	5. Nearly bare and untilled, and alluvial valley fans	5.64	65.00	1,153.00	2.370	0.135
		8. Large gullies, diversions, and low flowing streams	2.63	82.00	3,119.00	4.860	0.178
#7	**6**	**Time of Concentration:**					**0.313**
#7	7	5. Nearly bare and untilled, and alluvial valley fans	11.90	85.00	714.00	3.450	0.057
		8. Large gullies, diversions, and low flowing streams	2.93	132.00	4,503.00	5.130	0.243
#7	**7**	**Time of Concentration:**					**0.300**
#7	8	5. Nearly bare and untilled, and alluvial valley fans	3.61	25.00	693.00	1.890	0.101
		8. Large gullies, diversions, and low flowing streams	4.12	492.00	11,931.00	6.090	0.544
#7	**8**	**Time of Concentration:**					**0.645**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	3.35	90.00	2,687.00	1.830	0.407

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	0.58	20.00	3,463.00	2.270	0.423
#9	**1**	**Time of Concentration:**					**0.830**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	1.76	22.00	1,252.00	1.320	0.263
		8. Large gullies, diversions, and low flowing streams	0.63	42.00	6,683.00	2.370	0.783
#10	**1**	**Time of Concentration:**					**1.046**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	2.25	125.00	5,554.07	1.500	1.028
		8. Large gullies, diversions, and low flowing streams	2.13	85.00	3,997.36	4.370	0.254
#10	**2**	**Time of Concentration:**					**1.282**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.39	68.00	4,904.00	1.170	1.164
		8. Large gullies, diversions, and low flowing streams	4.73	90.00	1,904.00	6.520	0.081
#10	**3**	**Time of Concentration:**					**1.245**
#10	4	5. Nearly bare and untilled, and alluvial valley fans	3.76	51.00	1,357.00	1.930	0.195
		8. Large gullies, diversions, and low flowing streams	0.65	22.00	3,385.00	2.410	0.390
#10	**4**	**Time of Concentration:**					**0.585**
#10	5	5. Nearly bare and untilled, and alluvial valley fans	1.63	88.00	5,391.16	1.270	1.179
#10	**5**	**Time of Concentration:**					**1.179**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	4.50	75.00	1,667.00	2.120	0.218
		8. Large gullies, diversions, and low flowing streams	1.85	155.00	8,400.00	4.070	0.573
#12	**1**	**Time of Concentration:**					**0.791**
#12	2	5. Nearly bare and untilled, and alluvial valley fans	2.99	50.00	1,674.03	1.720	0.270
		8. Large gullies, diversions, and low flowing streams	1.67	70.00	4,201.17	3.870	0.301
#12	**2**	**Time of Concentration:**					**0.571**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	4.04	57.00	1,411.00	2.000	0.195
		8. Large gullies, diversions, and low flowing streams	1.55	107.00	6,884.00	3.740	0.511
#12	**3**	**Time of Concentration:**					**0.706**
#12	4	5. Nearly bare and untilled, and alluvial valley fans	2.23	84.00	3,771.04	1.490	0.703
		8. Large gullies, diversions, and low flowing streams	1.62	186.00	11,515.60	3.810	0.839
#12	**4**	**Time of Concentration:**					**1.542**
#12	5	5. Nearly bare and untilled, and alluvial valley fans	3.68	53.00	1,442.00	1.910	0.209

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.95	120.00	6,155.00	4.180	0.409
#12	**5**	**Time of Concentration:**					**0.618**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	4.62	62.00	1,342.00	2.140	0.174
		8. Large gullies, diversions, and low flowing streams	1.91	157.00	8,225.00	4.140	0.551
#13	**1**	**Time of Concentration:**					**0.725**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	2.91	50.00	1,717.00	1.700	0.280
		8. Large gullies, diversions, and low flowing streams	2.28	183.00	8,039.00	4.520	0.494
#13	**2**	**Time of Concentration:**					**0.774**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	6.18	95.00	1,537.00	2.480	0.172
		8. Large gullies, diversions, and low flowing streams	2.13	135.00	6,347.00	4.370	0.403
#13	**3**	**Time of Concentration:**					**0.575**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.17	10.00	315.00	1.780	0.049
		8. Large gullies, diversions, and low flowing streams	2.30	100.00	4,344.00	4.550	0.265
#13	**4**	**Time of Concentration:**					**0.314**
#13	5	5. Nearly bare and untilled, and alluvial valley fans	3.10	70.00	2,255.00	1.760	0.355
		8. Large gullies, diversions, and low flowing streams	1.23	140.00	11,392.00	3.320	0.953
#13	**5**	**Time of Concentration:**					**1.308**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	10.59	63.00	595.00	3.250	0.050
		8. Large gullies, diversions, and low flowing streams	2.60	151.00	5,808.00	4.830	0.334
#14	**1**	**Time of Concentration:**					**0.384**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	7.28	67.00	920.00	2.690	0.095
		8. Large gullies, diversions, and low flowing streams	2.17	123.00	5,670.00	4.410	0.357
#14	**2**	**Time of Concentration:**					**0.452**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	21.46	150.00	699.00	4.630	0.041
		8. Large gullies, diversions, and low flowing streams	3.10	364.00	11,728.00	5.280	0.617
#14	**3**	**Time of Concentration:**					**0.658**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	3.39	35.00	1,032.00	1.840	0.155
		8. Large gullies, diversions, and low flowing streams	2.97	103.00	3,470.00	5.160	0.186
#14	**4**	**Time of Concentration:**					**0.341**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	5	5. Nearly bare and untilled, and alluvial valley fans	28.15	125.00	444.00	5.300	0.023
		8. Large gullies, diversions, and low flowing streams	4.18	246.00	5,886.00	6.130	0.266
#14	**5**	**Time of Concentration:**					**0.289**
#14	6	5. Nearly bare and untilled, and alluvial valley fans	3.18	40.00	1,257.00	1.780	0.196
		8. Large gullies, diversions, and low flowing streams	2.29	228.00	9,963.00	4.530	0.610
#14	**6**	**Time of Concentration:**					**0.806**
#14	7	5. Nearly bare and untilled, and alluvial valley fans	16.72	100.00	598.00	4.080	0.040
		8. Large gullies, diversions, and low flowing streams	2.81	243.00	8,649.00	5.020	0.478
#14	**7**	**Time of Concentration:**					**0.518**
#14	8	5. Nearly bare and untilled, and alluvial valley fans	1.70	47.00	2,765.00	1.300	0.590
		8. Large gullies, diversions, and low flowing streams	2.44	274.00	11,208.00	4.690	0.663
#14	**8**	**Time of Concentration:**					**1.253**
#14	9	5. Nearly bare and untilled, and alluvial valley fans	2.87	105.00	3,657.00	1.690	0.601
		8. Large gullies, diversions, and low flowing streams	2.43	194.00	7,991.00	4.670	0.475
#14	**9**	**Time of Concentration:**					**1.076**
#14	10	5. Nearly bare and untilled, and alluvial valley fans	2.75	80.00	2,907.00	1.650	0.489
		8. Large gullies, diversions, and low flowing streams	2.41	172.00	7,149.00	4.650	0.427
#14	**10**	**Time of Concentration:**					**0.916**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	12.80	54.00	422.00	3.570	0.032
		8. Large gullies, diversions, and low flowing streams	1.68	181.00	10,781.00	3.880	0.771
#15	**1**	**Time of Concentration:**					**0.803**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	44.22	260.00	588.00	6.640	0.024
		8. Large gullies, diversions, and low flowing streams	2.45	254.00	10,354.00	4.690	0.613
#15	**2**	**Time of Concentration:**					**0.637**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	10.04	85.00	847.00	3.160	0.074
		8. Large gullies, diversions, and low flowing streams	2.34	366.00	15,663.00	4.580	0.949
#15	**3**	**Time of Concentration:**					**1.023**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	4.17	15.00	360.00	2.040	0.049
		8. Large gullies, diversions, and low flowing streams	1.42	108.00	7,618.00	3.570	0.592

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#16	**1**	**Time of Concentration:**					**0.641**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	8.70	62.00	713.00	2.940	0.067
		8. Large gullies, diversions, and low flowing streams	1.99	144.00	7,241.00	4.230	0.475
#16	**2**	**Time of Concentration:**					**0.542**
#16	3	5. Nearly bare and untilled, and alluvial valley fans	6.88	32.00	465.00	2.620	0.049
		8. Large gullies, diversions, and low flowing streams	2.29	81.00	3,543.00	4.530	0.217
#16	**3**	**Time of Concentration:**					**0.266**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	9.37	65.00	694.00	3.060	0.062
		8. Large gullies, diversions, and low flowing streams	1.19	56.00	4,712.00	3.270	0.400
#17	**1**	**Time of Concentration:**					**0.462**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	9.00	60.00	667.00	2.990	0.061
		8. Large gullies, diversions, and low flowing streams	0.97	61.00	6,287.00	2.950	0.591
#18	**1**	**Time of Concentration:**					**0.652**
#18	2	5. Nearly bare and untilled, and alluvial valley fans	2.47	33.00	1,336.00	1.570	0.236
		8. Large gullies, diversions, and low flowing streams	2.01	164.00	8,154.00	4.250	0.532
#18	**2**	**Time of Concentration:**					**0.768**
#20	1	5. Nearly bare and untilled, and alluvial valley fans	11.87	45.00	379.00	3.440	0.030
		8. Large gullies, diversions, and low flowing streams	0.75	45.00	5,969.00	2.600	0.637
#20	**1**	**Time of Concentration:**					**0.667**
#20	2	5. Nearly bare and untilled, and alluvial valley fans	5.40	45.00	833.00	2.320	0.099
		8. Large gullies, diversions, and low flowing streams	1.30	98.00	7,547.00	3.410	0.614
#20	**2**	**Time of Concentration:**					**0.713**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	4.09	60.00	1,467.00	2.020	0.201
		8. Large gullies, diversions, and low flowing streams	0.93	60.00	6,433.00	2.890	0.618
#21	**1**	**Time of Concentration:**					**0.819**
#21	2	5. Nearly bare and untilled, and alluvial valley fans	3.50	50.00	1,430.00	1.860	0.213
		8. Large gullies, diversions, and low flowing streams	2.15	60.00	2,785.00	4.400	0.175
#21	**2**	**Time of Concentration:**					**0.388**
#21	3	5. Nearly bare and untilled, and alluvial valley fans	1.70	15.00	881.00	1.300	0.188
		9. Small streams flowing bankfull	1.49	60.00	4,014.00	11.000	0.101

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#21	**3**	**Time of Concentration:**					**0.289**
#21	4	5. Nearly bare and untilled, and alluvial valley fans	2.21	40.00	1,811.02	1.480	0.339
		8. Large gullies, diversions, and low flowing streams	0.84	50.00	5,949.54	2.750	0.600
#21	**4**	**Time of Concentration:**					**0.939**
#23	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	65.00	2,660.01	1.560	0.473
		8. Large gullies, diversions, and low flowing streams	0.33	10.00	3,017.50	1.720	0.487
#23	**1**	**Time of Concentration:**					**0.960**
#23	2	5. Nearly bare and untilled, and alluvial valley fans	3.49	60.00	1,718.01	1.860	0.256
		8. Large gullies, diversions, and low flowing streams	1.66	65.00	3,926.06	3.860	0.282
#23	**2**	**Time of Concentration:**					**0.538**
#24	1	5. Nearly bare and untilled, and alluvial valley fans	1.71	430.00	25,118.00	1.300	5.367
#24	**1**	**Time of Concentration:**					**5.367**
#24	2	5. Nearly bare and untilled, and alluvial valley fans	1.84	430.00	23,393.00	1.350	4.813
#24	**2**	**Time of Concentration:**					**4.813**
#24	3	5. Nearly bare and untilled, and alluvial valley fans	1.82	155.00	8,498.00	1.350	1.748
		8. Large gullies, diversions, and low flowing streams	0.84	40.00	4,771.00	2.740	0.483
#24	**3**	**Time of Concentration:**					**2.231**
#24	4	5. Nearly bare and untilled, and alluvial valley fans	1.24	50.00	4,042.00	1.110	1.011
		8. Large gullies, diversions, and low flowing streams	0.49	60.00	12,150.00	2.100	1.607
#24	**4**	**Time of Concentration:**					**2.618**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	0.51	10.00	1,950.00	0.710	0.762
		8. Large gullies, diversions, and low flowing streams	1.81	60.00	3,322.00	4.030	0.228
#25	**1**	**Time of Concentration:**					**0.990**
#25	2	5. Nearly bare and untilled, and alluvial valley fans	1.11	25.00	2,254.00	1.050	0.596
		8. Large gullies, diversions, and low flowing streams	2.36	75.00	3,178.00	4.600	0.191
#25	**2**	**Time of Concentration:**					**0.787**
#25	3	5. Nearly bare and untilled, and alluvial valley fans	3.23	30.00	929.00	1.790	0.144
		8. Large gullies, diversions, and low flowing streams	2.45	154.00	6,297.00	4.690	0.372
#25	**3**	**Time of Concentration:**					**0.516**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	1.20	103.00	8,602.00	1.090	2.192

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#26	**1**	**Time of Concentration:**					**2.192**
#26	2	5. Nearly bare and untilled, and alluvial valley fans	1.23	120.00	9,780.00	1.100	2.469
		8. Large gullies, diversions, and low flowing streams	2.18	184.00	8,454.00	4.420	0.531
#26	**2**	**Time of Concentration:**					**3.000**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.32	50.00	1,158.02	2.070	0.155
		8. Large gullies, diversions, and low flowing streams	2.53	198.00	7,838.16	4.760	0.457
#27	**1**	**Time of Concentration:**					**0.612**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	5.26	30.00	570.00	2.290	0.069
		8. Large gullies, diversions, and low flowing streams	3.15	278.00	8,822.00	5.320	0.460
#27	**2**	**Time of Concentration:**					**0.529**
#27	3	5. Nearly bare and untilled, and alluvial valley fans	16.33	80.00	490.00	4.040	0.033
		8. Large gullies, diversions, and low flowing streams	2.15	225.00	10,443.00	4.400	0.659
#27	**3**	**Time of Concentration:**					**0.692**
#27	4	5. Nearly bare and untilled, and alluvial valley fans	12.43	65.00	523.00	3.520	0.041
		8. Large gullies, diversions, and low flowing streams	3.49	225.00	6,454.00	5.600	0.320
#27	**4**	**Time of Concentration:**					**0.361**
#27	5	5. Nearly bare and untilled, and alluvial valley fans	9.40	25.00	266.00	3.060	0.024
		8. Large gullies, diversions, and low flowing streams	2.32	364.00	15,700.00	4.560	0.956
#27	**5**	**Time of Concentration:**					**0.980**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	40.00	762.00	2.290	0.092
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**1**	**Time of Concentration:**					**0.657**
#28	2	5. Nearly bare and untilled, and alluvial valley fans	25.86	105.00	406.00	5.080	0.022
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**2**	**Time of Concentration:**					**0.587**
#29	1	5. Nearly bare and untilled, and alluvial valley fans	11.58	30.00	259.00	3.400	0.021
		8. Large gullies, diversions, and low flowing streams	3.61	288.00	7,976.00	5.700	0.388
#29	**1**	**Time of Concentration:**					**0.409**
#29	2	5. Nearly bare and untilled, and alluvial valley fans	8.06	40.00	496.00	2.830	0.048

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.90	252.00	8,693.55	5.100	0.473
#29	**2**	**Time of Concentration:**					**0.521**
#29	3	5. Nearly bare and untilled, and alluvial valley fans	7.25	25.00	345.00	2.690	0.035
		8. Large gullies, diversions, and low flowing streams	2.26	158.00	7,001.00	4.500	0.432
#29	**3**	**Time of Concentration:**					**0.467**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	35.00	710.00	2.220	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	243.00	14,540.00	3.870	1.043
#30	**1**	**Time of Concentration:**					**1.131**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.91	15.00	515.00	1.700	0.084
		8. Large gullies, diversions, and low flowing streams	2.74	247.00	9,006.00	4.960	0.504
#31	**1**	**Time of Concentration:**					**0.588**
#31	2	5. Nearly bare and untilled, and alluvial valley fans	7.46	25.00	335.00	2.730	0.034
		8. Large gullies, diversions, and low flowing streams	2.18	138.00	6,335.00	4.420	0.398
#31	**2**	**Time of Concentration:**					**0.432**
#31	3	5. Nearly bare and untilled, and alluvial valley fans	3.84	20.00	521.00	1.950	0.074
		8. Large gullies, diversions, and low flowing streams	2.24	108.00	4,826.00	4.480	0.299
#31	**3**	**Time of Concentration:**					**0.373**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	22.00	632.00	1.860	0.094
		8. Large gullies, diversions, and low flowing streams	1.56	101.00	6,494.00	3.740	0.482
#32	**1**	**Time of Concentration:**					**0.576**
#34	1	5. Nearly bare and untilled, and alluvial valley fans	3.21	25.00	779.00	1.790	0.120
		8. Large gullies, diversions, and low flowing streams	2.80	63.00	2,251.00	5.010	0.124
#34	**1**	**Time of Concentration:**					**0.244**
#34	2	5. Nearly bare and untilled, and alluvial valley fans	5.75	40.00	696.00	2.390	0.080
		8. Large gullies, diversions, and low flowing streams	23.00	2,100.00	9,130.43	14.380	0.176
#34	**2**	**Time of Concentration:**					**0.256**
#34	3	5. Nearly bare and untilled, and alluvial valley fans	2.67	40.00	1,500.00	1.630	0.255
		8. Large gullies, diversions, and low flowing streams	1.28	98.00	7,675.00	3.380	0.630
#34	**3**	**Time of Concentration:**					**0.885**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#36	1	5. Nearly bare and untilled, and alluvial valley fans	3.21	105.00	3,274.00	1.790	0.508
		8. Large gullies, diversions, and low flowing streams	0.21	5.00	2,367.00	1.370	0.479
#36	**1**	**Time of Concentration:**					**0.987**
#36	2	5. Nearly bare and untilled, and alluvial valley fans	5.50	140.00	2,547.00	2.340	0.302
		8. Large gullies, diversions, and low flowing streams	1.58	30.00	1,897.00	3.770	0.139
#36	**2**	**Time of Concentration:**					**0.441**
#36	3	5. Nearly bare and untilled, and alluvial valley fans	1.72	20.00	1,166.00	1.300	0.249
		8. Large gullies, diversions, and low flowing streams	2.31	70.00	3,029.00	4.560	0.184
#36	**3**	**Time of Concentration:**					**0.433**
#37	1	5. Nearly bare and untilled, and alluvial valley fans	4.68	129.00	2,754.05	2.160	0.354
		8. Large gullies, diversions, and low flowing streams	0.16	10.00	6,108.73	1.210	1.402
#37	**1**	**Time of Concentration:**					**1.756**
#37	2	5. Nearly bare and untilled, and alluvial valley fans	7.32	90.00	1,229.00	2.700	0.126
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,309.01	3.820	0.313
#37	**2**	**Time of Concentration:**					**0.439**
#37	3	5. Nearly bare and untilled, and alluvial valley fans	8.10	100.00	1,234.00	2.840	0.120
		8. Large gullies, diversions, and low flowing streams	2.66	100.00	3,763.21	4.890	0.213
#37	**3**	**Time of Concentration:**					**0.333**
#37	4	5. Nearly bare and untilled, and alluvial valley fans	5.09	90.00	1,768.03	2.250	0.218
		8. Large gullies, diversions, and low flowing streams	0.36	30.00	8,326.39	1.800	1.284
#37	**4**	**Time of Concentration:**					**1.502**
#37	5	5. Nearly bare and untilled, and alluvial valley fans	0.81	20.00	2,466.09	0.900	0.761
		8. Large gullies, diversions, and low flowing streams	4.06	50.00	1,231.01	6.040	0.056
#37	**5**	**Time of Concentration:**					**0.817**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	1.29	107.00	8,294.57	3.400	0.677
#1	**2**	**Muskingum K:**					**0.677**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	3	8. Large gullies, diversions, and low flowing streams	1.27	113.00	8,880.15	3.380	0.729
#1	**3**	**Muskingum K:**					**0.729**
#1	4	8. Large gullies, diversions, and low flowing streams	1.35	171.00	12,634.84	3.490	1.005
#1	**4**	**Muskingum K:**					**1.005**
#1	5	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,351.08	3.660	1.392
#1	**5**	**Muskingum K:**					**1.392**
#1	6	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**6**	**Muskingum K:**					**1.392**
#2	2	8. Large gullies, diversions, and low flowing streams	0.53	20.00	3,756.57	2.180	0.478
#2	**2**	**Muskingum K:**					**0.478**
#2	3	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.38	2.210	0.574
#2	**3**	**Muskingum K:**					**0.574**
#2	4	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**4**	**Muskingum K:**					**0.574**
#2	5	8. Large gullies, diversions, and low flowing streams	0.65	45.00	6,955.17	2.410	0.801
#2	**5**	**Muskingum K:**					**0.801**
#3	3	8. Large gullies, diversions, and low flowing streams	0.92	20.00	2,168.02	2.880	0.209
#3	**3**	**Muskingum K:**					**0.209**
#5	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#5	**1**	**Muskingum K:**					**0.000**
#5	2	8. Large gullies, diversions, and low flowing streams	1.34	125.00	9,339.51	3.470	0.747
#5	**2**	**Muskingum K:**					**0.747**
#5	3	8. Large gullies, diversions, and low flowing streams	1.24	155.00	12,461.81	3.340	1.036
#5	**3**	**Muskingum K:**					**1.036**
#5	4	8. Large gullies, diversions, and low flowing streams	1.24	155.00	12,461.81	3.340	1.036
#5	**4**	**Muskingum K:**					**1.036**
#5	5	8. Large gullies, diversions, and low flowing streams	1.35	239.00	17,712.88	3.480	1.413
#5	**5**	**Muskingum K:**					**1.413**
#5	6	8. Large gullies, diversions, and low flowing streams	1.35	239.00	17,712.00	3.480	1.413
#5	**6**	**Muskingum K:**					**1.413**
#6	2	8. Large gullies, diversions, and low flowing streams	1.01	25.00	2,481.38	3.010	0.228
#6	**2**	**Muskingum K:**					**0.228**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	3	8. Large gullies, diversions, and low flowing streams	0.80	47.00	5,846.00	2.680	0.605
#6	**3**	**Muskingum K:**					**0.605**
#6	4	8. Large gullies, diversions, and low flowing streams	0.80	47.00	5,846.00	2.680	0.605
#6	**4**	**Muskingum K:**					**0.605**
#6	5	8. Large gullies, diversions, and low flowing streams	0.82	89.00	10,838.00	2.710	1.110
#6	**5**	**Muskingum K:**					**1.110**
#6	6	8. Large gullies, diversions, and low flowing streams	0.84	125.00	14,917.00	2.740	1.512
#6	**6**	**Muskingum K:**					**1.512**
#6	7	8. Large gullies, diversions, and low flowing streams	0.84	125.00	14,917.00	2.740	1.512
#6	**7**	**Muskingum K:**					**1.512**
#7	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**1**	**Muskingum K:**					**0.000**
#7	2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**2**	**Muskingum K:**					**0.000**
#7	4	8. Large gullies, diversions, and low flowing streams	1.05	140.00	13,344.77	3.070	1.207
#7	**4**	**Muskingum K:**					**1.207**
#7	5	8. Large gullies, diversions, and low flowing streams	1.05	140.00	13,344.00	3.070	1.207
#7	**5**	**Muskingum K:**					**1.207**
#7	6	8. Large gullies, diversions, and low flowing streams	1.07	158.00	14,716.84	3.100	1.318
#7	**6**	**Muskingum K:**					**1.318**
#7	7	8. Large gullies, diversions, and low flowing streams	1.08	187.00	17,322.83	3.110	1.547
#7	**7**	**Muskingum K:**					**1.547**
#7	8	8. Large gullies, diversions, and low flowing streams	1.08	187.00	17,322.00	3.110	1.547
#7	**8**	**Muskingum K:**					**1.547**
#10	2	8. Large gullies, diversions, and low flowing streams	0.74	50.00	6,729.00	2.580	0.724
#10	**2**	**Muskingum K:**					**0.724**
#10	3	8. Large gullies, diversions, and low flowing streams	0.69	36.00	5,241.00	2.480	0.587
#10	**3**	**Muskingum K:**					**0.587**
#10	4	8. Large gullies, diversions, and low flowing streams	0.69	36.00	5,241.00	2.480	0.587
#10	**4**	**Muskingum K:**					**0.587**
#10	5	8. Large gullies, diversions, and low flowing streams	0.69	44.00	6,399.00	2.480	0.716
#10	**5**	**Muskingum K:**					**0.716**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#12	2	8. Large gullies, diversions, and low flowing streams	8.24	111.00	1,347.00	8.610	0.043
#12	**2**	**Muskingum K:**					**0.043**
#12	3	8. Large gullies, diversions, and low flowing streams	8.01	109.00	1,360.00	8.490	0.044
#12	**3**	**Muskingum K:**					**0.044**
#12	4	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**4**	**Muskingum K:**					**0.487**
#12	5	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**5**	**Muskingum K:**					**0.487**
#13	2	8. Large gullies, diversions, and low flowing streams	1.34	54.00	4,025.00	3.470	0.322
#13	**2**	**Muskingum K:**					**0.322**
#13	3	8. Large gullies, diversions, and low flowing streams	0.98	72.00	7,333.00	2.970	0.685
#13	**3**	**Muskingum K:**					**0.685**
#13	4	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**4**	**Muskingum K:**					**0.923**
#13	5	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**5**	**Muskingum K:**					**0.923**
#14	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#14	**1**	**Muskingum K:**					**0.000**
#14	2	8. Large gullies, diversions, and low flowing streams	0.83	58.00	6,957.00	2.730	0.707
#14	**2**	**Muskingum K:**					**0.707**
#14	3	8. Large gullies, diversions, and low flowing streams	0.81	77.00	9,480.00	2.700	0.975
#14	**3**	**Muskingum K:**					**0.975**
#14	4	8. Large gullies, diversions, and low flowing streams	0.86	147.00	17,117.00	2.770	1.716
#14	**4**	**Muskingum K:**					**1.716**
#14	5	8. Large gullies, diversions, and low flowing streams	0.88	175.00	19,934.00	2.810	1.970
#14	**5**	**Muskingum K:**					**1.970**
#14	6	8. Large gullies, diversions, and low flowing streams	0.95	211.00	22,155.00	2.920	2.107
#14	**6**	**Muskingum K:**					**2.107**
#14	7	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**7**	**Muskingum K:**					**2.544**
#14	8	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**8**	**Muskingum K:**					**2.544**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	9	8. Large gullies, diversions, and low flowing streams	0.95	307.00	32,146.59	2.930	3.047
#14	**9**	**Muskingum K:**					**3.047**
#14	10	8. Large gullies, diversions, and low flowing streams	0.96	339.00	35,382.00	2.930	3.354
#14	**10**	**Muskingum K:**					**3.354**
#15	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#15	**1**	**Muskingum K:**					**0.000**
#15	2	8. Large gullies, diversions, and low flowing streams	1.14	86.00	7,535.00	3.200	0.654
#15	**2**	**Muskingum K:**					**0.654**
#15	3	8. Large gullies, diversions, and low flowing streams	1.25	115.00	9,236.00	3.340	0.768
#15	**3**	**Muskingum K:**					**0.768**
#16	2	8. Large gullies, diversions, and low flowing streams	0.58	24.00	4,161.00	2.270	0.509
#16	**2**	**Muskingum K:**					**0.509**
#16	3	8. Large gullies, diversions, and low flowing streams	0.51	37.00	7,269.00	2.140	0.943
#16	**3**	**Muskingum K:**					**0.943**
#17	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#17	**1**	**Muskingum K:**					**0.000**
#18	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#18	**1**	**Muskingum K:**					**0.000**
#18	2	8. Large gullies, diversions, and low flowing streams	1.02	62.00	6,103.00	3.020	0.561
#18	**2**	**Muskingum K:**					**0.561**
#20	2	8. Large gullies, diversions, and low flowing streams	17.00	3,605.00	21,205.88	12.360	0.476
#20	**2**	**Muskingum K:**					**0.476**
#21	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#21	**1**	**Muskingum K:**					**0.000**
#21	2	8. Large gullies, diversions, and low flowing streams	0.41	20.00	4,824.00	1.930	0.694
#21	**2**	**Muskingum K:**					**0.694**
#21	3	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,626.00	1.780	0.877
#21	**3**	**Muskingum K:**					**0.877**
#21	4	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,626.00	1.780	0.877
#21	**4**	**Muskingum K:**					**0.877**
#23	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#23	**1**	**Muskingum K:**					**0.000**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#23	2	8. Large gullies, diversions, and low flowing streams	0.63	30.00	4,771.75	2.370	0.559
#23	**2**	**Muskingum K:**					**0.559**
#24	1	8. Large gullies, diversions, and low flowing streams	0.79	180.00	22,769.00	2.660	2.377
#24	**1**	**Muskingum K:**					**2.377**
#24	2	8. Large gullies, diversions, and low flowing streams	0.78	180.00	23,111.00	2.640	2.431
#24	**2**	**Muskingum K:**					**2.431**
#24	4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#24	**4**	**Muskingum K:**					**0.000**
#25	1	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**1**	**Muskingum K:**					**0.342**
#25	2	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**2**	**Muskingum K:**					**0.342**
#25	3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#25	**3**	**Muskingum K:**					**0.000**
#27	1	8. Large gullies, diversions, and low flowing streams	1.38	216.00	15,629.00	3.520	1.233
#27	**1**	**Muskingum K:**					**1.233**
#27	2	8. Large gullies, diversions, and low flowing streams	1.17	144.00	12,301.00	3.240	1.054
#27	**2**	**Muskingum K:**					**1.054**
#27	3	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**3**	**Muskingum K:**					**0.551**
#27	4	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**4**	**Muskingum K:**					**0.551**
#28	1	8. Large gullies, diversions, and low flowing streams	1.30	84.00	6,445.17	3.420	0.523
#28	**1**	**Muskingum K:**					**0.523**
#29	1	8. Large gullies, diversions, and low flowing streams	0.88	37.00	4,210.00	2.810	0.416
#29	**1**	**Muskingum K:**					**0.416**
#29	2	8. Large gullies, diversions, and low flowing streams	0.88	26.00	2,949.00	2.810	0.291
#29	**2**	**Muskingum K:**					**0.291**
#31	1	8. Large gullies, diversions, and low flowing streams	1.35	76.00	5,639.00	3.480	0.450
#31	**1**	**Muskingum K:**					**0.450**
#31	2	8. Large gullies, diversions, and low flowing streams	1.15	20.00	1,734.00	3.220	0.149
#31	**2**	**Muskingum K:**					**0.149**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#34	1	8. Large gullies, diversions, and low flowing streams	0.73	65.00	8,900.00	2.560	0.965
#34	**1**	**Muskingum K:**					**0.965**
#34	2	8. Large gullies, diversions, and low flowing streams	0.73	65.00	8,900.00	2.560	0.965
#34	**2**	**Muskingum K:**					**0.965**
#36	3	8. Large gullies, diversions, and low flowing streams	2.71	80.00	2,957.00	4.930	0.166
#36	**3**	**Muskingum K:**					**0.166**
#37	2	8. Large gullies, diversions, and low flowing streams	0.29	30.00	10,319.91	1.610	1.780
#37	**2**	**Muskingum K:**					**1.780**
#37	3	8. Large gullies, diversions, and low flowing streams	0.31	30.00	9,800.71	1.650	1.649
#37	**3**	**Muskingum K:**					**1.649**
#37	4	8. Large gullies, diversions, and low flowing streams	0.29	30.00	10,319.91	1.610	1.780
#37	**4**	**Muskingum K:**					**1.780**
#37	5	8. Large gullies, diversions, and low flowing streams	0.56	100.00	17,956.54	2.230	2.236
#37	**5**	**Muskingum K:**					**2.236**

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#30	476.400	476.400	20.29	4.54
#28	1,217.900	1,217.900	424.40	68.00
#26	2,486.400	2,486.400	99.26	38.78
#24	8,061.800	8,061.800	143.61	112.28
#25	1,015.700	9,077.500	147.45	138.55
#27	1,783.700	13,347.600	319.11	223.74
#29	966.000	15,531.500	673.55	344.54
#32	293.700	16,301.600	697.34	369.21
#31	957.100	957.100	395.36	62.12
#33	0.000	17,258.700	785.16	431.33
#34	932.500	18,191.200	818.88	481.33
#5	2,023.000	2,023.000	540.04	94.54
#6	1,743.200	3,766.200	575.19	181.93
#7	2,395.300	6,161.500	982.59	341.46
#8	0.000	6,161.500	982.59	341.46
#10	1,053.200	7,214.700	1,026.78	400.15
#1	2,411.100	2,411.100	450.10	89.93
#2	1,497.000	3,908.100	539.84	181.84
#3	862.700	4,770.800	673.76	226.50
#4	0.000	4,770.800	673.76	226.50
#9	425.500	5,196.300	707.87	255.01
#11	0.000	12,411.000	1,567.95	655.16
#21	1,080.800	13,491.800	1,637.22	712.16
#18	848.500	848.500	210.88	42.35
#17	182.200	182.200	128.80	12.48
#19	0.000	1,030.700	301.55	54.83
#15	1,992.700	1,992.700	484.43	95.22
#12	3,494.500	3,494.500	276.49	72.29
#13	2,720.700	6,215.200	528.75	128.90
#14	5,096.800	11,312.000	706.02	346.80
#16	876.500	14,181.200	1,014.86	501.20
#20	681.900	15,893.800	1,080.51	600.87
#22	0.000	29,385.600	2,595.82	1,313.03
#23	752.900	30,138.500	2,593.51	1,351.53
#35	0.000	48,329.700	3,267.78	1,832.86
#36	891.700	49,221.400	3,263.49	1,865.82
#37	2,208.500	51,429.900	3,234.48	1,949.23

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	50 yr - 6 hr
Rainfall Depth:	1.800 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#30	476.400	476.400	32.83	6.99
#28	1,217.900	1,217.900	525.53	83.61
#26	2,486.400	2,486.400	143.85	55.25
#24	8,061.800	8,061.800	208.85	162.63
#25	1,015.700	9,077.500	214.09	197.55
#27	1,783.700	13,347.600	423.24	314.60
#29	966.000	15,531.500	856.40	463.26
#32	293.700	16,301.600	887.94	494.50
#31	957.100	957.100	482.72	75.24
#33	0.000	17,258.700	973.26	569.73
#34	932.500	18,191.200	1,013.26	631.43
#5	2,023.000	2,023.000	673.75	118.20
#6	1,743.200	3,766.200	718.40	226.70
#7	2,395.300	6,161.500	1,214.13	419.42
#8	0.000	6,161.500	1,214.13	419.42
#10	1,053.200	7,214.700	1,264.38	491.32
#1	2,411.100	2,411.100	576.49	114.84
#2	1,497.000	3,908.100	683.05	226.67
#3	862.700	4,770.800	828.28	281.95
#4	0.000	4,770.800	828.28	281.95
#9	425.500	5,196.300	868.93	316.37
#11	0.000	12,411.000	1,927.22	807.69
#21	1,080.800	13,491.800	2,011.10	878.14
#18	848.500	848.500	267.05	52.51
#17	182.200	182.200	155.60	15.04
#19	0.000	1,030.700	366.68	67.55
#15	1,992.700	1,992.700	608.76	118.63
#12	3,494.500	3,494.500	379.69	99.03
#13	2,720.700	6,215.200	721.87	176.27
#14	5,096.800	11,312.000	942.87	450.84
#16	876.500	14,181.200	1,258.26	640.88
#20	681.900	15,893.800	1,337.03	762.67
#22	0.000	29,385.600	3,203.79	1,640.81
#23	752.900	30,138.500	3,200.38	1,688.52
#35	0.000	48,329.700	4,045.08	2,319.96
#36	891.700	49,221.400	4,039.79	2,362.07
#37	2,208.500	51,429.900	4,005.46	2,468.74

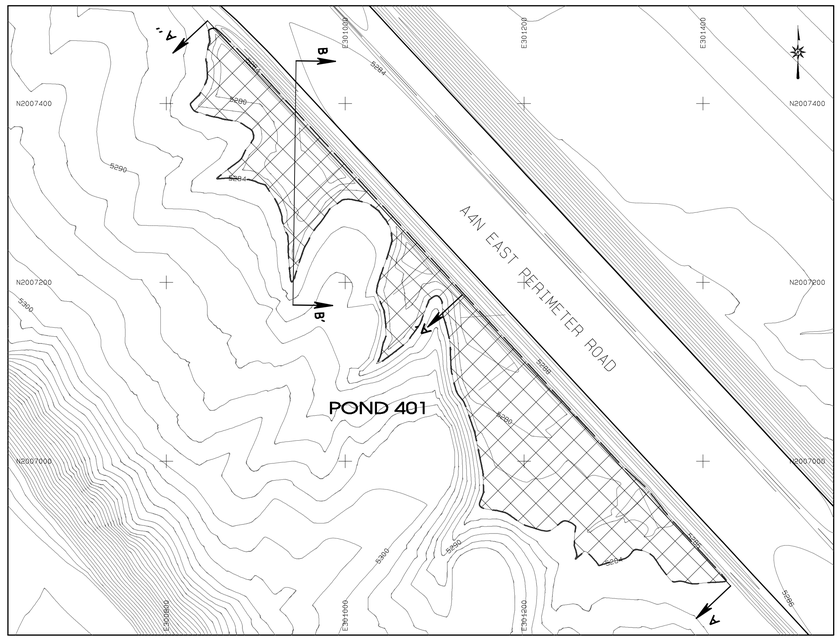
General Information

Storm Information:

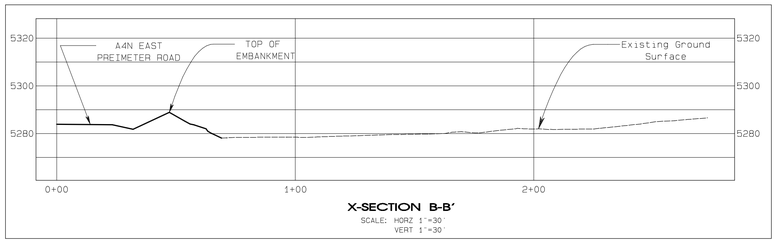
Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Summary:

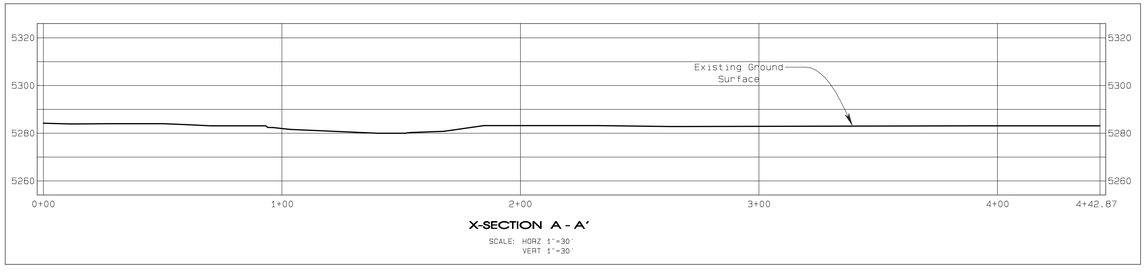
	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#30	476.400	476.400	48.15	9.85
#28	1,217.900	1,217.900	630.72	99.84
#26	2,486.400	2,486.400	194.88	73.81
#24	8,061.800	8,061.800	283.23	219.79
#25	1,015.700	9,077.500	289.91	264.16
#27	1,783.700	13,347.600	536.81	416.52
#29	966.000	15,531.500	1,051.27	594.15
#32	293.700	16,301.600	1,091.37	632.47
#31	957.100	957.100	573.16	88.75
#33	0.000	17,258.700	1,188.90	721.22
#34	932.500	18,191.200	1,217.27	795.10
#5	2,023.000	2,023.000	815.52	143.06
#6	1,743.200	3,766.200	868.02	273.64
#7	2,395.300	6,161.500	1,455.93	500.51
#8	0.000	6,161.500	1,455.93	500.51
#10	1,053.200	7,214.700	1,512.16	586.13
#1	2,411.100	2,411.100	711.39	141.39
#2	1,497.000	3,908.100	834.50	273.80
#3	862.700	4,770.800	988.87	340.16
#4	0.000	4,770.800	988.87	340.16
#9	425.500	5,196.300	1,036.48	380.66
#11	0.000	12,411.000	2,314.22	966.80
#21	1,080.800	13,491.800	2,400.12	1,051.28
#18	848.500	848.500	326.50	63.15
#17	182.200	182.200	182.95	17.67
#19	0.000	1,030.700	433.80	80.82
#15	1,992.700	1,992.700	740.10	143.20
#12	3,494.500	3,494.500	493.90	128.59
#13	2,720.700	6,215.200	935.07	228.65
#14	5,096.800	11,312.000	1,201.98	563.09
#16	876.500	14,181.200	1,513.07	790.26
#20	681.900	15,893.800	1,605.07	934.99
#22	0.000	29,385.600	3,839.19	1,986.27
#23	752.900	30,138.500	3,834.77	2,043.61
#35	0.000	48,329.700	4,859.19	2,838.72
#36	891.700	49,221.400	4,853.45	2,890.59
#37	2,208.500	51,429.900	4,813.30	3,022.02



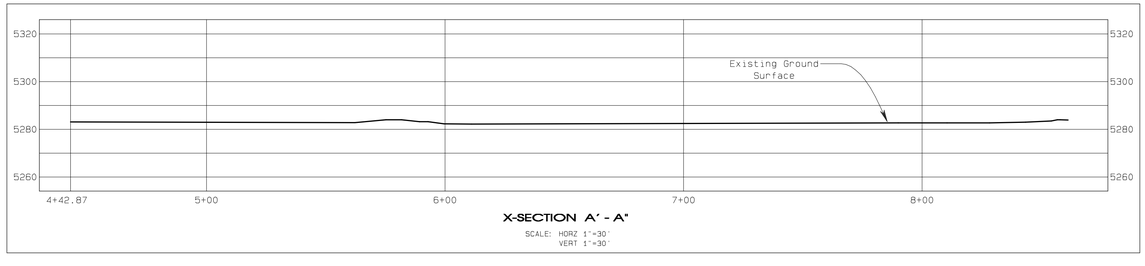
PLAN VIEW
CONTOUR INT: 2 FT
SCALE: 1"=80'



X-SECTION B-B'
SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION A - A'
SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION A' - A"
SCALE: HORZ 1"=30'
VERT 1"=30'

LEGEND

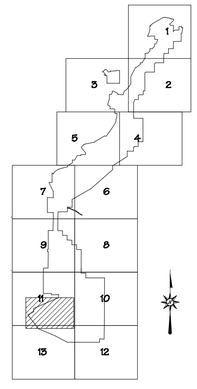
- ROAD
- BUILDING
- FENCE
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5274	0.046	0.00	0.00
5276	0.199	0.20	0.20
5278	0.471	0.70	0.90
5280	0.949	1.40	2.30
5282	1.237	2.20	4.50



SCALE AS NOTED

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

REVISION	DATE
01-JUPDATED A4N DEVELOPMENT AND SUBMITTED TO OSM FOR REVIEW	07/30/09
11-1 A4N EXPANSION REVISION RESUBMITTAL TO OSM FOR REVIEW	FEB-2011

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO. NM 9263
SRVYR of RECORD:
REG. NO.

