

SECTION 23

ROADS

TABLE OF CONTENTS

SECTION	SECTION TITLE	PAGE NUMBER
SECTION 23	ROADS.....	1
23.1	Existing Roads.....	1
23.2	Primary Roads.....	1
23.2.1	Design Criteria.....	1
23.2.2	Construction.....	3
23.2.3	Drainage and Sediment Control.....	4
23.2.4	Operation and Maintenance.....	5
23.2.5	Removal and Reclamation.....	5
23.3	Ancillary Roads.....	5
23.3.1	Design, Construction, and Maintenance.....	5
23.4	Information Collection and Analysis.....	6
	Personnel.....	7
	References.....	7

SECTION 23

ROADS

LIST OF TABLES

TABLE

NUMBER TABLE TITLE

<u>23.2-1</u>	Primary Roads
<u>23.2-2</u>	Primary Road Drainage Structures
<u>23.3-1</u>	Ancillary Roads
<u>23.3-2</u>	Ancillary Road Drainage Structures

SECTION 23

ROADS

LIST OF EXHIBITS

EXHIBIT

NUMBER

EXHIBIT TITLE

<u>23.2-1</u>	Location Map - Roads, Culverts and Watersheds - Sheet 1
<u>23.2-1</u>	Location Map - Road Relief Ditches and Watersheds - Sheet 2
<u>23.2-2</u>	East Haul Road Design - Cover Sheet & Sheet Index - Sheet 1
<u>23.2-2</u>	East Haul Road Design - Site Plan, General Notes and Curve Table - Sheet 2
<u>23.2-2</u>	Plan and Profile: East Haul Road & Service Road - Sheet 3
<u>23.2-2</u>	Plan and Profile: East Haul Road & Service Road - Sheet 4
<u>23.2-2</u>	Plan and Profile: East Haul Road & Service Road - Sheet 5
<u>23.2-2</u>	Plan and Profile: East Haul Road & Service Road - Sheet 6
<u>23.2-2</u>	Plan and Profile: East Haul Road - Sheet 7
<u>23.2-2</u>	Plan and Profile: East Haul Road & Service Road - Sheet 8
<u>23.2-2</u>	Plan and Profile: East Haul Road & Service Road - Sheet 9
<u>23.2-2</u>	Plan and Profile: Service Road Loop - Sheet 10
<u>23.2-2</u>	Plan and Profile: Service Road Loop - Sheet 11
<u>23.2-2</u>	Typical Road Sections, Guardrail Table & Details, Culvert Table & Drainage Details - Sheet 12
<u>23.2-2</u>	Super Elevation Table and Details - Sheet 13
<u>23.3-1</u>	Typical Ancillary Roads Design - Typical Sections and Profiles

SECTION 23

ROADS

LIST OF APPENDICES

APPENDIX

NUMBER APPENDIX TITLE

23.A	Slope Stability Analysis
23.B	East Haul Road Culverts – Hydrologic Analysis and Design
23.C	East Haul Road Relief Ditches – Hydrologic Analysis and Design

SECTION 23

ROADS

LIST OF REVISIONS DURING PERMIT TERM

REV.		DATE
NUMBER	REVISION DESCRIPTION	APPROVED

SECTION 23 ROADS

BHP Navajo Coal Company (BNCC) will utilize both primary and ancillary roads in its mining operations for the Pinabete Mine Plan permit area (permit area). Roads classified as primary consist of roads used to transport coal and spoil, main access roads to the mining areas used by small and heavy equipment, and access roads to the support facilities. Roads classified as ancillary consist of roads used infrequently by small vehicles for accessing environmental monitoring stations, accessing ponds/water control structures, surveying, and power line service/inspections. The haul roads to topsoil stockpiles and temporary roads used during the construction of support facilities are also classified as ancillary roads. Ramps leading from the bottom of the pits to the intersection with the haul roads and roads in the active or immediate mining areas are not classified as either primary or ancillary roads.

23.1 Existing Roads

The use of existing roads will be limited to two-track roads that will be used to access environmental monitoring stations for collection of data. The locations of these roads are presented on [Exhibit 23.2-1](#). They are classified as ancillary roads. Their existing conditions are suitable for the intended use, so no modification or reconstruction is anticipated. The profiles of these roads closely follow the existing topography with no significant cuts or fills. To minimize additional disturbance and adverse environmental impacts, maintenance will be limited to occasional light blading, particularly after heavy precipitation events that may cause damages.

Some of these roads will eventually be disturbed or blocked due to construction of mine support facilities and mining activities. As construction of new mine roads is completed they will be reconnected to the newly constructed roads. The mine permit will be revised accordingly.

23.2 Primary Roads

All primary roads are designed, constructed, and maintained in a manner to facilitate safe operations and minimize adverse environmental impacts. Adequate drainage and erosion control structures are incorporated into the road designs. Information on each primary road segment is presented on [Table 23.2-1](#) and their locations are presented on [Exhibit 23.2-1](#).

23.2.1 Design Criteria

Primary roads are typically designed to meet the applicable performance standards of CFR 30 Subchapter K and the Mine Safety and Health Administration (MSHA) standards and requirements for roads.

Geometric Design

The geometric design of primary roads will be done in a manner to ensure the safe operation of small vehicles and heavy equipment. The layout of the vertical and horizontal curves is for safe sight and

stopping distances of the vehicles using the road. The geometric design (i.e., width, vertical/horizontal curves, crown, safety barriers, etc.) will comply with the design criteria outlined in "Design of Surface Mine Haulage Roads" (Kaufman and Ault 1977).

At elevated roadways, MSHA regulations require a safety barrier along the edge of the road that is capable of deflecting the largest vehicle back onto the road or prevent it from leaving the roadway. An acceptable barrier is an earth berm having a height equal to or greater than the axle height of the largest vehicle using the road. BNCC uses an earth safety berm in road designs at its Pinabete Mine Plan operations. On roads used by heavy mining equipment, whenever the road is elevated 4 feet or more, a 6-foot high safety berm is incorporated into the design template. On roads used by only small vehicles, a 3-foot high safety berm is used.

A 2% crown will be incorporated into the design template to divert surface runoff from the roadway into side ditches or to the toe of safety berms.

Road Structure

To design and construct the road structure to a recognized design criteria or standard would be economically unfeasible due to the very heavy wheel loads imposed by the heavy mining equipment.

Cut and Fill Side Slopes

The steepness of cut and embankment slopes shall be as follows:

1. Cut slopes will not be steeper than 2 horizontal: 1 vertical (2h:1v) in unconsolidated material and not steeper than 1h:1v in consolidated material.
2. Embankment slopes will be 4h:1v when the embankment height is less than 4 feet and 2h:1v with a safety berm when the embankment height is equal to or greater than 4 feet.

Embankment Slope Stability

The minimum static safety factor for road embankments shall be 1.3. To demonstrate this, slope stability analysis was performed on two worst-case scenarios (i.e., maximum embankment height and cut slope). Since all the embankments are to be constructed with similar soils, a worst-case analysis should be sufficient. Slope stability analyses are presented in [Appendix 23.A](#).

Design Storm

All required drainage and sediment control structures (i.e., culverts, side ditches, relief ditches, downdrains, etc.) are designed to pass the peak flow from the 10yr-6hr storm event or larger event.

Design Loads

Culverts and other buried structures within the roadway will be designed to withstand the dead load plus the maximum live surcharge load imposed upon it.

23.2.2 Construction

Road construction will not commence until the regulatory authority approves the designs. Prior to commencing construction, 1 foot of topdressing will be salvaged along the roadways. The salvaged topdressing will be removed and placed either in a stockpile or hauled directly onto a regraded area. If mining activities encroach onto a road and the road needs to be removed, the remaining topdressing beneath the road will be salvaged. Fugitive dust emitted from construction areas will be controlled by watering or by other proven means. The fugitive dust control plan is discussed in Section 40 (Environmental Protection).

Excavation

Excavation or cuts for roads shall conform to the following:

1. To keep surface disturbance to a minimum, the excavation will be limited to the lines and grades indicated on the design drawings.
2. Rock excavation may require blasting; appropriate permits will be obtained prior to commencing blasting activities.

Embankments

The construction of the embankments shall conform to the following:

1. Prior to beginning placement of fill material, the fill area will be cleared of trees, stumps, roots, boulders, vegetation, and rubbish.
2. Only approved suitable fill material free of debris, organic material, frozen matter, and excessive moisture or dryness will be used.
3. Fill material shall be placed in lifts and compacted before placing the next lift. registered professional engineer will specify the degree of compaction required and the thickness of the lifts. No additional lifts will be placed until the specified degree of compaction is achieved.

Installation of Culverts

To insure that the design strength of the culvert is developed, selected fill material shall be placed in lifts around the culvert and compacted. No additional lifts will be placed until the specified degree of compaction is achieved.

23.2.3 Drainage and Sediment Control

Primary roads are designed, constructed and maintained in a manner to minimize the contribution of additional suspended solids to surface runoff leaving the permit area. The primary roads will be located with minimal impact upon existing drainage channels.

Culverts are used unless site conditions or other factors dictate otherwise. At topographical lows or areas where roads intersect drainage channels, surface flows are routed through road embankments with culverts. The placement and orientation of culverts will be in a manner to minimize the alteration of the stream channel. If the stream channel is to be significantly altered, appropriate mitigation measures will be incorporated into the design to minimize the impacts. The inlet and outlet of culverts will be riprapped when required to prevent erosion.