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

PROJECT: A4N
DATE: AUG. 6, 2009
DESIGNED BY: RCV
DRAWN BY: PJFOSTER
CHECKED BY: RCV
APPROVED BY: RCV

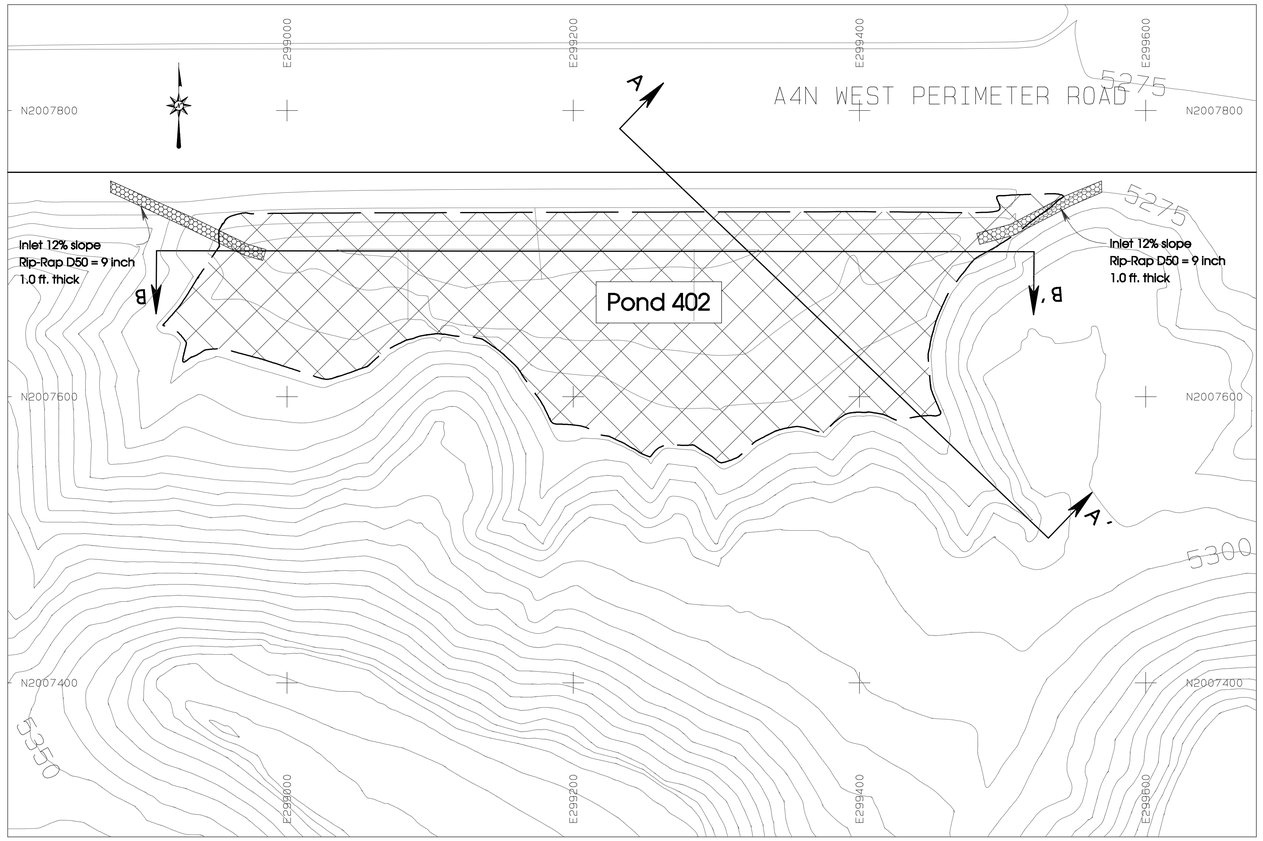
PLAN, PROFILE AND SECTION

EXHIBIT 11-01D
AREA 4 NORTH
POND 401
Design

DRAWING

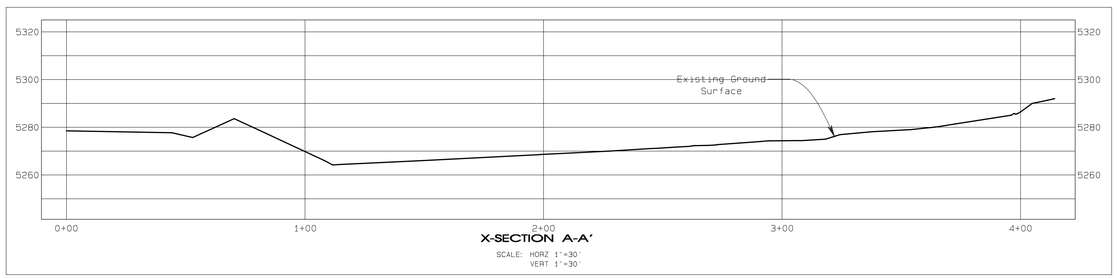
SHEET
OF 0

G:\GS\Permit Fi\Ch 11\Exh 11-001_A4N_PD 401\OSM Subm-12011\Exh 11-01D_A4N_Pond 401_Design.pro
Tue Feb 15 09:42:49 2011



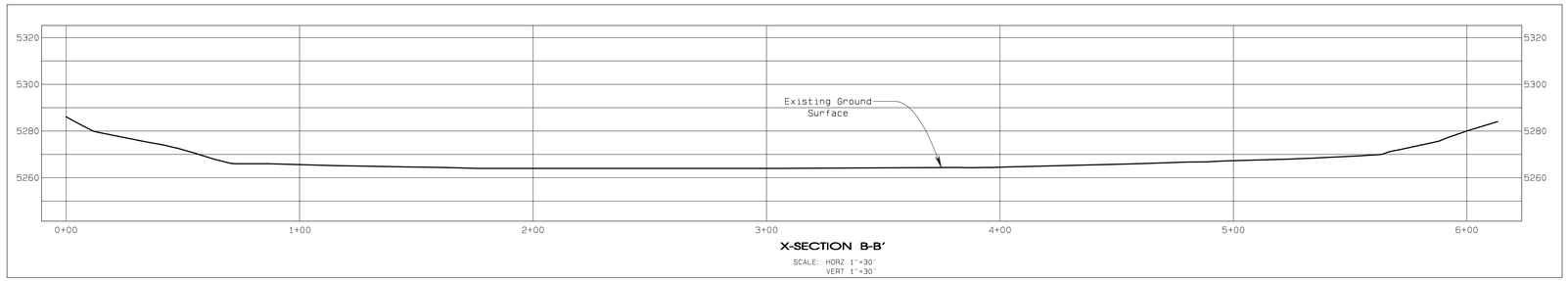
PLAN VIEW

SCALE: 1"=80'



X-SECTION A-A'

SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION B-B'

SCALE: HORZ 1"=30'
VERT 1"=30'

LEGEND

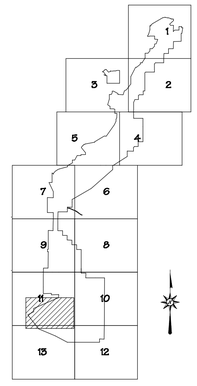
- ROAD
- BUILDING
- FENCE
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5260	0.09	0.00	0.00
5262	0.31	0.40	0.40
5264	0.49	0.80	1.20
5266	0.66	1.10	2.30
5268	0.84	1.50	3.80
5270	1.06	1.90	5.70
5272	1.31	2.40	8.10
5274	1.54	2.90	11.00
5276	1.75	3.30	14.30



SCALE AS NOTED

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

REVISION	DATE
09-UPDATED AIR DEVELOPMENT AND SUBMITTED TO DSM FOR REVIEW	8/28/09
11-4 YEAR 2 MONTH REVISION RESUBMITTAL TO DSM FOR REVIEW	FEB-2011

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO. NM 9263
SRVYR of RECORD:
REG. NO.

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

PROJECT: 4AN
DATE: AUG.8, 2009
DESIGNED BY: RCV
DRAWN BY: PJFOSTER
CHECKED BY: RCV
APPROVED BY: RCV

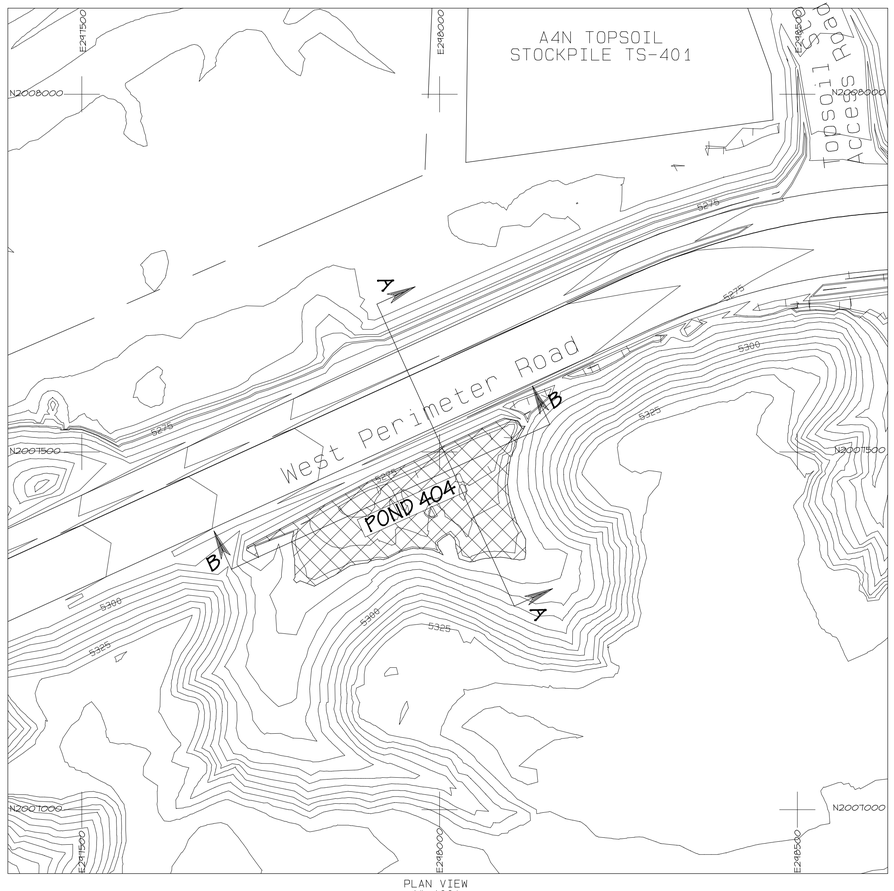
PLAN, PROFILE AND SECTION

EXHIBIT 11-02D AREA 4 NORTH POND 402 Design

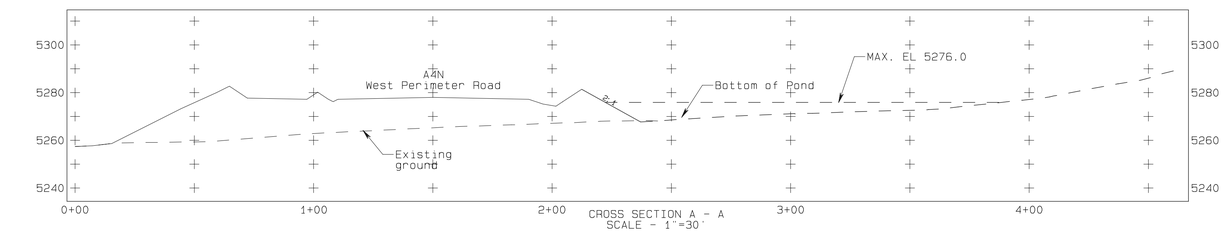
DRAWING

SHEET
OF 0

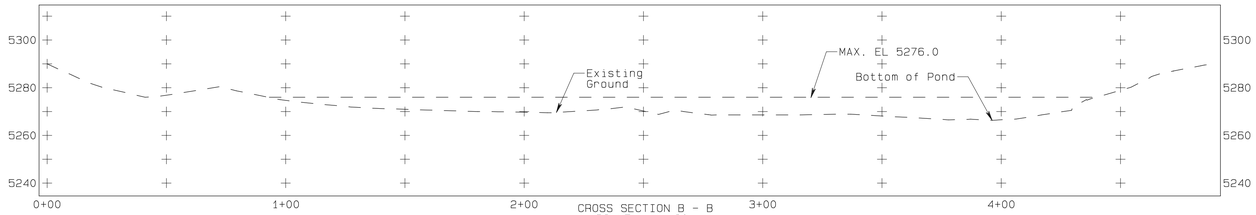
G:\GS\Permit F\Ch 11\Exh 11-002-03_4AN PDS 402-403\DSW SubM-12011\Exh 11-020_030_Pond -402_403_Design.pro
Tue Feb 15 09:53:33 2011



PLAN VIEW
1"=100'



CROSS SECTION A - A
SCALE - 1"=30'



CROSS SECTION B - B
SCALE - 1"=30'

N
W E
S

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5266	0.01	0.0	0.0
5268	0.05	0.1	0.1
5270	0.21	0.3	0.3
5272	0.52	0.7	1.1
5274	0.77	1.3	2.3
5276	0.97	1.7	4.1

Design Volume Capacity (AC-FT) 4.1

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 LEASE CORNER
- L-30
- PERMIT/LEASE BOUNDARY

NOTES

1. Refer to Exhibit 11-13F for watershed information and location of ponds.
2. For hydrology and design information refer to Table 11-5 in the approved PAP.

SCALE AS NOTED

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

DATE	REVISION
08/28/09	1 SUBMITTED TO OSM FOR APPROVAL
01/14/10	2 SUBMITTED TO OSM FOR APPROVAL AND PAP REVISION
FEB-2011	3 PER M. ROHR REVISION RESUBMITTAL 11-4 PER OSM REVIEW AND APPROVAL

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO. 9263
SRVYR of RECORD:
REG. NO.

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416, PHONE 505-598-3209/FAX 505-598-3361

ACCOUNT:
DATE: AUGUST 31, 2009
DESIGNED BY: RCV
DRAWN BY:
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTIONS

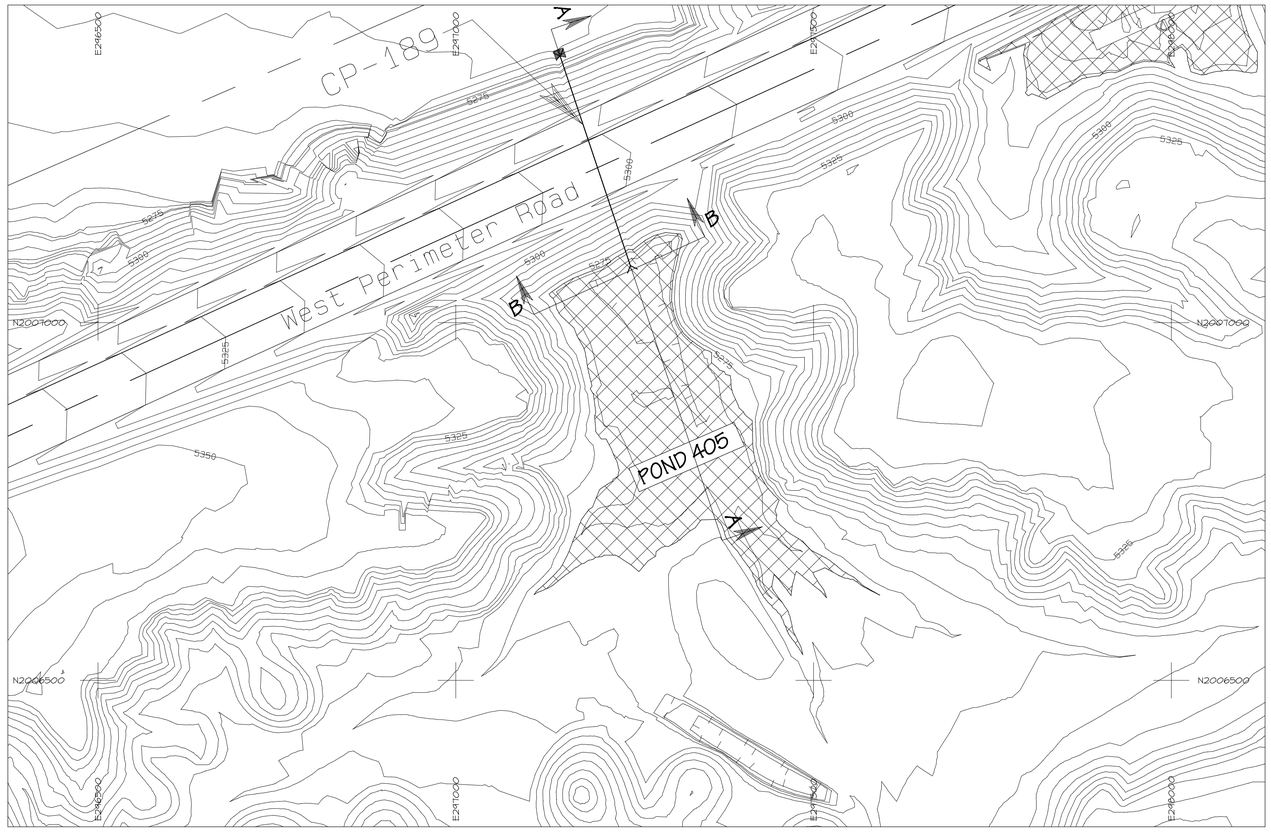
EXHIBIT 11-04D

AREA 4 NORTH
POND 404
Design

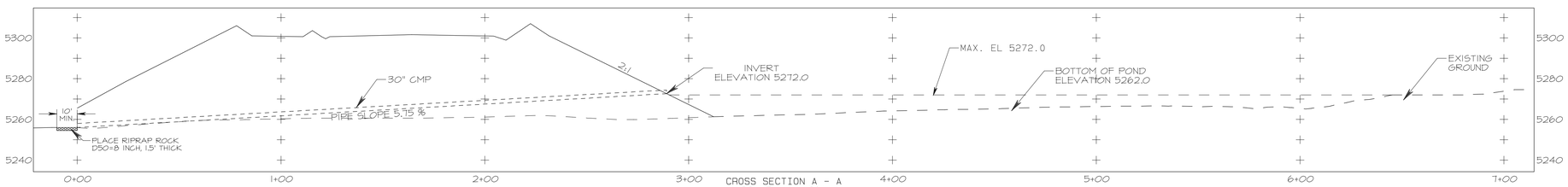
DRAWING

SHEET 1
OF 1

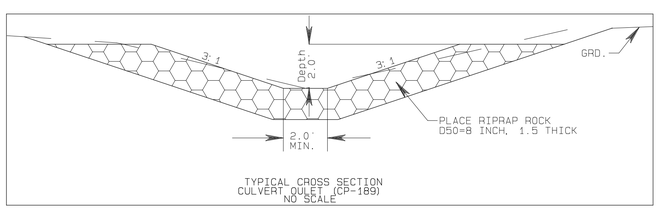
Project Desc: ... Path: G:\Gis\Permit Fl\Ch 11\Exh 11-004-05_A4N PDS 404-405\OSM Submit2011\Exh 11-04D-05D_Pond-404_405_Design.pro Plot Date/Time: Tue Feb 15, 2011 / 10:46:28



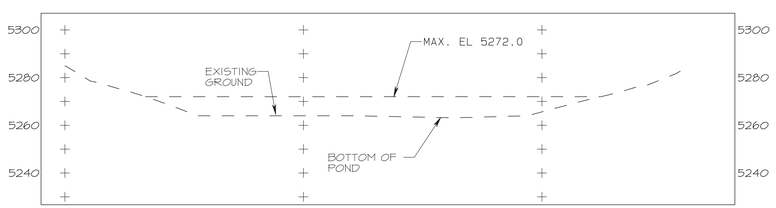
PLAN VIEW
1"=100'



CROSS SECTION A - A
SCALE - 1"=30'



TYPICAL CROSS SECTION
CULVERT OULET (CP-189)
NO SCALE



CROSS SECTION B - B
SCALE - 1"=30'

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5262	0.023	0.0	0.00
5264	0.141	0.2	0.2
5266	0.484	0.6	0.8
5268	0.877	1.4	2.2
5270	1.399	2.3	4.4
5272	2.068	3.5	7.9

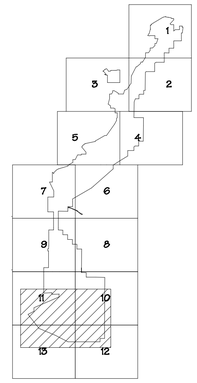
Design Volume Capacity (AC-FT) 7.9

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. For hydrology and design information refer to Table 11-5 in the approved PAP.
2. The watershed areas for culverts are shown on Exhibit 11-12F.
3. The watershed areas and location for Ponds are shown on Exhibit 11-13F.



SCALE AS NOTED

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

REVISION	DATE
1. SUBMITTED TO OSM FOR APPROVAL	08/28/09
2. SUBMITTED TO OSM FOR APPROVAL	01/14/10
PER E-M PERMIT REVISION RESUBMITTAL	FEB-2011
11-4, 11-5, 11-12F, 11-13F	

PROJECT MANAGER: FS
ENGR. of RECORD: RCV
REG. NO. 9263
SURVR of RECORD:
REG. NO.

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416, PHONE: 505-598-3209/FAX: 505-598-3361

ACCOUNT:
DATE: AUGUST 31, 2009
DESIGNED BY: RCV
DRAWN BY:
CHECKED BY: RCV
APPROVED BY: RCV

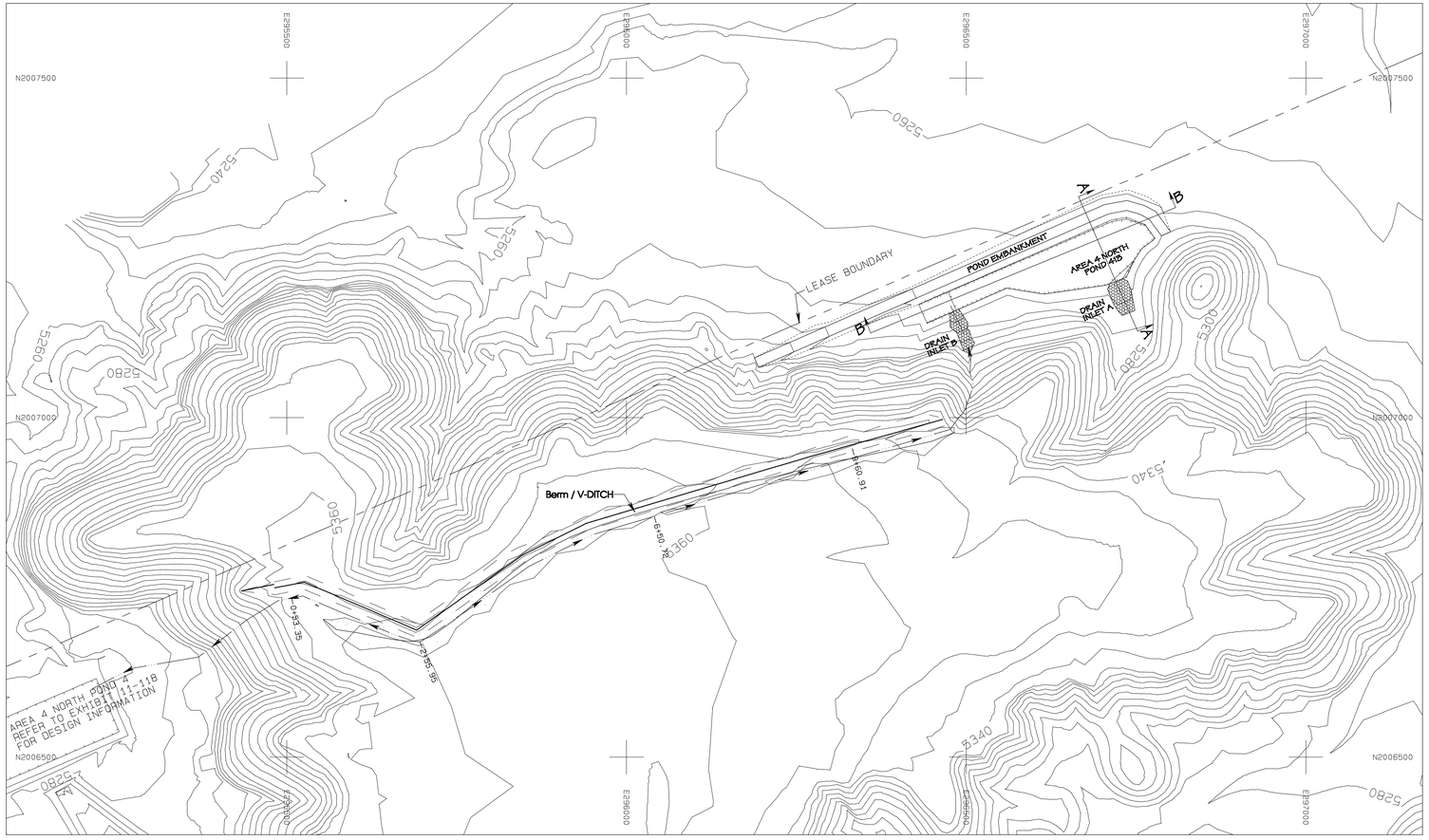
PLAN, PROFILE AND SECTIONS

EXHIBIT 11-05D
AREA 4 NORTH
POND 405
Design

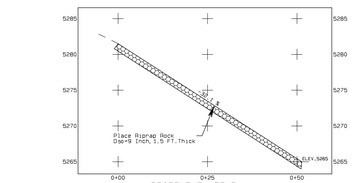
DRAWING

SHEET 1
OF 1

Project Desc.: Path: G:\Gis\Permit Fi\Ch 11\Exh 11-004-05_AAN PDS 404-405\DGN Suite-12011\Exh 11-040-05D_Pond-404_405_Design.pro Plot Date/Time: Tue Feb 15, 2011 / 10:44:29



PLAN VIEW
1"=100'



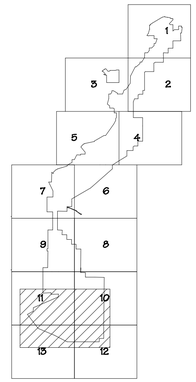
PROFILE INLET B
HORIZ. - 1"=20'
VERT. - 1"=10'

LEGEND

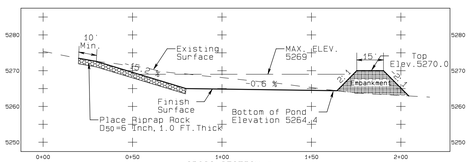
- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- 5298 — INTERMEDIATE CONTOUR
- 218 / 5422.45 — LEASE CORNER
- L-30 — PERMIT/LEASE BOUNDARY
- DRAIN FLOW PATH

NOTES

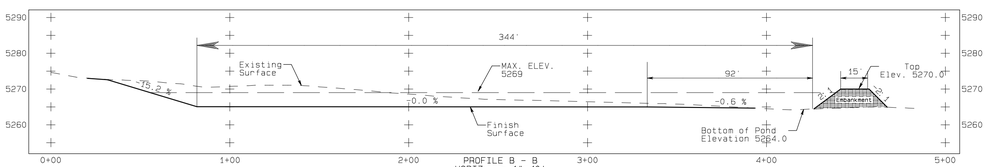
1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
1. Refer to Exhibit 11-13F for watershed information and location of ponds.



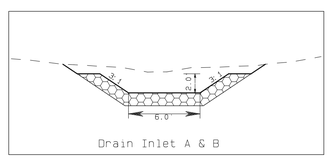
SCALE AS NOTED



CROSS SECTION A - A
HORIZ. - 1"=40'
VERT. - 1"=20'

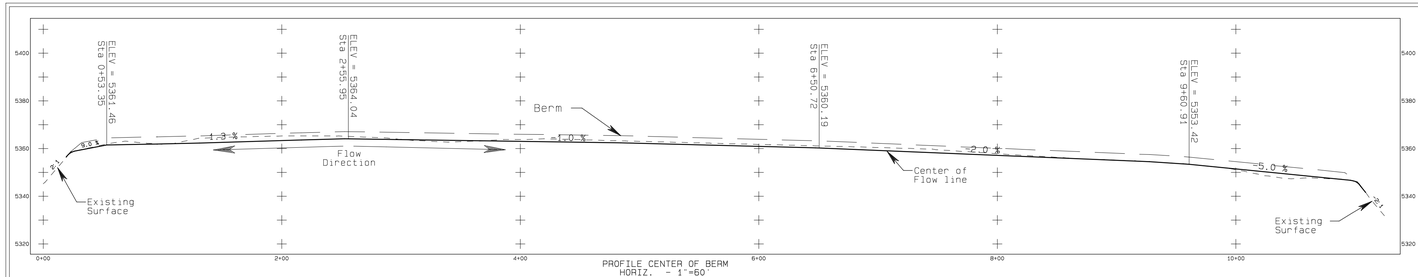


PROFILE B - B
HORIZ. - 1"=40'
VERT. - 1"=20'

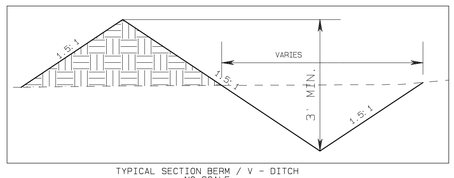


TYPICAL CROSS SECTION
NO SCALE

PROFILE AND CROSS SECTIONS OF AREA 4 NORTH POND 413



PROFILE CENTER OF BERM
HORIZ. - 1"=60'
VERT. - 1"=30'



TYPICAL SECTION BERM / V - DITCH
NO SCALE

PROFILE AND CROSS SECTION OF BERM

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5264	0.01	0.0	0.00
5265	0.42	0.22	0.22
5266	0.47	0.44	0.66
5268	0.55	0.51	1.68
5270	0.67	0.61	2.90

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

REVISION	DATE
1. SUBMITTED TO OSM FOR APPROVAL	01/25/10
1-A SUBMITTED TO OSM FOR REVIEW AND APPROVAL	FEB-2011

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SMVR of RECORD:
REG. NO.