All primary road culverts are designed to safely pass the peak discharge from a 10yr-6hr event or larger event. The watersheds for all the culverts are delineated from contour mapping. Soil curve numbers were determined using data from the Natural Resources Conservation Service soil surveys (Keetch 1980). The curve numbers assigned to the hydrologic groups are: A 65, B 78, C 87, and D 93. Using this data, a weighted curve number was calculated for the watersheds. The precipitation values for the design storm were obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas IV-New Mexico (NOAA 2006). The watersheds and culverts were modeled in SEDCAD to determine the peak flows and the culvert sizes required. If the results from the hydraulic analysis indicate the potential for erosion to occur at the inlet or outlet, riprap rock or other forms of protective lining will be installed.

At transitions from cut to fill a relief ditch is constructed to direct flows along the toe of the road embankment. Additional relief ditches may be needed at the safety berm termination points on the downstream end. The gradient of the relief ditches varies depending on the adjacent topography. The road crown, side ditches, and safety berms direct the surface flows into the relief ditches. The safety berms minimize uncontrolled flows down the slopes of road embankment. The relief ditch watersheds and geometric configuration of the ditches were modeled in SEDCAD to determine the peak flow and if any protective lining will be required in the ditch to control erosion. Only the relief ditches with steep grades and sufficient watershed area are analyzed.

The availability of rock size greater than D_{50} equal to 9 inches is very limited in the local area. Therefore, if results from the hydraulic analysis specify riprap size of D_{50} equal to 12 inches or greater, wire-enclosed riprap will be used in lieu of the size specified. D_{50} equal to 6-inches rock will be placed and enclosed with wire.

Hydrologic and channel information pertinent to the primary road culverts, downdrains, and relief ditches are presented on [Table 23.2-2](#). The appendices containing the supporting design data are referenced on the table. The location of the culverts, relief ditches, downdrains, and their corresponding watersheds are presented on [Exhibit 23.2-1](#).

23.2.4 Operation and Maintenance

Routine road maintenance consists of surface repairs; blading of side ditches and roadway surfaces; application of water and chemical road stabilizers; maintaining drainage control structures to design standards; and maintaining safety berms. Periodic inspections will be conducted to insure proper maintenance and safe operating conditions.

For description of fugitive dust control and the removal and reclamation of primary roads, refer to Section 40 (Environmental Protection) and Section 32 (Temporary Structures and Facilities Removal and Reclamation), respectively.

23.2.5 Removal and Reclamation

Refer to Section 32 (Temporary Structures and Facilities Removal and Reclamation) for removal and reclamation of primary roads.

23.3 Ancillary Roads

Ancillary roads are roads that are used infrequently by small vehicles for accessing environmental monitoring stations, accessing ponds/water control structures, surveying, and servicing/inspecting power lines. The haul roads to topdressing stockpiles and temporary roads used during the construction of the mine support facilities are also classified as ancillary roads; these are utilized infrequently during periods of topsoil removal and construction. They are designed, constructed, and maintained in a manner to minimize adverse environmental impacts. Information on each ancillary road segments is presented on [Table 23.3-1](#) and their locations are presented on [Exhibit 23.2-1](#).

23.3.1 Design, Construction, and Maintenance

New ancillary roads will be constructed to the typical cross section presented on [Exhibit 23.3-1](#). They will primarily be constructed with a motor grader. The road width is typically one blade wide for small vehicles and approximately 80 feet wide for topsoil haulage roads. Their profile will closely traverse the existing topography to minimize cuts and fills or surface disturbance. At topographic lows or where drainages are intersected, the road profile will be constructed flush with the flow line to prevent ponding and restriction of flows in existing drainage channels. In badland areas, it is not unusual to encounter minor drainages (small watersheds) with deeply incised channels. When the road alignment crosses this type of drainage, a culvert is installed to minimize the excavation and surface disturbance. If the results from the hydraulic

analysis indicate the potential for erosion to occur at the inlet or outlet, riprap rock or other forms of protective lining will be installed. Culverts and other drainage or required erosion control structures will be designed to pass the peak flow from the 2yr-6hr storm event. Typical road profiles at drainage crossings are presented on [Exhibit 23.3-1](#).

Hydrologic and channel information pertinent to the ancillary road culverts, and any other required drainage or erosion control structures are presented on [Table 23.3-2](#). The appendices containing the supporting design data are referenced on the table. All culvert locations and corresponding watersheds are presented on [Exhibit 23.2-1](#).

Ancillary roads constructed as described above and to the typical section do not require approval prior to construction. After construction, the actual alignment will be surveyed and added to [Exhibit 23.2-1](#).

Ancillary roads will be maintained in a manner to minimize adverse environmental impacts. To minimize additional surface disturbance, the maintenance is limited to occasional light blading particularly after heavy precipitation that may cause damage. The drainage control structures (i.e., culverts, riprap channels, etc.) will be properly maintained. Periodic inspections will be conducted to insure proper maintenance and safe operating conditions.

Fugitive dust emitted from ancillary roads is expected to be minimal since these roads will be infrequently used. Therefore, they will not be treated or watered to control dust.

For information on the removal and reclamation of ancillary roads, refer to Section 32 (Temporary Structures and Facilities Removal and Reclamation).

If deviations from the typical design, such as significant cuts and fills and the crossing of perennial or intermittent stream channels are required, a site-specific design will be developed for the road in order to demonstrate compliance with performance standards. The road design will be submitted to the regulatory authority for approval. Construction will not commence until the design is approved.

23.4 Information Collection and Analysis

Certified exhibits for Section 23 are available for review upon request at either the BNCC offices or the Office of Surface Mining Reclamation and Enforcement, Western Region technical office in Denver, Colorado. Certified as-built drawings will be kept on file at the mine site and made available upon request.

Personnel

Persons or organizations responsible for data collection, analysis, and preparation of this permit application package section:

Ron Van Valkenburg

GEOMAT, Inc.

Kent Applegate

Farmington, NM

BHP Navajo Coal Company

References

Kaufman, Walter W., and James C. Ault. 1977. Design of Surface Mine Haulage Roads – A Manual. Information Circular 8758. U.S. Department of the Interior, Bureau of Mines, Washington D.C.

Keetch, C. Wesley. 1980. Soil Survey of San Juan County, New Mexico, Eastern Part. United States Department of Agriculture, Soil Conservation Service, Washington, D.C. Survey Available at <http://soildatamart.nrcs.usda.gov/manuscripts/NM618/0/sanjuan.pdf> (Verified March 29, 2012)

NOAA 2006. Precipitation-Frequency Atlas of the United States, Volume 1, Version 4.0: Semiarid Southwest (Arizona, Southeast California, Nevada, New Mexico, Utah). NOAA Atlas 14. U.S. Department of Commerce, Washington D.C.

Table 23.2-1 Primary Roads

Road ID	Purpose	Length (ft)	Width (ft)	Maximum grade (%)	Surface material	Construction date	Removal or reclamation date	Design data
East Haul Road and Service Road Loop	Access/haulage	16,600	120	3.5	Gravel	2023	2041	Section 23.2.1, Exhibit 23.2-2 Sheet 1 to 13
West Haul Road (Future)	Haulage	10,900	80	NA	Gravel	2025	2041	Section 23.2.1

Table 23.2-2 Primary Road Drainage Structures

Road ID	Structure ID	Structure type	Watershed area (ac)	Length (ft)	Width or diameter (ft)	Design drawing	Hydrology and design data
East Haul Road	CP-406	Culvert	9.6	180	2.5	Exhibit 23.2-2	Appendix 23.B
East Haul Road	CP-407	Culvert	448.4	220	5.0	Exhibit 23.2-2	Appendix 23.B
East Haul Road	CP-408	Culvert	6.7	252	2.0	Exhibit 23.2-2	Appendix 23.B
East Haul Road	CP-409	Culvert	148.2	227	3.5	Exhibit 23.2-2	Appendix 23.B
East Haul Road	CP-410	Culvert	248.9	216	4.0	Exhibit 23.2-2	Appendix 23.B
East Haul Road	CP-411	Culvert	266.7	217	4.0	Exhibit 23.2-2	Appendix 23.B
East Haul Road	CP-412	Culvert	76.6	177	3.0	Exhibit 23.2-2	Appendix 23.B
East Haul Road	CP-413	Culvert	4.1	98	2.0	Exhibit 23.2-2	Appendix 23.B
East Haul Road	CP-414	Culvert	156.1	97	3.0	Exhibit 23.2-2	Appendix 23.B
East Haul Road	EHR-RD1	Relief ditch	3.0	30	4.0	Exhibit 23.2-2	Appendix 23.C
East Haul Road	EHR-RD2	Relief ditch	0.3	52	4.0	Exhibit 23.2-2	Appendix 23.C
East Haul Road	EHR-RD3	Relief ditch	2.2	48	4.0	Exhibit 23.2-2	Appendix 23.C
East Haul Road	EHR-RD4	Relief ditch	0.4	26	4.0	Exhibit 23.2-2	Appendix 23.C
East Haul Road	EHR-RD5	Relief ditch	0.5	32	4.0	Exhibit 23.2-2	Appendix 23.C
East Haul Road	EHR-CB1	Relief ditch	4.0	10	10	Exhibit 23.2-2	Appendix 23.C
East Haul Road	EHR-CB2	Relief ditch	4.6	10	10	Exhibit 23.2-2	Appendix 23.C
East Haul Road	EHR-RD6	Relief ditch	0.9	30	4.0	Exhibit 23.2-2	Appendix 23.C
East Haul Road	SRL-RD7	Relief ditch	0.7	32	4.0	Exhibit 23.2-2	Appendix 23.C
East Haul Road	SRL-RD8	Relief ditch	1.4	30	4.0	Exhibit 23.2-2	Appendix 23.C
East Haul Road	SRL-RD9	Relief ditch	3.2	100	4.0	Exhibit 23.2-2	Appendix 23.C