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO 87416 PHONE 505-598-3009/FAX 505-598-3961

ACCOUNT:
DATE: 01-26-10
DESIGNED BY: RCV
DRAWN BY: FG
CHECKED BY: RCV
APPROVED BY: RCV

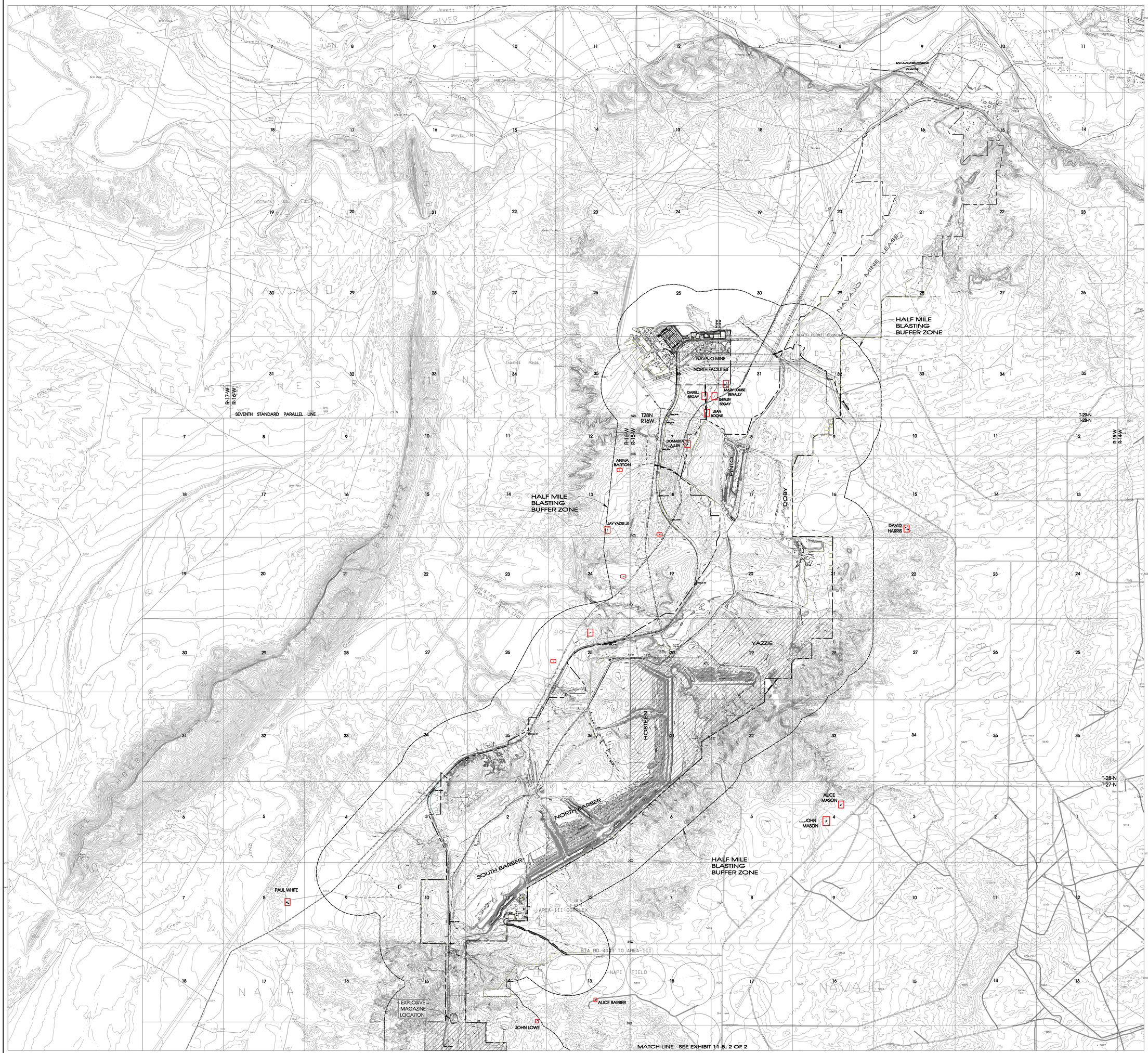
EXHIBIT 11-6D
AREA 4 NORTH
POND 413
Design

PLAN, PROFILE AND SECTIONS

DRAWING

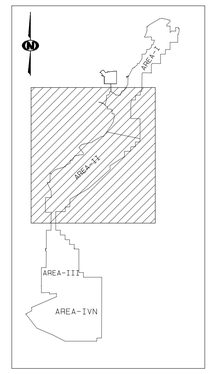
SHEET 1
OF 1

Project Desc.: Path: G:\GA\Permit Fi\Ch 11\Exh 11-006_A4N PD 413\GSM+Supm-12011\Exh 11-06D_A4N Pond 413_Design.pro Plot Date/Time: Tue Feb 15, 2011 / 10:51:17



LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 5422.45 HORIZ. & VERT. CONTROL
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY
- BLASTING AREAS



2000 0 2000 4000

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG. BY	E.G.	P.E.	APPROVED DATE
				APPROVALS			
11-A	FEB-2011	PJF	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	S.Smith	S.Yazzie		
10-A	12-13-10	PJF	UPDATED NAMES OF RESIDENTS LOCATIONED WITHIN THE HALF MILES BLASTING BUFFER ZONE AND SUBMITTED TO OSM FOR REVIEW.	S.Smith	S.Yazzie		
09-A	3-11-09	PJF	UPDATED EXHIBIT, WITH HALF MILE BLASTING BUFFER ZONE FROM THE LEASE BOUNDARY, REMOVED TEXT distance from the active mining areas AND SUBMITTED TO OSM FOR REVIEW	KAJ/ SDH	YB		
08-A	9-24-08	PJF	UPDATED EXHIBIT, WITH HALF MILE BLASTING BUFFER ZONE FROM THE LEASE BOUNDARY, REMOVED TEXT distance from the active mining areas AND OSM FOR REVIEW.	KAJ/ SDH	YB	KAB	
07-A	9-05-07	PJF	UPDATED EXHIBIT FOR 2007 MID-TERM AND SUBMITTED TO OSM FOR REVIEW.	KAJ/ SF	YB	DJR	
B	12-15-05	PJF	UPDATED RESIDENTS AND SUBMITTED TO OSM FOR REVIEW.	BH	KJ	WB	
A	9-25-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL	DR	WC	SF	

EXHIBIT 11-08

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-598-3361

BLASTING AREA LOCATION MAP

PREPARED BY PJF	DRAWN BY PJF	SCALE 1" = 2000'	
APPROVED BY	DATE Sept. 15, 1998	SHT 1 OF 2	

MAP LOCATION: (See Lower Left Corner)

G:\Gs\Permit F\Ch 11\Exh 11-008_Drill-Blast LocMap\APPROVED PAP 2010\2009 DATA\OSM Subm-Feb-2011\Exh_11-08_1of2.pro
NM PAP Thu Feb 03 13:07:27 2011

EXPLOSIVE MAGAZINE LOCATION

ALICE BARBER

JOHN LOWE

MATCH LINE SEE EXHIBIT 11-8_1 OF 2

KATIE DOBY

REX ANTONIO

JIM MASON

KATIE JOE & FRED BEGAY

CYNTHIA DIXON

KATIE DOBY

LOWE PIT

Surface Use Permit Boundary

HALF MILE BLASTING BUFFER ZONE

HALF MILE BLASTING BUFFER ZONE

AREA-III

PERTINE YAZZIE

DIXON PIT

ELSIE DOBY

EL PASO NATURAL GAS PIPELINE

R-17-W R-16-W

R-16-W R-15-W

R-15-W R-14-W

LEVONA BEGAY STANLEY SIMS

T-27-N T-26-N

ALICE D. GILMORE

AREA-4 NORTH

RONALD BUSH

NAVAJO MINE PERMIT BOUNDARY

LOUISE BENALLY

HALF MILE BLASTING BUFFER ZONE

DA & LARRY LOPEZ

BHP-NAVAJO MINE LEASE BOUNDARY

T-26-N T-25-N

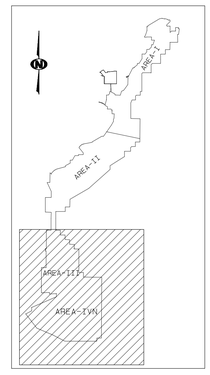
R-17-W R-16-W

R-16-W R-15-W

R-15-W R-14-W

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 5422.45 HORIZ. & VERT. CONTROL
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY
- BLASTING AREAS



2000 0 2000 4000

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG. APPROVAL	E.O. APPROVAL	P.E. APPROVAL
11-A	FEB-2011	PJF	AREA 4 NORTH REVISION RESUBMITAL TO OSM FOR REVIEW AND APPROVAL.	SSH-LYL	SHigh	
09-B	7-12-09	PJF	Original Exhibit 8 signed 04/15/15.pdf Registered at the Mine Site and OSM ADDED EXISTING OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.	KAJ SSH-LYL	YB	KAB
09-A	3-11-09	PJF	UPDATED EXHIBIT WITH ALL RESIDENTIAL LOCATIONS WITHIN THE HALF MILES BLASTING BUFFER ZONE AND SUBMITTED TO OSM FOR REVIEW.	KAJ SSH-LYL	YB	KAB
08-B	9-24-08	PJF	UPDATED EXHIBIT WITH HALF MILE BLASTING BUFFER ZONE FROM THE LOWE PIT BOUNDARY. REMOVED TEXT: DISTANCE FROM THE ACTIVE MINING AREAS AND OSM FOR REVIEW.	KAJ SSH-LYL	YB	KAB
08-A	6-27-08	PJF	UPDATED AVN BLASTING MAP AND SUBMITTED TO OSM FOR REVIEW.	LR	YB	KAB
07-A	10-31-07	PJF	UPDATED EXHIBIT, SUBMITTED FOR AVN DEVELOPMENT TO OSM FOR REVIEW AND APPROVAL.	KAJ OF	YB	DJR
E	7-28-06	PJF	CORRECTED REX MASON TO REX ANTONIO WEST OF JIM MASON RESIDENT AND SUBMITTED TO OSM FOR REVIEW.		MS	KJ MB
D	5-02-06	PJF	ADDED NEW RESIDENT (REX MASON) WEST OF JIM MASON RESIDENT AND SUBMITTED TO OSM FOR REVIEW.		BH	KJ MB
C	12-12-05	PJF	UPDATED RESIDENTS FOR 2ND QTR 2006 AS ALICE DILWORTH VACATED HER CAMP SITE EAST OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.		BH	KJ MB
B	10-17-05	PJF	ADDED AVN BLASTING AREA AND SUBMITTED TO OSM FOR REVIEW.		LR	MC LR
A	9-25-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL		DR	MC BF

EXHIBIT 11–08

bhpbilliton

BHP Navajo Coal Company

P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-4200
Fax: 505-598-3361

BLASTING AREA LOCATION MAP

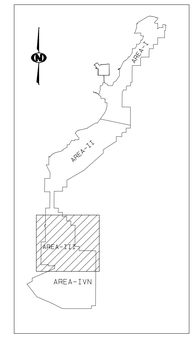
PREPARED BY PJF	DRAWN BY PJF	SCALE 1" = 2000'
APPROVED BY	DATE Sept. 15, 1998	SHT 2 OF 2
MAP LOCATION: (See Lower Left Corner)		

C:\Gis\Permit F\Cn 11\Exh_11-08_Drill-Blast LocMap\APPROVED PAP 2010\2009 DATA\OSM Subm-Feb-2011\Exh 11-08_2of2.mxd
NM PAP Thu Feb 03 13:32:22 2011

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 / 5422.45 — HORIZ. & VERT. CONTROL
- L-30 — LEASE CORNER
- PERMIT/LEASE BOUNDARY

CP-82 37.0 AC. — CULVERT AND DOWN DRAINAGE STRUCTURE LOCATIONS AND WATERSHED BOUNDARY



500 0 500 1000
CONTOUR INTERVAL: 10'

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.
				APPROVALS		
11-A	FEB-2011	PJF	AREA-A NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	RCV	SO	RCV
DS09	9-01-09	PJF	ADDED NEW TEMPORARY REROUTE ROAD AS-BUILT CULVERTS/WATERSHED DATA AND SUBMITTED FOR REVIEW	Welch	YB	RCV
09-B	7-12-09	PJF	ADDED 18th EXISTING OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.			
09-A	6-22-09	PJF	ADDED CDTP/HAGER HAULROAD CROSSING WITH CP 188, N.S. AREAS NOTE AND SUBMITTED TO OSM FOR REVIEW.	Shaw/ Welch	YB	RVV
08-A	5-14-08	PJF	UPDATED CP-22,CP-91,CP-171, CP-184, CP-4, DD-5 WATERSHED AREAS, AND SUBMITTED TO OSM FOR REVIEW.	Shaw/ Welch	YB	RVV
07-A	7-25-07	PJF	ADDED CP-184, WITH WATERSHED, SOUTH DIXON PIT AREA AND SUBMITTED TO OSM FOR REVIEW.	RVV	YB	RVV
H	11-15-06	PJF	REMOVED CP-115 EXISTING OF DIXON PIT AREA AND SUBMITTED TO OSM FOR REVIEW.	LR	KJ	LR
G	11-25-06	PJF	REMOVED CP-113,114 EXISTING OF DIXON PIT AREA AND SUBMITTED TO OSM FOR REVIEW.	LR	KJ	LR
F	7-08-05	PJF	CHANGED APPENDIX REFERENCE	LR	MC	LR
E	12-14-04	PJF	ADDED CP-183 WATERSHED CROSSING, REVISED CP-182 AND SUBMITTED UNDER CP-152.	LR	MC	LR
L	12-29-03	BH	ADDED CP-171 THROUGH CP-182 WITH WATERSHED AND DATA, ALSO UPDATED AREAS FOR CP-152.	LR	MC	LR
K	11-08-03	BH	ADDED CP-169, CP-75 WITH WATERSHED AND DATA, ALSO REVISED DATA FOR CP-150.	LR	MC	LR
J	7-12-02	PJF	ADDED CP-150, 153, 154, 155, 156 WITH WATERSHED DATA, REMOVED CP-4, 80, 476, 81, 475, 85, 90 AND 110	LR	MC	LR
I	11-03-00	PJF	Removed CP_105, South Dixon Pit	LR	MC	LR
H	5-14-00	PJF	Removed Collyer Road, CP_112 and CP-118 Culverts.	LR	MC	LR
G	5-27-98	PJF	MCO TERM SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	BH	PNS	LR
F	01-28-98	PJF	Updated CP-113 Watershed Drng and Acreage. Removed DD-6, CP-21 and watershed areas. Updated watershed areas for DD-4,5 and CP-22.	BH / FTJ	PNS	LR
E	11-14-97	PJF	Added CP-113,114,115 and watershed areas, Modified CP-90 watershed and Removed CP-80.	BH	PNS	FS
D	9-4-97	PJF	Added CP-112 and watershed B south and of Lee Pit's area, with OSM approval, 8-97.			
C	6-20-97	PJF	Added CP-110 and watershed B south and of Lee Pit Area.			
B	4-07-97	PJF	UPDATED WATERSHED FOR CP-91 LOWE PIT AREA			
A	12-20-95	PJF	SUBMITTED TO OSM FOR APPROVAL.			

Original Certified signed exhibits are maintained at the Mine Site and OSM

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing has 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 — REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 11-12E

bhpbilliton

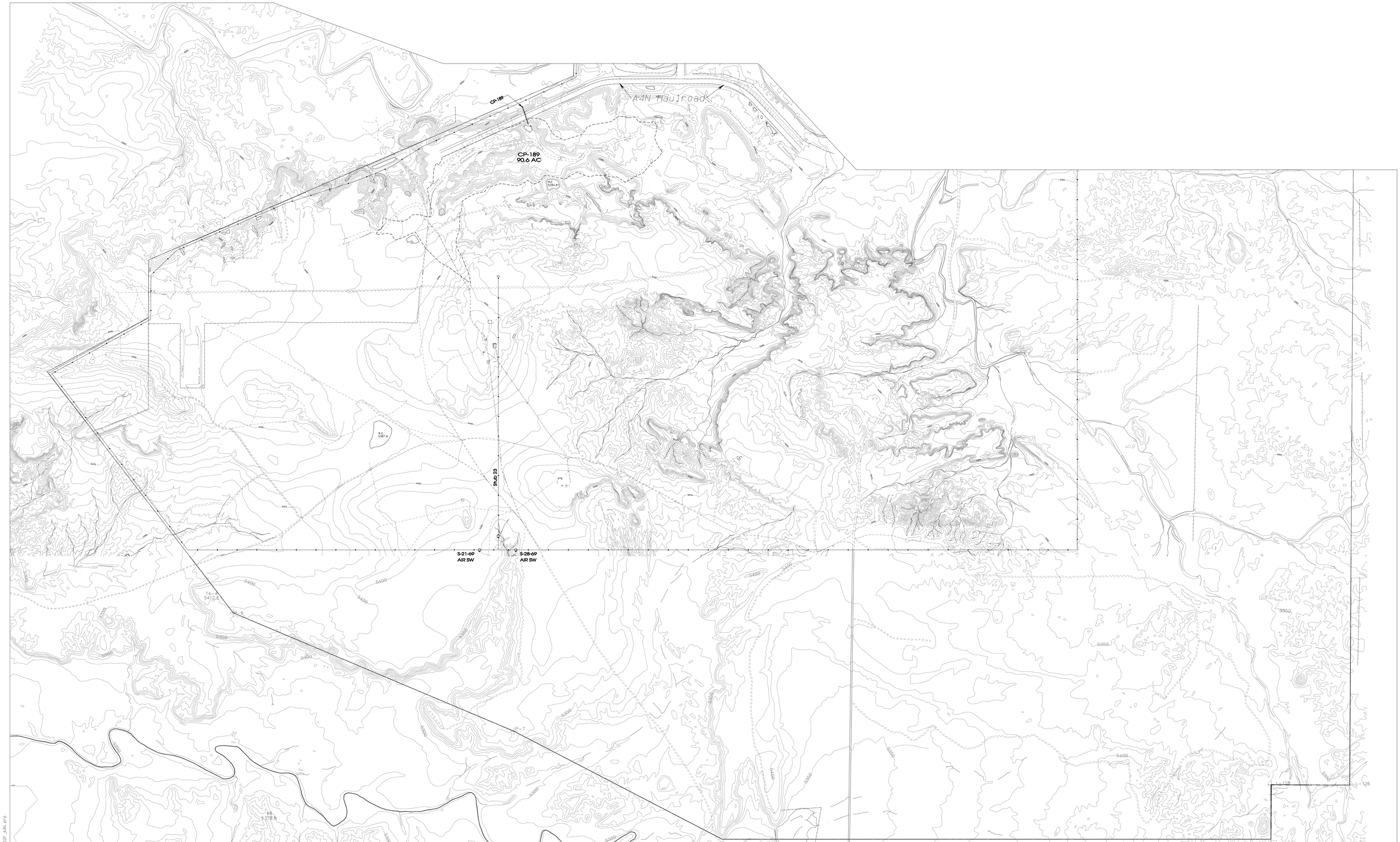
BHP Navajo Coal Company
P.O. Box 1717, Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-598-3361

AREA-III CULVERT/DOWN DRAINAGE STRUCTURE LOCATIONS AND WATERSHED AREAS

PREPARED BY	BTS/PJF	DRAWN BY	PJF
SCALE	1" = 500'		
APPROVED BY		DATE	DEC. 02, 1995

MAP LOCATION: (See Lower Left Corner)

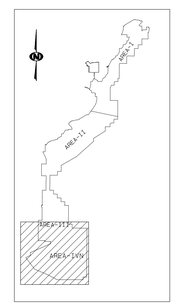
G:\GxVPermit Fi\Ch 11\Exh 11-012_Culverts-WG Data\DSM Subm-Feb-2011\Exh 11-12E.pro
NM PAP Thu Feb 10 08:11:06 2011



NOTE:
1. ONLY ROADS ON THE PERMANENT PROGRAM LANDS WERE CLASSFIED. SEE EXHIBIT 1-4-10F7 THRU 1-4-70F7 FOR LANDS STATUS.

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 / 5422.45 — HORIZ. & VERT. CONTROL
- L-30 — LEASE CORNER
- PERMIT/LEASE BOUNDARY
- PRIMARY ROADS
- ANCILLARY ROADS
- PUBLIC ACCESS ROADS
- DOWN DRAIN STRUCTURE
- CULVERT LOCATION



500 0 500 1000
CONTOUR INTERVAL: 10'

Revised by
Aero-Graphics, Inc.
2930 South West Temple
Salt Lake City, Utah 84115

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify, that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.	P.S.	QUALITY ENG.
				APPROVALS				
D-A	FEB-2001	PJF	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	RCV	SD	RCV		
C	9-27-13	BH	ADDED SOUTH TIP OF CP-179	LR	KC	LR		
B	7-12-02	PJF	ADDED SOUTH TIP OF CP-184	LR	KC	LR		
B	3-27-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL	BH	PVC	LR		
A	11-05-95	PJF	SUBMITTED TO OSM FOR APPROVAL					

EXHIBIT 11–12F

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

AREA 4N
CULVERT/DOWN DRAINAGE STRUCTURE LOCATIONS AND WATERSHED AREAS

PREPARED BY	BS/PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY		DATE Nov. 5, 1995	

MAP LOCATION: (See Lower Left Corner)

G:\GIS\Permit F\Ch 11\Ex11_11-12f_Culverts-WG Data\OSM Sum-Feb-2011\Ex 11-12F_A4N.pro
NM PRP Thu Feb 10 08:20:30 2011

Revised by
Aero - Graphics, Inc.
40 West Oakland Avenue
Salt Lake City, Uath 84115

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 / 5422.45 — HORIZ. & VERT. CONTROL
- L-30 — LEASE CORNER
- PERMIT/LEASE BOUNDARY
- WATERSHED BOUNDARY
- PONDS

NOTES :
1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	PRE'D BY:	E.D.	P.E.	APPROVED DATE APPROVALS
11-A	FEB-2011	PJF	AREA-3 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	RCV	SD	RCV	
10-D	7-21-10	PJF	ADDED HIGHWALL POND 303 WITH WATERSHED AND SUBMITTED TO OSM FOR REVIEW	RVV	YB	RVV	
10-C	3-04-10	PJF	PREPARED SOUTH DIXON POND NO. 302 WATERSHED AND SUBMITTED TO OSM FOR REVIEW	RVV	YB	RVV	
10-B	02-10-10	PJF	UPDATED SOUTH DIXON POND 7 WATERSHED, REMOVED SOUTH DIXON POND 6 WATERSHED AND SUBMITTED TO OSM FOR REVIEW	RVV	YB	RVV	
10-A	01-08-10	PJF	UPDATED SOUTH DIXON POND 6 WITH AS-BUILT DATA, REMOVED NORTH FORK HIGHWALL POND 1 WATERSHED AND SUBMITTED TO OSM FOR REVIEW	RVV	YB	RVV	
09-C	12-17-09	PJF	PREPARED NORTH FORK CR. POND-4 UPDATED WATERSHED, AND SUBMITTED TO OSM FOR REVIEW	Dave Smith	YB	RCV	
09-B	7-12-09	PJF	On-river Carlisle mine's pits impounded all the way East and other updates. ADDED 12H EXTENSION OF L.DAM #11 AND SUBMITTED TO OSM FOR REVIEW.	Dave Smith	YB	KAB	
09-A	02-02-09	PJF	REVISED POND 1 TO BE ROAD POND 8 IN THE WATERSHED DATA AND SUBMITTED TO OSM FOR REVIEW	Dave Smith	YB	RVV	
08-D	11-20-08	PJF	ADDED NORTH DIXON POND 7 AND POND-8 WATERSHED AREA AND SUBMITTED TO OSM FOR REVIEW	Dave Smith	YB	RVV	
08-C	11-20-08	PJF	REVISED SOUTH DIXON POND 3 AND POND-1 WATERSHED AREA AND SUBMITTED TO OSM FOR REVIEW	Dave Smith	YB	RVV	
08-B	5-14-08	PJF	REVISED SOUTH DIXON POND-3, LOWE RAILROAD IMPOUNDMENT #1, LOWE STOCKPILE POND, LOWE LOADOUT POND, AND DIVERSION SOUTH POND AND SUBMITTED TO OSM FOR REVIEW	Dave Smith	YB	RVV	
08-A	1-23-08	PJF	UPDATED EXHIBIT, REMOVED NORTH FORK HIGHWALL IMPOUNDMENT, ADDED NORTH FORK HIGHWALL POND 303 WATERSHED AND SUBMITTED POND #303 WATERSHED AREA AND SUBMITTED TO OSM FOR REVIEW	RVV	YB	RVV	
J	3-07-06	BH	UPDATED WATERSHED AREA FOR SO. DIXON POND 1.	LR	KJ	LR	
V	1-25-06	PJF	REMOVED NORTH DIXON POND 6 WATERSHED AREA AND SUBMITTED TO OSM FOR REVIEW	LR	KJ	LR	
X	8-13-04	PJF	CHANGE TEXT (SEE EXHIBIT 11-13F-2) TO SEE EXHIBIT 11-13E1, AND SUBMITTED TO OSM FOR REVIEW	LR	MC	LR	
W	4-09-03	PJF	REMOVED DRAGLINE ERECTION SITE POND (FK No1) ADDED NORTH FORK PERMANENT DIVERSION POND AND SUBMITTED TO OSM FOR REVIEW	LR	MC	LR	
V	12-31-03	BY	UPDATED WATERSHED AREA FOR LOWE RAILROAD IMPOUNDMENT #1 AND ADJUSTED AREAS.	LR	MC	LR	
U	10-20-03	PJF	REMOVED SOUTH DIXON POND 5 AND SUBMITTED TO OSM FOR REVIEW	LR	MC	LR	
T	07-01-03	PJF BY	ADDED NORTH FORK HIGHWALL IMPOUNDMENT, UPDATED WATERSHED FOR DIVERSION POND AND REMOVED SOUTH DIXON POND No2	LR	MC	LR	
S	03-05-03	BY	UPDATED WATERSHED AREA FOR SOUTH DIXON POND 5.	LR	MC	LR	
R	11-22-02	PJF	UPDATED SOUTH DIXON POND-5, REMOVED THE FOLLOWING WATERSHED: SOUTH DIXON POND-4, LOWE STOCKPILE POND, FUNCTIONAL AUXILIARY SPILLWAY POND-4, WEST POND, AND LOWE LOADOUT POND. WATERSHED AND SUBMITTED TO OSM FOR REVIEW	LR	MC	LR	
Q	7-12-02	PJF	ADDED POND-5,6 AND 7 WITH WATERSHED AREAS IN SOUTH DIXON PIT EXTENSION.	LR	MC	LR	
P	7-23-01	BY	UPDATED WATERSHED FOR SOUTH DIXON POND 4	LR	MC	LR	
O	1-19-01	PJF	UPDATES WATERSHED FOR CR POND-4	LR	MC	LR	
N	11-03-00	PJF	REMOVED CR POND 5	LR	MC	LR	
M	3-13-00	BY	UPDATED WATERSHED AREA FOR SO DIXON 1,2 & 3, CR POND 4 & 5, AREA-III & IIIA AND #2 TEMPORARY DIVERSION IMPOUNDMENT # 4, 5 & 6		MC	LR	
L	7-29-99	PJF	UPDATED WATERSHED AREA FOR LOWE HOLE3 POND-3	KBB	MC	LR	
K	7-29-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR	
J	01-28-98	PJF	UPDATED WATERSHED AREA FOR LOWE IMPOUNDMENT 12 AND DRAGLINE ERECTION SITE, POND HW4 AND WATERSHED	BH	PRE'D FJF	MC	LR
I	7-09-97	PJF	ADDED DRAGLINE ERECTION SITE, POND HW4 AND WATERSHED	RW			
H	5-21-97	PJF	UPDATES WATERSHED AREA FOR LOWE RAILRD EMBANKMENT #2	MW			
G	3-4-97	PJF	CHANGE WATERSHED AREA FOR AREA-III TEMPORARY DIVERSION IMPOUNDMENT #2	LR			
F	1-29-97	PJF	CHANGE WATERSHED AREAS FOR SOUTH DIXON POND 1 & 3	MW			
E	10-25-96	PJF	ADDED LEGEND FOR CR POND # 4 & 5	LR			
D	10-16-96	PJF	CHANGE THE WORD IMPOUNDMENTS TO PONDS AND UPDATED WATERSHEDS FOR COLLYER ROAD PONDS				
C	8-30-96	PJF	ADDED WATERSHEDS FOR COLLYER ROAD IMPOUNDMENTS				
B	12-20-95	PJF	REVISED DRAINAGE AREAS.				
A	11-30-95	PJF	SUBMITTED TO OSM FOR APPROVAL.				

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 — REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 11-13E

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-598-3361

AREA-III IMPOUNDMENT AND POND LOCATIONS/ WATERSHED AREAS

PREPARED BY PJF	DRAWN BY PJF	SCALE	1" = 500'
APPROVED BY	DATE Sept. 11, 1995	(Plot Area: 35"x47")	

MAP LOCATION: (See Lower Left Corner)

G:\Admin\F_YDN_11\Exh 11-013_Ponds-WS Data\APPROVED PAP-2010\OSM Subm-10\11Exh-11-13E.dgn
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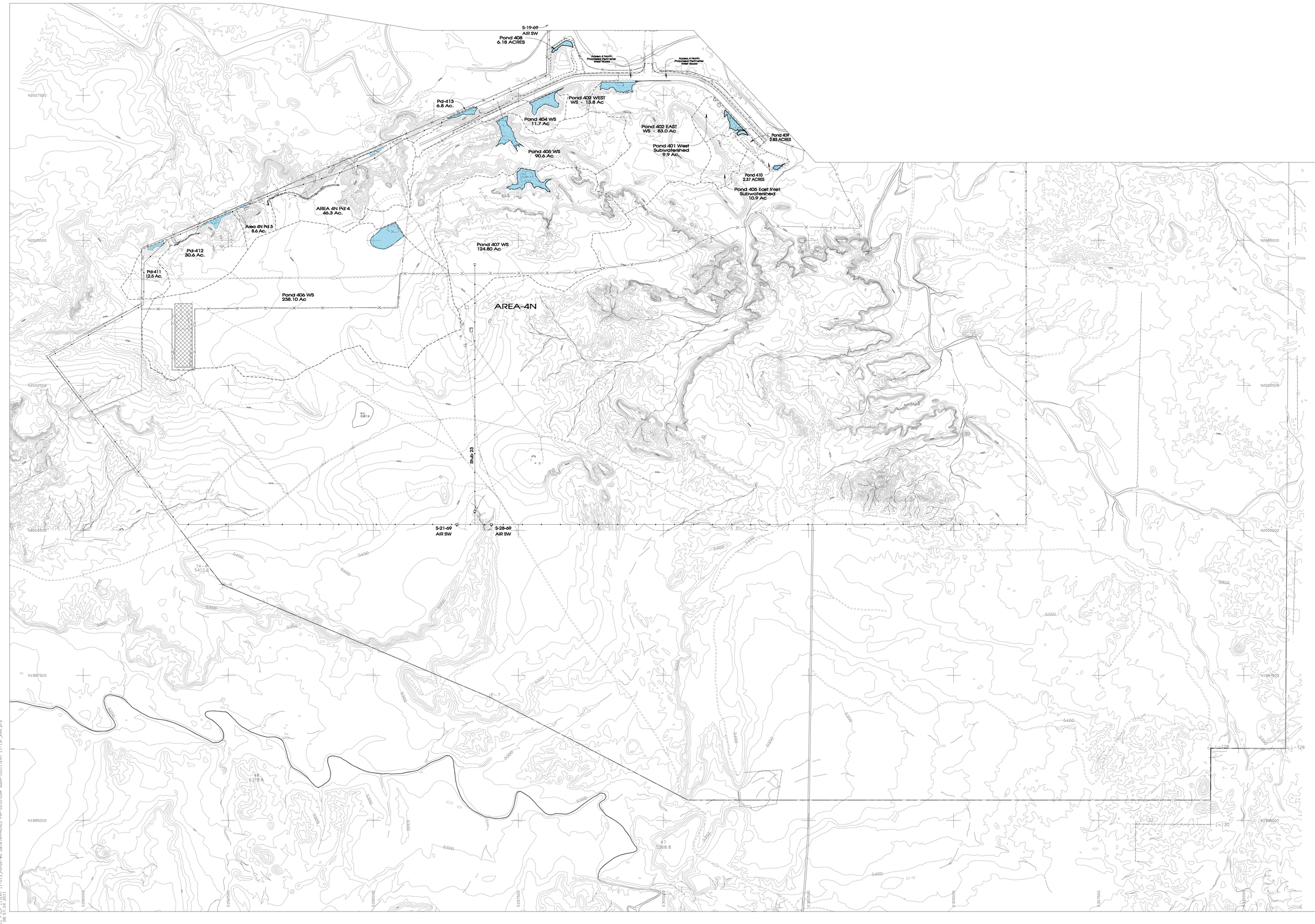
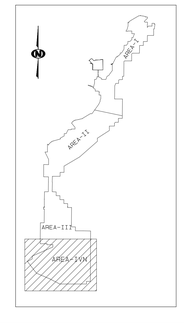


LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 5422.45 — HORIZ. & VERT. CONTROL
- L-30 — LEASE CORNER
- PERMIT/LEASE BOUNDARY
- WATERSHED BOUNDARY
- A4N PONDS

NOTES:
1. FOR HYDROLOGY INFORMATION REFER TO APPENDIX 11-AA IN THE APPROVED PAP.



500 0 500 1000

CONTOUR INTERVAL: 10'
DATE OF PHOTOGRAPHY: MAY, 2010

Revised by
Aero - Graphics, Inc.
40 West Oakland Avenue
Salt Lake City, Uath 84115

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	DES. BY	P.E.	P.E. APPROVAL DATE
11-a	7/28/2011	PJF	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	RCV	SD	RCV
10-B	3/3-09/10	PJF	REVISED WATERSHED FOR POND #3=BUILT 3 APR. REVISED AREA 4 NORTH PERIMETER DITCH ROUTING	RCV	TB	RCV
10-A	1/28/10	PJF	ADDED PROPOSED AREA 4 NORTH PONDS 411,412 AND 413 AND REVISED AS-BUILT POND #3 AREA. AN PONDS 3, 9 AND 10 WERE RE-DESIGNED TO PASS PMF.	RCV	TB	RCV
09-B	12-07-09	PJF	ADDED AS-BUILT AREA 4 NORTH PONDS #08, #09 AND #10 WATERSHED AND SUBMITTED TO OSM FOR REVIEW.	RCV	TB	RCV
09-A	8-28-09	PJF	ADDED PROPOSED AREA 4 NORTH REVISION AND SUBMITTED TO OSM FOR REVIEW.	RCV	TB	RCV
C	11-17-04	PJF	ADDED A4N DATA AND SUBMITTED TO OSM FOR REVIEW.	LR	RC	LR
B	7-29-08	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL	BH	RC	LR
A	11-05-05	PJF	SUBMITTED TO OSM FOR APPROVAL			

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

EXHIBIT 11-13F

bhpbilliton

BHP Navajo Coal Company

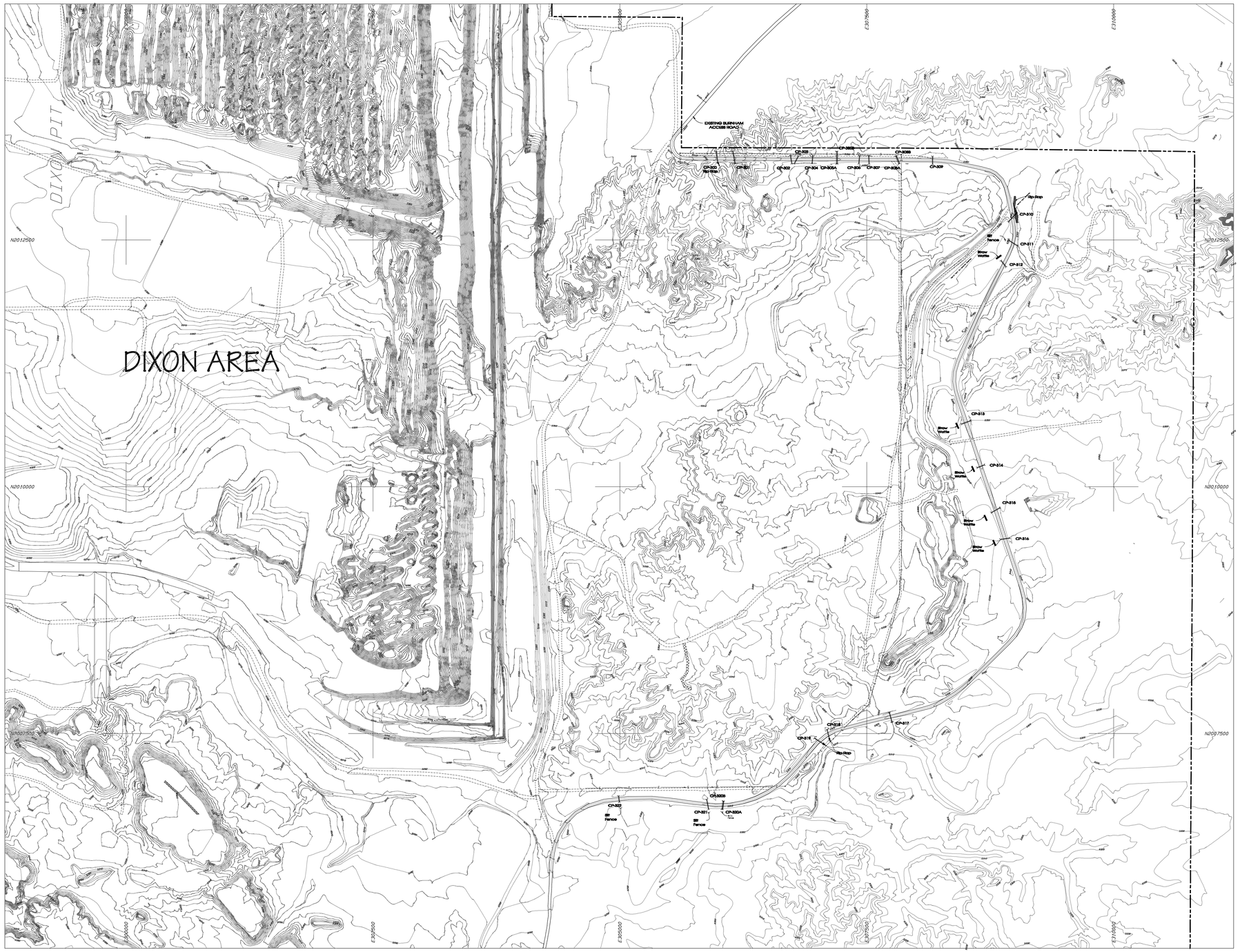
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

AREA 4N IMPOUNDMENT AND POND LOCATIONS/ WATERSHED AREAS

PREPARED BY RV/LR	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE Nov. 12, 2004	

MAP LOCATION: (See Lower Left Corner)

R:\gis\Permit_Eff\11-13\Ch 11-13\Ponds-WO Data\APPROVED PAP-2010\OSM Subs-12011\Ex11-13F_A4N.pro
Thu Aug 01 08:42:41 2013



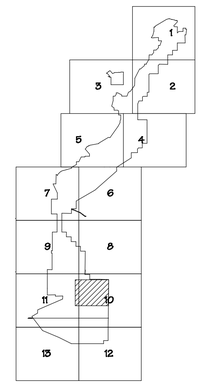
LOCATION MAP
SCALE: 1"=500'

LEGEND

- ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 CONTROL
- LEASE
- LOCATION
- WATERSHED

NOTES

1. For hydrology and design information refer to Appendix 11-V in the approved PAP.
2. The watershed areas for culverts are shown on Exhibit 11-12E & 11-12F.



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

REVISION	DATE
1. SUBMITTED TO OSM FOR APPROVAL	04/30/01
2. REVISED TITLE & SUBMITTED TO OSM	09/21/01
3. REVISED ALIGNMENT, PLAN & PROFILE AND ADDED CULVERTS	10/29/08
4. REVISED ALIGNMENT, PLAN & PROFILE	2-21-09
5. Per 4 Month Revision Requirements to OSM for Review and Approval.	Sep-2011

PROJECT MANAGER: MJ NAPOLEON
ENGR. of RECORD: RON VAN VALKENBURG
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
PO BOX 155, FRUITLAND, NEW MEXICO, 87416

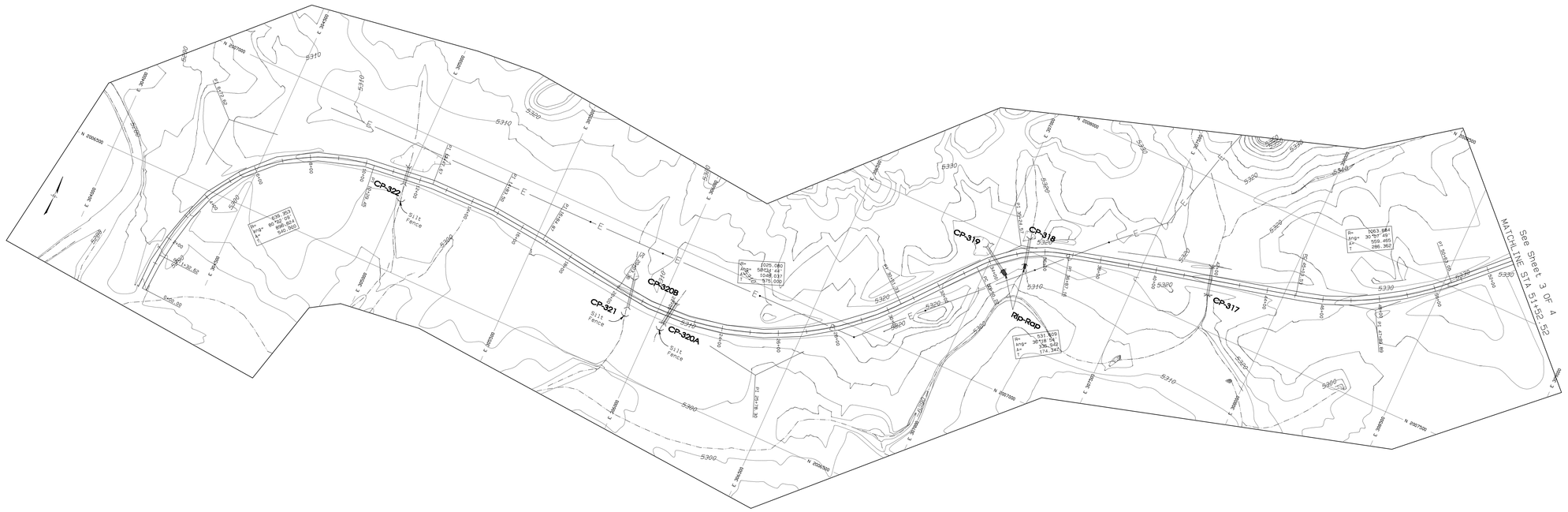
ACCOUNT:
DATE: APRIL 30, 2001
DESIGNED BY: Prazzie
DRAWN BY: PJFoster
CHECKED BY: RCV
APPROVED BY:

LOCATION MAP

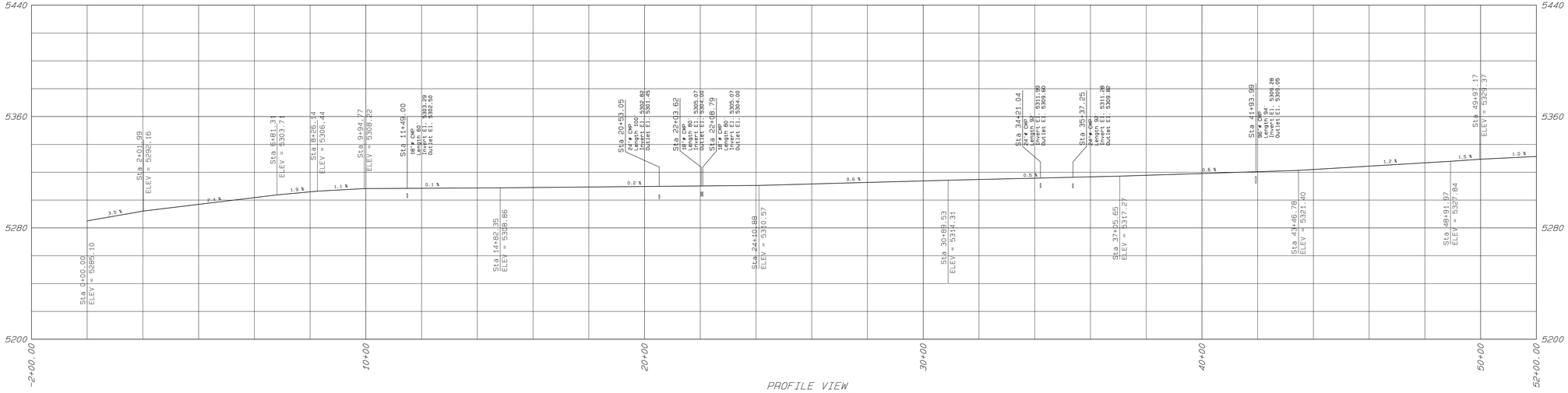
EXHIBIT 11-60
BURNHAM ROAD
TEMPORARY REROUTE #2
AS-BUILT

DRAWING
SHEET 1 OF 4

Project Desc.:
Path: G:\GIS\Permit Fish 11\Exh 11-06D_Burnham Temp Reroute\Burnham Temp Reroute Data\OSM Subm Feb-2011\Exh 11-60_ASC_BR_Temp_Reroute_Asbuilt.prj
Plot time: Fri Feb 04 11:37:35 2011



PLAN VIEW
Scale: 1" = 200'



PROFILE VIEW
Horz. Scale: 1" = 200'
Vert. Scale: 1" = 40'

LEGEND

- ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 CONTROL
- LEASE
- WATERSHED

NOTES

1. For hydrology and design information refer to Appendix 11-V in the approved PAP.
2. The watershed areas for culverts are shown on Exhibit 11-12E & 11-12F.
3. Watershed for 96" culvert see Appendix 11-D.

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

REVISION	DATE
1 RE-ROUTING TO DOM FOR APPROVAL	05/30/07
2 RE-ROUTED ALIGNMENT, PLAN, PROFILE	09/27/07
3 LAND AGREED COMMENTS	10/29/08
4 AS-BUILT ROUTE SUBMITTED TO DOM FOR APPROVAL	02/15/11
11-A Area 4 North Revision Resubmittal to OSM (for Review and Approval).	Feb-2011

PROJECT MANAGER: MJ NAPOLEON
ENGR. of RECORD: RON VAN VALKENBURG
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.

PO BOX 1515, FRUITLAND, NEW MEXICO, 87416

ACCOUNT:
DATE: APRIL 30, 2001
DESIGNED BY: Prazzie
DRAWN BY: PJFoster
CHECKED BY: RCV
APPROVED BY:

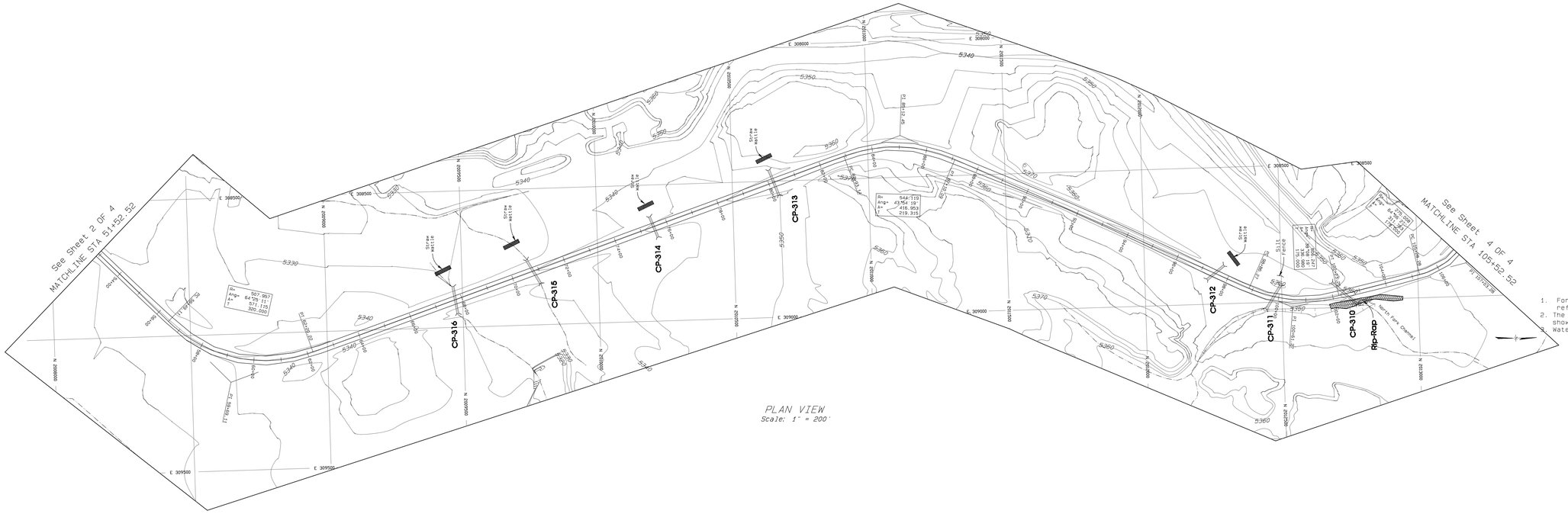
PLAN AND PROFILE

EXHIBIT 11-60A
BURNHAM ROAD
TEMPORARY REROUTE #2
AS-BUILT

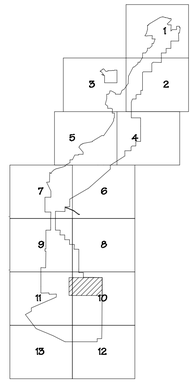
DRAWING

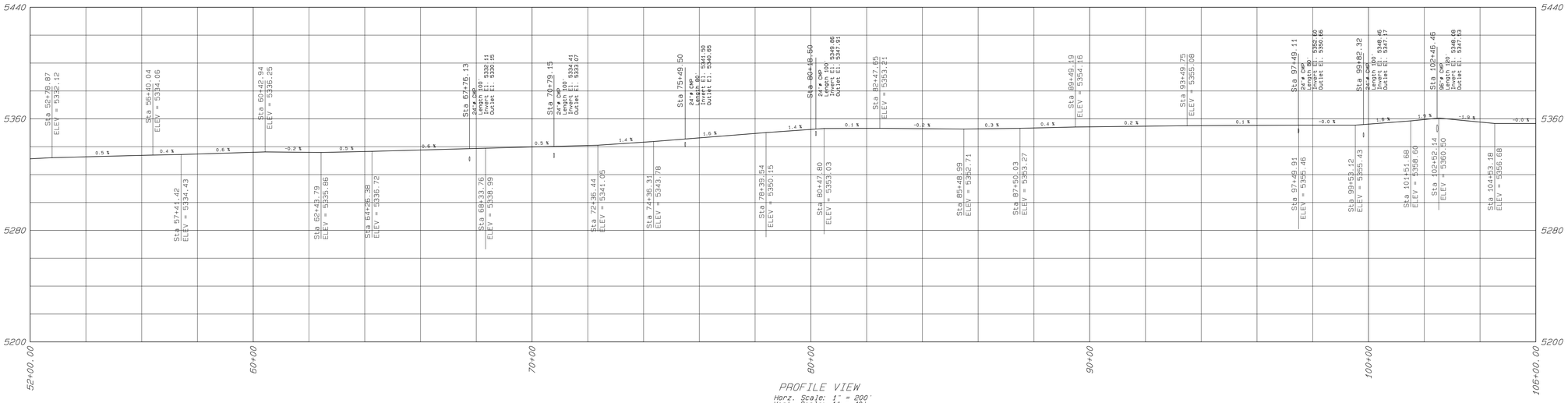
SHEET 2 OF 4

Project Desc.: Path: G:\GIS\Permit Fish Files\Ch 11-060_Burnham Temp Reroute\As-Built\BTRR_AS-Built\MAP Exhibit-2011\BRA_Temp_Reroute_Asbuilt.prd Plot time: Thu Jan 27 09:02:15 2011



PLAN VIEW
Scale: 1" = 200'





PROFILE VIEW
Horz. Scale: 1" = 200'
Vert. Scale: 1" = 40'

LEGEND

- ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 △5422.45 CONTROL
- LEASE
- WATERSHED

NOTES

1. For hydrology and design information refer to Appendix 11-V in the approved PAP.
2. The watershed areas for culverts are shown on Exhibit 11-12E & 11-12F.
3. Watershed for 96" culvert see Appendix 11-D.

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 REGISTERED PROFESSIONAL ENGINEER

NO	REVISION	DATE
1	SUBMITTED TO OSM FOR APPROVAL	07/27/01
2	REVISED TITLE & SUBMITTED TO OSM	05/27/05
3	REVISED ALIGNMENT, PLAN, PROFILE & CROSS SECTIONS	10/29/08
4	AS-BUILT AND SUBMITTED TO OSM FOR APPROVAL	12-21-09
5	Revised Plan, Profile, Cross Sections (per Re-view and Approval)	Feb-2011

PROJECT MANAGER: MJ NAPOLEON
ENGR. of RECORD: RON VAN VALKENBURG
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
PO BOX 155, FRUITLAND, NEW MEXICO, 87416

ACCOUNT:
DATE: APRIL 30, 2001
DESIGNED BY: Ron Valkenburg
DRAWN BY: PJFoster
CHECKED BY: RCV
APPROVED BY:

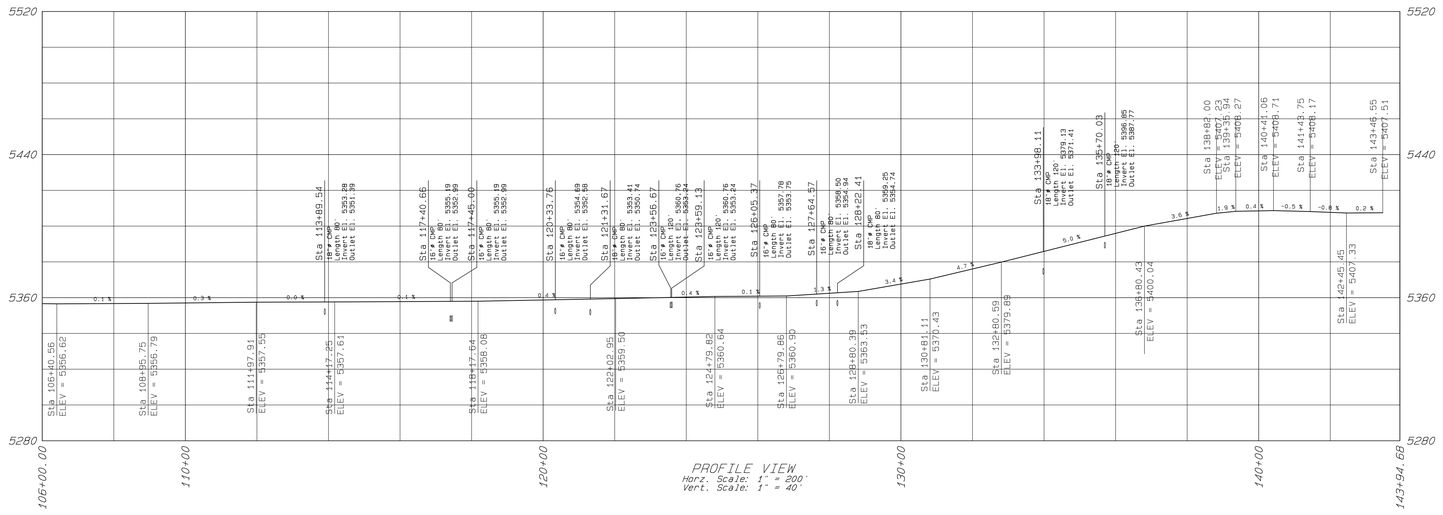
PLAN AND PROFILE

EXHIBIT 11-60B
BURNHAM ROAD
TEMPORARY REROUTE #2
AS-BUILT

DRAWING
SHEET 3 OF 4

Project Desc.: Path: G:\da\Permit F\Ch 11\Exh 11-060_Burnham Temp Reroute\As-Built\BTRR_AS-Built\PAP Exhibit-2010\BR_Temp_Reroute_Asbuilt.pro Plot time: Thu Jan 27 09:05:41 2011

PLAN VIEW
Scale: 1" = 200'



PROFILE VIEW
Horz. Scale: 1" = 200'
Vert. Scale: 1" = 40'

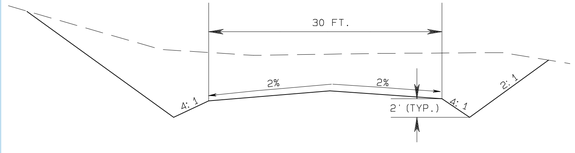
LEGEND

- ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 CONTROL
- LEASE
- WATERSHED

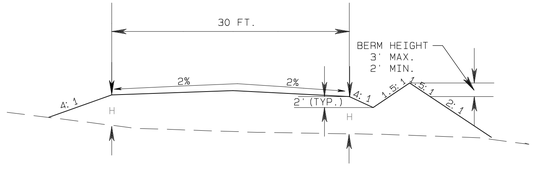
NOTES

1. For hydrology and design information refer to Appendix 11-V in the approved PAP.
2. The watershed areas for culverts are shown on Exhibit 11-12E & 11-12F.
3. Watershed for 96" culvert see Appendix 11-D.

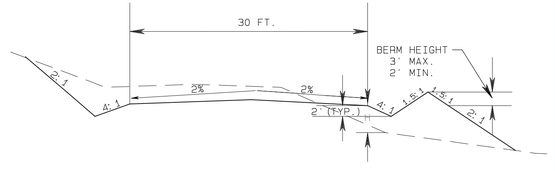
SCALE AS NOTED



TYPICAL CUT SECTION



TYPICAL FILL SECTION



TYPICAL CUT/FILL SECTION

H ≤ 4.0' SIDESLOPE=3:1
H > 4.0' SIDE SLOPE 2:1 WITH SAFETY BERM

N.T.S

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

REVISION	DATE
1 SUBMITTED TO OSM FOR REVIEW	08/27/01
2 REVISED TITLE & SUBMITTED TO OSM	08/27/01
3 ADDED CULVERTS, REVISED CHANNEL AND ADDED CULVERTS	10/29/08
4 REVISED TITLE & SUBMITTED TO OSM	12-1-09
11-Area 4 North Revision Republished to OSM for Review and Approval.	(MD-2011)

PROJECT MANAGER: MJ NAPOLEON
ENGR. of RECORD: RON VAN VALKENBURG
REG. NO: 9263
SRNVR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
PO BOX 155, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: APRIL 30, 2001
DESIGNED BY: RVazzie
DRAWN BY: PJFoster
CHECKED BY: RCV
APPROVED BY:

PLAN AND PROFILE

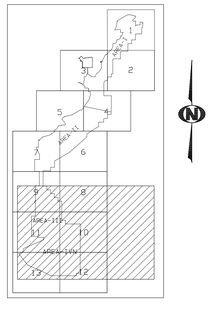
EXHIBIT 11-60C
BURNHAM ROAD
TEMPORARY REROUTE #2
AS-BUILT

DRAWING
SHEET 4 OF 4

Project Desc.: Path: G:\GIS\Permits F\Ch 11\Exh 11-060_Burnham Temp Reroute\As-Built\TAP Exhibit-2010\BR_temp_Reroute_Asbuilt.pnz Plot time: Thu Jan 27 09:08:50 2011

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 / 5422.45 — HORIZ. & VERT. CONTROL
- L-30 — LEASE CORNER
- PERMIT BOUNDARY



2000 0 2000 4000

CONTOUR INTERVAL: 10'

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	APPROVALS			
11-A	FEB-2011	SY	AREA 6 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	RY	SD	RCV	
09-A	7-12-09	PJF	ADDED TWO EASTSIDE OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.	Brian Hall	SD	KKB	
07-A	10-31-07	PJF	SUBMITTED FOR AAN DEVELOPMENT TO OSM FOR REVIEW AND APPROVAL.	LR	TB	LR	
E	10-17-06	PJF	REVISED TO REFLECT FSC REVISIONS AND SUBMITTED TO OSM FOR APPROVAL.	LR	RJ	LR	
D	10-17-05	PJF	REVISED TO REFLECT FSC REVISIONS AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR	
C	11-15-04	PJF	REVISED TO INCLUDE AA NORTH AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR	
B	3-17-03	PJF	REVISED TO REFLECT AOC REVISIONS AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR	
A	9-10-01	PJF	UPDATE PERMIT EXHIBIT AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL	LR	MC	LR	

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

EXHIBIT 11–77

bhpbilliton

BHP Navajo Coal Company

P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-4200
Fax: 505-568-3361

LOWE, COTTONWOOD AND PINABETE ARROYO POST-MINING SEDCAD DRAINAGE SUBDIVISIONS

PREPARED BY AAY/LR	DRAWN BY PJFOSTER	SCALE	1" = 2000'
APPROVED BY AAY/LR	DATE MAY 3, 2001		

G:\Engineering\Drawings\Permit Revisions\Permit Revision 11-77_REVISION_FIGS_Misc_Figs\2011-11-17_REVISION_FIG01_MISC_DETAILS.dwg

MATCH LINE SEE EXHIBIT 11-82

RAMP-1

S-20-69 AIR SW

NAVAJO MINE RAILROAD

STUB-17 AIR SW

RAMP-2

LOWE RAMP-2 HAULROAD

LOWE COAL STOCKPILE

LOWE BY-PASS

LOWE

LW STRIP-57

STUB-26

S-22-69 AIR SW

Surface Use Permit Boundary

RAMP-1

S-15-69 AIR SW

DIXON

DX STRIP-58

L-110

L-112

BURNHAM ROAD BIA N6382

BURNHAM ROAD (BIA 6382)

Burnham Temporary Reroute Road

STUB-30

LOWE-DIXON DIVERSION

NORTH FORK DIVERSION

RAMP-2

STUB-19 AIR SW

S-17-69 AIR SW

POWERLINE ROAD

North Fork Highwall Pond

DIXON HAULROAD

STUB-21

HIGHWALL POND 303

S-24-69 AIR SW

Stub 21

RAMP-4

S-19-69 AIR SW

COTTONWOOD HAULROAD X-ING

MATCH LINE SEE EXHIBIT 11-84

Burnham Temporary Reroute Road

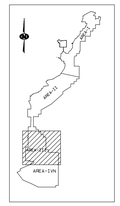
S-26-69 AIR SW

Stub 32

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 5422.45 HORIZ. & VERT. CONTROL
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY
- PRIMARY ROADS
- ANCILLARY ROADS
- PUBLIC ACCESS ROADS

NOTE;
ONLY ROADS ON PERMANENT PROGRAM LANDS WERE CLASSIFIED.
SEE EXHIBIT 1_4-1 OF 7 THRU 1_4-7 OF 7 FOR LANDS STATUS.



500 0 500 1000

CONTOUR INTERVAL: 10'
DATE OF PHOTOGRAPHY: May, 2010

Revised by
Aero - Graphics, Inc.
40 West Oakland Avenue
Salt Lake City, Uath 84115

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG. BY	C.S.	P.E.	APPROVED DATE
			Original certified signed exhibits are maintained at the Mine Site and OSM				
09-B	7-12-09	PJF	ADDED 2 NEW SECTION OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW	KAI/ SEARLE	YB	KAB	
09-A	6-22-09	PJF	ADDED CUTOWOOD HAULROAD CROSSING WITH A-B CONVEYOR AND ADDED ALL UPDATED OTHER HAUL ROADS AND SUBMITTAL TO OSM FOR REVIEW	RHV	YB	RHV	
07-A	11-20-07	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	KA	YB	LR	
T	11-15-06	PJF	THE DIXON "E-E" AND PART OF "AA-FF-E" HAS BEING REMOVED AND THE NEW DIXON HAULROAD "E-E" AND PART OF "AA-FF-E" HAS SUBMITTED TO OSM FOR REVIEW.	KA	MC	LR	
S	8-17-06	PJF	MODIFIED ANCILLARY ROAD ALONG THE EBAY POWERLINE BETWEEN THE LEASE BOUNDARY AND L-114, AND PART OF DIXON PIT AREA AND SUBMITTED TO OSM FOR REVIEW	VM	KJ	LR	
R	8-29-03	PJF	MODIFIED ANCILLARY ROAD ALONG THE LEASE BOUNDARY FROM L-110 TO L-114, AREA 3, EAST DIXON PIT AREA AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR	
Q	5-29-03	PJF	EXTENDED LINE DOG, STOCKPILE RAILROAD BY 300 FT SOUTH. MODIFIED DIXON HAULROAD AND SUBMITTED TO OSM FOR REVIEW.	DJR	MC	LR	
P	11-12-02	BH	ADDED ANCILLARY ROADS IN AREA 4 NORTH FROM POWER LINE ACCESS	LR	MC	LR	
O	7-12-02	PJF	ADDED AREA #4 ANCILLARY ROADS REROUTE BURNHAM ROAD AROUND KNOLL AND POWERLINE IN SOUTH DIXON AREA.	KAY/ LR	MC	LR	
N	2-20-01	PJF	ADDED ANCILLARY ROADS IN AREA 4 NORTH.	PJF	MC	LR	
M	6-28-00	PJF	ADDED SOUTH DIXON PUBLIC ACCESS ROAD REROUTE.	KS	MC	LR	
L	6-14-00	PJF	REMOVED COLLYER ROAD IN SOUTH DIXON AREA.	LR	MC	LR	
K	3-27-00	PJF	ADDED DIXON HAULROAD AND ANCILLARY ROAD TO TOPSOIL STOCKPILE DXFL_PLX DIXON PIT AREA.	LR	MC	LR	
J	1-18-99	PJF	ADDED BTSO DRAGLINE WALK ROAD (ANCILLARY)	BNC	MC	LR	
I	9-24-98	RH	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR	
H	7-29-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR	
G	1-13-98	PJF	UPDATED PRIMARY AND ANCILLARY ROADS	BH	PNS	LR	
F	6-16-97	PJF	UPDATED EXHIBIT				
E	9-27-96	PJF	UPDATED ROADS.				
D	5-3-96	PJF	RESUBMITTED PER OSM LETTER DATED APRIL 3, 1996 APPROVAL OF AREA III ROAD RECLASSIFICATION.				
C	3-21-96	PJF	UPDATED PER OSM APPROVAL, COLLYER AND ANCILLARY RD.				
B	2-9-96	PJF	LOCATIONS LOWE BY-PASS, PER OSM APPROVAL, 2-26-96, AND LOWE HAULROAD, ROAD PER OSM APPROVAL, 02-29-96.				
A	9-12-95	PJF	SUBMITTED TO OSM FOR APPROVAL.				
REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG. BY	C.S.	P.E.	APPROVED DATE

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 REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 11-83

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-598-3361

AREA 3
ROADS AND RAILROADS LOCATION MAP

PREPARED BY PJF	DRAWN BY PJF	SCALE	1" = 500'
APPROVED BY	DATE Sept. 11, 1995		

MAP LOCATION: (See Lower Left Corner)

G:\GIS\Permit\Fig\11\Exh_11-083_A3 Access-Primary Rds\OSM Subm-Feb-2011\Exh_11-83_Railroad and Roads.prn
NAD_A27 Tue Feb 15 12:26:09 2011

P.O. Box 1717

MATCH LINE SEE EXHIBIT 11-83

NM07

A4N MET 3 STA

Burnham Temp. Reroute Road

Stub 23

S-21-69 AIR SW

S-28-69 AIR SW

BURNHAM ACCESS ROAD

COTTONWOOD WASH

AEN_0510-1

A307-1

A307-4

A3N408-3

AER509-2

A4-2

14-6 5412.6

IP-6

IP-7

48 5378.8

L-128

L-126

W.E. 5384.8

W.E. 5387.9

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 — SPOT ELEVATION
- 5390 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 5422.45 — HORIZ. & VERT. CONTROL
- L-30 — LEASE CORNER
- PERMIT/LEASE BOUNDARY
- PRIMARY ROADS
- ANCILLARY ROADS
- PUBLIC ACCESS ROADS

AREA-1N

AREA-2N

AREA-3N

AREA-4N

500 0 500 1000

CONTOUR INTERVAL: 10'
DATE OF PHOTOGRAPHY: MAY, 2010

Revised by
Aero - Graphics, Inc.
40 West Oakland Avenue
Salt Lake City, Uath 84115

NOTE:
1. ONLY ROADS ON THE PERMANENT PROGRAM LANDS WERE CLASSFIED. SEE EXHIBIT 1-4-10F7 THRU 1-4-70F7 FOR LANDS STATUS.

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.	P.S.	DOGM APPROVALS
11-A	Feb-2011	PJF	Area 4 North Revision Resubmittal to OSM for Review and Approval.	RCV	SD	RCV		
07-A	11-20-07	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL	KA	YB	LR		
G	12-14-04	PJF	ADDED A4N PROJECT, ANCILLARY ROADS AND SUBMITTED TO OSM FOR REVIEW.	LR	MC	LR		
F	9-29-98	RY	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR		
E	7-29-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR		
C	6-16-97	PJF	UPDATED EXHIBIT					
B	9-30-96	PJF	UPDATED ROADS					
A	9-12-95	PJF	SUBMITTED TO OSM FOR APPROVAL					

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing has 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

EXHIBIT 11-84

bhpbilliton

BHP Navajo Coal Company

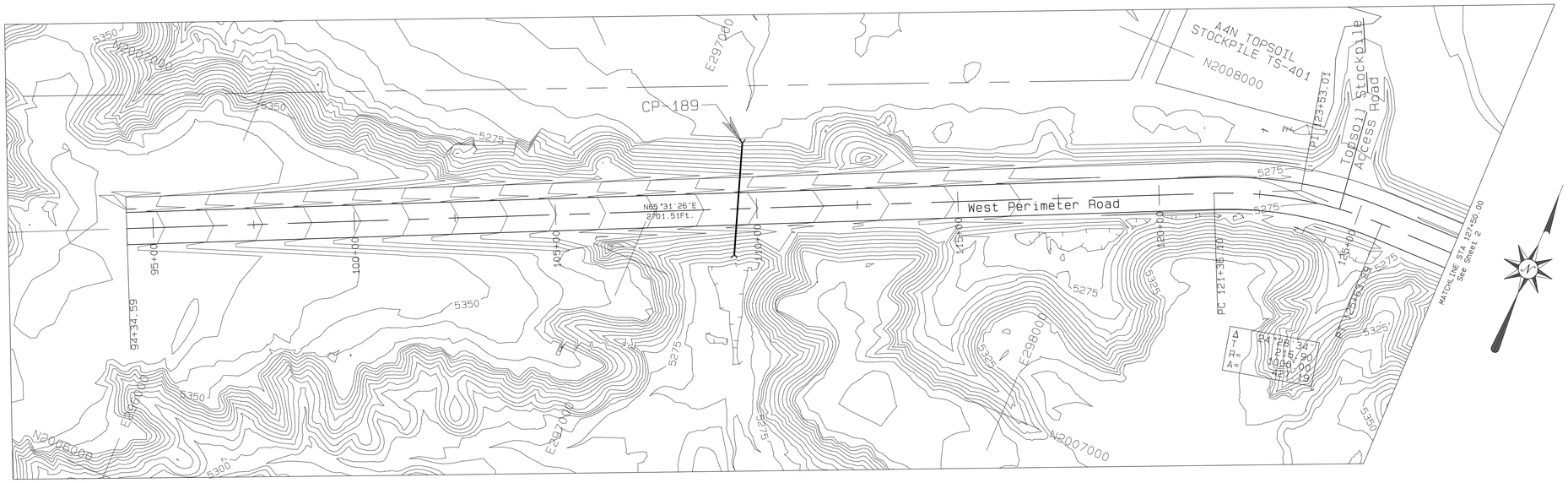
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-566-3361

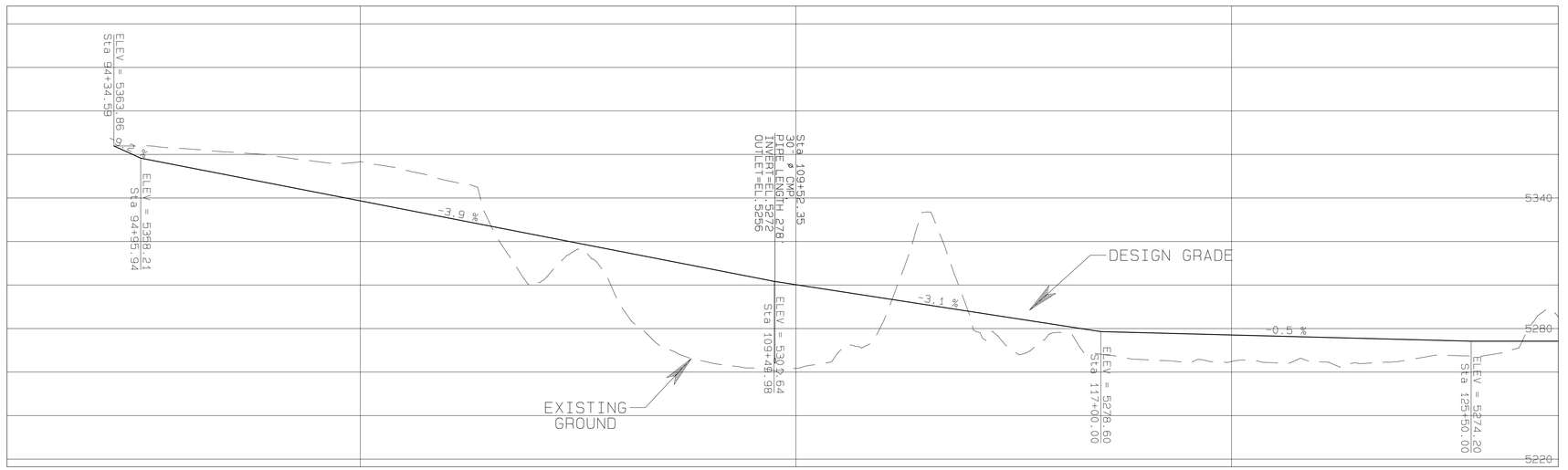
AREA-4N ROADS AND RAILROADS

PREPARED BY	PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY		DATE Sept.11, 1995	

MAP LOCATION: (See Lower Left Corner)

G:\GisProjects\DGN\Exh_11-084-84A_4An Access-Primary Roads\DGN Subm Feb-2011\Exh 11-84_A4N_Railroad and Roads.prp
Workunit: Exh 11-84_A4N_2011





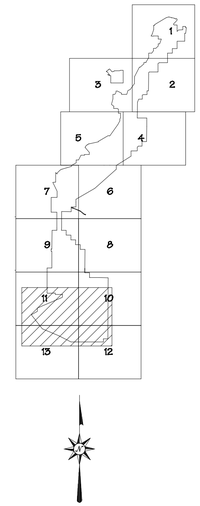
PROFILE
HORIZONTAL 1"=150'
VERTICAL 1"=30'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. The watersned areas for Culvert are shown on Exhibit 11-12F.
2. For location refer to Exhibit 11-84.
3. The road will be constructed before the placement of the box-cut spoils.



SCALE AS NOTED

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

REVISION		DATE
1	SUBMITTED TO OSM FOR APPROVAL	12/12/04
2	REVISED PER OSM	08/28/09
3	REVISED LOAD RAMP STA. 30+95 TO 2:1 (40+94) AND SLOPE FROM 1.5:1 TO 2:1	01/12/10
	For Year 3 Re-submittal to OSM FEB-2011	

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO. 9263
SRVYR of RECORD:
REG. NO.

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO 87416 PHONE 505-598-3009/FAX 505-598-3961

ACCOUNT:
DATE: AUGUST 31, 2009
DESIGNED BY: RY
DRAWN BY: RY
CHECKED BY: RCV
APPROVED BY: RCV

PLAN AND PROFILE

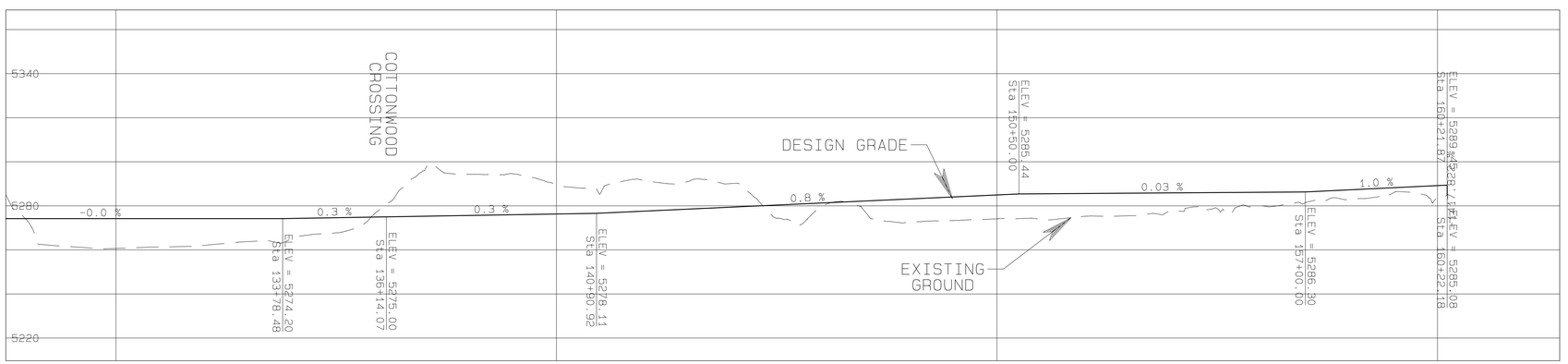
EXHIBIT 11-94

AREA 4 NORTH
EAST & WEST PERIMETER ROAD
Design

DRAWING

SHEET 1
OF 3

Project Desc.: Path: G:\Ga\Permit Fldr\11\Exh 11-094_A4N Perimeter Rd\Design Data\OSM Subm FEB-2011\Exh 11-91_A4N E_W PERIMETER RD_R2010.pro Plot Date/Time: Mon Feb 14,2011 / 10:54:02



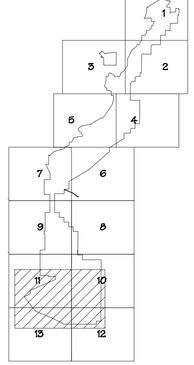
PROFILE
HORIZONTAL 1"=150'
VERTICAL 1"=30'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. For location refer to Exhibit 11-B4.
2. The design of the cottonwood crossing is presented in Appendix 11-TT.
3. The road will be constructed before the placement of the Box-cut spoils.



SCALE AS NOTED

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

REVISION		DATE
1	SUBMITTED TO OSM FOR APPROVAL	12/12/04
2	REVISED TO ADDRESS OSM COMMENTS	08/28/09
3	REVISED ROAD DESIGN CRITERIA: 34'PIT TO 140'@1.5&1 TO 2:1 SIDE SLOPE FROM 1.5:1 TO 2:1	01/12/10

1) Per Mine Plan Presentation to OSM FEB-2011
2) Per Mine Plan Submittal

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR of RECORD:
REG. NO.