RD = Relief Ditch
 CP = Culvert

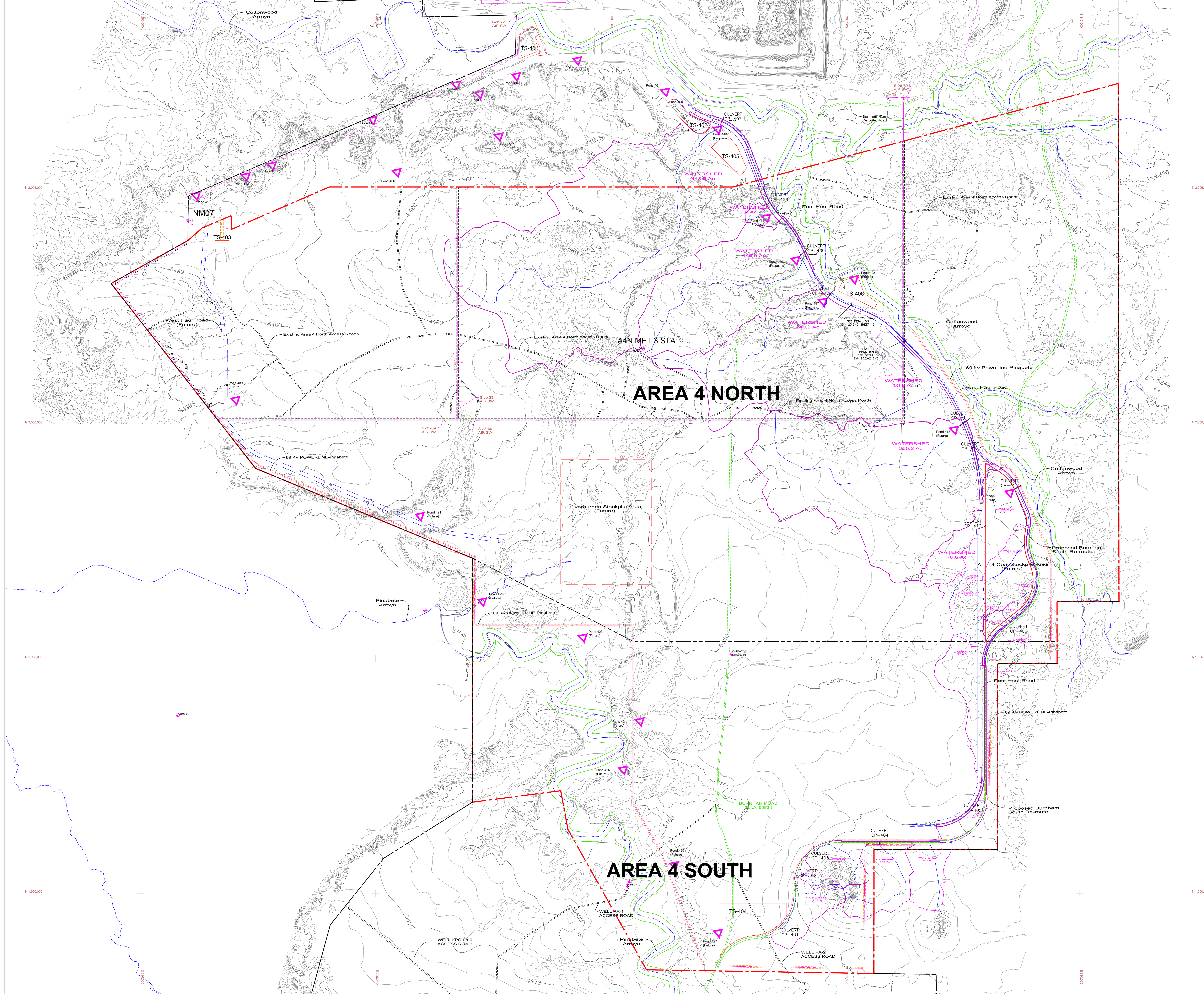
Table 23.3-1 Ancillary Roads

Road ID	Purpose	Length (ft)	Width (ft)	Max. grade (%)	Surface material	Construction date	Removal or reclamation date	Design data
TS-403 Haul Road	Haulage/access	450	60	1.0	Dirt	2016	2041	Section 23.3.1, Exhibit 23.3-1
TS-404 Haul Road <i>[Future]</i>	Haulage/access	<i>[NA]</i>	<i>[NA]</i>	<i>[NA]</i>	Dirt	2025	2041	Section 23.3.1, Exhibit 23.3-1
TS-406 Haul Road <i>[Future]</i>	Haulage/access	<i>[NA]</i>	<i>[NA]</i>	<i>[NA]</i>	Dirt	2023	2041	Section 23.3.1, Exhibit 23.3-1
Well PA-1 Access Road	Access	3,235	12	12.5	Dirt	N/A	2041	Exhibit 23.3-1
Well PA-2 Access Road	Access	2,370	12	3.0	Dirt	N/A	2041	Exhibit 23.3-1
Area 4 North Access Roads	Access	32,000	12	10	Dirt	N/A	2041	Exhibit 23.3-1
Met Station 3 Access Road	Access	3,500	12	9.5	Dirt	N/A	2041	Exhibit 23.3-1
69 kv Powerline-A4N	Access	30,800	12	10	Dirt	2010	2041	Exhibit 23.3-1
69 kv Powerline-Pinabete	Access	40,700	12	10	Dirt	2023	2041	Exhibit 23.3-1

Table 23.3-2 Ancillary Road Drainage Structures

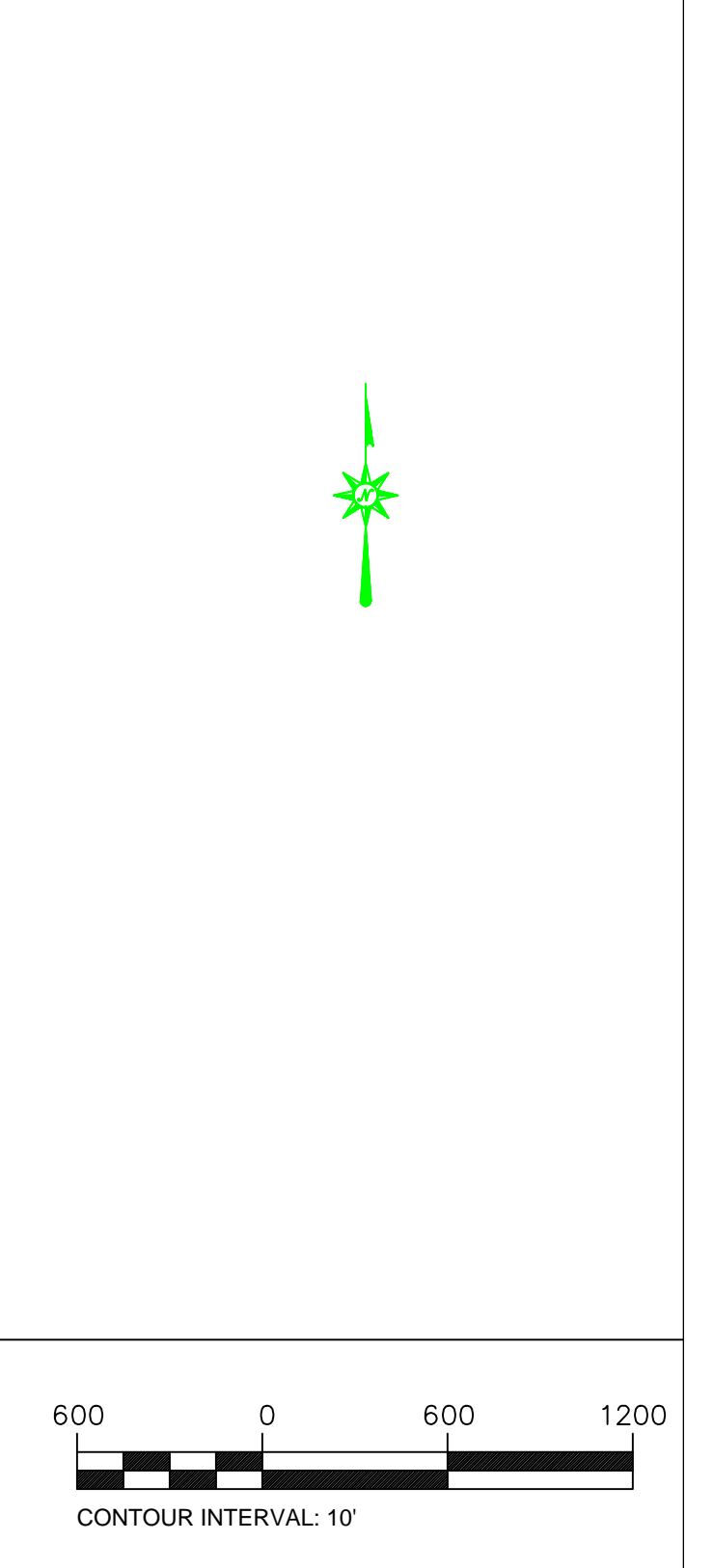
Road ID	Structure ID	Structure type	Watershed area (ac)	Length (ft)	Width or diameter (ft)	Design drawing	Hydrology and design data
<i>[Reserved for future structures]</i>							

RD = Relief Ditch
CP = Culvert



LEGEND

	PRIMARY ROAD
	ANCILLARY ROAD
	PUBLIC ACCESS ROAD
	EXISTING DIRT ROAD
	TRAIL
	BUILDING
	FENCE
	IRRIGATION LINE
	CULVERT
	DAM
	DRAINAGE
	RAILROAD
	TREES
	POWERLINE
	SPOT ELEVATION
	INDEX CONTOUR
	INTERMEDIATE CONTOUR
	HORIZ & VERT. CONTROL
	LEASE CORNER
	LEASE BOUNDARY
	PINABETE PERMIT BOUNDARY
	MONITORING SITES
	WATERSHED BOUNDARY
	POND LOCATION POINTS



Topo Revised by
Aero-Graphics, Inc.
 2930 South West Temple
 Salt Lake City, Utah 84115

- Notes:
- The design data for primary roads are referenced on Table 23.2-1 Pinabete PAP.
 - Typical profile and sections for ancillary roads are presented on Exhibit 23.3-1
 - The hydrology and supporting design data for the drainage control structures are referenced on Table 23.2-2 of the Pinabete PAP.