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO 87416 PHONE 505-598-3009/FAX 505-598-3961

ACCOUNT:
DATE: AUGUST 31, 2009
DESIGNED BY: RV
DRAWN BY: RV
CHECKED BY: RCV
APPROVED BY: RCV

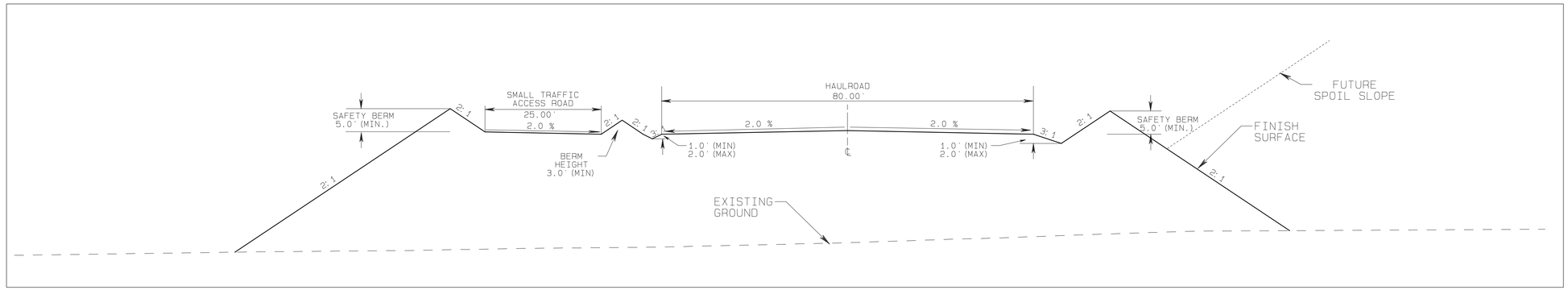
PLAN AND PROFILE

EXHIBIT 11-94
AREA 4 NORTH
EAST & WEST PERIMETER ROAD
Design

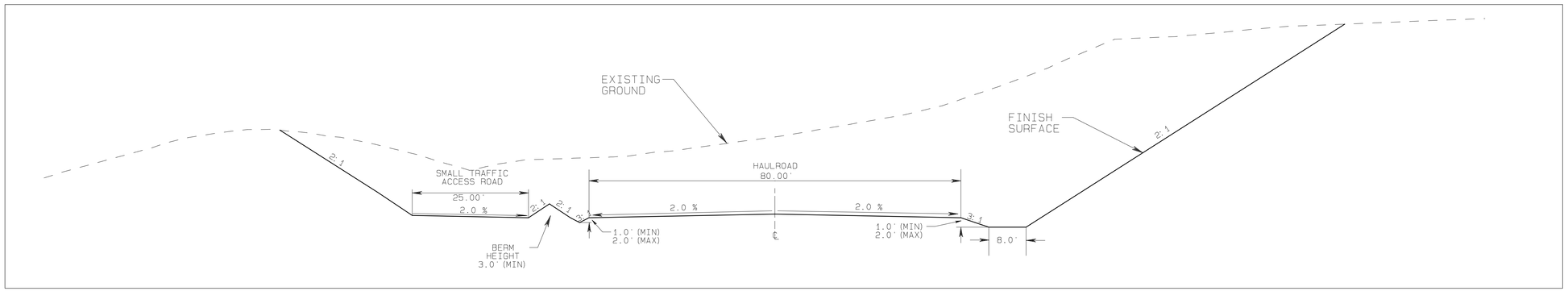
DRAWING

SHEET 2
OF 3

Project Desc.: Path: G:\GS\Permit F\Ch 11\Exh 11-094_AAN Perimeter RD\Design Data\OSM Subm FEB-2011\Exh 11-91_AAN E_W PERIMETER RD_R2010.pro Plot Date/Time: Mon Feb 14,2011 / 10:54:03

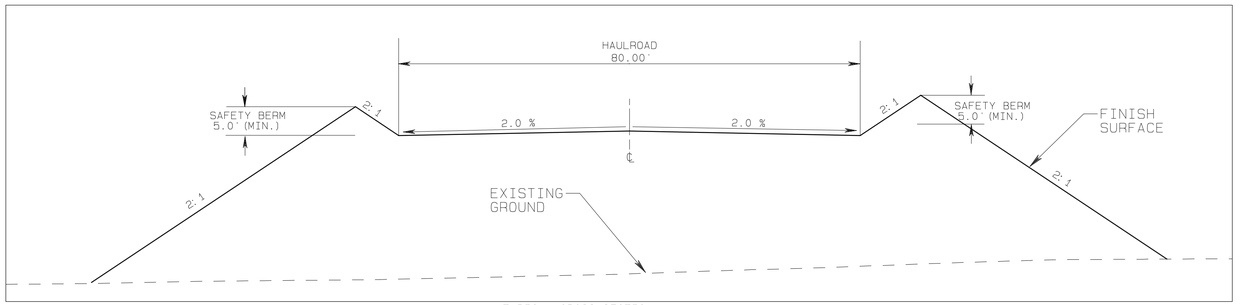


TYPICAL FILL SECTION
NO SCALE

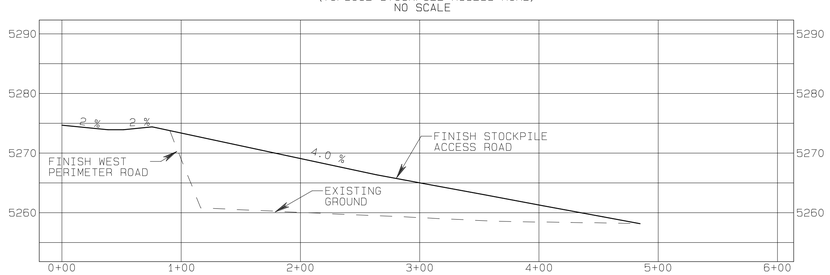


TYPICAL CUT SECTION
NO SCALE

ABOVE TYPICAL CUT AND FILL SECTIONS
EAST PERIMETER ROAD (VIEW LOOKING SE)
WEST PERIMETER ROAD (VIEW LOOKING NE)



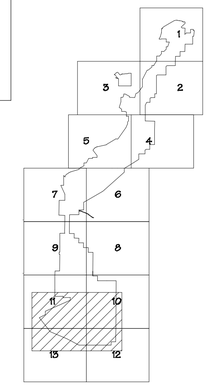
TYPICAL CROSS SECTION
(TOPSOIL STOCKPILE ACCESS ROAD)
NO SCALE



CENTERLINE OF ROAD PROFILE
(TOPSOIL STOCKPILE ACCESS ROAD)
Horizontal - 1"=60'
Vertical - 1"=12'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- 5298 — INTERMEDIATE CONTOUR
- 218 / 5422.45
- L-30 — LEASE CORNER
- PERMIT/LEASE BOUNDARY



N

SCALE AS NOTED

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

REVISION		DATE
1	SUBMITTED TO OSM FOR APPROVAL	12/12/04
2	REVISED HAUL ROAD GRADE FROM 10% TO 12%	08/28/09
3	REVISED HAUL ROAD SIDE SLOPE FROM 1.5:1 TO 2:1 (1'=10' Rise and Run)	01/12/10

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO 87416 PHONE 505-598-3009/FAX 505-598-3951

ACCOUNT:
DATE: December 12, 2004
DESIGNED BY: RF
DRAWN BY: RF
CHECKED BY: LA
APPROVED BY: LA

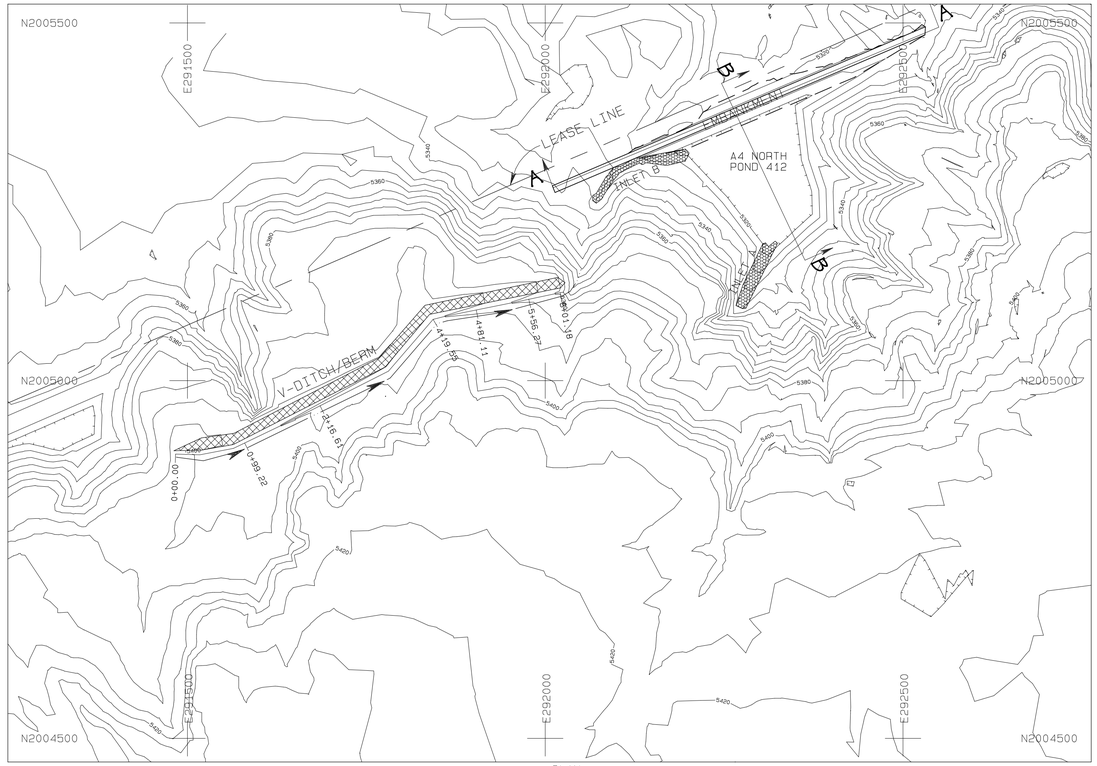
PLAN, PROFILE AND SECTIONS

EXHIBIT 11-94
AREA 4 NORTH
EAST & WEST PERIMETER ROAD
Design

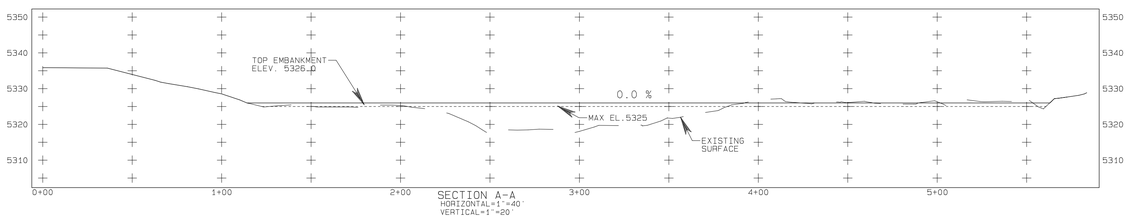
DRAWING

SHEET 3
OF 3

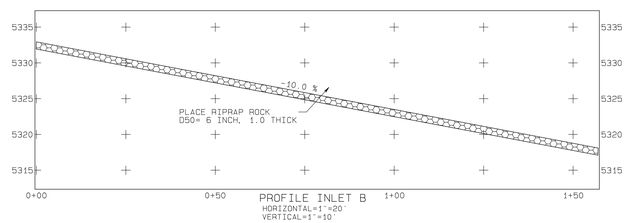
Project Desc.: Path: G:\GaVernell F\Cn 11\Exh 11-094_AAN Perimeter Rd\Design Data\OSM Subm FEB-2011\Exh 11-91_AAN_E_W PERIMETER RD_R2010.pro Plot Date/Time: Mon Feb 14,2011 / 10:54:04



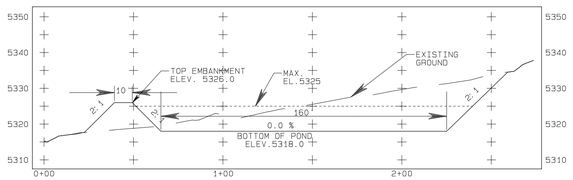
PLAN
Scale: 1" = 100'



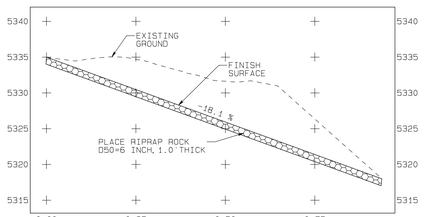
SECTION A-A
HORIZONTAL=1"=40'
VERTICAL=1"=20'



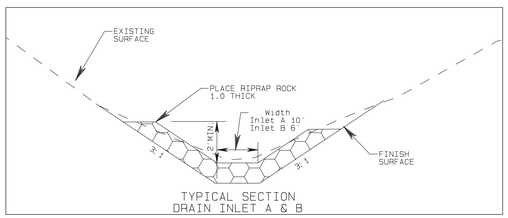
PROFILE INLET B
HORIZONTAL=1"=20'
VERTICAL=1"=10'



SECTION B-B
HORIZONTAL=1"=40'
VERTICAL=1"=20'



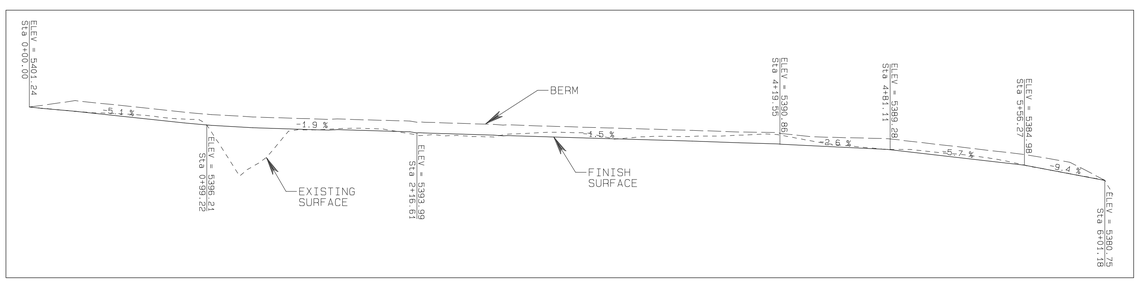
PROFILE INLET A
HORIZONTAL=1"=20'
VERTICAL=1"=10'



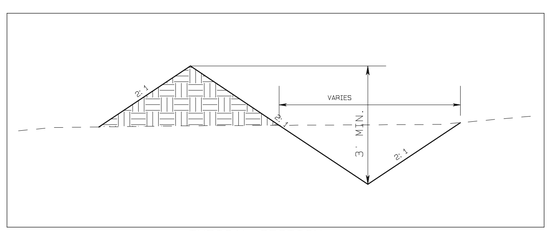
TYPICAL SECTION
DRAIN INLET A & B

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5318	0.42	0.0	0.0
5320	0.48	0.9	0.9
5322	0.56	1.0	1.9
5324	0.64	1.2	3.1
5326	0.77	1.4	4.5



PROFILE OF DIVERSION BERM
HORIZONTAL=1"=40'
VERTICAL=1"=20'



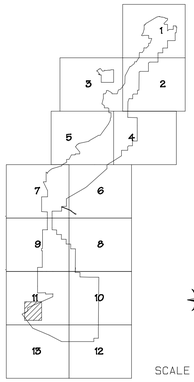
TYPICAL SECTION
V-DITCH / BERM

LEGEND

- ROAD
- WATERSHED
- BUILDING
- DRAIN DITCH
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for impoundment and pond locations are shown on Exhibit 11-13F.



SCALE AS NOTED

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 #	DESCRIPTION	DATE
0	SUBMITTED TO OSM FOR APPROVAL	11-18-04
1	SUBMITTED TO OSM FOR APPROVAL	01-26-10
2	SUBMITTED TO OSM FOR APPROVAL REVISION RESUBMITTAL	FEB-2011
21+4	CHECK & MATH REVISION RESUBMITTAL 12-2010 REVISED PLAN RESUBMITTAL	

PROJECT MANAGER: TG
ENGR. of RECORD: RCV
REG. NO. 9263
SRVYR of RECORD:
REG. NO.

ACCOUNT:
DATE: 01-26-10
DESIGNED BY: AY
DRAWN BY: AY
CHECKED BY: RCV
APPROVED BY: RCV

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

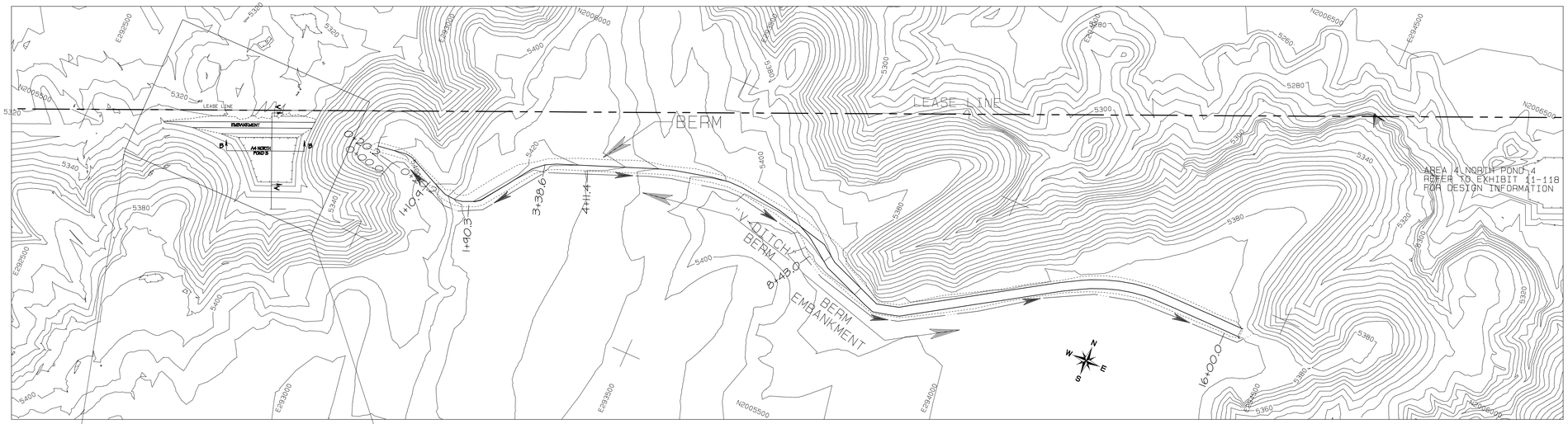
PLAN, PROFILE AND SECTION

EXHIBIT 11-111D
AREA 4 NORTH POND 412 DESIGN

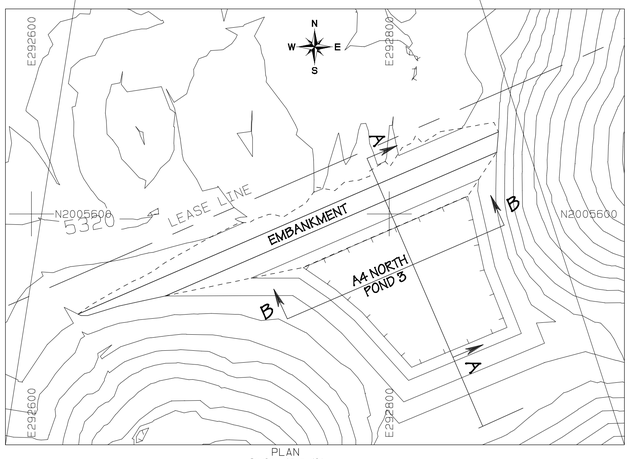
DRAWING

SHEET 1
OF 1

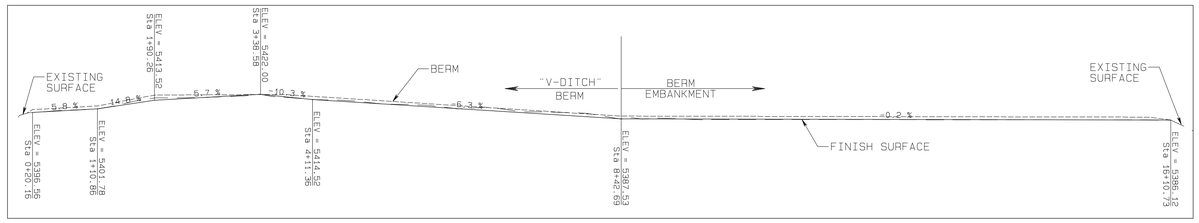
Path: G:\Permit Tch files\11-111\AR Rs 425\DRW Subm 1001\Exh 11-111D_AR4 Pond 412 Design.pro



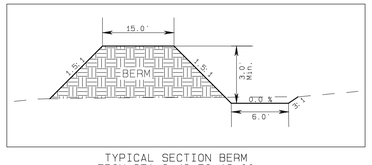
LOCATION MAP
Scale: 1" = 100'



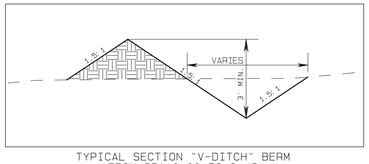
PLAN
Scale: 1" = 40'



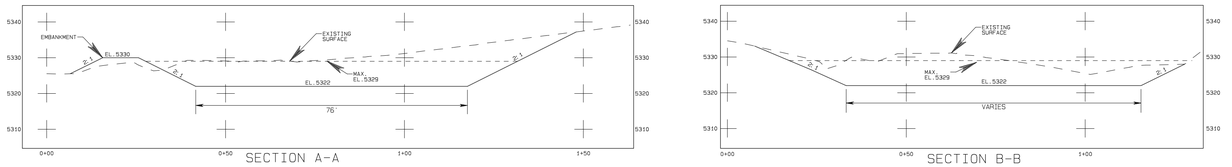
PROFILE - DIVERSION BERM
Scale: 1" = 100'



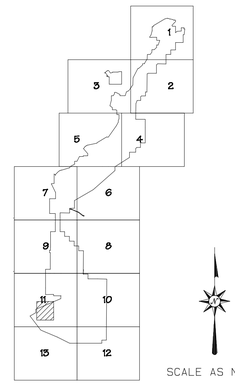
TYPICAL SECTION BERM
FROM STA 8+43 TO 16+00
N.T.S



TYPICAL SECTION "V-DITCH" BERM
FROM STA 0+00 TO 8+43
N.T.S



SECTIONS A AND B
SCALE=1"=20'



SCALE AS NOTED

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 LEASE CORNER
- L-30
- PERMIT/LEASE BOUNDARY
- DRAIN FLOW

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for Impoundment and pond locations are shown on Exhibit 11-13F.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5322	0.13	0.0	0.0
5324	0.16	0.3	0.3
5326	0.20	0.4	0.7
5328	0.24	0.4	1.1
5330	0.29	0.5	1.6

Exhibit 11-115D

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.	DESCRIPTION	REV BY	DATE
1	SUBMITTED TO DOM FOR APPROVAL		11-19-04
2	SUBMITTED to DOM FOR APPROVAL, ADD DIVERSION BERM	RV	01-26-10
3	AREA 4 NORTH REVISION RESUBMITTAL TO DOM FOR PERMIT AND APPROVAL.	PJF	FEB-2011

PROJECT MANAGER: TG
ENGR. of RECORD: RCV
REG. NO. 9263
SRVR of RECORD:
REG. NO.

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACRONYM:
DATE: 01-26-10
DESIGNED BY: RV
DRAWN BY: RV
CHECKED BY: RCV
APPROVED BY: RCV

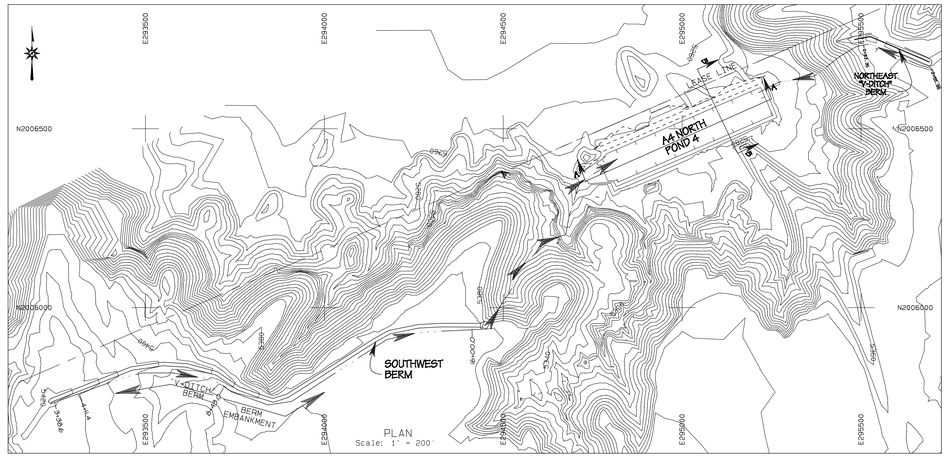
PLAN, PROFILE AND SECTION

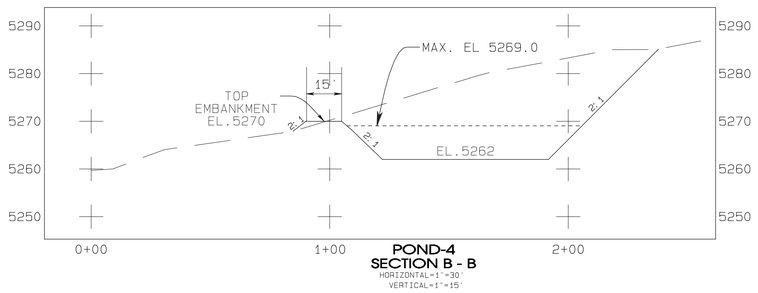
EXHIBIT 11-115
AREA 4 NORTH POND 3 DESIGN

DRAWING

SHEET 1
OF 1

Path: G:\GIS\Permit Pids\11\11-115_AR~#2 2\DOM-Subm-010911\Area 4 North Pond 3_Design.pro

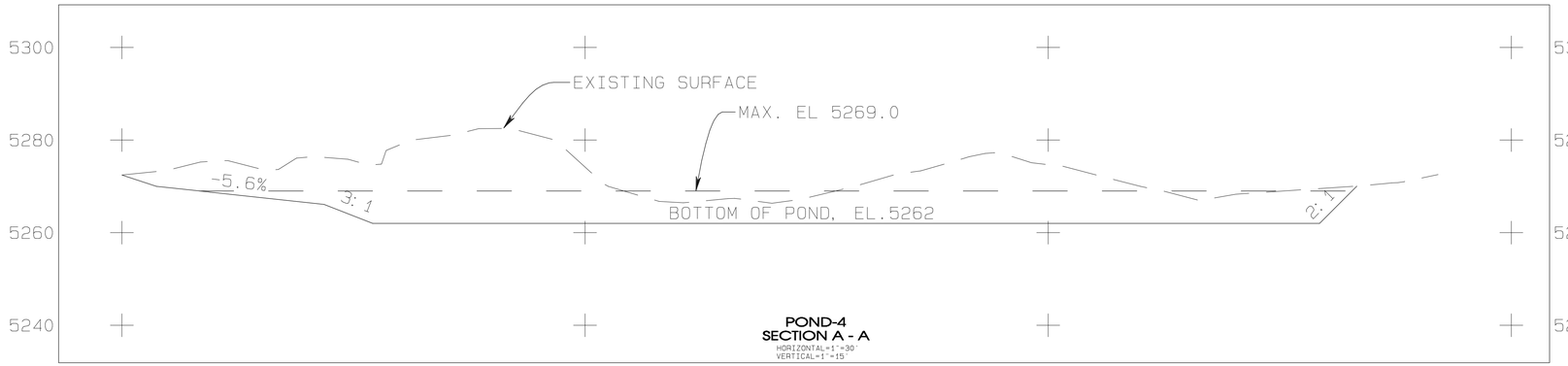




POND-4
SECTION B - B
HORIZONTAL=1"=30'
VERTICAL=1"=15'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- 5298 — INTERMEDIATE CONTOUR
- 218 / 5422.45 — LEASE CORNER
- L-30 — PERMIT/LEASE BOUNDARY



POND-4
SECTION A - A
HORIZONTAL=1"=30'
VERTICAL=1"=15'

STAGE STORAGE DATA

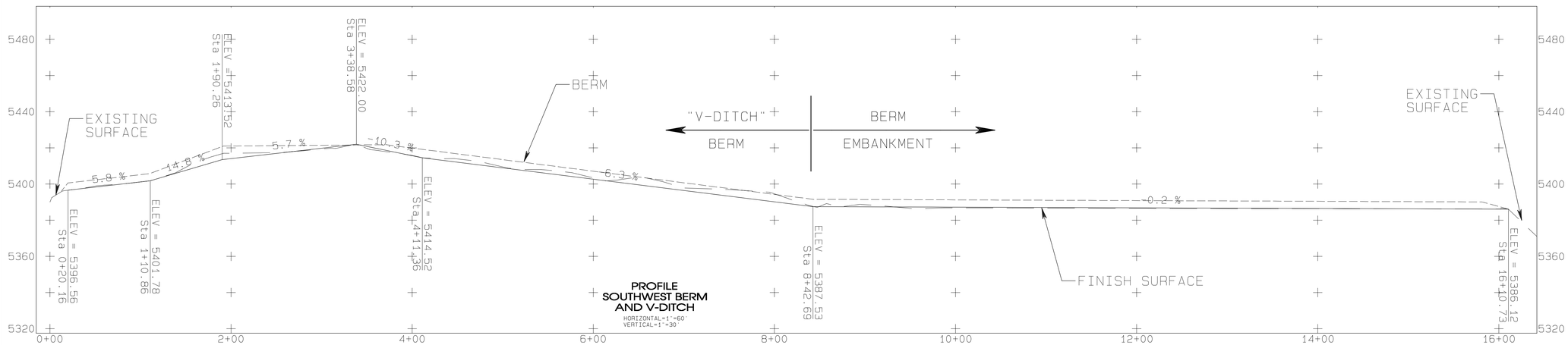
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5262	0.65	0.00	0.00
5264	0.79	1.44	1.44
5266	0.95	1.74	3.18
5268	1.15	2.10	5.28
5270	1.40	2.56	7.84

Design High Water El. 5269.0
Design Capcity at High Water El. 6.6 Ac-Ft

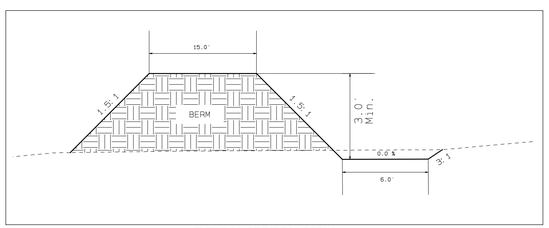
NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
2. The watershed areas for impoundment and pond locations are shown on Exhibit 11-13F.

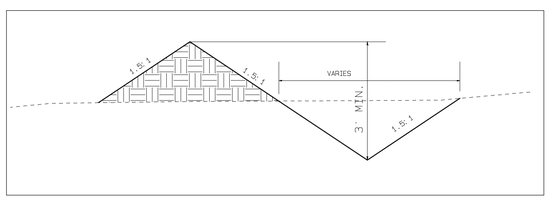
SCALE AS NOTED



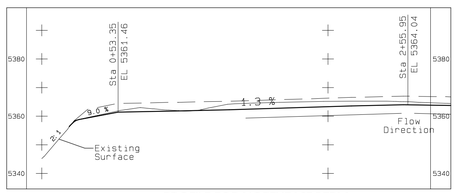
PROFILE
SOUTHWEST BERM
AND V-DITCH
HORIZONTAL=1"=60'
VERTICAL=1"=30'



TYPICAL SECTION BERM
FROM STA. 8+43 TO 16+00 SOUTHWEST BERM
N.T.S.



TYPICAL SECTION "V-DITCH" BERM
FROM STA. 0+00 TO8+43 SOUTHWEST BERM
AND STA. 0+53.0 TO 2+56.0 NORTHEAST BERM
N.T.S.



PROFILE FOR NORTHEAST BERM
STA. 0+53.0 TO 2+56.0 FROM EXH 11-06
HORIZONTAL=1"=50'
VERTICAL=1"=25'

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 BY	DESCRIPTION	DATE
RV	SUBMITTED TO DSM FOR APPROVAL	3-24-10
DJF	AREA-4 NORTH, REVISION RESUBMITTAL TO DSM FOR RETURN AND APPROVAL.	FEB-2011

PROJECT MANAGER: FERGUSON-GORMAN
ENGR. of RECORD: RON VAN VALKENBURG
REG. NO. 9263
STRVR. of RECORD:
REG. NO.

BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT:
DATE: 11-16-04
DESIGNED BY: RV
DRAWN BY:
CHECKED BY: RCVV
APPROVED BY: RCVV

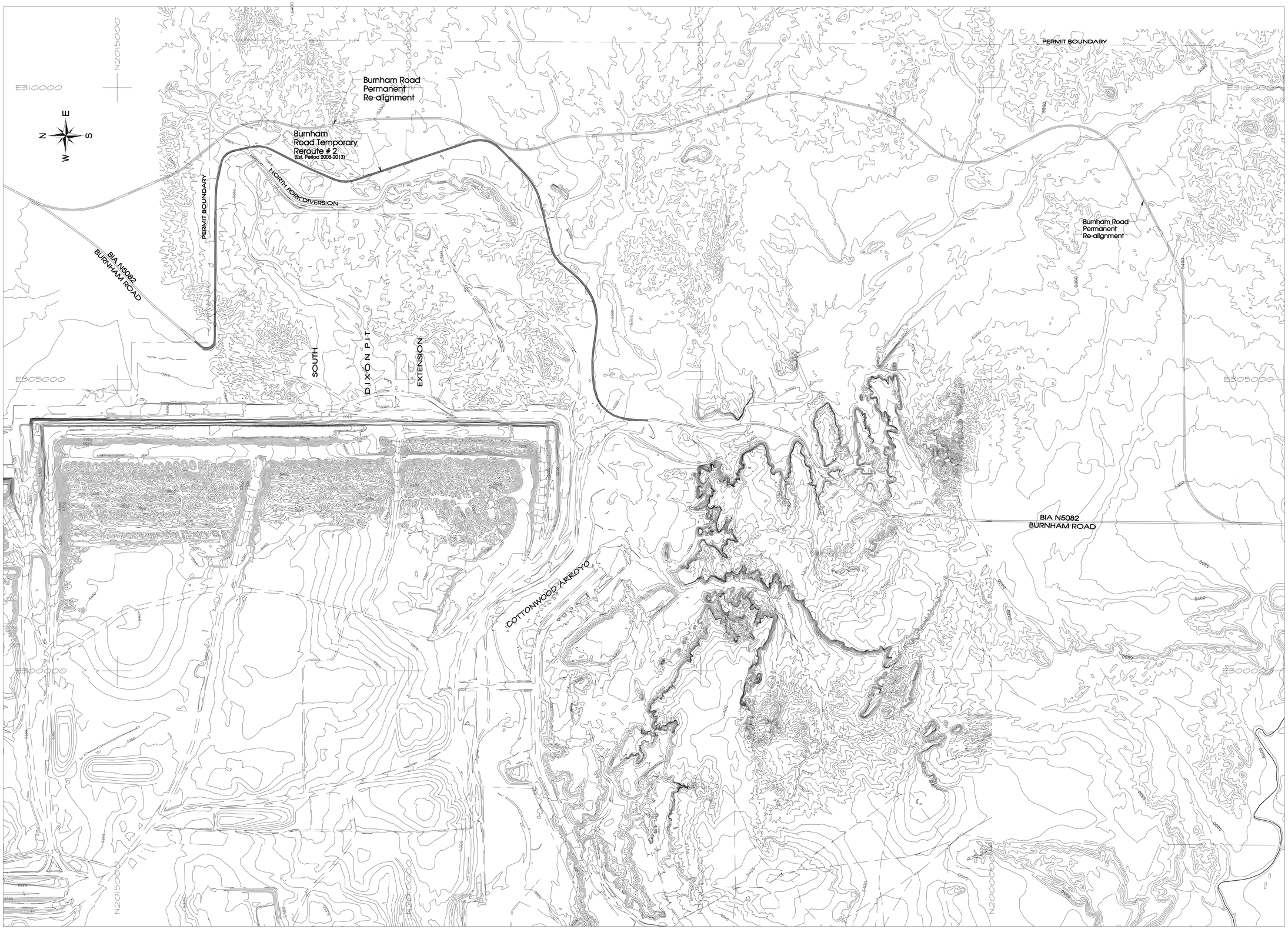
PLAN, PROFILE AND SECTION

EXHIBIT 11-118D
AREA 4 NORTH POND 4
DESIGN

DRAWING

SHEET 1
OF 1

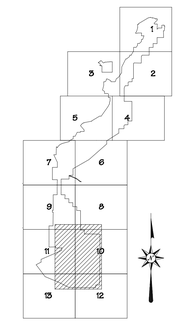
Path: G:\GIS\Permit\11D\11Exh\11-118JAN\Pd 4\DSM Subm-2011\Exh 11-118D_AN Pond 4_Design.prn



SCALE : 1" = 600'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY



CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PRE. D BY	EG	PE	PLS	ADMIN D DATE
				APPROVALS				
11-A	2-11-11	RY	Updated Burnham Roads alignment. Submitted to OSM for review and approval.	LR	SO	LR		
A	8-16-01	PJF	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	LR	MC	LR		

EXHIBIT 11 – 143

bhpbilliton

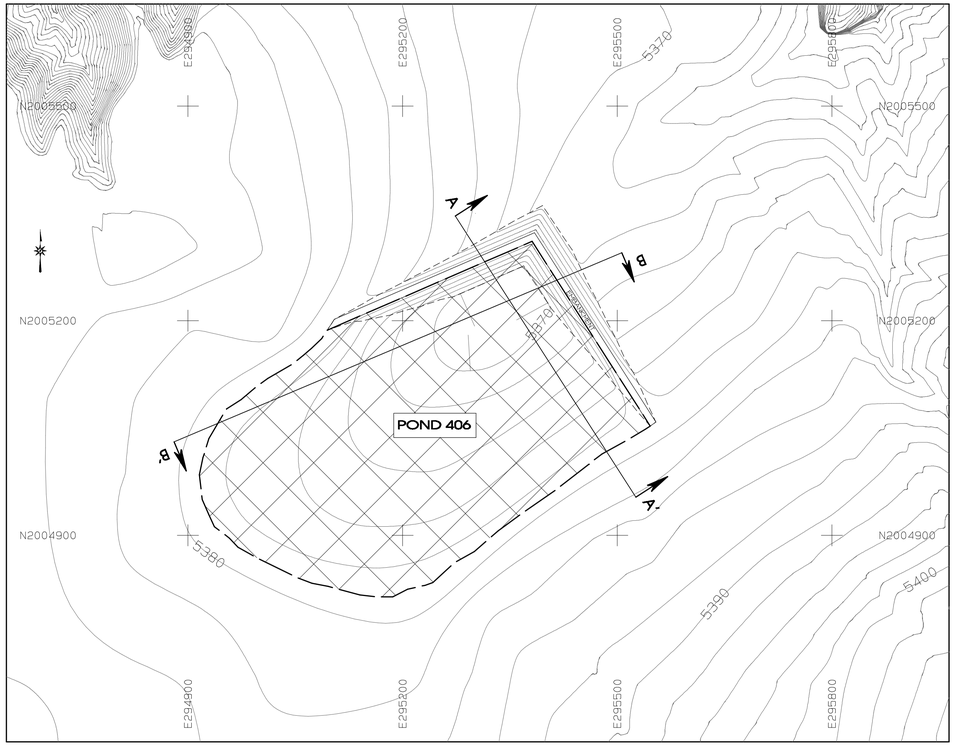
BHP BILLITON NAVAJO COAL COMPANY
P.O. Box 1717 Phone: 505-598-4200
Fruitland, New Mexico 87416 Fax: 505-598-3361

BURNHAM ROAD RE–ALIGNMENT

PREPARED BY PJF	DRAWN BY PJFOSTER	SCALE : 1" = 600'
APPROVED BY LR	DATE AUG. 16, 2001	

PATH: G:\Ga\Permit F\Ch 11\Exh 11-143_S Dixon Burnham Rd\OSM Subm-Feb-2011\EXH_11-143_Feb2011.pro

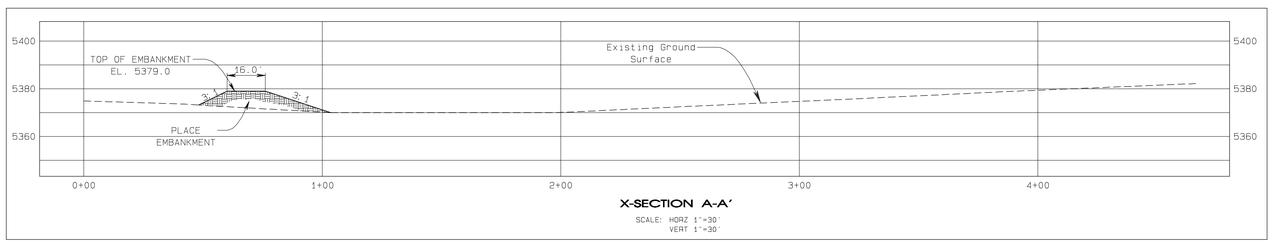
Path: G:\Ga\Permit F\Ch 11\Exh 11-143_S Dixon Burnham Rd\OSM Subm-Feb-2011\EXH_11-143_Feb2011.pro
PJFoster \ Mon Feb 14 11:09:03 2011



PLAN VIEW

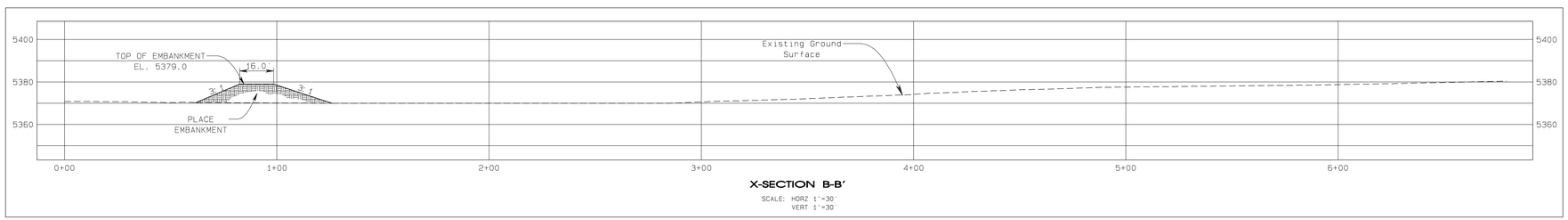
CONTOUR INT: 2 FT

SCALE: 1"=100'



X-SECTION A-A'

SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION B-B'

SCALE: HORZ 1"=30'
VERT 1"=30'

LEGEND

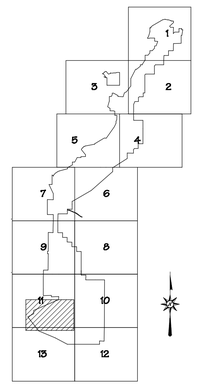
- ROAD
- BUILDING
- FENCE
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5370	0.36	0.00	0.00
5371	0.54	0.5	0.50
5372	0.78	0.7	1.10
5373	1.09	0.90	2.00
5374	1.51	1.30	3.30
5375	1.92	1.70	5.10
5376	2.43	2.20	7.20
5377	2.95	2.70	9.90
5378	3.58	3.30	13.20
5379	4.26	3.90	17.10



SCALE AS NOTED

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

REVISION	DATE
09-UPDATED AIR DEVELOPMENT AND SUBMITTED TO BHP FOR REVIEW	8/28/09
11-4 AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	FEB-2011

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO. NM 9263
SRVYR of RECORD:
REG. NO.

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE

PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

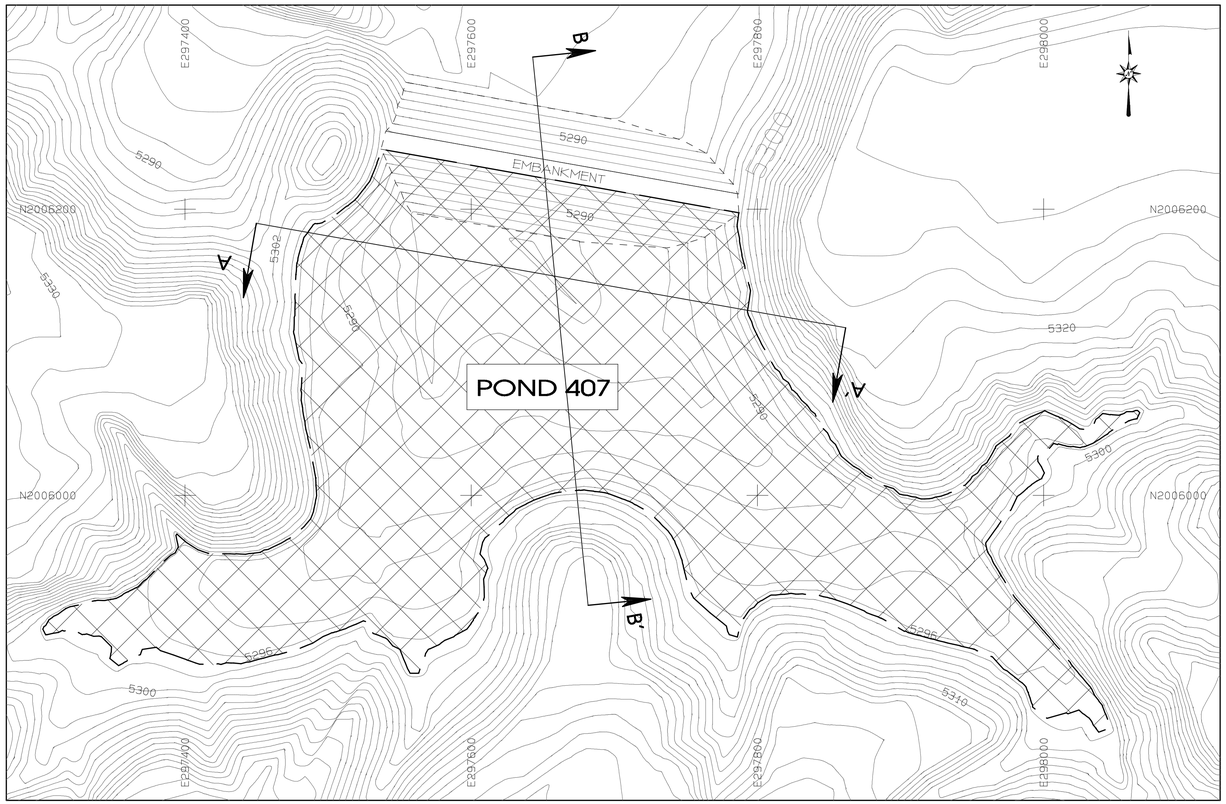
PROJECT: AAN
DATE: AUG.8, 2009
DESIGNED BY: RCV
DRAWN BY: PJFOSTER
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 11-156D
AREA 4 NORTH
POND 406
Design

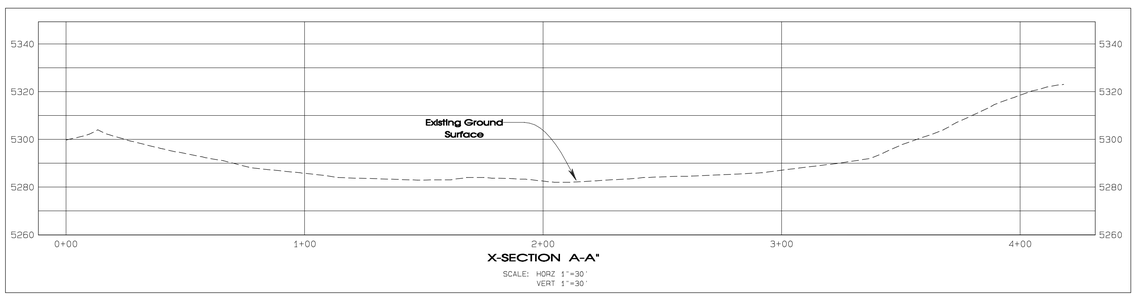
DRAWING

SHEET
OF 0



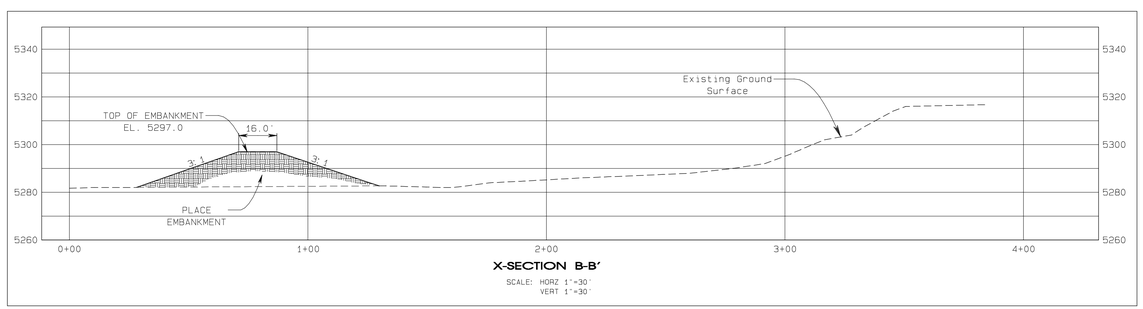
PLAN VIEW

SCALE: 1"=50'



X-SECTION A-A'

SCALE: HORZ 1"=30'
VERT 1"=30'



X-SECTION B-B'

SCALE: HORZ 1"=30'
VERT 1"=30'

LEGEND

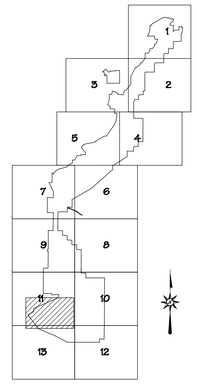
- ROAD
- BUILDING
- FENCE
- CULVERT
- DRAINAGE
- POWERLINE
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5282	0.01	0.00	0.00
5284	0.14	0.10	0.10
5286	0.44	0.60	0.70
5288	0.81	1.20	2.00
5290	1.22	2.00	4.00
5292	1.64	2.90	6.90
5294	2.09	3.70	10.60
5296	2.54	4.60	15.20
5297	2.79	2.70	17.90



SCALE AS NOTED

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

REVISION	DATE
09-JUPDATED AIR DEVELOPMENT AND SUBMITTED TO BHP FOR REVIEW	8/28/09
11-4 AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	FEB-2011

PROJECT MANAGER: F. GORMAN
ENGR. of RECORD: RON C. VAN VALKENBURG
REG. NO. NM 9263
SRVYR of RECORD:
REG. NO.

bhpbilliton
NAVAJO COAL COMPANY
NAVAJO MINE

PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3361

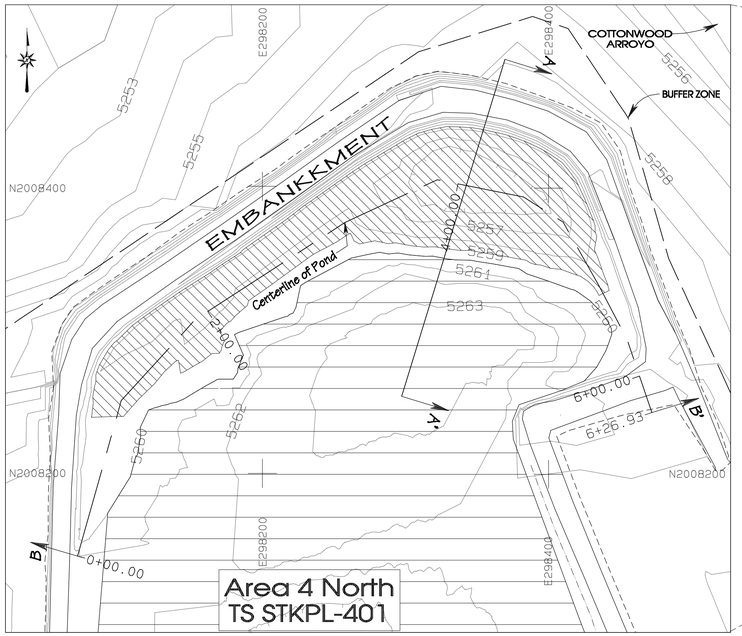
PROJECT: AAN
DATE: AUG.6, 2009
DESIGNED BY: RCV
DRAWN BY: PJFOSTER
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

EXHIBIT 11-157D
AREA 4 NORTH
POND 407
Design

DRAWING

SHEET
OF 0



PLAN VIEW
CONTOUR INT: 1 FT
SCALE: 1"=50'

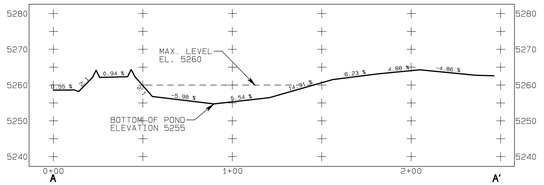
PLAN VIEW
SCALE: 1"=100'

LEGEND

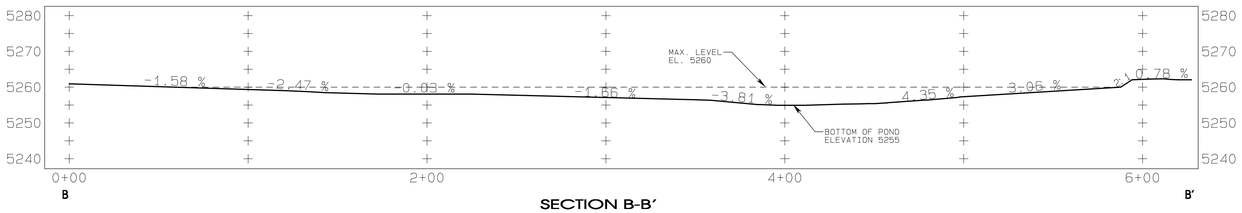
- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referenced on Table 11-5 of the NM PAP.



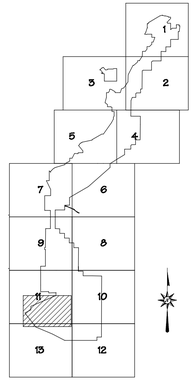
SECTION A-A'
SCALE: HORIZ 1"=40'
VERT 1"=20'



SECTION B-B'
SCALE: HORIZ 1"=40'
VERT 1"=20'

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5254.8	0.00	0.0	0.0
5255	0.005	0.0	0.0
5256	0.073	0.0	0.0
5257	0.195	0.1	0.2
5258	0.342	0.3	0.4
5259	0.540	0.4	0.9
5260	0.712	0.5	1.5



SCALE AS NOTED

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this Impoundment has been constructed in accordance with the Approved Design Plans except:
* Pond bottom at El. 5255 (Design was El. 5254).
* Embankment to El. 5261 (Design was El. 5259).
* Storage capacity 1.5 Ac-Ft.(Design was 0.5 Ac-Ft).

Ron C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

NO.	REVISION	DATE
1	SUBMITTED TO OSM FOR APPROVAL	8-29-08
2	PREPARED AS-BUILT AND SUBMITTED TO OSM FOR REVIEW (NOT SUBMITTED)	12-22-09
3	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	1-26-2011

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717 FRUITLAND, NEW MEXICO 87419 PHONE: 505-598-2500/FAX: 505-598-3781

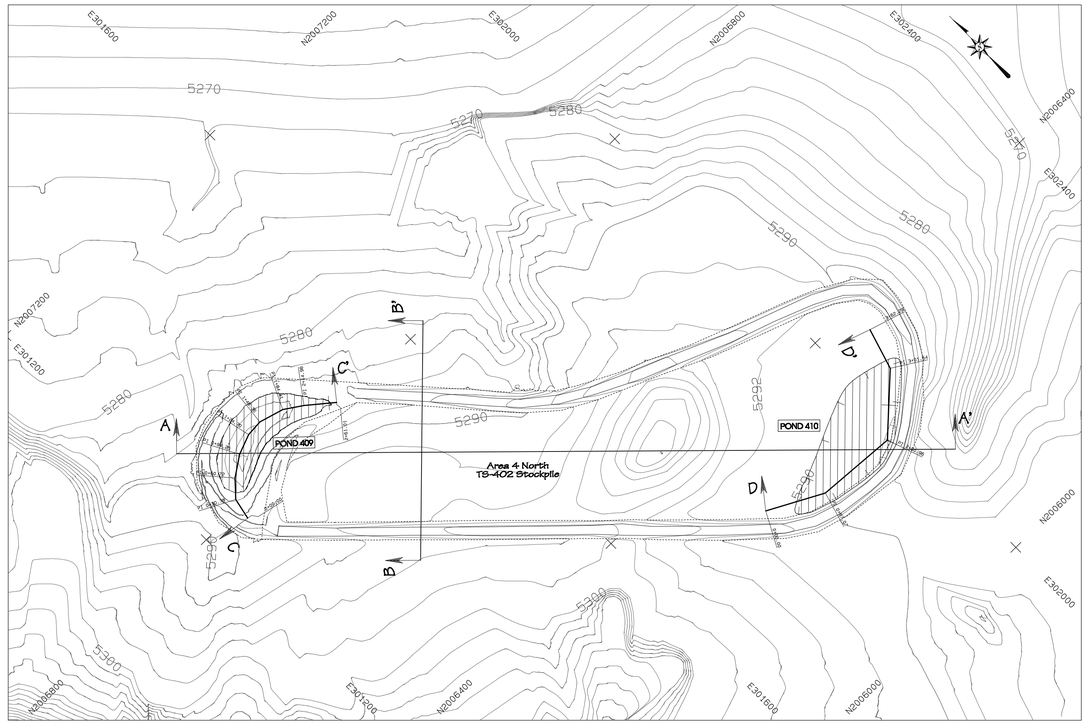
ACCOUNT:
DATE: Dec 02, 2009
DESIGNED BY: RC
DRAWN BY: PJF
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

Exhibit 11-158
Area 4 North Pond 408
As-Built

DRAWING

SHEET 1
OF 1



PLAN VIEW
SCALE 1"=100'

NOTES

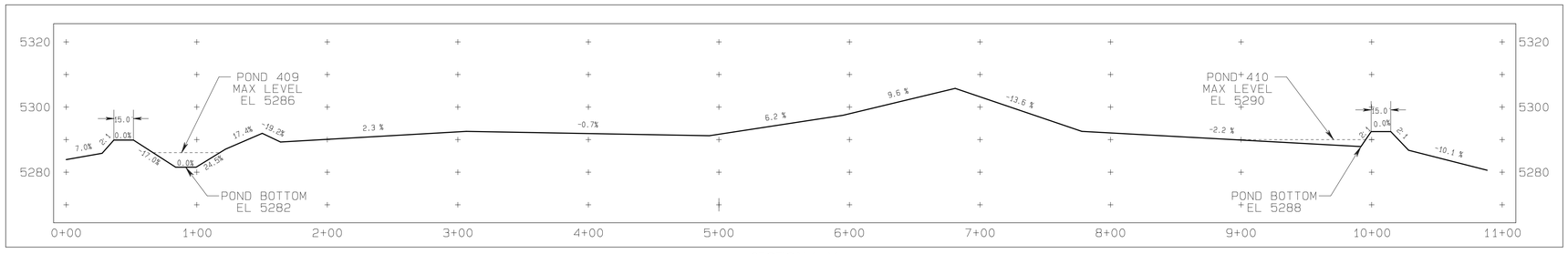
1. For location of drainage control structures and watersheds, refer to Exhibit 11-13F
2. The hydrology and supporting design data for the drainage control structures are referened on Table 11-5 the NM PAP.

STAGE STORAGE DATA
A4 NORTH POND-409

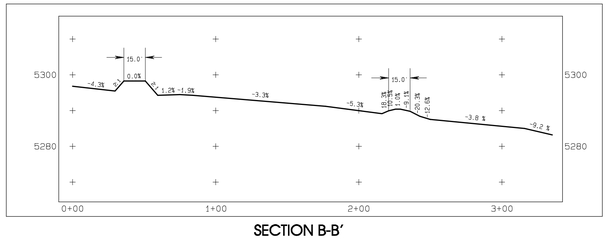
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5282	0.02	0.0	0.01
5283	0.06	0.0	0.05
5284	0.10	0.1	0.13
5285	0.15	0.1	0.26
5286	0.22	0.2	0.44

STAGE STORAGE DATA
A4 NORTH POND-410

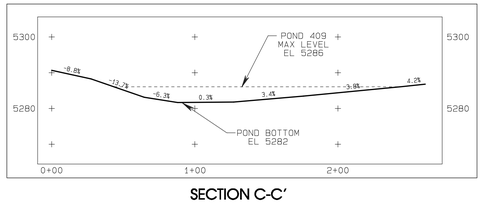
ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5288	0.01	0.0	0.0
5289	0.15	0.1	0.1
5290	0.39	0.3	0.3
5291	0.79	0.6	0.9
5292	1.28	1.0	2.0



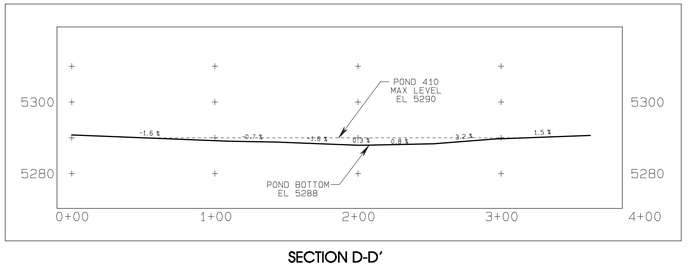
SECTION A-A'
SCALE HORIZ 1"=50'
VERT 1"=20



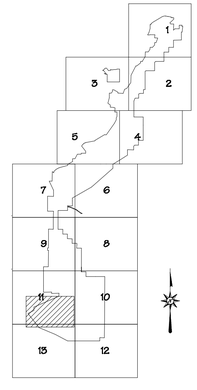
SECTION B-B'
SCALE HORIZ 1"=50'
VERT 1"=20



SECTION C-C'
SCALE HORIZ 1"=50'
VERT 1"=20



SECTION D-D'
SCALE HORIZ 1"=50'
VERT 1"=20



SCALE AS NOTED

Exhibit 11-159D

CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this impoundment has been constructed in accordance with the Aproved Design Plans except:

* Pond 409 capacity 0.44 Ac-Ft (Design was 0.23 Ac-Ft)
* Pond 410 capacity 0.35 Ac-Ft (Design was 0.4 Ac-Ft)

Ron C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

NO.	REVISION	DATE
1	SUBMITTED TO OSM FOR APPROVAL	12/12/04
2	SUBMITTED TO OSM FOR APPROVAL	08/17/06
3	PREPARED AS-BUILT SUBMITTED TO OSM FOR REVIEW	12/03/09
4	PER 4 JANUARY 2010 REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	FEB-2011

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416, PHONE: 505-598-3009 FAX: 505-598-3951

ACCOUNT:
DATE: Dec. 03, 2009
DESIGNED BY: RCV
DRAWN BY: P.Foster
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTION

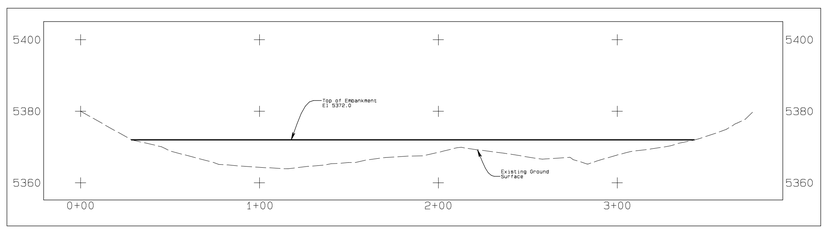
Exhibit 11-159
Area 4 North
TS-402 Pond
As-Built

DRAWING

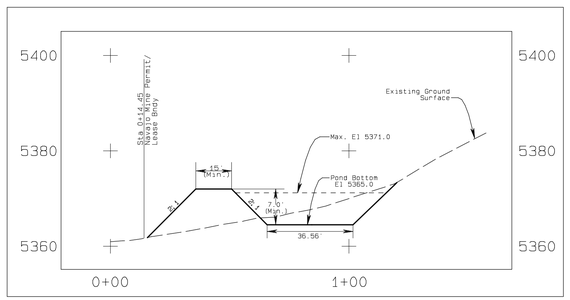
SHEET 1 OF 1

G:\Projects\Ch 11\Exh 11-159_A4N Pnds 409-410\OSM Subm-12011\Exh 11-159_TS-402_PD- 409-410-Design-11.dro
Tue Feb 08 08:33:45 2011

PLAN VIEW
1"=40'



CROSS SECTION A - A'
SCALE - H - 1"=40'
V - 1"=20'



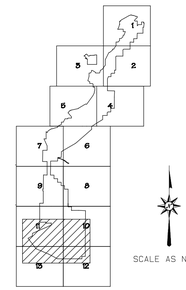
CROSS SECTION B - B'
SCALE - H - 1"=30'
V - 1"=15'

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 / 5422.45
- L-30 LEASE CORNER
- PERMIT/LEASE BOUNDARY

NOTES

1. For hydrology and design information refer to Appendix 11-AA in the approved PAP.
1. Refer to Exhibit 11-13F for watershed information and location of ponds.



SCALE AS NOTED

STAGE STORAGE DATA

ELEV feet	AREA acres	VOLUME ac-ft	CUM. VOLUME ac-ft
5365	0.13	0.0	0.0
5366	0.162	0.1	0.1
5368	0.217	0.4	0.5
5370	0.276	1.5	1.0
5372	0.344	0.6	1.6

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

	REVISION	DATE
1	PREPARED FOR SUBMITTAL TO OSM	1-28-10
11-A	REV'S. of NORTH REGION ASSIGNMENT TO A4N PERMIT REVIEW AND APPROVAL	FEB-2011

PROJECT MANAGER: FG
ENGR. of RECORD: RCV
REG. NO: 9800
SRVYR of RECORD:
REG. NO:

bhpbilliton
BHP NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 PHONE 505-598-3209/FAX 505-598-3381

ACCOUNT:
DATE: AUGUST 31, 2009
DESIGNED BY: RCV
DRAWN BY: RF
CHECKED BY: RCV
APPROVED BY: RCV

PLAN, PROFILE AND SECTIONS

EXHIBIT 11-161D
AREA 4 NORTH
POND 411
Design

DRAWING

SHEET 1
OF 1

G:\Eng\Permit Fil\Ch 11\Exh 11-161_A4N Pd 411\DGN Subm-12011\Exh 11-161D_A4N Pond-411-Design.pro
Tue Feb 15, 2011 / 11:20:57

Vegetation is sampled during the last two years of the liability period and as often as needed in the interim to determine trends of successful revegetation. The sampling is done from June through October.

12.2.2 Backfilling and Grading Schedule

SMCRA regulation state backfilling and grading activities "shall occur as contemporaneously as practicable with mining operations" (30 CFR 816.100). BNCC use the following guidelines to define practicable backfilling and grading:

- Sufficient equipment capacity and manning levels to sustain constant progress backfilling available areas simultaneous with mining operations
- Holding equipment and manning levels at a steady rate (not hiring or laying off extra people to meet demands caused by short term fluctuations in available regrade volumes).
- Allowing spoil material that is reserved to fill final pits and ramps to remain ungraded in place until the final pits or ramps are available to fill (not double handing material to develop out-of-pit spoil dumps)

BNCC provides information for short term and long term backfilling and grading. Both of these sources combined constitute the backfilling and grading plan.

Short term information is provided in EXHIBIT 12-32a and 12-32b. EXHIBIT 12-32a shows detailed regrading, mitigation and topsoil areas by year for three years. EXHIBIT 12-32b shows detailed revegetation and irrigation areas by year for three years. BNCC meets with the OSM Navajo Mine Team on an annual basis during the 4th quarter of each calendar year. At this meeting, BNCC presents these exhibits with the regrade commitment for the next calendar year and a general outlook at the following two years. This meeting informs OSM and other agencies of the sequence of reclamation activities and solicits approval of EXHIBITS 12-32a and 12-32b, which are then updated in the permit each year.

Long term backfill and grading information is provided in TABLE 12-2 and FIGURE 12-2-1. TABLE 12-2 show the approximate volume of material placed in final regrade of Area 2 and Area 3 by fiscal year until all pits in those areas are completely regraded. Disturbed acres in this

table are based on EXHIBITS 12-1 through 12-3, Permit Term Disturbance Schedule. FIGURE 12.2-1 shows a summary schedule for the final regrading of Area 2 and Area 3. The bars represent the cumulative fill volume available for final regrade i.e. final pits, ramps or fill areas. The lines represent the planned volume to be placed in final regrade in that fiscal year. FIGURE 12.2-1 and TABLE 12-2 do not provide information on the number of acres completed as "final regrade", regrade acres are provided in EXHIBIT 12-32a and 12-32b. The volumes presented in TABLE 12-2 and FIGURE 12.2-1 are general estimates based on the current mine plan and may be altered due to unforeseen significant changes

There are several factors in determining the appropriate timing for contemporaneous reclamation to be completed. Five examples of these factors are explained below.

1. Pit Backfill A buffer of approximately 4500 feet from the centerline of the final pit is required to leave enough cut material to backfill the final pit to FSC elevation. In order to successfully time the backfilling of pits, some spoil material must remain in place until their final resting place becomes available for regrading to the final surface configuration (FSC). This material is required for backfilling the ramps and pits, and will not be moved until the designated location for that material is available to be filled.

2. Drainage Construction. The re-establishment of postmining drainages requires that some acres not be regraded during active mining, but regraded after the area is inactive. This allows ramps and pits to be backfilled to proper elevations to establish drainage either through the old pits and ramps or through other mined-out areas as dictated by the FSC.

3. Maximization of Coal Recovery. In some areas, the land must not be regraded until a later date in order to facilitate future coal recovery in adjacent areas.

Table 12-2

Regrade Volume by Area

Volume Moved (Bank Cyds)	Location		
Year	Area 2	Area 3	Area 4
2010	6,113,331	4,602,065	
2011	5,583,134	4,826,890	
2012	4,249,955	5,770,431	
2013	4,942,521	5,463,651	
2014	5,452,429	4,064,407	
2015	6,063,844	4,378,689	248,000
2016	3,759,176	6,781,872	1,140,000
2017	2,500,000	8,308,488	2,330,000
2018	2,500,000	7,354,127	3,320,000
2019	2,500,000	10,775,504	
2020	5,500,964	4,599,732	2,660,000
2021	2,192,310	5,052,194	5,930,000
2022			4,571,000

Estimated volume (cubic yard) of spoil material moved each fiscal year for cut and/or fill requirements to meet Final Surface Configuration (FSC)

Figure 12.2-1

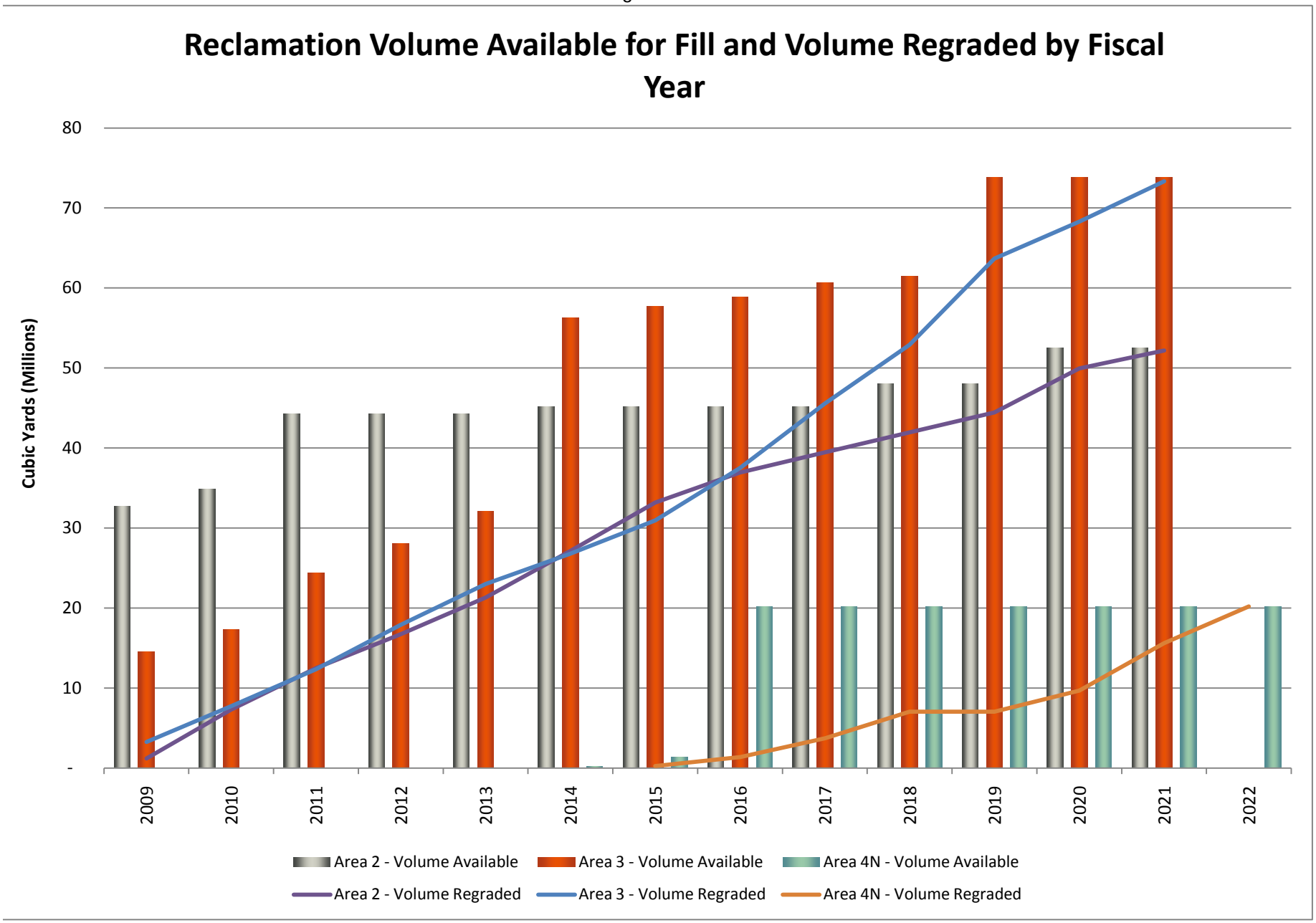

Reclamation Volume Available for Fill and Volume Regraded by Fiscal Year
Cubic Yards (Millions)
80
70
60
50
40
30
20
10
-
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Area 2 - Volume Available
Area 3 - Volume Available
Area 4N - Volume Available
Area 2 - Volume Regraded
Area 3 - Volume Regraded
Area 4N - Volume Regraded

Figure 12.2-2

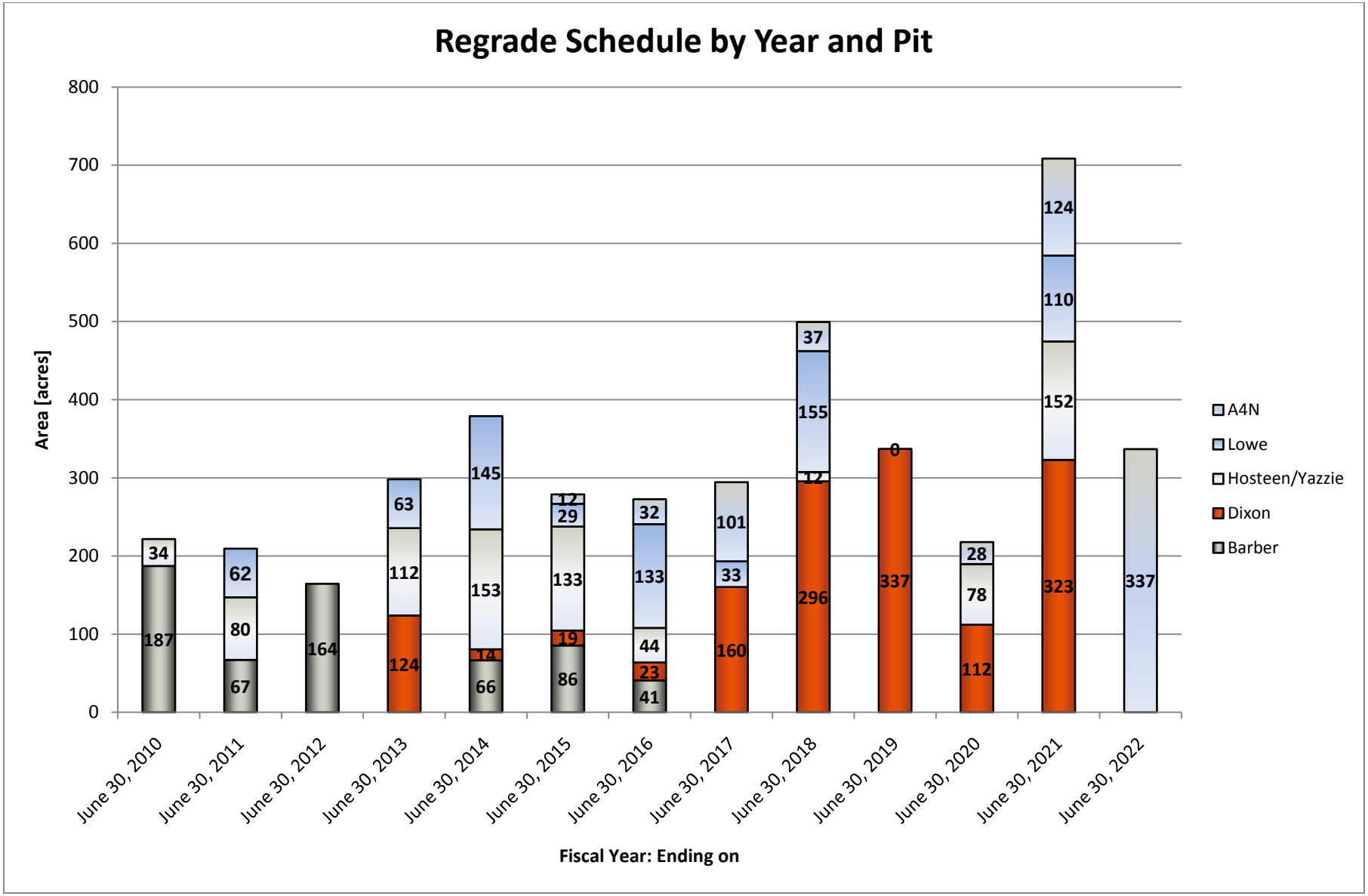

Regrade Schedule by Year and Pit
Area [acres]
800
700
600
500
400
300
200
100
0
34
187
62
80
67
164
63
112
124
145
153
66
12
29
133
19
86
32
133
44
23
41
101
33
160
37
155
12
296
0
337
28
78
112
124
110
152
323
337
June 30, 2010
June 30, 2011
June 30, 2012
June 30, 2013
June 30, 2014
June 30, 2015
June 30, 2016
June 30, 2017
June 30, 2018
June 30, 2019
June 30, 2020
June 30, 2021
June 30, 2022
Fiscal Year: Ending on
A4N
Lowe
Hosteen/Yazzie
Dixon
Barber

Figure 12.2-3

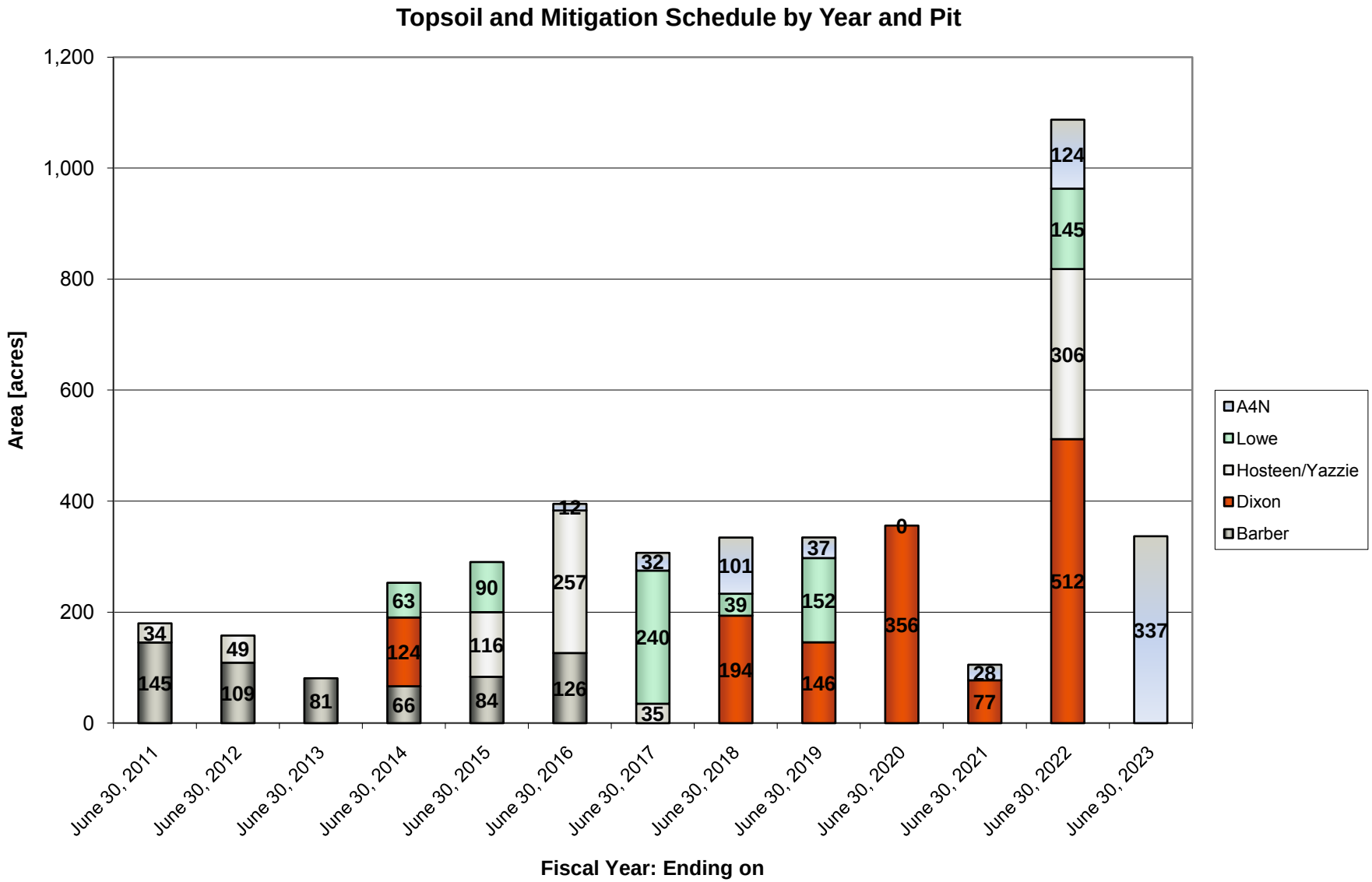

Topsoil and Mitigation Schedule by Year and Pit
Area [acres]
1,200
1,000
800
600
400
200
0
34
145
49
109
81
63
124
66
90
116
84
12
257
126
32
240
35
101
39
194
37
152
146
0
356
28
77
124
145
306
512
337
June 30, 2011
June 30, 2012
June 30, 2013
June 30, 2014
June 30, 2015
June 30, 2016
June 30, 2017
June 30, 2018
June 30, 2019
June 30, 2020
June 30, 2021
June 30, 2022
June 30, 2023
Fiscal Year: Ending on
A4N
Lowe
Hosteen/Yazzie
Dixon
Barber