Original certified signed exhibits are maintained at the mine site and at GSA.

DATE	BY	REVISION	DESCRIPTION

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.

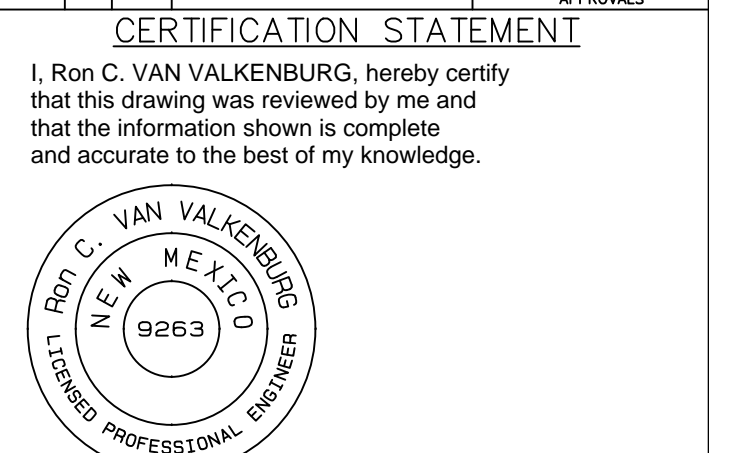
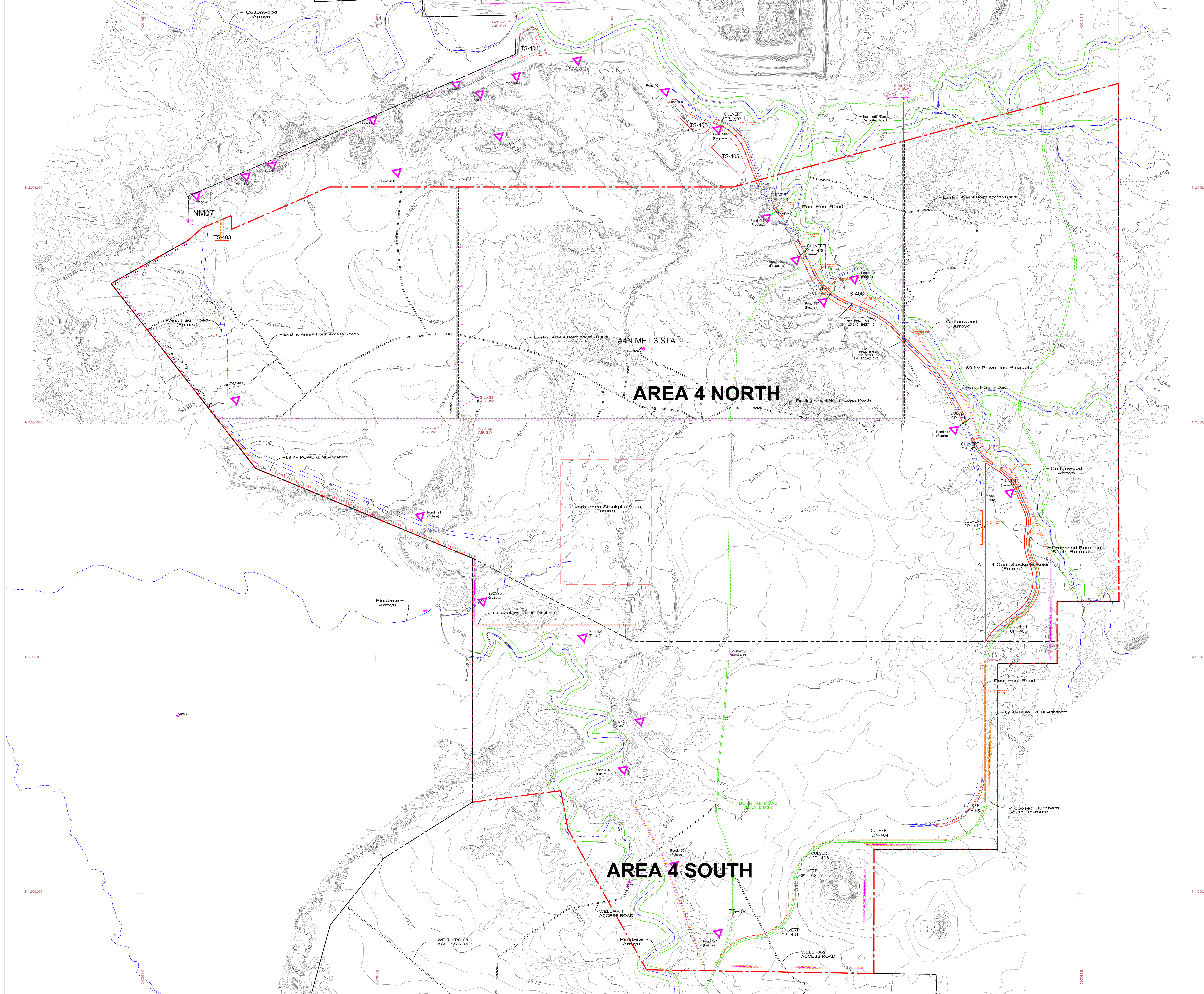


EXHIBIT 23.2-1 SHEET 1
 BHP NAVAJO COAL COMPANY



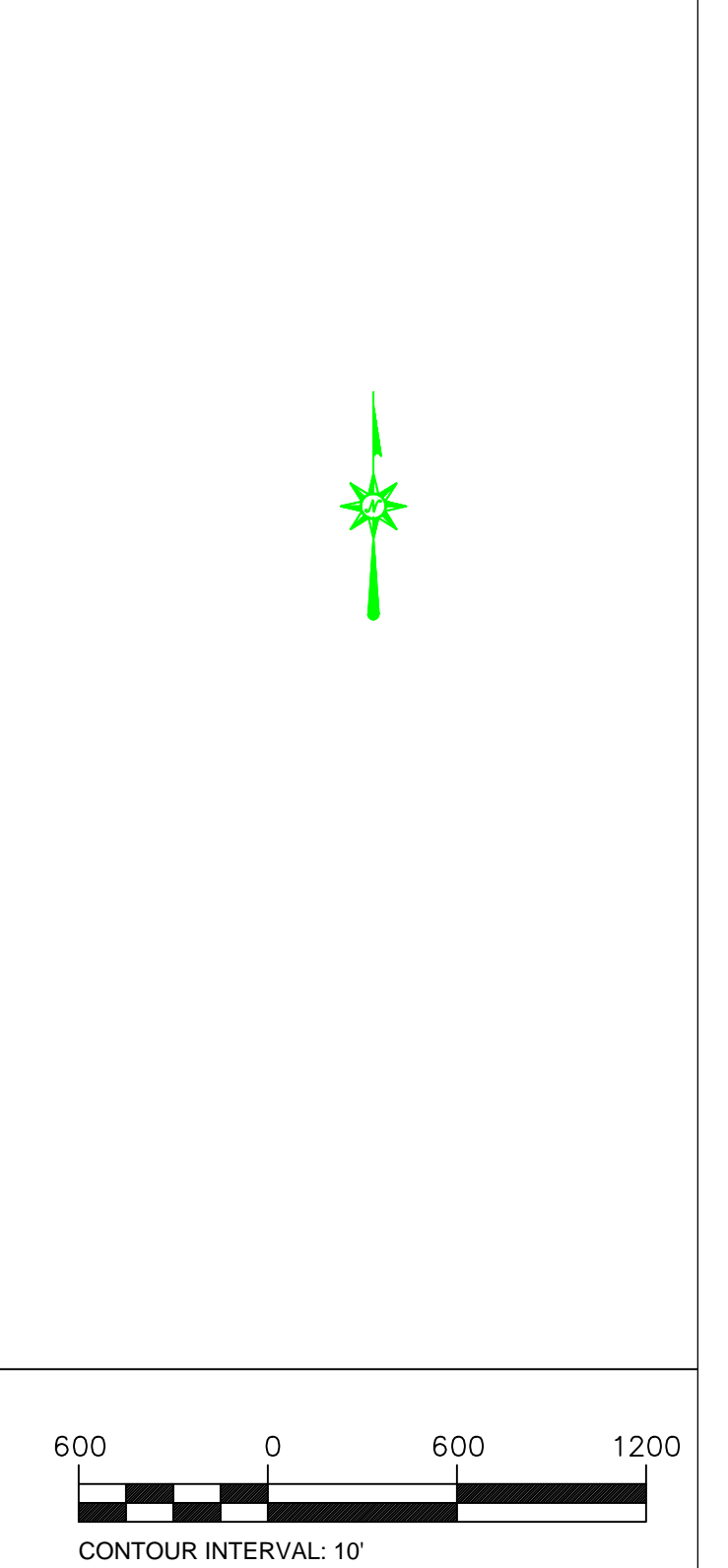
P.O. BOX 1717 PHOENIX, ARIZONA 85006-0177
 PHOENIX, ARIZONA 85006-0177
 PINABETE PERMIT
 ROADS, CULVERTS
 AND WATERSHEDS

PREPARED BY rv DRAWN BY ry SCALE: 1" = 600'
 APPROVED BY cn DATE Feb. 2012 Sheet 1 of 2



LEGEND

	PRIMARY ROAD
	ANCILLARY ROAD
	PUBLIC ACCESS ROAD
	EXISTING DIRT ROAD
	TRAIL
	BUILDING
	FENCE
	IRRIGATION LINE
	CULVERT
	DAM
	DRAINAGE
	RAILROAD
	TREES
	POWERLINE
	SPOT ELEVATION
	INDEX CONTOUR
	INTERMEDIATE CONTOUR
	218 HORIZ & VERT. CONTROL
	L-30 LEASE CORNER
	LEASE BOUNDARY
	PINABETE PERMIT BOUNDARY
	MONITORING SITES
	WATERSHED BOUNDARY
	POND LOCATION POINTS



Topo Revised by
Aero-Graphics, Inc.
 2930 South West Temple
 Salt Lake City, Utah 84115

- Notes:
- The design data for primary roads are referenced on Table 23.2-1 Pinabete PAP.
 - Typical profile and sections for ancillary roads are presented on Exhibit 23.3-1.
 - The hydrology and supporting design data for the drainage control structures are referenced on Table 23.2-2 of the Pinabete PAP.

Original certified signed exhibits are maintained at the mine site and at GSA.

REV	DATE	BY	DESCRIPTION

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.



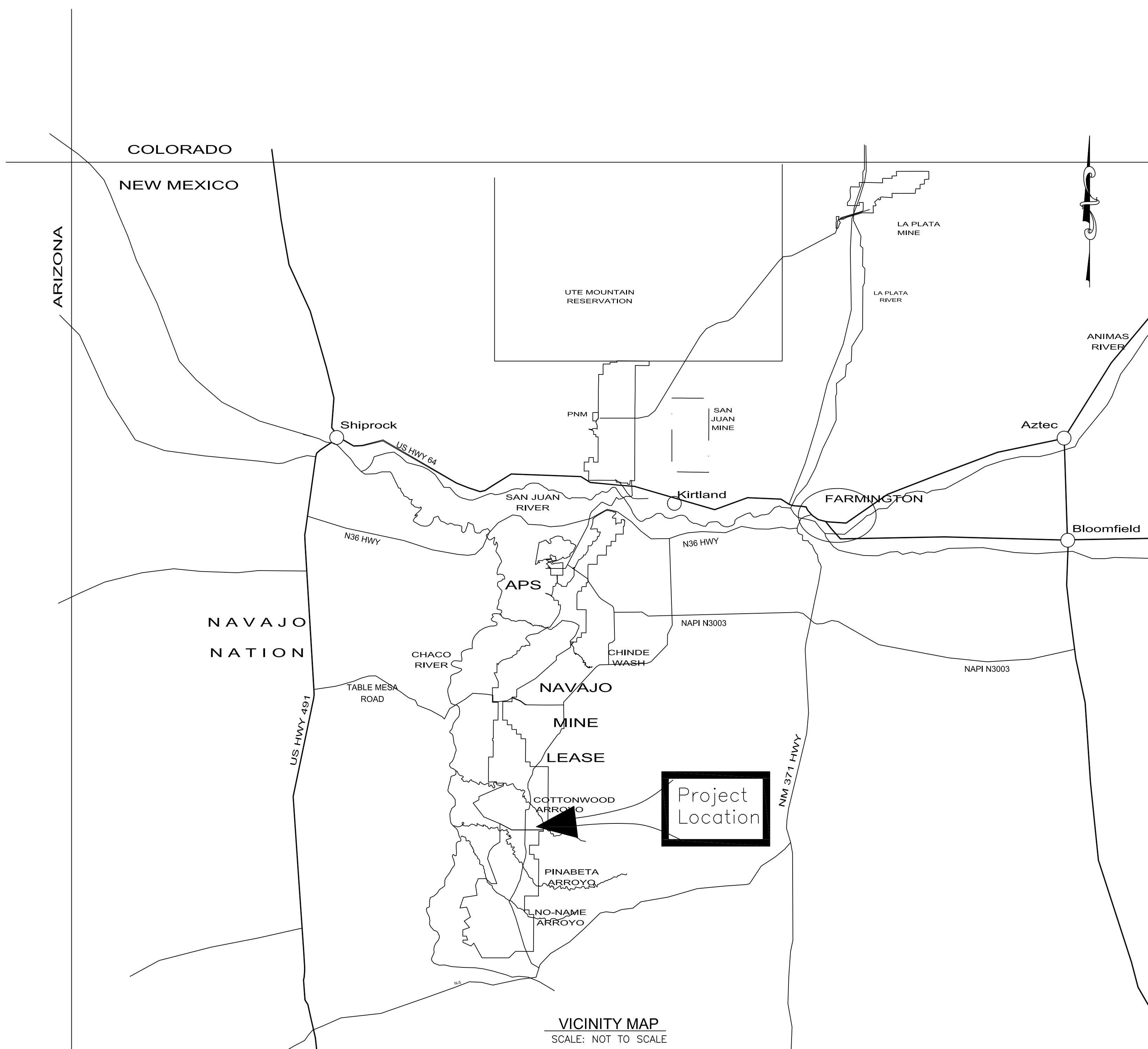
EXHIBIT 23.2-1 SHEET 2
BHP NAVAJO COAL COMPANY



PINABETE PERMIT LOCATION MAP ROAD RELIEF DITCHES AND WATERSHEDS

PREPARED BY rv DRAWN BY ry SCALE: 1" = 600'
 APPROVED BY cn DATE Feb. 2012 Sheet 2 of 2

EAST HAUL ROAD DESIGN PINABETE PERMIT BHP NAVAJO COAL COMPANY EXHIBIT 23.2-2

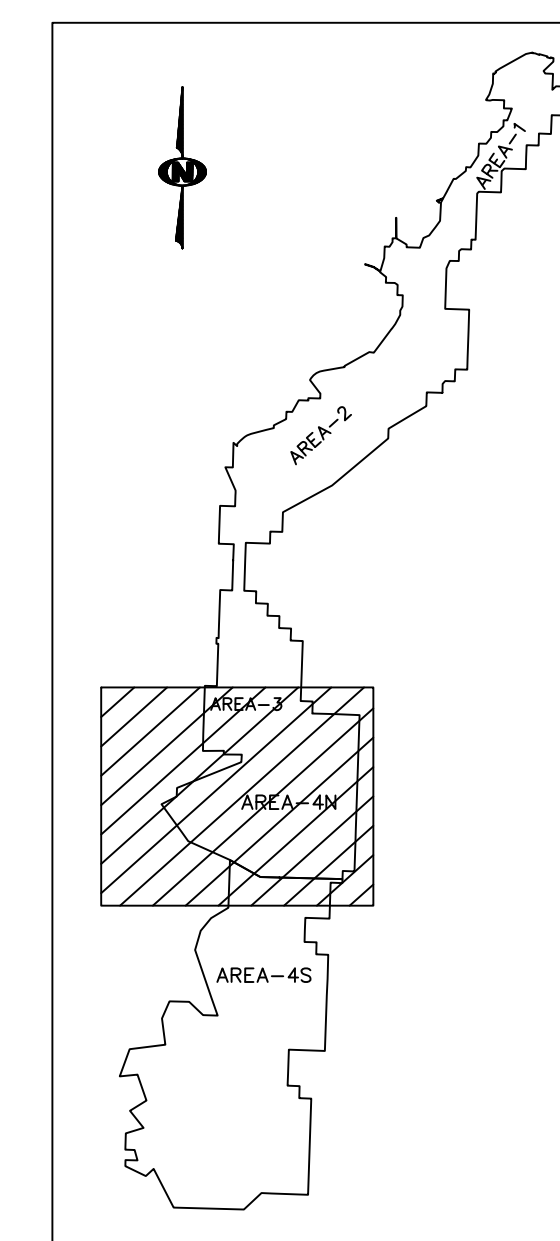


INDEX OF SHEETS	
SHEET NO.	DESCRIPTION
1	COVER SHEET AND SHEET INDEX
2	SITE PLAN, GENERAL NOTES AND CURVE TABLE
3	PLAN AND PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 154+00 TO 183+00
4	PLAN AND PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 183+00 TO 212+00
5	PLAN AND PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 212+00 TO 241+00
6	PLAN AND PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 241+00 TO 270+00
7	PLAN AND PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 270+00 TO 298+00
8	PLAN AND PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 298+00 TO 326+00
9	PLAN AND PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 326+00 TO 348+00
10	PLAN AND PROFILE: SERVICE ROAD LOOP STA 0+00 TO 29+00
11	PLAN AND PROFILE: SERVICE ROAD LOOP STA 29+00 TO 57+66
12	TYPICAL ROAD SECTIONS, GUARDRAIL TABLE & DETAILS, CULVERT TABLE & DRAINAGE DETAILS
13	SUPER ELEVATION TABLE AND DETAILS

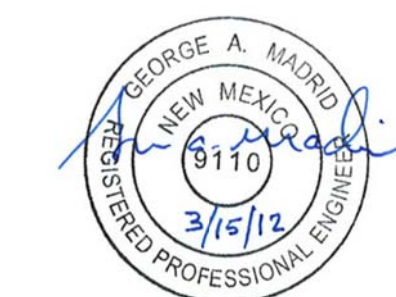
PROJECT LENGTH			
ROAD	LENGTH, ft.	LENGTH, miles	
EAST HAUL ROAD			
BEGINNING STATION 154+00			
ENDING STATION 348+00	19,400.00	3.67	
SERVICE ROAD LOOP -			
BEGINNING STATION 0+00			
ENDING STATION 57+65.72	5,765.72	1.09	
TOTAL	25,165.72	4.76	

Design Data	
Max. Super Elevation	4 %
Maximum Gradient	6 %
Min. Stopping Sight Distance	460 ft
Design Speed Limit	45 mph
Posted Speed Limit	45 mph