Figure 12.2-4

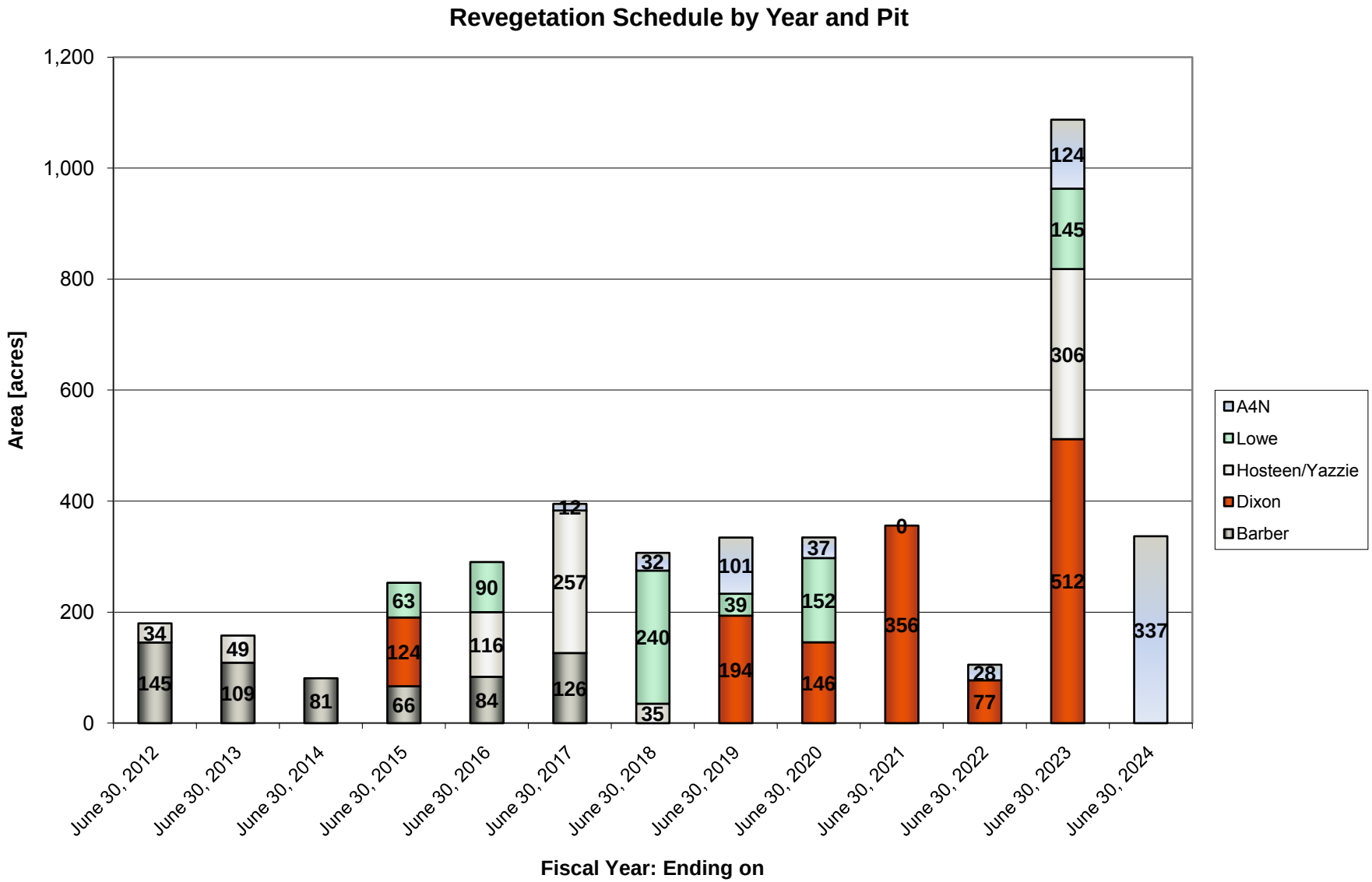
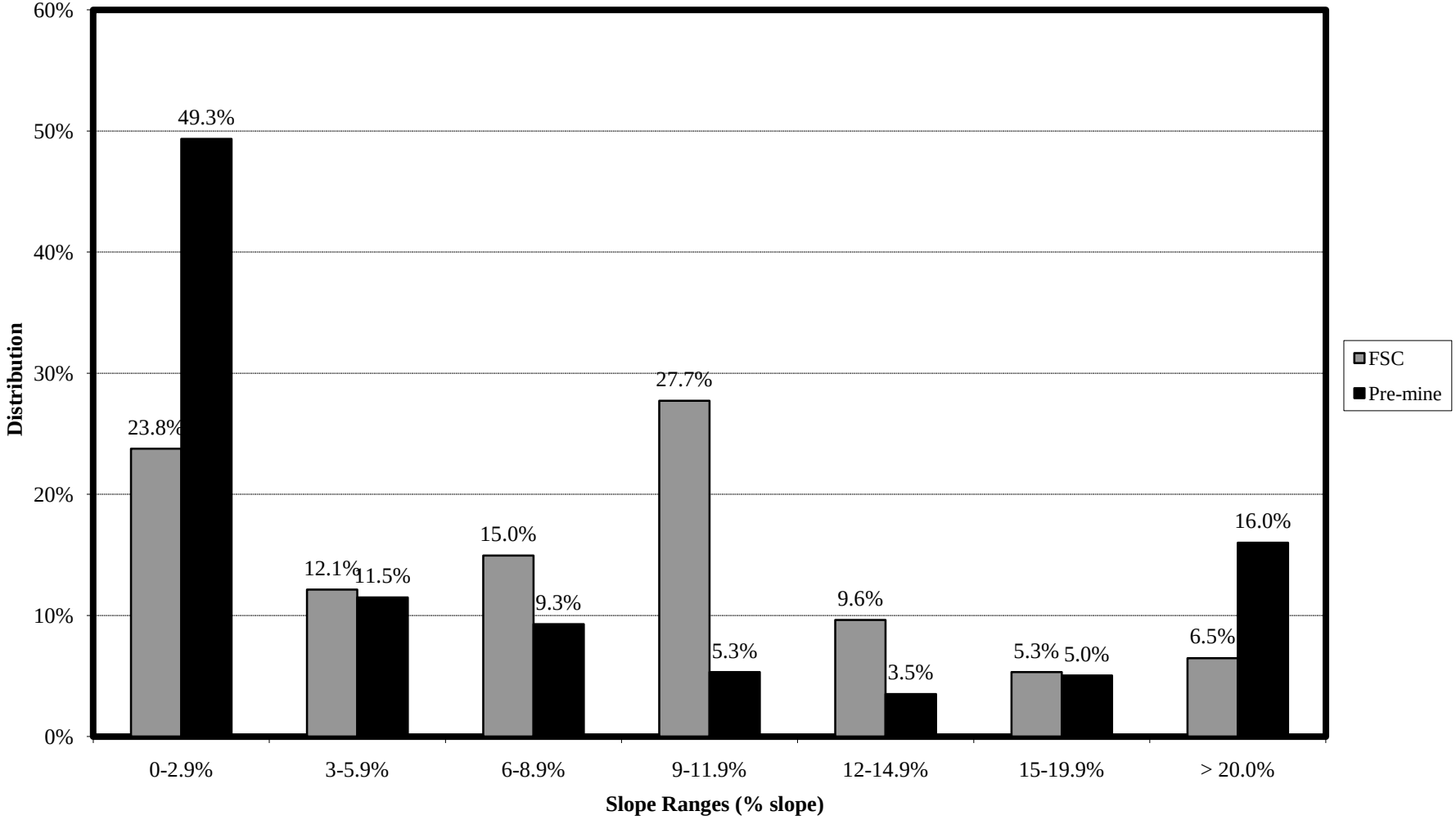

Revegetation Schedule by Year and Pit
Area [acres]
1,200
1,000
800
600
400
200
0
34
145
49
109
81
63
124
66
90
116
84
12
257
126
32
240
35
101
39
194
37
152
146
0
356
28
77
124
145
306
512
337
June 30, 2012
June 30, 2013
June 30, 2014
June 30, 2015
June 30, 2016
June 30, 2017
June 30, 2018
June 30, 2019
June 30, 2020
June 30, 2021
June 30, 2022
June 30, 2023
June 30, 2024
Fiscal Year: Ending on
A4N
Lowe
Hosteen/Yazzie
Dixon
Barber

Figure 12.3-4
Area 4 North Slope Histogram



(11/04; 2/11)

Table 12 - 8

Slope Distribution by Area for Pre- and Post-mining Topography

Percent

	Area 1			Area 2			Area 3			Area 4 North		
	AOC	PRE	**Variance**	AOC	PRE	**Variance**	AOC	PRE	**Variance**	FSC	PRE	**Variance**
0-2.9%	47.2%	62.0%	**-14.8%**	26.9%	34.9%	**-8.0%**	50.1%	57.4%	**-7.3%**	23.8%	49.3%	**-25.6%**
3-5.9%	25.9%	23.4%	**2.6%**	28.3%	27.6%	**0.7%**	25.6%	18.7%	**6.9%**	12.1%	11.5%	**0.6%**
6-8.9%	12.7%	7.9%	**4.7%**	20.4%	14.3%	**6.1%**	11.7%	9.0%	**2.7%**	15.0%	9.3%	**5.7%**
9-11.9%	6.4%	3.3%	**3.1%**	11.6%	8.4%	**3.2%**	6.2%	4.8%	**1.4%**	27.7%	5.3%	**22.4%**
12-14.9%	3.7%	1.6%	**2.1%**	6.6%	5.1%	**1.5%**	3.1%	2.8%	**0.3%**	9.6%	3.5%	**6.1%**
15-19.9%	2.5%	1.1%	**1.5%**	4.1%	4.3%	**-0.2%**	2.1%	2.8%	**-0.7%**	5.3%	5.0%	**0.3%**
> 20.0%	1.6%	0.7%	**0.8%**	2.2%	5.5%	**-3.3%**	1.2%	4.6%	**-3.4%**	6.5%	16.0%	**-9.5%**
Total	100%	100%		100%	100%		100%	100%		100%	100%	

Acres

	Area 1			Area 2			Area 3			Area 4 North		
	AOC	PRE	**Variance**	AOC	PRE	**Variance**	AOC	PRE	**Variance**	FSC	PRE	**Variance**
0-2.9%	1,035	1,360	**(325)**	1,579	2,047	**(467.6)**	2,060	2,359	**(298.9)**	167	347	**(180.1)**
3-5.9%	568	512	**56**	1,660	1,622	**38.5**	1,052	768	**283.6**	85	81	**4.5**
6-8.9%	278	174	**104**	1,198	838	**360.0**	481	369	**111.8**	105	65	**39.9**
9-11.9%	140	72	**68**	679	493	**186.0**	255	196	**59.3**	195	37	**157.8**
12-14.9%	81	35	**46**	387	297	**89.5**	129	115	**14.3**	68	25	**43.1**
15-19.9%	56	23	**33**	240	251	**(11.3)**	85	116	**(30.7)**	37	36	**1.9**
> 20.0%	34	16	**19**	126	321	**(195.2)**	50	189	**(139.3)**	46	113	**(67.1)**
Total	2,193	2,193		5,870	5,870		4,113	4,113		704	704	

12.3.3 Railroad Removal and Reclamation

The railroad and service road will be removed when mining operations terminate or when the facilities are no longer required. The current plan for completion of mining operations is scheduled for the year 2016, though it is highly likely that operations will be extended beyond this date. The removal of the railroad will begin at the time of ultimate closure.

Upon removal and reclamation of the railroad, all salvageable structures and equipment components will be disassembled and removed from the area. The unsalvageable materials, such as concrete, railroad ties and unsuitable rail will be disposed of in one of the final pits or by other approved methods. The reclamation of the railroad and service road will follow the measures in CHAPTER 12, Section 12.3.2 steps 1 through 7.. The Big Fill removal will consist of hauling 580,000 cubic yards of material to Hosteen Ramp 3 for final regrade material.

12.3.4 Reclamation of Surface Water Controls

All surface water controls will be reclaimed and drainages re-established according to the following procedures and the timetable in TABLE 12-1:

1. Sediment from ponds will be analyzed for potentially unsuitable constituents prior to removal and reclamation. Any unsuitable sediments from the ponds will be disposed of properly (CHAPTER 11, Section 11.2.5). After a database has been established, a determination will be made as to whether future sediment analyses need to be made. In addition, in the process of reclamation, clay liners installed in certain ponds will be ripped and either (a) covered in-place with 4 feet of suitable (root-zone) material or (b) physically removed and disposed of in the active pit or the ungraded spoils. In either case, the clay liner material will no longer hold water.

for control structures on permanent program lands, are provided in Chapter 12, Appendix 12-F and listed below in Table 12.3.7-1.

Table 12.3.7-1 Drainage Control Structures

Structure Name	Location	Structure Type	Comments
Lowe Corner 3 Drop Structures	NE Lowe	Highwall Drop Structure	Gabion mats and grouted rip-rap
West Lowe Drainage Control Structures	West Lowe	Ephemeral channel	Gabion and rip-rap

In addition to using drainage control structures, where appropriate and feasible, cattle may also be utilized to stabilize reclaimed land and minimize erosion. Cattle grazing will be used to impact reclaimed land to reduce erosion by incorporating mulch and seed into the soil, and increase water infiltration by creating increased surface roughness with cattle hoof action.

12.3.8 Reclamation of Ash Disposal Areas

Between 1971 and January 2008 BNCC placed Coal Combustion Byproducts (CCB) from Four Corners Power Plant (FCPP) in mined-out pits or ramps at Navajo Mine. BNCC does not intend to use CCB materials for future reclamation within the permit boundary. The following permit text is maintained for historical context.

12.3.8.1 Ash Cover

Following closure of an ash disposal area, a total of three meters of material was used to cover the ash. This three meters of cover includes all topdressing and suitable root zone materials. All reclaimed ash disposal areas incorporated positive drainage.

12.3.9 Use of CCB in Backfilling and Grading

In specific areas of the mine, Coal Combustion By-products (CCB) were used to achieve the FSC. The targets for ash disposal were generally final pits and ramps. The specific permanent

program lands are indicated on EXHIBIT 1-4.

12.9 DETERMINATION OF BOND

The determination of the bond is an estimation of the maximum reclamation cost that the Regulatory Authority would incur in the event of bond forfeiture by Navajo Mine during the permit term ending in 2014. Areas bonded include those areas which will be disturbed in the process of recovering coal from the permit area and those facilities that support the mine. The following costs and procedures apply only for determining the bond dollar figure at year 2014 and are not necessarily meant to represent current or future operational practices. Direct costs are calculated in Worksheets 2 through 15 and are totaled in Worksheet 16 in APPENDIX 12-B. Indirect costs are applied as percentages of the direct cost in Worksheet 16 to achieve a total bond cost.

12.9.1 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.

For the purposes of this calculation, the disturbed areas have been updated with aerial flight topography and merged with the bond post mining configuration. BNCC will evaluate, and adjust if neccasry, the bond amount based on significant permit revisions, mid-term renewals, and permit renewal periods.

The amount of disturbance taking place during the permit term is primarily controlled by strip progression, which is shown on EXHIBITS 12-2 and 12-3.

Mining activities will continue in Dixon, Lowe, Barber, Hosteen and Yazzie pits. Additionally, a box-cut and strip progression will commence in Area IV North as seen in EXHIBIT 12-03. Pinto pit will be reclaimed during the permit term. Consequently Areas II and III are the primary areas for reclamation during this permit term.

12.9.2 Reclamation Costs

Reclamation costs are calculated as shown in APPENDIX 12-B, Worksheets 1 through 16. Reclamation liabilities for permit areas will occur in Areas I, II, III, and IV. It is assumed that all final bond pits will progress as scheduled as noted in EXHIBITS 12-2 and 12-3 and will be stripped to their lowest recoverable coal seam. Reclamation activities will consist of the following:

1. Facility Demolition and Removal

2. Earthmoving

3. Revegetation

4. Miscellaneous

12.9.2.1 Facility Demolition and Removal

Facility demolition and removal of all existing permit structures on the mine site includes the industrial complexes; water pipelines, intakes, and loadouts; electric power lines; explosive stores; coal facilities; water control structures; transportation facilities; and miscellaneous structures. A summary of demolition unit costs is presented in TABLE 12-B-1, APPENDIX 12-B. Most of these costs were obtained from R.S. Means software "Cost Works 2009" Version 13.0.

All permit structures are tabulated in Worksheet 2 (APPENDIX 12-B). Structure dimensions are taken from existing plans, while unit costs are from TABLE 12-B-1, APPENDIX 12-B. The resulting costs are totaled in Worksheet 16, Item 1 (APPENDIX 12-B).

12.9.2.2 Earthmoving

Topsoil required to achieve the 5.6 inch depth is placed over the remaining (unmitigated) disturbed surfaces in Area II. This is available in stockpile and in-situ reserves. Area II topdressing material movement is shown on EXHIBITS 12-23 and 12-24.

12.9.2.2.5 Area III

Generally, ramps and pits are used as drainages, spoil material is required from the Dixon Pit area for pit backfill in North Lowe, and Lowe boxcut material is graded to the west. Calculations for material movement and scheduling were performed without the inclusion of Dixon Box-cut Exchange. Pending negotiations with the Navajo Nation, an update will be submitted including the Dixon Box-cut Exchange.

As seen in EXHIBIT 12-13, a considerable volume of material is to be pre-stripped, or truck stripped, before dragline progression into strip DX74. For calculation purposes, this pre-strip volume was removed from the Post Mining Configuration and added to balance the Bond Surface Configuration (BSC) using Microsoft Excel. The pre-strip volume is accounted for in spreadsheet calculations, however the cut block "Dixon PS" is not shown in exhibits.

Cut and Fill contours for Area III are shown on EXHIBITS 12-19. Area III regrade material movement is shown on EXHIBIT 12-22.

Area III topdressing and spoil mitigation material movement required to achieve four (4) feet of rootzone (including 9.7 inches of topsoil) is shown on EXHIBITS 12-25 and 12-28. As with Areas I and II it is assumed that 2% of the disturbed surface areas will require mitigation. The remaining surface areas will receive only the 9.7 inches of topdressing.

12.9.2.2.6 Area IV North

Ramps and pits are used as drainages and spoil material is used to backfill designed open

pits and ramps using dozer and front end loader operations. Cut and Fill contours for Area IV North are shown on EXHIBIT 12-30. Area IV North regrade material movement is shown on EXHIBIT 12-30c.

Material to achieve the required four (4) feet of suitable root zone material/topdressing is available in stockpile reserves in southern Area III. It should be noted that in realistic scenarios, BNCC will remove topsoil material prior to mining, and stockpile such materials for use in reclamation activities. The Bond calculations however, represent a "Worst Case Scenario", where BNCC strips without removing topsoil material. In this "Worst Case Scenario", topsoil would be hauled using trucks from Area III.

The suitable rootzone and topsoil movement consists of the mitigation of four (4) feet of suitable rootzone material over 2% of the surface area, with this four (4) foot total inclusive of the required 5.6 inches of topsoil as outlined in TABLE 12-4.

Area IV North suitable rootzone material movement is shown on EXHIBIT 12-30e. Topsoil required to achieve the 5.6 inch depth is placed over the remaining (unmitigated) disturbed surfaces in Area IV North. This is available in stockpile reserves in Area III. Area IV North topdressing material movement is shown on EXHIBIT 12-30d. It should be noted that in realistic scenarios, BNCC will remove regolith material prior to mining, and stockpile such material for use in reclamation activities. The Bond calculations however, represent a "Worst Case Scenario", where BNCC strips without removing regolith material. In this "Worst Case Scenario", mitigation material would be hauled using trucks from Area III.

12.9.2.3 Revegetation

After backfilling the pits and ramps the bonded areas will be graded with graders and then these areas and facilities areas will be topsoiled as noted in previous sections. After topsoiling, revegetation activities will initiate. This involves seeding, crimping, mulching and irrigation. Costs are noted on APPENDIX 12-B, Worksheet 14(A-C).

TABLE 12-7

RECLAMATION BOND SUMMARY[1]

Item	Source	Amount
Total Facility and Structure Removal	Worksheet 2	$ 8,224,864
Total Earthmoving Costs	Worksheet 13	$ 99,330,498
Total Revegetation Costs	Worksheet 14	$13,527,793
Total Other Reclamation Activities Costs	Worksheet 15	$ 2,251,645
Subtotal: Direct Costs		**$123,334,799**
Mobilization and Demobilization	1.00%	$1,233,348
Contingencies	2.00%	$2,466,696
Engineering Redesign Fee	1.80%	$2,220,026
Contractor Profit and Overhead	15.00%	$18,500,220
Reclamation Management Fee	3.90%	$4,810,057
Subtotal: Indirect Costs		**$29,230,347**
Grand Total Bond Amount		**$152,565,146**
August 2006 Approved Bond Amount including Yazzie and A4N		**$150,289,771**

1Bond summary information can also be found in APPENDIX 12-B and 12-C, Worksheet No. 16.

Project: Navajo Mine
Date: May 2009

TABLE 12-7A
RECLAMATION BOND ADJUSTMENT SUMMARY

Item #	Item	OSM Project ID	ADJ Sum [1]	ADJ Amount	
1	Bond Cost Estimate in Approved PAP (Permit Renewal)	NM0003F	1, 2, 3	$	152,565,146
				$	**152,565,146**

[1] The BHP initial reclamation bond adjustments summary sheets and worksheets are found in APPENDIX 12-B.

[2] Section 12.0 and APPENDIX 12-B established the base reclamation cost estimate in the permit renewal application.

[3] Reclamation bond adjustments summary sheets and worksheets are found in APPENDIX 12-D.

APPENDIX 12-B

BOND CALCULATION WORKSHEETS AND TABLES

WORST CASE BOND SCENARION 2009

APPENDIX 12 - B

Table of Contents

Item	Title

Figure B-1 ..... Worksheet Flow Diagram

WORKSHEETS

2..... Structure Demolition Worksheet
3..... Material Handling Worksheet
5..... Dozer Activities Worksheet
8..... Loader Activities Worksheet
9..... Truck Activities Worksheet
11..... Scraper Activities Worksheet
12..... Motor Grader Activities Worksheet
13..... Summary of Earth Moving Costs
14..... Revegetation Costs
15..... Other Reclamation Activities Costs
16..... Reclamation Bond Summary

TABLES

12-B-1 ..... Demolition Unit Costs
12-B-2 ..... Culvert Volumes
12-B-3 ..... Backfilling of Ponds and Impoundments
12-B-4 ..... Road Ripping
12-B-5 ..... Area I Bond Regrade Earthmoving Dozers
12-B-6 ..... Area II Bond Regrade Earthmoving Dozers
12-B-7 ..... Area III Bond Regrade Earthmoving Dozers
12-B-9 ..... Area II Bond Regrade Earthmoving Trucks

APPENDIX 12 - B

Table of Contents

Item	Title

TABLES (cont'd).

12-B-10 .....Area III Bond Regrade Earthmoving Trucks and Loader
12-B-11 ..... Area I Bond Reclamation Topsoil Material Movement Trucks
12-B-12 ..... Area II Bond Reclamation Topsoil Material Movement Trucks
12-B-13 .....Area III Bond Reclamation Topsoil Material Movement Trucks
12-B-14 .....Area I Bond Reclamation Mitigation Material Movement Trucks
12-B-15 ..... Area II Bond Reclamation Mitigation Material Movement Trucks
12-B-16 ..... Area III Bond Reclamation Mitigation Material Movement Trucks
12-B-17 ..... Area II Bond Regrade Earthmoving Scrapers
12-B-18 ..... Area III Bond Regrade Earthmoving Scrapers
12-B-19 .....Area I Bond Reclamation Topsoil Material Movement Scrapers
12-B-20 ..... Area II Bond Reclamation Topsoil Material Movement Scrapers
12-B-21 ..... Area III Bond Reclamation Topsoil Material Movement Scrapers
12-B-22 ..... Area III Bond Reclamation Topsoil Material Movement Scrapers
12-B-23 .....Equipment Ownership and Operating Costs
12-B-24 .....Equipment Operator Wage Rates
12-B-25 .....Drill and Blast Quantities
12-B-26 .....Bond Equipment Availabilities

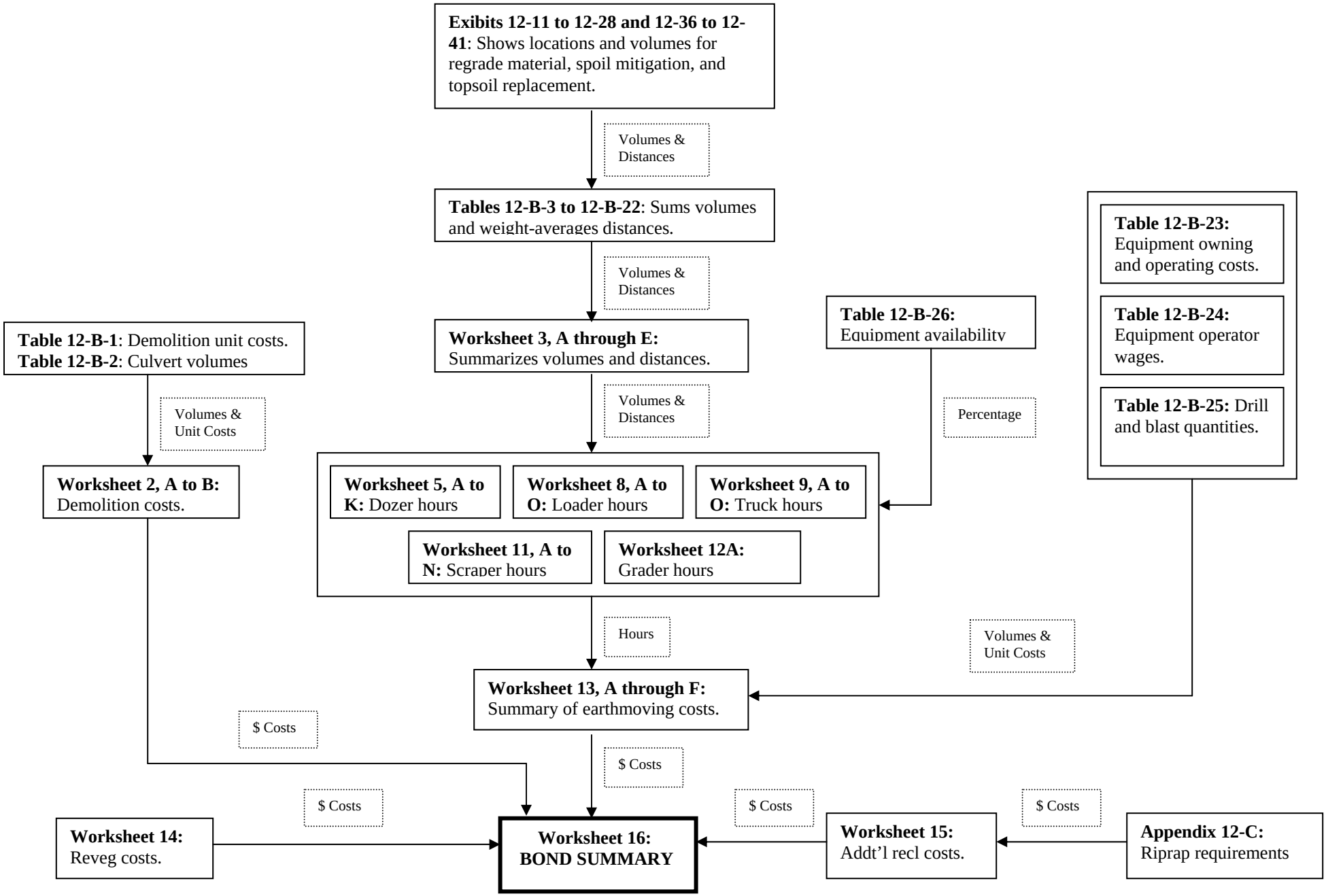
BOND CALCULATION WORKSHEETS

WORST CASE BOND SCENARIO 2009

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT
BOND AMOUNT CALCULATION

FIGURE 12-B-1

FLOWCHART



Project **Navajo Mine**
Date **May 2009**

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	$2,986	-	-	-	-
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	$13,776				
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

Project: Navajo Mine
Date: May-2009

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	$36,691	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	128	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	778,688	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**				**$1,265,432**
TOTAL DEMOLITION COST																	**$6,760,527**

Project: Navajo Mine
Date: May-2009

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

Project: Navajo Mine
Date: May-2009

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

Project: Navajo Mine
Date: May-2009

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

Project: Navajo Mine
Date: May-2009

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

Project: Navajo Mine
Date: May-2009

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]:

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) * 3,230 LCY/hr (Normal Hourly Production) = 2,030 LCY/hr

Hours Required[2] = 256,950 LCY (volume to be moved[1]) / 2,030 LCY/hr (net hourly production) = 126.6 hrs

Data Sources:

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

Project: Navajo Mine
Date: May-2009

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/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) * 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/yd^3]

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

Project: Navajo Mine
Date: May-2009

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/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) * 1,070 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

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 = ( ) / 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] = 21,331,902 LCY / volume to be moved[1] / 1,015 LCY/hr / net hourly production = 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

Project: Navajo Mine
Date: May-2009

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 = (loaded haul time) + (empty haul time) + 0.7 min (basic cycle time) = 0.7 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) / 0.7 min (cycle time) * 50 min/hr (work hour factor) = 1,212 LCY/hr

Hours Required[2] = 366,108 LCY (volume to be moved[1]) / 1,212 LCY/h (net hourly production) = 302 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. 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 = (loaded haul time) + (empty haul time) + 0.7 min (basic cycle time) = 0.7 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) / 0.7 min (cycle time) * 50 min/hr (work hour factor) = 1,212 LCY/hr

Hours Required[2] = 54,338 LCY (volume to be moved[1]) / 1,212 LCY/h (net hourly production) = 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

Project: Navajo Mine
Date: May-2009

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 = (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] = 49,955 LCY (volume to be moved[1]) / 1,212 LCY/hr (net hourly production) = 41 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. 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

Project: Navajo Mine
Date: May-2009

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

Project: Navajo Mine
Date: May-2009

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.):

10,156 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

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

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

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

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

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

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

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

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 = 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

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] = 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

Project: Navajo Mine
Date: May-2009

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

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

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

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

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

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

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

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

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

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 = 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

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

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

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

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) = 2.8 min

Truck Cycle Time = 8.3 min (haul time) + 4.5 min (return time) + 2.8 min (loading time per truck) + 1.0 min (dump and maneuver time) = 16.3 min

Number of Trucks Required = 16.3 min (truck cycle time) / 2.8 min (truck loading time) = 6 trucks (round down)

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

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

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

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 = 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

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

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.):

11,958 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 = 6.7 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

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 = 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

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] = 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[2]

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 = 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

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

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

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

Hours Required[2] = 3,715,674 LCY (volume to be moved[1]) / 352 LCY/hr (hourly production) = 10,566 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. 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

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) + 3.1 min (return time) + 2.6 min (loading time per truck) + 1.0 min (dump and maneuver time) = 12.4 min

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

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

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

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

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 = 4.6 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

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

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

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

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 3
2) Hours required go to Wertsheet 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

Project: Navajo Mine
Date: May-2009

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

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

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

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

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

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

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

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
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

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

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

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

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

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

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

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 (load time per pair) + 1.2 min (loaded trip time) + 0.6 min (maneuver and spread time) + 0.9 min (return trip time) = 3.7 min

Net Hourly Production = 29 LCY (adjusted capacity) * 50 min/hr (work hour factor) / 3.7 min (cycle time) * 2 (number of scrapers) = 784 LCY/hr

Hours Required[2] = 28,912,821 LCY (volume to be handled[1]) / 784 LCY/hr (net hourly production) = 36,889 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. 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 (load time per pair) + 1.3 min (loaded trip time) + 0.6 min (maneuver and spread time) + 1.0 min (return trip time) = 3.9 min

Net Hourly Production = 29 LCY (adjusted capacity) * 50 min/hr (work hour factor) / 3.9 min (cycle time) * 2 (number of scrapers) = 753 LCY/hr

Hours Required[2] = 11,327 LCY (volume to be handled[1]) / 753 LCY/hr (net hourly production) = 15 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. 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 (load time per pair) + 0.0 min (loaded trip time) + 0.6 min (maneuver and spread time) + 0.0 min (return trip time) = 1.6 min

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

Hours Required[2] = 0 LCY (volume to be handled[1]) / 1813 LCY/hr (net hourly production) = - 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. 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 (load time per pair) + 1.1 min (loaded trip time) + 0.6 min (maneuver and spread time) + 0.8 min (return trip time) = 3.5 min

Net Hourly Production = 29 LCY (adjusted capacity) * 50 min/hr (work hour factor) / 3.5 min (cycle time) * 2 (number of scrapers) = 841 LCY/hr

Hours Required[2] = 619,263 LCY (volume to be handled[1]) / 841 LCY/hr (net hourly production) = 737 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. 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 ft^2/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 ft^2/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 (speed) x 9.75 ft. (effective blade width) x 5,280 ft/mi / 43,560 ft^2/ac (conversion factor) x 0.83 (work hour factor) x 0.90 (availability) = 3.0 ac / hr

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

Scarification:

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

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

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

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

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

Hours Required = 418 ac (acreage to be graded[1]) \ 2.99 ac/hr (hourly productivity) = 140 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 ft^2/ac (conversion factor) x 0.83 (work hour factor) x 0.90 (availability) = 1.1 ac / hr

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

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

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

Project: Navajo Mine
Date: May-2009

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	= $ 26,098
	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	= $ 106,166
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

Project: Navajo Mine
Date: May-2009

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	= $	47,396
	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

Project: Navajo Mine
Date: May-2009

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 Accesory 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
Data: 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

Project: Navajo Mine
Date: May-2009

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

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

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

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 1998:

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

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

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

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

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

Costs For Reseeding = 0 ac (Acreage to be reseeded*) * (383 $/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):

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 DM-M2 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) * 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 = 44,689 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 DM2 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) * 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 = 3,342,325 bcy (volume to be blasted) / 3,898 bcy/hr (production rate) = 857 hr

Project: Navajo Mine
Date: May-2009

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 = 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) * 44,889 bcy (volume to be blasted) = $ 6,376

Project: Navajo Mine
Date: May-2009

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

Project: Navajo Mine
Date: May-2009

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

Project: Navajo Mine
Date: May-2009

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

Project: Navajo Mine
Date: May-2009

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**

Project: Navajo Mine
Date: May-2009

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**

Project: Navajo Mine
Date: May-2009

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

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

CULVERT ID	Diameter [in]	Length [ft]	Volume [ft^3]
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 [ft^3]
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	-

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**

TABLE 12-B-3
BACKFILLING OF PONDS AND IMPOUNDMENTS

Pond	Pond Volume		Dam[2]					Dozer Push Distance	Backfill Volume[3]
	[ac-ft]	[bcy][1]	Bottom [ft]	Top [ft]	Height [ft]	Length [ft]	Volume [bcy][1]	[ft]	[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	4,815	200	4,815
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	9,486	-	-	-	-	Incised	200	9,486
Southwest Dixon Pond	3.0	4,840	-	-	-	-	Incised	125	4,840
Vinnel Pond	9.8	15,748	-	-	-	-	Incised	250	15,748
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.

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

Pond	Pond Volume		Dam[2]					Dozer Push Distance [ft]	Backfill Volume[3] [bcy][1]
	[ac-ft]	[bcy][1]	Bottom [ft]	Top [ft]	Height [ft]	Length [ft]	Volume [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.

Project: Navajo Mine
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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**	

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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**	

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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	5,387	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	OS BLUFF 01	48,191	100%	48,191	5,386	5,411	-	200	12.3%	Internal
HOS BLUFF 02	OS 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	516	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%	

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	5,367	-	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%	256,438	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

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%	Not included in material movement costs. In the bond scenario, all the material is located in final resting place.
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%	
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	8,508	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	24,559	5,356	5,403	13,967	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	64,694	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	1.6%	
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	10,338	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	3,693	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

TABLE 12-B-13
AREA 3 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
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	5,356	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	61,802	5,257	5,361	2,515	3,018	3.4%	
LWR4_TS_N	D-07	2.7	3,513	5,257	5,367	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	26,258	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	5,296	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	5,283	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	19,835	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	4,858	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	6,784	-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 accomodated 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 [yd³]	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	5,366	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	5,336	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

5.6 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-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	5,366	6,805	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	5,386	6,631	7,957	0.9%	
LWR4_RG_N	S-05	67.9	6,992	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	2,762.9	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 [yd³]	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	281	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%	35,546	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	166,540	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%	26,325	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	5,387	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 12-8-18
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	5,362	-	1,000	0.1%	Internal
D-02	D-02	1,386	100%	1,386	5,400	5,301	-	1,000	-6.0%	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	5,363	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	6,339	100%	6,339	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	6.0%	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	6.0%	Internal
P-04	P-04	110,081	100%	110,081	5,222	5,337	-	1,000	6.0%	Internal
R-01	R-01	372	100%	372	5,374	5,368	-	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	-6.0%	Internal
R-06	R-06	87,362	100%	87,362	5,362	5,265	-	1,000	-6.0%	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	36,685	100%	36,685	5,328	5,340	-	1,000	1.2%	Internal
S-08	S-08	1,009	100%	1,009	5,245	5,312	-	1,000	6.0%	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	62,252	100%	62,252	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	44,696	100%	44,696	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	-6.0%	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	-6.0%	External
DX-PS	P-04	326,264	100%	326,264	5,378	5,337	1,337	1,700	-3.1%	External
TP-14	TP-18	26,386	100%	26,386	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

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	$ 21.00	$ 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	$ 162.73
D11R Dozer	U Blade	$ 67.91	0.83	$ 56.59	$ 8.70	0.84	$ 7.29	$ 51.81	$ 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	$ 27.48	$ 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	$ 17.63	$ 6.47	0.84	$ 5.42	$ 19.45	$ 100.24	0.56	$ 55.80	$ 21.04	$ 27.90	1.00	$ 27.90	$ 2.65	$ 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	$ 11.05	$ 3.18	0.84	$ 2.66	$ 10.72	$ 36.12	0.56	$ 20.11	$ 7.39	$ 6.82	1.00	$ 6.82	$ 0.88	$ 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	$ 2.45	$ 1.76	1.00	$ 1.76	$ 0.27	$ 28.83
Grader Ripper		$ 2.11	0.83	$ 1.76	$ 0.04	0.84	$ 0.03	$ 0.66	$ 0.85	0.84	$ 0.71	$ 0.97	$ -	0.56	$ -	$ 0.18	$ -	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	$ 11.09	$ 36.12	0.56	$ 20.11	$ 7.48	$ 6.82	1.00	$ 6.82	$ 1.69	$ 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	$ 1.62	$ 0.81	0.84	$ 0.68	$ 0.90	$ 17.11	0.56	$ 9.53	$ 2.60	$ 0.76	1.00	$ 0.76	$ -	$ 19.45
DM42 Drill		$ 42.48	0.83	$ 35.40	$ 43.74	0.84	$ 36.84	$ 23.44	$ 81.67	0.84	$ 68.41	$ 40.84	$ 104.39	0.56	$ 58.11	$ 17.86	$ -	1.00	$ -	$ 4.06	$ 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	$3.86 /gal	
	Local Cost	$2.18 /gal	
	Fuel Multiplier		0.56
Lube:	No adjustment		1
Tires:	No adjustment		1
GEC:	No adjustment		1
Inflation:			7.9%

Project: Navajo Mine
Date: Sep 2008

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**		

Project: Navajo Mine
Date: Aug 2007

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

February 2011

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

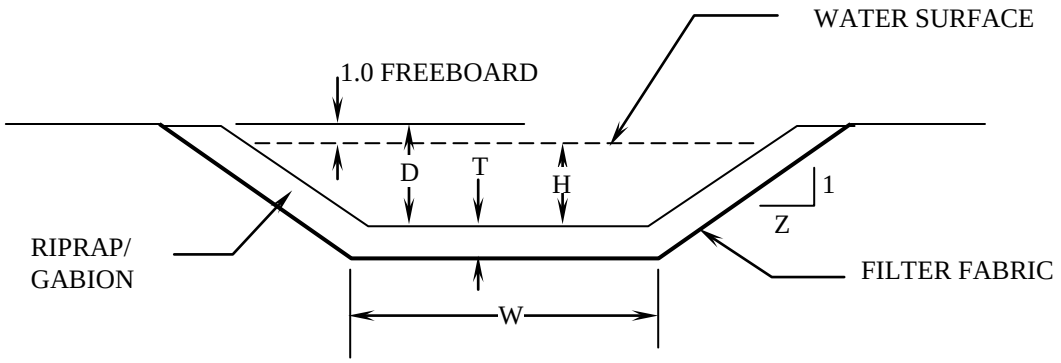
The riprap and gabion cost are based on the cost of material, labor, and equipment associated with recent riprap/gabion placement at the Navajo Mine.