LEGEND	
	BURNHAM SOUTH ROAD
	EAST HAUL ROAD
	SERVICE ROAD & SERVICE ROAD LOOP
	PAVED ROAD
	DIRT ROAD
	TRAIL
	BUILDING
	FENCE
	IRRIGATION LINE
	CULVERT
	LOW SPOT ELEVATION
	DRAINAGE
	RAILROAD
	TREES
	POWERLINE
	SPOT ELEVATION
	INDEX CONTOUR
	INTERMEDIATE CONTOUR
	HORIZ. & VERT. CONTROL
	LEASE CORNER
	LEASE BOUNDARY
	PERMIT BOUNDARY



CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT INC.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

REV. NO.	DATE	COMMENT
1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL

EXHIBIT 23.2-2



BHP Navajo Coal Company
P.O. Box 1717 • Farmington, NM 87416 • Phone: 505-568-4200
Fac: 505-568-3261

PINABETE PERMIT

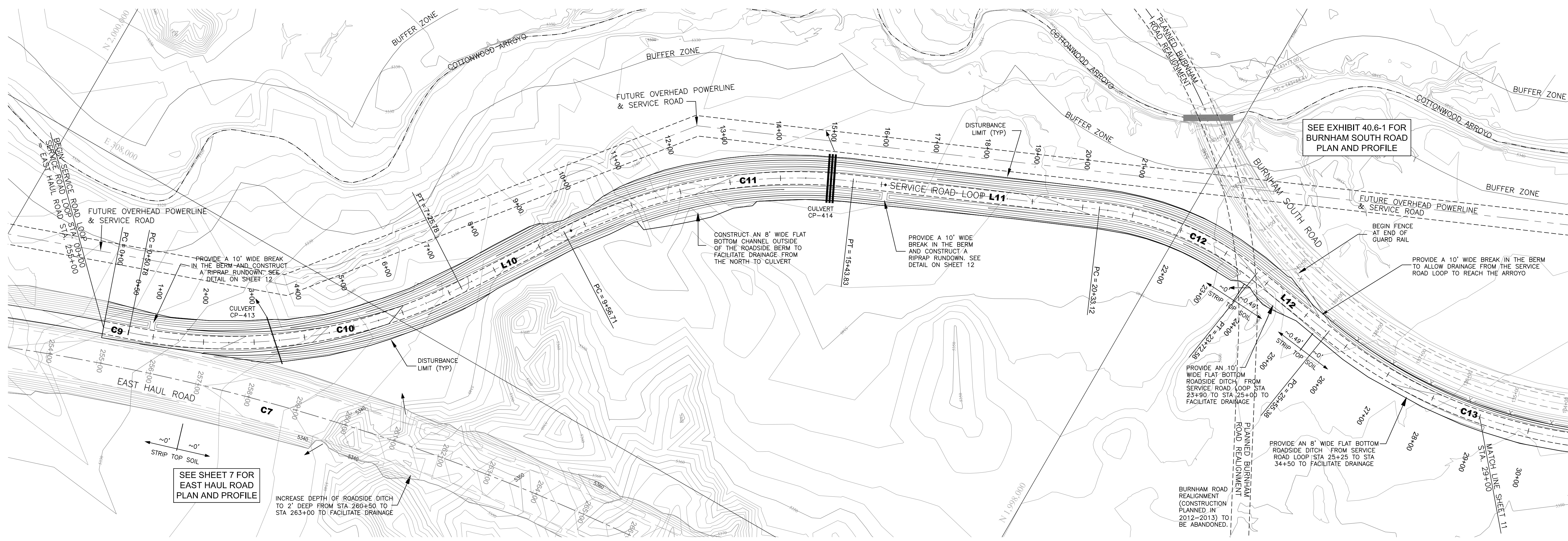
EAST HAUL ROAD DESIGN
COVER SHEET & SHEET INDEX

SHEET: 1 OF 13

PREPARED BY: BT&PR DRAWN BY: BT&PR SCALE: AS SHOWN
APPROVED BY: GM DATE: 02-07-2012
GEOMAT PROJECT NO. 112-1434

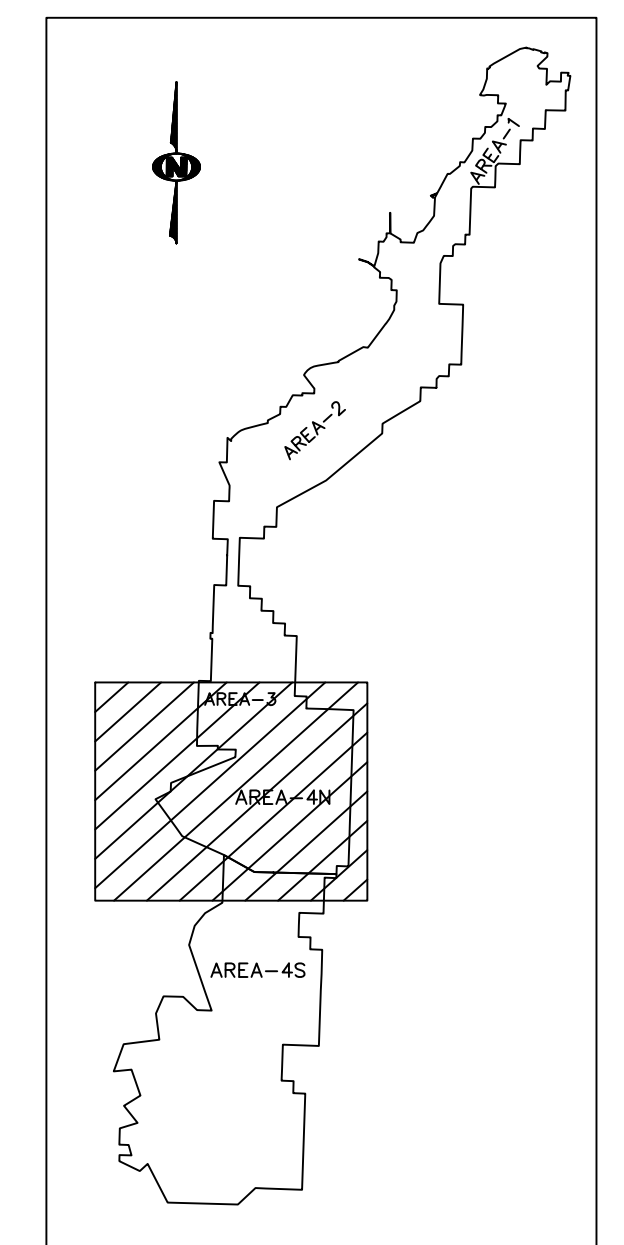
THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

NOT ISSUED FOR CONSTRUCTION



LEGEND

- BURNHAM SOUTH ROAD
- EAST HAUL ROAD
- SERVICE ROAD & SERVICE ROAD LOOP
- PAVED ROAD
- DIRT ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- LOW SPOT ELEVATION
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5360 INDEX CONTOUR
- 5338.5 INTERMEDIATE CONTOUR
- △ 218 5422.45 HORIZ. & VERT. CONTROL
- + L-30 LEASE CORNER
- LEASE BOUNDARY
- PERMIT BOUNDARY



NOTE: CULVERTS ARE TO BE INSTALLED AT EXISTING GRADE - NOT BURIED.

THESE PLANS ILLUSTRATE THE DESIGN OF THE PROPOSED EAST HAUL ROAD AND SERVICE ROAD LOOP AND ASSUME THAT THEY WILL BE CONSTRUCTED CONCURRENTLY WITH THE BURNHAM SOUTH ROAD. SEE EXHIBIT 40.6-1 FOR THE DESIGN OF THE BURNHAM SOUTH ROAD. IF CONSTRUCTION IS NOT PERFORMED CONCURRENTLY PROVIDE TEMPORARY GRADING TO FACILITATE DRAINAGE.

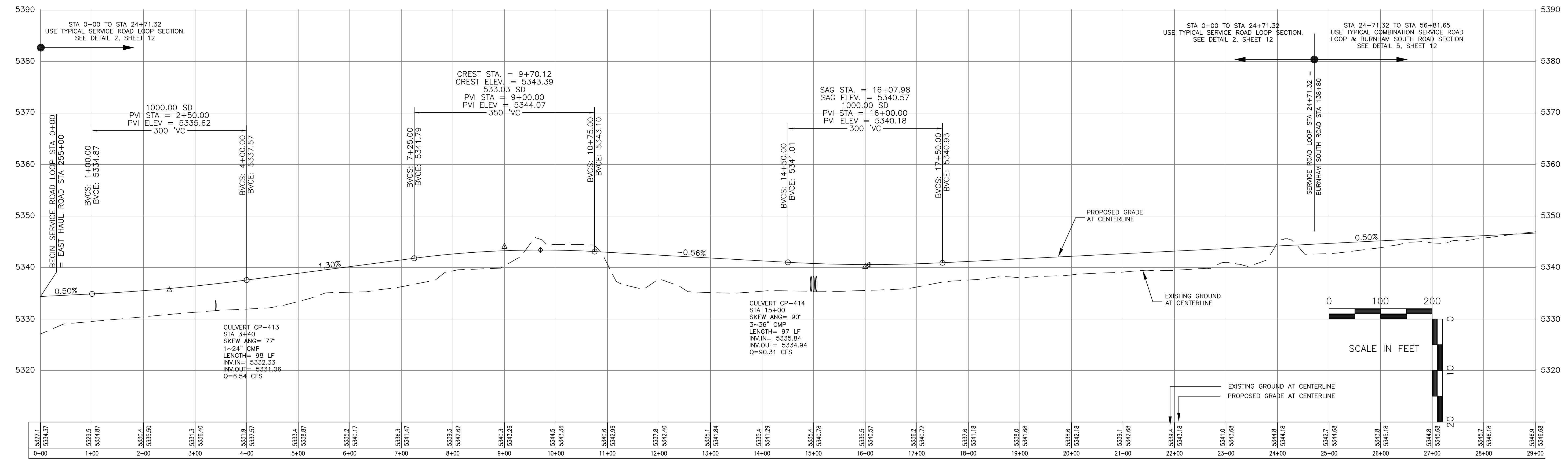
SERVICE ROAD LOOP
STA 0+00 TO 29+00

0 100' 200'

SCALE: 1" = 100'

SERVICE ROAD LOOP LINE AND CURVE TABLE

LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING	CURVE	LENGTH	RADIUS	DELTA ANGLE	TANGENT	CHORD BRG	CHORD
C9	50.78'						C9	50.78'	4570.50'	00°38'12" Right	25.39'	S 18°46'57" E	50.78'
L10	230.93'	S 57°08'20" E	1999172.68	308117.32	1999047.38	308311.30	C10	675.00'	1000.00'	38°40'29" Left	350.93'	S 37°48'05" E	662.26'
L11	489.30'	S 23°29'59" E	1998606.14	308685.76	1998157.42	308880.86	C11	587.11'	1000.00'	33°38'21" Right	302.29'	S 40°19'09" E	578.72'
L12	182.81'	S 08°54'56" W	1997825.19	308923.38	1997644.59	308895.05	C12	339.45'	600.00'	32°24'58" Right	174.40'	S 07°17'33" E	334.94'
L13	524.07'	S 51°49'39" W	1995992.63	308739.28	1995668.73	308327.29	C13	607.90'	996.42'	34°57'20" Left	313.74'	S 08°33'44" E	598.52'
							C14	1177.05'	863.58'	78°05'34" Right	700.48'	S 13°00'23" W	1088.03'
							C15	901.32'	996.42'	51°49'39" Left	484.13'	S 25°54'49" W	870.90'



SERVICE ROAD LOOP
STA 0+00 TO 29+00

1"=100'H, 1"=10'V

THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

NOT ISSUED FOR CONSTRUCTION

CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT INC.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

REV. NO.	DATE	INITIAL PERMIT SUBMITTAL	COMMENT
1	03-15-12	REVISED TITLE & TITLE BLOCK	
0	02-07-12	INITIAL PERMIT SUBMITTAL	

EXHIBIT 23.2-2

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717 Fruitland, New Mexico, 87416 Phone: 505-598-4200 Fax: 505-598-1361

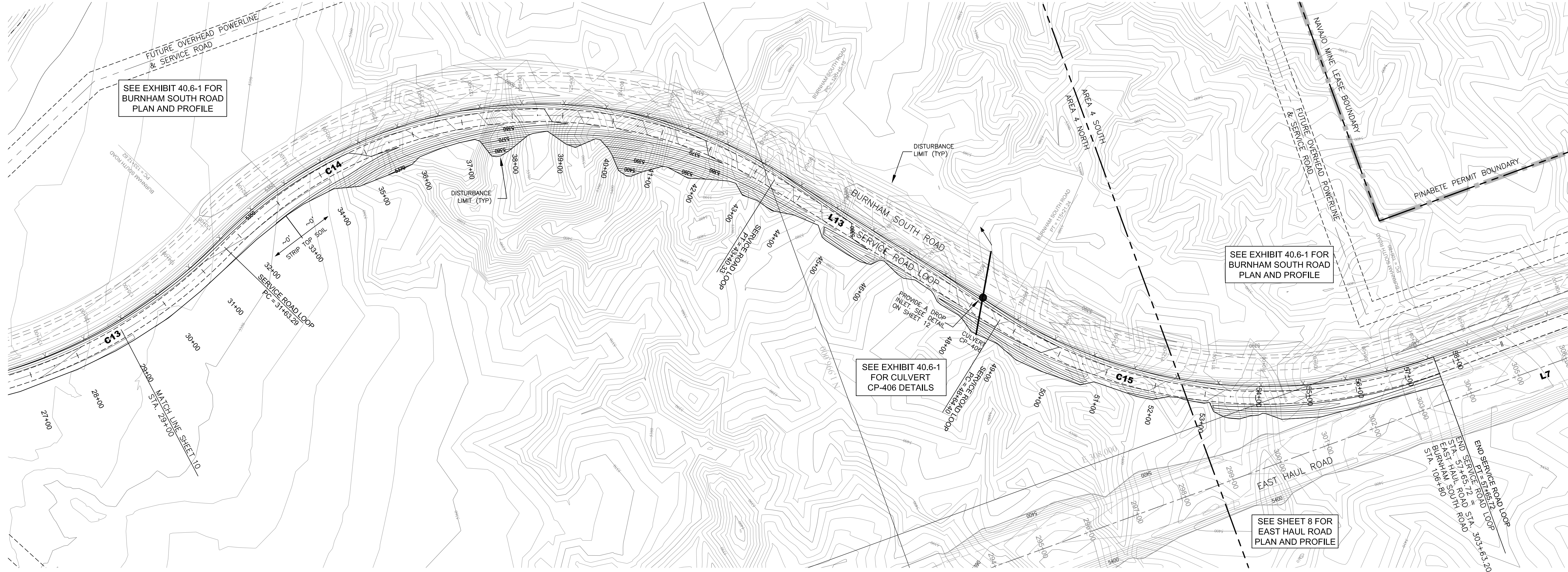
PINABETE PERMIT

PLAN & PROFILE:
SERVICE ROAD LOOP
STA 0+00 TO 29+00

SHEET: 10 OF 13

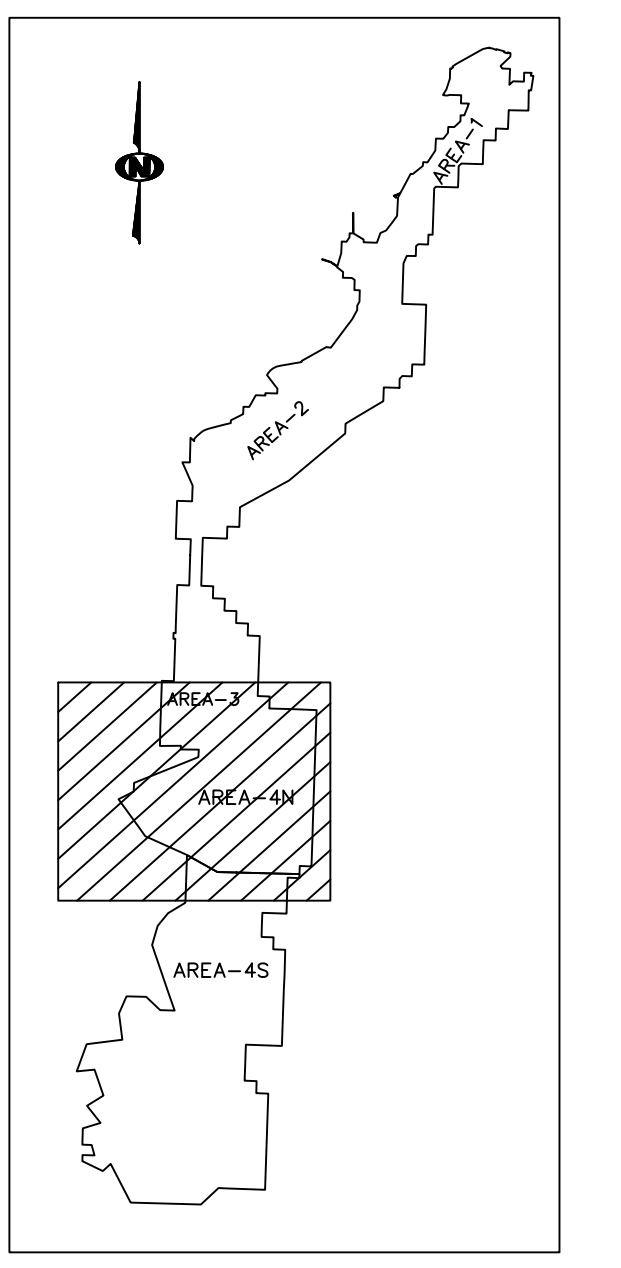
PREPARED BY: BT&PR DRAWN BY: BT&PR SCALE: AS SHOWN
APPROVED BY: GM DATE: 02-07-2012

GEOMAT PROJECT NO. 112-1434



LEGEND

- BURNHAM SOUTH ROAD
- EAST HAUL ROAD
- SERVICE ROAD & SERVICE ROAD LOOP
- PAVED ROAD
- DIRT ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- LOW SPOT ELEVATION
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5360 INDEX CONTOUR
- △ 218 5422.45 INTERMEDIATE CONTOUR
- + L-30 LEASE CORNER
- - - LEASE BOUNDARY
- - - PERMIT BOUNDARY