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

						Soil Classification, Hydrologic Soil Group, and Curve Number (CN)			
Predicition Point	Watershed Area (ac)	Drainage Length (ft)	High Pt. Elev. (ft)	Low Pt. Elev. (ft)	Delta Elev. (ft)	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

						Soil Classification, Hydrologic Soil Group, and Curve Number (CN)			
Predicition Point	Watershed Area (ac)	Drainage Length (ft)	High Pt. Elev. (ft)	Low Pt. Elev. (ft)	Delta Elev. (ft)	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**

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Bond Senario 9/2014

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

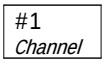
General Information

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



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

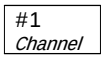
General Information

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



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

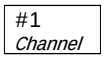
General Information

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



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

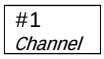
General Information

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



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

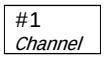
General Information

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



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

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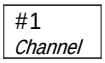
Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Prediction Point PP-31



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**

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

(12/04; 2/11)

APPENDIX 12 - D
AREA 4 NORTH BOND WORKSHEETS

Table of Contents

Item	Title
Figure B-1	Worksheet Flow Diagram (see Appendix 12-B)

WORKSHEETS

1	Worst Case Bond Reclamation Scenario for Area 4 North
2	Structure Demolition and Disposal Cost Summary
3	Material Handling Summary Sheet
5H thru 5J	Productivity and Hours Required for Dozer Use
8M thru 8P	Productivity and Hours Required for Loader Use
9M thru 9P	Productivity and Hours Required for Truck Use
11I	Productivity for Scraper Use
12C and 12D	Productivity and Hours Required for Motor Grader Use - Grading
13G thru 13K	Summary Calculation of Earth Moving Costs
14D	Revegetation Costs
15D	Other Reclamation Activity Costs
16	Reclamation Bond Summary Sheet
12-B-23	Area IV North Bond Regrade Earthmoving - Dozers
12-B-24	Area IV North Bond Regrade Earthmoving – Trucks and Loader
12-B-26	Area IV North Bond Reclamation Topsoil Material Movement - Scrapers
12-B-27	Area IV North Bond Reclamation Topsoil Material Movement – Trucks and Loader
12-B-29	Area IV North Bond Reclamation Mitigation Material Movement – Trucks and Loader

Project **Navajo Mine**
Date **February 2011**

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 4 North.

The Yazzie, Hosteen, North Barber, South Barber, Lowe, Dixon and Area 4 North 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

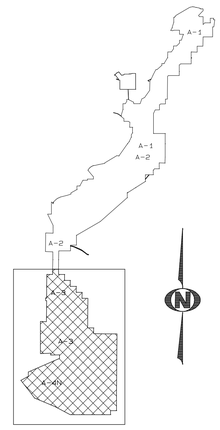
their final contours, and mitigation material will be placed where required; topsoil will be placed, revegetation will occur with a 20% failure rate and the mine facilities will be removed. Facilities areas will be mitigated as required and topsoiled. At this time, the mine will be ready to begin phased 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 reclamation costs for ownership and operating cost along with operator wage rates were taken from worksheets and tables located in Appendix 12-B.

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 — SPOT ELEVATION
- 5300 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218 / 5422.45 — HORIZ. & VERT. CONTROL
- L-30 — LEASE CORNER
- PERMIT/LEASE BOUNDARY

YEAR 1 COMMENCES SEPT. 1, 2009



1000 0 1000 2000

CONTOUR INTERVAL: 10'

"NOTE"

ADDITIONAL MINE STRUCTURES, INCLUDING ROADS, RAILROAD, PONDS, IMPOUNDMENTS AND CULVERTS, ALTHOUGH PRESENT ON THIS EXHIBIT AS PART OF AERIAL BASE MAPPING, ARE NOT INTENDED TO BE CURRENT OR ACCURATE ON THIS EXHIBIT. PLEASE REFER TO THE APPROPRIATE P.A.P. TEXT SECTION FOR A MINE STRUCTURE EXHIBIT REFERENCE.

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.G.	PE
				APPROVALS		
11-B	FEB-2011	PJF	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	RCV	OS	RCV
11-A	1-21-11	PJF	UPDATED MINE PLAN CHANGES FOR LOWE, DIXON PIT, REMOVED A4N STRIPPING AND SUBMITTED TO OSM FOR REVIEW	RCV	OS	RCV
10-B	10-29-10	PJF	REMOVED A4 NORTH STRIPPING LABELS, CHANGE YEAR 1 TO YEAR-2 IN LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.	RCV	YB	RCV
10-A	10-13-10	PJF	ADDED POTENTIAL COAL BLOCKS IN A4N, UPDATED YEARS LABELS IN LOWE AND DIXON PIT AND SUBMITTED TO OSM FOR REVIEW.	S. Hoskie	YB	RCV
09-B	8-28-09	PJF	ADDED PROPOSED AREA 4 NORTH REVISION AND SUBMITTED TO OSM FOR REVIEW.	S. Place	YB	KAB
09-A	7-12-09	PJF	Original certified signed exhibits are maintained at the Mine Site and OSM ADDED 1BH EASTSIDE OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	KAB
08-C	12-01-08	PJF	UPDATED A3 FOR MINE PLAN CHANGES, ADDED BLOCLKS IN YR-5, YR-4 FOR STRIPPING BB SEAM ONLY, RELINIT SOUTH DIXON YR-4 TO STRIP 56, AND SUBMITTED TO OSM FOR REVIEW.	B. HOSKIE	Y. BENALLY	RON C. VAN V.
08-B	8-18-08	PJF	UPDATED A3, A4N FOR MINE PLAN CHANGES AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	B. HOSKIE	Y. BENALLY	RON C. VAN V.
08-A	01-11-08	PJF	CHANGE YR-13 TO YR-4, STRIP 53 IN LOWE PIT, ADDED SHOVEL/ TRUCK STRIPPING IN THE SOUTH PORTION OF STRIP 57 TO STRIP-60 IN DIXON PIT AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	B. HOSKIE	Y. BENALLY	D.C. RAGON
07-A	10-31-07	PJF	RESUBMITTED FOR A4N DEVELOPMENT TO OSM FOR REVIEW AND APPROVAL.	KB/ OS	YB	KB
L	3-15-07	PJF	Updated Lowe Pit Stripping, change Strip 52 to YR-3, Strip 53 to YR-13 and submitted for Review.	KB/ OS	MC	KB
K	10-20-05	PJF	Updated Lowe, Dixon Stripping Layout and submittal to OSM for Review.	BH	MC	LR
J	1-11-05	PJF	Updated A4N Stripping Layout and submittal to OSM for Review.	CBN	MC	LR
I	4-15-04	PJF	PAP Renewal submittal to OSM for Review.	DJR	MC	LR
H	3-04-04	PJF	Extended Strips 47 to 52 on the south end and submitted to OSM for Review.	DJR	MC	
G	8-10-99	PJF	Update Strip Sequence and submitted to OSM for Review and Approval	DJR	MC	
F	8-10-99	PJF	Update Strip Sequence and submitted to OSM for Review and Approval.	BRC	MC	BRC
E	3-05-99	PJF	Permit Renewal submitted to OSM for Review and Approval.	BRC	MC	BRC
D	1-25-99	PJF	ADDED AREA IV NORTH STRIP LAYOUT AND UPDATED STRIP LAYOUT YEARS IN AREA-III	CN	MC	BRC
C	9-11-98	PJF	ADDED STRIP LW R4 SOUTH OF LOWE RAMP-4			
B	7-15-98	PJF	STRIP LAYOUT CHANGES			
A	7-15-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL			

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

EXHIBIT 12–03

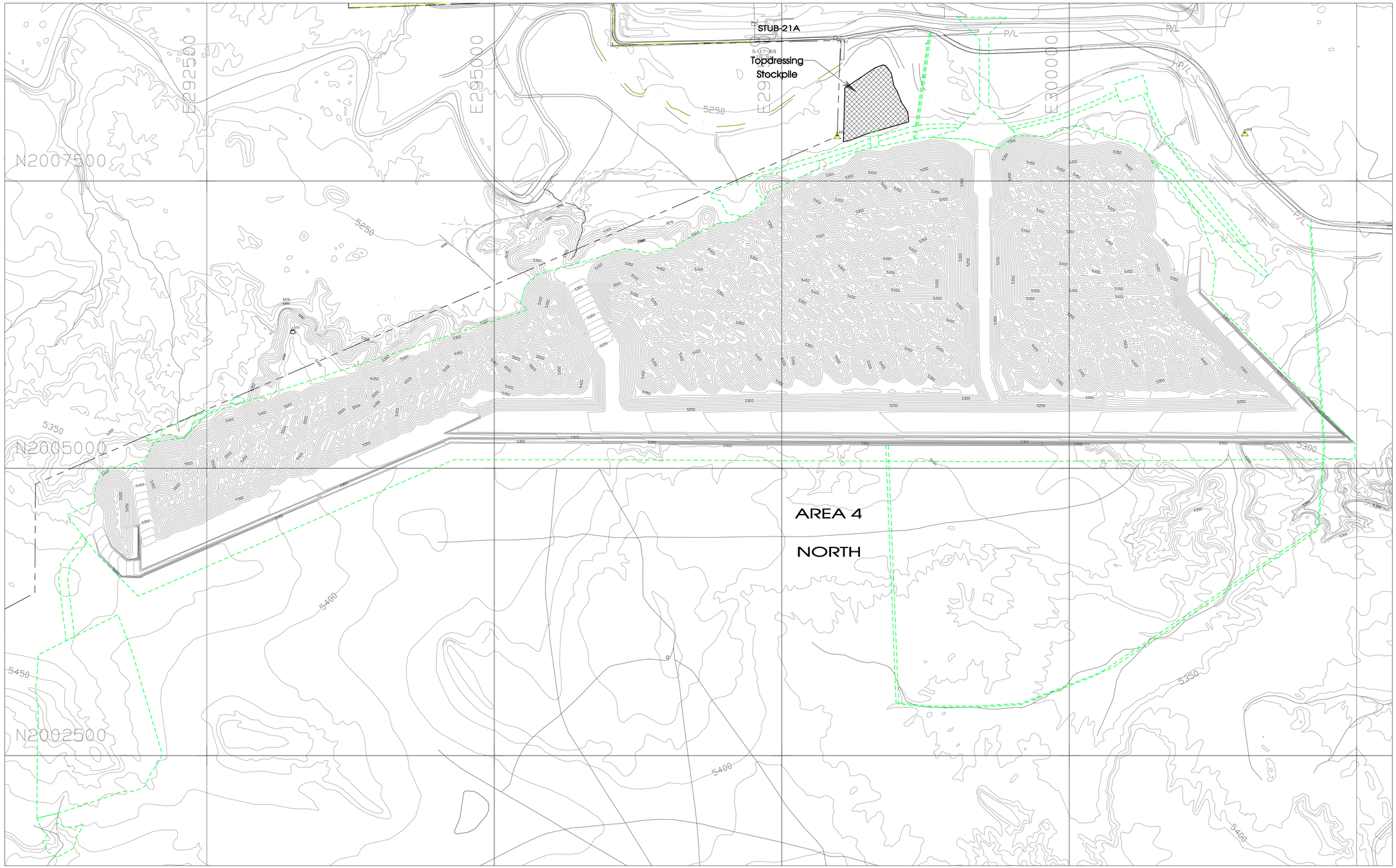
bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

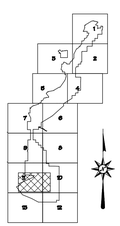
AREA-III AND A4N PERMIT TERM DISTURBANCE SCHEDULES

PREPARED BY	BRC/ MC/PTJ	DRAWN BY	PJF	SCALE	1" = 1000'
APPROVED BY		DATE	June 03, 1998		

G:\Shared Files\Engineering\Exhibit 12-03\A3-A4N Distr Sch\Area 4 North Distr Map\OSM Subs-FEB-2011\Exh 12-03_A3_A4N-Distr Sch.pro
PLOTTED: Fri Feb 11 08:28:01 2011



LOCATION MAP
SCALE: 1" = 400'



LEGEND
- 5300 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- LEASE BOUNDARY
- TOPSOIL REMOVAL

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

	REVISION	DATE
1	Submitted to OSM for Review.	Oct. 17, 2014
2	Updated per Permit Renewal and OSM Review Comments.	May 01, 2009
11-1	ADD 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	FEB-2011

PROJECT MANAGER: Ferguson Gorman
ENGR. of RECORD: Ron C. Van Valkenburg
REG. NO. 9263
SRVYR of RECORD:
REG. NO.

BHP-NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717 FRUITLAND, NEW MEXICO 87416

ACCOUNT: AAN PERMITTING
DATE: May 01, 2009
DESIGNED BY: Kent Gorman
DRAWN BY: Kent Gorman
CHECKED BY: Kent Gorman
APPROVED BY: Ferguson Gorman

LOCATION MAP

EXHIBIT 12-30A AREA-4N
POST-MINE CONFIGURATION
BOND SCENARIO 9/2009

DRAWING

SHEET
OF 0

D:\GisPermit\Fch 12\Exhibit 12-30\AAN CFV\DSM Subm\FEB-2011\2009 BOND DATA\Exh-12-30A_AAN_Post Mining Config.grd
Mon Feb 14 08:16:17 2011

N2007500

N2005000

N2002500

E292500

E295000

E297500

E300000

D 07
CUT: 1,063,923 cu. yds.
FILL: 468,400 cu. yds.
D 07: -468,400 cu. yds.
D 04: -595,523cu. yds.

R 04
CUT: 7,515 cu. yds.
FILL: 1,688,003 cu. yds.
D 07: +595,523 cu. yds.
D 08: +1,055,998 cu. yds.
R 04: -7,515 cu. yds.
T 03: +28,967 cu. yds

T 03
CUT: 4,591,892 cu. yds.
FILL: 87,895 cu. yds.
P 02: -544,983 cu. yds.
P 03: -3,895,164 cu. yds.
R 04: -28,967 cu. yds.
T 03: -87,895 cu. yds.

T 02
CUT: 6,960,704 cu. yds.
FILL: 326,413 cu. yds.
P 04: -5,481,359 cu. yds.
T 02: -326,413 cu. yds.
P 01: -1,152,932 cu. yds.

D 05
CUT: 697,711 cu. yds.
FILL: 35,488 cu. yds.
D 05: -35,488 cu. yds.
P 02: -405,785 cu. yds.
R 03: -256,438 cu. yds.

R 03
CUT: 161,309 cu. yds.
FILL: 674,186 cu. yds.
D 04: +256,438 cu. yds.
D 05: +256,438cu. yds.
R 03: -161,309 cu. yds.

R 05
CUT: 73,266 cu. yds.
FILL: 559,494 cu. yds.
D 10: +486,228 cu. yds.
R 05: -73,266 cu. yds.

T 01
CUT: 2,581,063 cu. yds.
FILL: 7,437 cu. yds.
T 01: -7,437 cu. yds.
P 01: -2,573,627 cu. yds.

D 10
CUT: 1,432,310 cu. yds.
FILL: 10,762 cu. yds.
D 10: -10,762 cu. yds.
p 03: -935,321 cu. yds.
r 06: -486,228 cu. yds.

D 02
CUT: 556,582 cu. yds.
FILL: 14,603 cu. yds.
D 02: -14,603 cu. yds.
R 02: -84,414 cu. yds.
P 01: -457,565 cu. yds.

D 03
CUT: 1,073,683 cu. yds.
FILL: 654,496 cu. yds.
D 03: -654,496 cu. yds.
P 01: -419,187 cu. yds.

R 02
CUT: 7,523 cu. yds.
FILL: 146,506 cu. yds.
D 01: +54,568 cu. yds.
D 02: +84,414 cu. yds.
R 02: -7,523 cu. yds.

P 01
CUT: 0 cu. yds.
FILL: 5,164,194 cu. yds.
D 02: +457,565 cu. yds.
D 03: +419,187 cu. yds.
D 04: +560,882 cu. yds.
T 01: +2,573,627 cu. yds.
T 02: +1,152,932 cu. yds.

D 04
CUT: 825,473 cu. yds.
FILL: 8,152 cu. yds.
D 04: -8,152 cu. yds.
D 03: -256,438cu. yds.
P 01: -560,882 cu. yds.

D 06
CUT: 465,045 cu. yds.
FILL: 198,200 cu. yds.
D 06: -198,200 cu. yds.
P 02: -266,846 cu. yds.

P 02
CUT: 51 cu. yds.
FILL: 6,699,023 cu. yds.
D 05: +405,785 cu. yds.
D 06: +266,846 cu. yds.
P 02: -51 cu. yds.
T 02: +5,481,359 cu. yds.
T 03: +544,983 cu. yds.

D 08
CUT: 1,343,539 cu. yds.
FILL: 287,540 cu. yds.
D 08: -287,540 cu. yds.
R 04: -1,055,998 cu. yds.

D 09
CUT: 411,089 cu. yds.
FILL: 87,350 cu. yds.
D 09: -87,350 cu. yds.
P 03: -323,738 cu. yds.

P 03
CUT: 129 cu. yds.
FILL: 5,154,351 cu. yds.
D 09: +323,738 cu. yds.
D 10: +935,321 cu. yds.
P 03: -129 cu. yds.
T 03: +3,895,164 cu. yds.

D 01
CUT: 233,662 cu. yds.
FILL: 22,593 cu. yds.
D 01: -5,648 cu. yds.
R 01: -22,593 cu. yds.
R 02: -54,568 cu. yds.

R 01
CUT: 603 cu. yds.
FILL: 157,104 cu. yds.
D 01: +156,501 cu. yds.
R 01: -603 cu. yds.

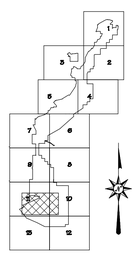
AREA 4

NORTH

TOTAL CUT: 22,487,072 cu. yds.

TOTAL FILL: 22,452,188 cu. yds.

LOCATION MAP
SCALE: 1"=400'



LEGEND

~10 CUT CONTOUR

20 FILL CONTOUR

LEASE BOUNDARY

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

REVISION

		DATE
1	Submitted to OSM for Review.	Oct. 13, 2009
2	Updated Top Bonded Permit and Submitted	May 01, 2009
3	Updated Permit Boundary	FEB-2011
11	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	

PROJECT MANAGER: Ferguson Gorman
ENGR. of RECORD: Ron C. Van Valkenburg
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: AM PERMITTING
DATE: MAY 01, 2009
DESIGNED BY: R. Logan
DRAWN BY: P. Foster
CHECKED BY: R. Logan
APPROVED BY: Ferguson Gorman

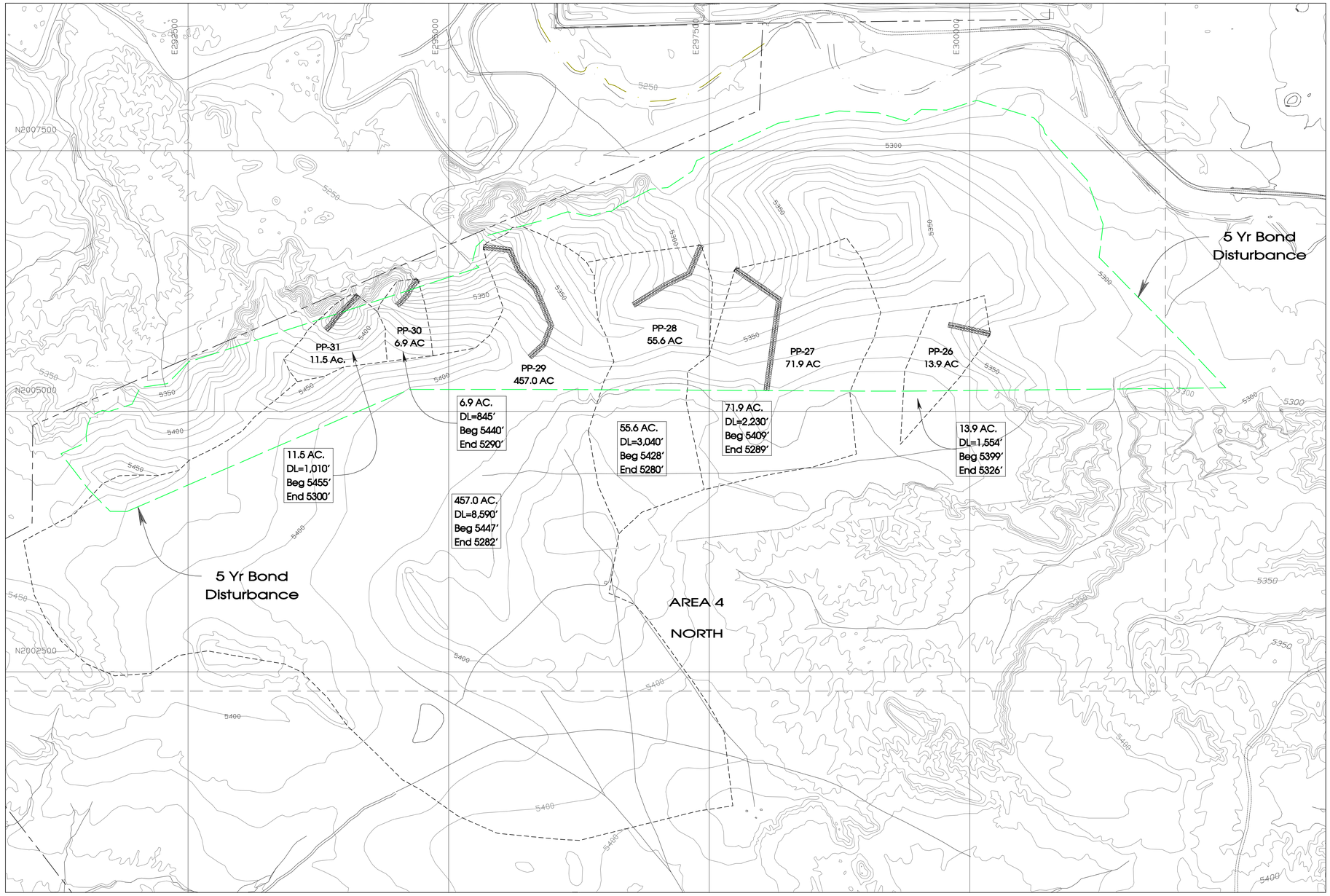
LOCATION MAP

EXHIBIT 12-30 – AREA-4N
CUT/FILL CONTOURS
AND BLOCKS
BOND SCENARIO 9/2014

DRAWING

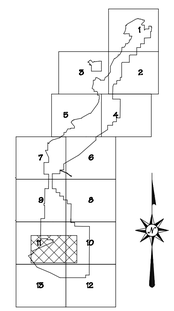
SHEET
OF 0

G:\Documents and Settings\PJFoster\Desktop\12-30_A4N CFC\OSM Subm-FEB-2011\0009 BOND DATA\Exh-12-30_A4N_Cut-Fill Contour_Blocks.pro
PJFOSTER Mon Feb 14 08:00:55 2011



LOCATION MAP

SCALE: 1" = 500'



LEGEND

- 5300 — INDEX CONTOUR
- INTERMEDIATE CONTOUR
- LEASE BOUNDARY
- RIP-RAP CHANNEL
- PP3 — PREDICTION POINT
- WATERSHED BOUNDARIES

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

REVISION	DATE
1 Submitted to OSM for Review.	Oct.17,2014
2 Updated for Permit Renewal and Submitted	May 01,2009
11-4 AREA 4 NORTH REVISION RESUBMITTAL TO OSM	Feb-2011
OSM REVIEW AND APPROVAL	

PROJECT MANAGER: Ferguson Gorman
ENGR. OF RECORD: Ron C. Van Valkenburg
REG. NO: 9263
SRVYR OF RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717 FRUITLAND, NEW MEXICO, 87416

ACCOUNT: AAN PERMITTING
DATE: May 01, 2009
DESIGNED BY: Ken Logan
DRAWN BY: PJFoster
CHECKED BY: Ron Van Valkenburg
APPROVED BY: Ferguson Gorman

LOCATION MAP

EXHIBIT 12-30B – AREA 4N
BOND SURFACE CONFIGURATION AND DROP STRUCTURE W/WATERSHED BOUNDARY
BOND SCENARIO 9/2014

DRAWING

SHEET
OF 0

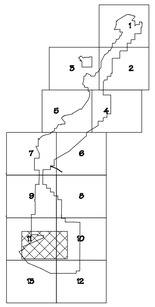
G:\GisPermit\CD\12\Exhibit 12-30B_AAN CFC\DGN Sub=FEB-2011\2009 BOND DATA\Exh-12-30B_AAN_Bond Surface Config.prn
PJFoster Mon Feb 14 08:18:52 2011

DXR4_TS

LEGEND

TOPSOIL STOCKPILE

LEASE BOUNDARY



E292500 E295000 E297500 E300000 E302500

N2007500 N2005000 N2002500

Topsoil Stockpile
Yards: 924,400 cu. yds.

D 07
13,635 cu. yds.

Haulage Roads
7,201 cu. yds.

Topdressing
Stockpile
4,368 cu. yds.

R 04
9,725 cu. yds.

Pond 7
2,442 cu. yds.

D 08
14,199 cu. yds.

Pond 5
3,163 cu. yds.

D 05
6,480 cu. yds.

R 03
7,686 cu. yds.

D 04
5,003 cu. yds.

T 02
65,757 cu. yds.

D 07

R 04

D 08

T 03
32,255 cu. yds.

D 10
9,342 cu. yds.

R 05
11,657 cu. yds.

Pond 3
90 cu. yds.

D 02
3,420 cu. yds.

Pond 2
740 cu. yds.

R 02
1,762 cu. yds.

T 01
19,679 cu. yds.

D 01
3,275 cu. yds,

D 03
19,621 cu. yds.

P 01
26,884 cu. yds.

D 06
11,173 cu. yds.

D 09
6,366 cu. yds.

P 02
27,304 cu. yds.

P 03
22,668 cu. yds.

Powerline
200 cu. yds.

Ancillary Road
2,600 cu. yds.

R 01
2,694 cu. yds.

Coal Stockpile
24,410 cu. yds.

Pond 1
1,439 cu. yds.

Total Topsoil: 362,870 cy. yds.

LOCATION MAP

SCALE: 1" = 400'

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

REVISION	DATE
1 Submitted to OSM for Review.	Oct. 17, 2008
2 Updated for Permit Renewal and Bond Release Application	May 01, 2009
11-AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	FEB-2011

PROJECT MANAGER: Ferguson Gorman
ENGR. of RECORD: Ron C. Van Valkenburg
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: AAN PERMITTING
DATE: May 01, 2009
DESIGNED BY: K.Logan
DRAWN BY: PJFOSTER
CHECKED BY: R.Van Valkenburg
APPROVED BY: Ferguson Gorman

LOCATION MAP

EXHIBIT 12-30D AREA-4N
TOPDRESSING RELACEMENT
BOND SCENARIO 9/2014

DRAWING

SHEET
OF 0

G:\GIS\Permit F\CD_12\Exhibit 12-30_AAN_CF\CIVDA Sum-FEB-2011\2009 BOND Data\Exh-12-30D_AAN_Topdressing Bond Scenario.prc
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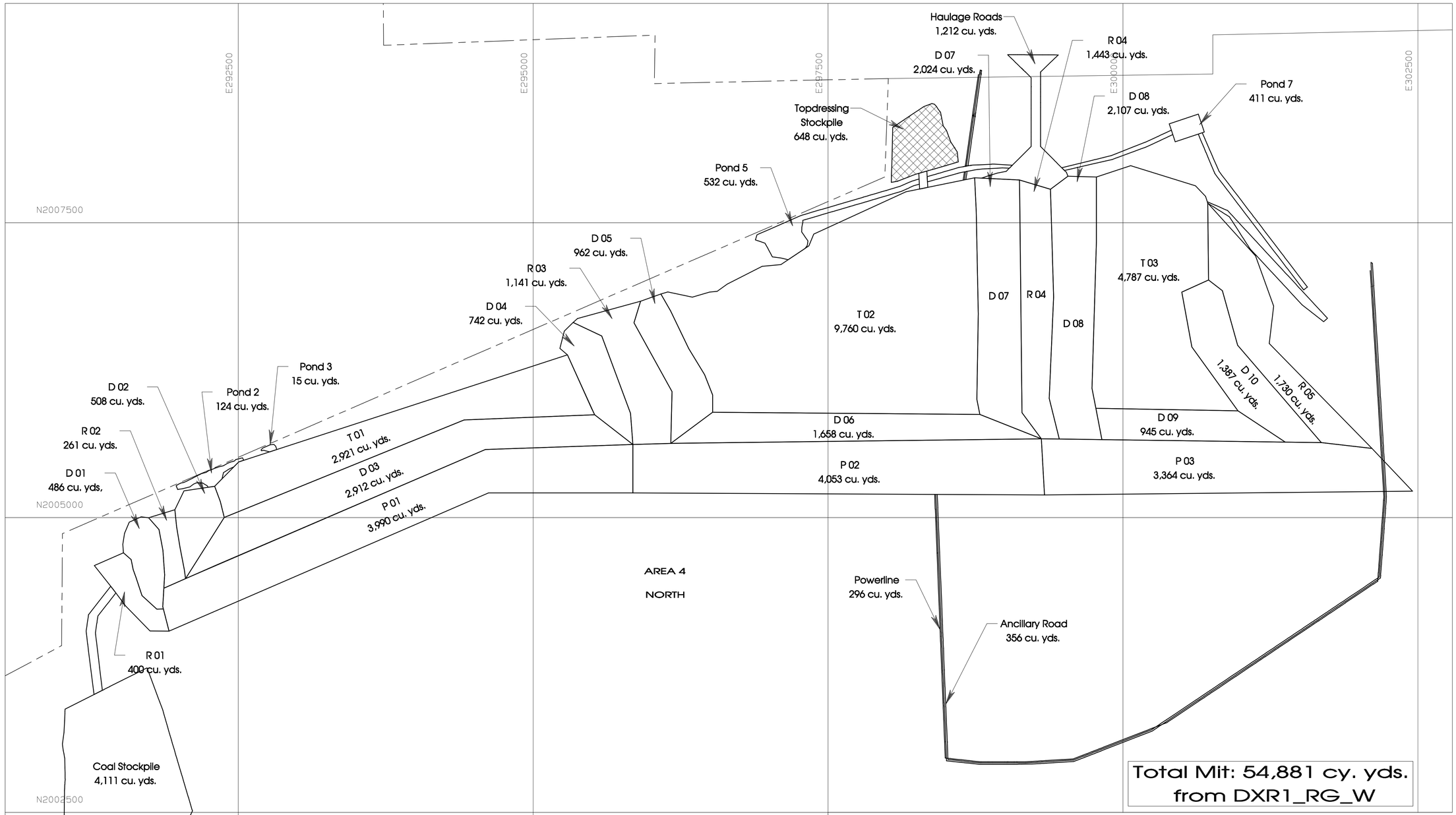
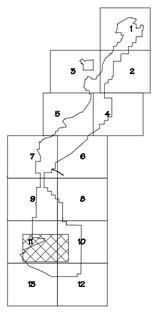


LOCATION MAP

SCALE: 1" = 400'



LEGEND

TOPSOIL STOCKPILE

LEASE BOUNDARY

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 SURVEYOR

DATE
Oct. 17, 2004
May 01, 2009
Feb 2011

REVISION
1 Submitted to OSM for Review.
2 Updated for Permit Renewal and Mitigation Revisions.
3 AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR 1st REVIEW AND APPROVAL.

PROJECT MANAGER: Ferguson Gorman
ENGR. of RECORD: Ron C. Van Valkenburg
REG. NO: 9263
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: AM PERMITTING
DATE: May 01, 2009
DESIGNED BY: K.Logan
DRAWN BY: PJFOSTER
CHECKED BY: K.Logan
APPROVED BY: Ferguson Gorman

LOCATION MAP

EXHIBIT 12-30E AREA-4N
BOND SPOIL MITIGATION
BOND SCENARIO 9/2014

DRAWING

SHEET
OF 0

G:\GeoPermit F:\Cb 12\Exhibit 12-30E_AM OFC\OSM Submit\FEB-2011\2009 BOND DATA\Exh-12-30E_AM_Bond Spoil Bond Scenario.dro
PJFoster Mon Feb 14 08:22:00 2011

MATCH LINE - SEE EXHIBIT 12-6B

LEASE/PERMIT BOUNDARY

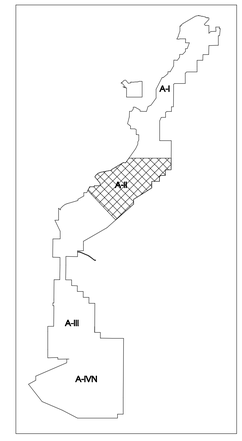
LEASE/PERMIT BOUNDARY

Area-I

Area-II

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 / 5422.45 / L-30 LEASE CORNER
- PERMIT BOUNDARY



REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.	P.S.	CHIEF ENG.
				APPROVALS				
11-A	FEB-2011	PJF	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL. FUTURE ASH DISPOSAL AREA REMOVED	KA	SG	LR		
H	6-08-05	PJF	A2 FSC Revision and submitted to OSM for Review	LR	MC	LR		
G	10-13-04	PJF	A2 FSC Revision and submitted to OSM for Review	LR	MC	LR		
F	8-29-03	PJF	AOC Revision, and submitted to OSM for Review.	LR	MC	LR		
E	3-31-03	PJF	AOC REVISION AND SUBMITTED TO OSM FOR REVIEW.	DJR	MC	LR		
D	6-13-01	PJF	ADDED RE-ALIGNMENT OF THE CHINDE DIVERSION AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	LR	MC	LR		
C	10/21/99	PJF	Added Future Ash Disposal Area Boundary and Submitted to OSM for Approval	CN	MC	LR		
B	05/19/99	PJF	ADDED CHINDE PERMANENT DIVERSION AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	PJF	MC	LR		SNF
A	07/23/98	FTJ	SUBMITTED TO OSM FOR APPROVAL	FTJ				

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND — NEW MEXICO — 6600 — REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 12-6A

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

AREA II
FINAL SURFACE CONFIGURATION

PREPARED BY FTJ	DRAWN BY FTJ	SCALE 1" = 500'
APPROVED BY LR	DATE 07/23/98	REF DWG **EXH. 12-6B**

G:\Gs\Permit F\Ch 12\Exhibit 12-006_A2 AOC\A2 FSC-2005\R5-EXH 12-6A_B.pro

G:\Gs\Permit F\Ch 12\Exhibit 12-006_A2 AOC\A2 FSC-2005\R5-EXH 12-6A_B.pro
PJFOSTER Tue Feb 15 08:14:41 2011

LEASE/PERMIT BOUNDARY

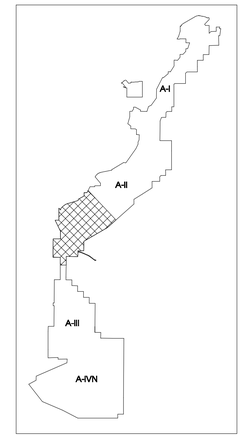
LEASE/PERMIT BOUNDARY

LEASE/PERMIT BOUNDARY

MATCH LINE - SEE EXHIBIT 12-6A

LEGEND

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45
- L-30 LEASE CORNER
- PERMIT BOUNDARY



REV. NO.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.	P.S.	CHIEF ENG.
					APPROVALS			
II-A	FEB-2011	PJF	AREA A NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL. FUTURE ASH DISPOSAL AREA REMOVED.	KA	SO	LR		
G	6-08-05	PJF	A2 FSC Revision and submitted to OSM for Review.	LR	MC	LR		
F	10-13-04	PJF	A2 FSC Revision and submitted to OSM for Review.	LR	MC	LR		
E	8-29-03	PJF	AOC Revision, and submitted to OSM for Review.	LR	MC	LR		
D	3-31-03	PJF	AOC Revision, and submitted to OSM for Review.	DJR	MC	LR		
C	10/21/99	PJF	Added Future Ash Disposal Area Boundary and Submitted to OSM for Approval	CN	MC	LR		
B	05/19/99	PJF	ADDED BLOCK-C AOC AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL.	BH	MC	LR		SW
A	07/23/98	FTJ	SUBMITTED TO OSM FOR APPROVAL	FTJ				

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 12-6B

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

AREA II
FINAL SURFACE CONFIGURATION

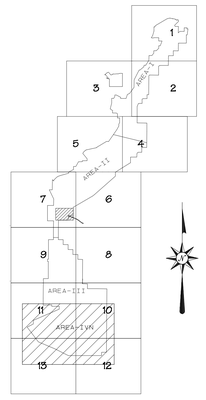
PREPARED BY FTJ	DRAWN BY FTJ	SCALE 1" = 500'
APPROVED BY LR	DATE 07/23/98	REF DWG **EXH. 12-6A**

G:\Gs\Permit F\Ch 12\Exhibit 12-006_A2 AOC\A2 FSC-2005\R5-EXH 12-6A_B.pro

G:\Gs\Permit F\Ch 12\Exhibit 12-006_A2 AOC\A2 FSC-2005\R5-EXH 12-6A_B.pro
PJFOSTER Tue Feb 15 08:14:37 2011

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- LEASE/PERMIT BOUNDARY
- DISTURBANCE LIMIT



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	ENGR.	EG	PE	PLS
				APPROVALS			
11-A	FEB-2011	PJF	AREA 4 NORTH REVISION RESUBMITTAL TO OSM FOR REVIEW AND APPROVAL	RCV	SO	RCV	
A	11-15-04	PJF	SUBMITTED TO OSM FOR APPROVAL	LR	MC	LR	

EXHIBIT 12-7A

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-598-3361

AREA-4N FINAL SURFACE CONFIGURATION

PREPARED BY PJF	DRAWN BY PJFOSTER	SCALE 1"= 500'
APPROVED BY LR	DATE 11-18-04	

G:\Gis\Permit F\Ch 12\Exhibit 12-007_A3 AOC\OSM Subm-Feb-2011\EXH 12-7A_A4N_FSC.prs

Project Desc.: NEW AREA-III AOC/REVISED BY KGUNESC Path: G:\Gis\Permit F\Ch 12\Exhibit 12-007_A3 AOC\OSM Subm-Feb-2011\EXH 12-7A_A4N_FSC.prs
PJFoster _Plot time: Fri Feb 04 10:06:48 2011