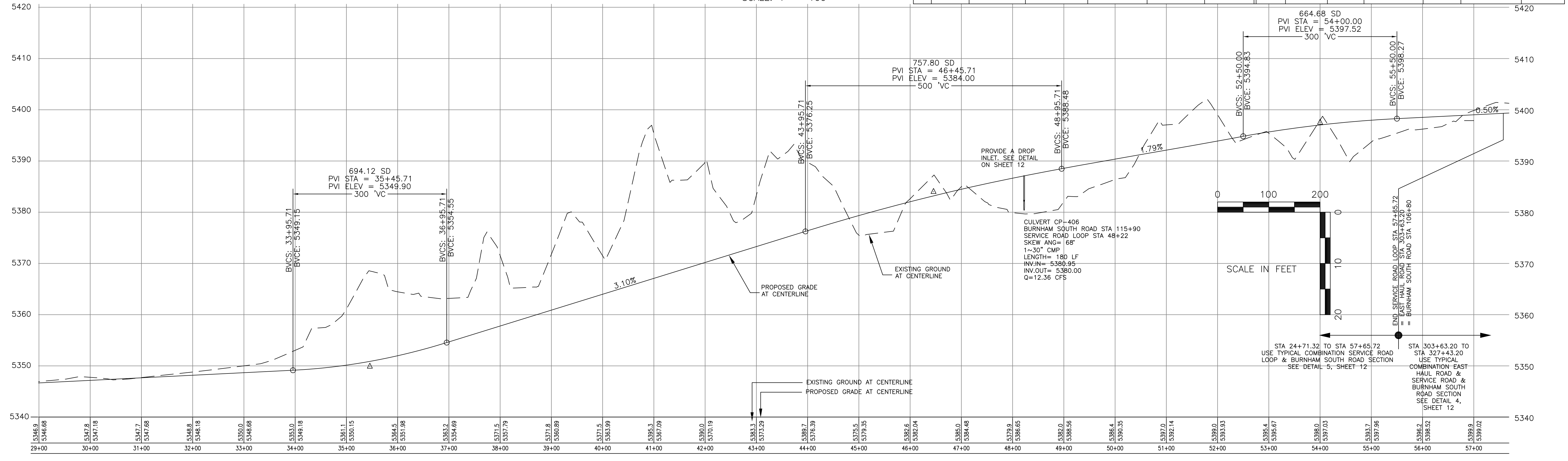


NOTE: CULVERTS ARE TO BE INSTALLED AT EXISTING GRADE - NOT BURIED. THESE PLANS ILLUSTRATE THE DESIGN OF THE PROPOSED EAST HAUL ROAD AND SERVICE ROAD LOOP AND ASSUME THAT THEY WILL BE CONSTRUCTED CONCURRENTLY WITH THE BURNHAM SOUTH ROAD. SEE EXHIBIT 40.6-1 FOR THE DESIGN OF THE BURNHAM SOUTH ROAD. IF CONSTRUCTION IS NOT PERFORMED CONCURRENTLY PROVIDE TEMPORARY GRADING TO FACILITATE DRAINAGE.

SERVICE ROAD LOOP
STA 29+00 TO 57+65.72
SCALE: 1" = 100'

SERVICE ROAD LOOP LINE AND CURVE TABLE

LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING	CURVE	LENGTH	RADIUS	DELTA ANGLE	TANGENT	CHORD BRC	CHORD
L10	230.93'	S 57°08'20" E	1999172.68	308117.32	1999047.38	308311.30	C11	587.11'	1000.00'	33°38'21" Right	302.29'	S 40°19'09" E	578.72'
L11	489.30'	S 23°29'59" E	1998606.14	308685.76	1998157.42	308880.86	C10	675.00'	1000.00'	38°40'29" Left	350.93'	S 37°48'05" E	662.26'
L12	162.61'	S 08°54'56" W	1997825.19	308923.38	1997644.59	308895.05	C12	339.45'	600.00'	32°24'55" Right	174.40'	S 07°17'32" E	334.94'
L13	524.07'	S 51°49'39" W	1995992.63	308739.28	1995668.73	308327.29	C14	1177.05'	863.58'	78°05'34" Right	700.48'	S 13°00'23" W	1088.03'
							C15	901.32'	996.42'	51°49'39" Left	484.13'	S 25°54'49" W	870.90'



SERVICE ROAD LOOP
STA 29+00 TO 57+65.72
1"=100'H, 1"=10'V

THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

NOT ISSUED FOR CONSTRUCTION

CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT inc.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

REV. NO.	DATE	COMMENTS
1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL

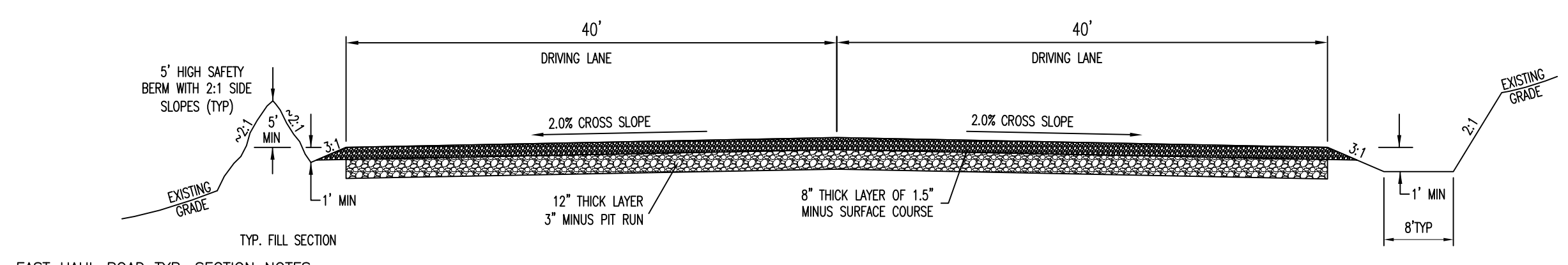
EXHIBIT 23.2-2

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717 Fruitland, New Mexico 87416 Phone: 505-598-4200 Fax: 505-598-1361

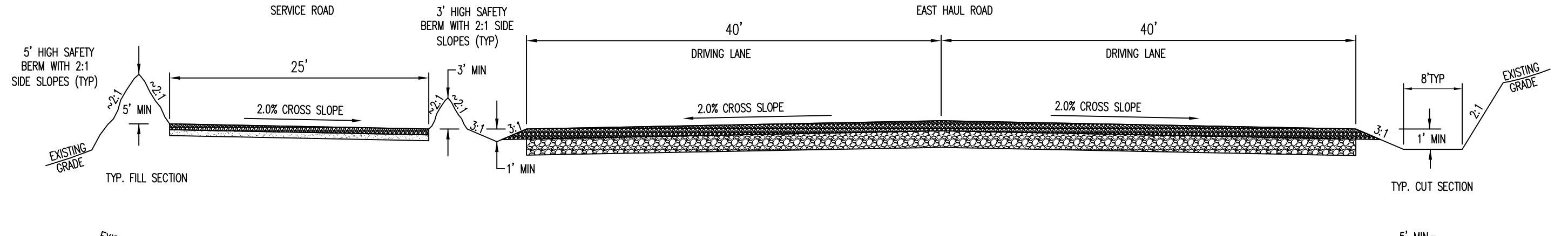
PINABETE PERMIT
PLAN & PROFILE:
SERVICE ROAD LOOP
STA 29+00 TO 57+66

SHEET: 11 OF 13
PREPARED BY: BT&PR DRAWN BY: BT&PR SCALE: AS SHOWN
APPROVED BY: GM DATE: 02-07-2012
GEOMAT PROJECT NO. 112-1434

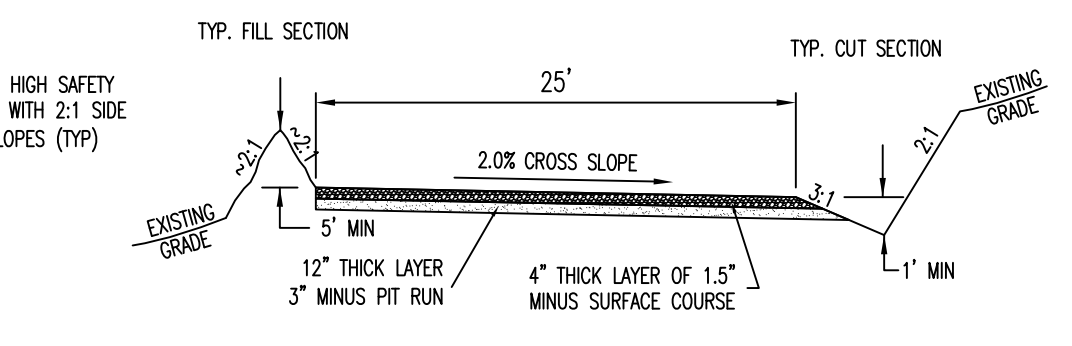


EAST HAUL ROAD TYP. SECTION NOTES:
 1. ALL EMBANKMENT AND SUB-GRADE TO BE COMPACTED PER NMDOT SECTION 207.
 2. NATIVE SUB-GRADE TO BE SCARIFIED, MOISTURE CONDITIONED AND COMPACTED TO 95% MIN OF 199 PROCTOR AT NEAR OPTIMUM MOISTURE.
 3. SUB-BASE PIT RUN TO BE OBTAINED FROM A BORROW AREA AS DESIGNATED BY BHP NAVAJA COAL COMPANY. COMPACT PIT RUN SUB-BASE TO 95% MIN OF 199 PROCTOR AT NEAR OPTIMUM MOISTURE.
 4. SURFACE COURSE TO BE AGGREGATE BASE COURSE COMPACTED TO 95% MIN OF 1180 PROCTOR AT NEAR OPTIMUM MOISTURE.

1 TYPICAL EAST HAUL ROAD SECTION
N.T.S.

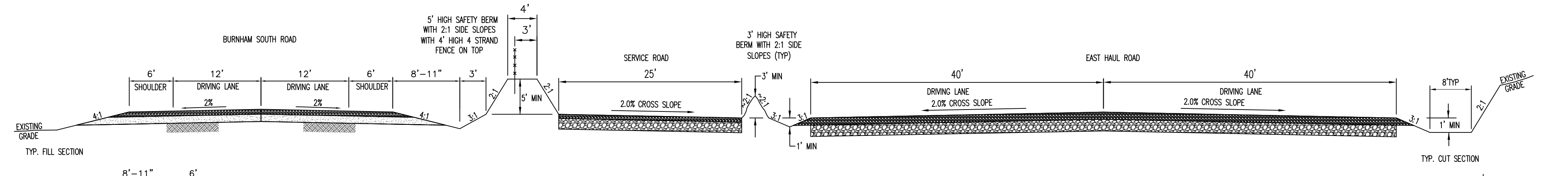


3 TYPICAL COMBINATION EAST HAUL ROAD & SERVICE ROAD SECTION
N.T.S.
SEE TYPICAL SECTION 1, & 2 FOR ADDITIONAL NOTES

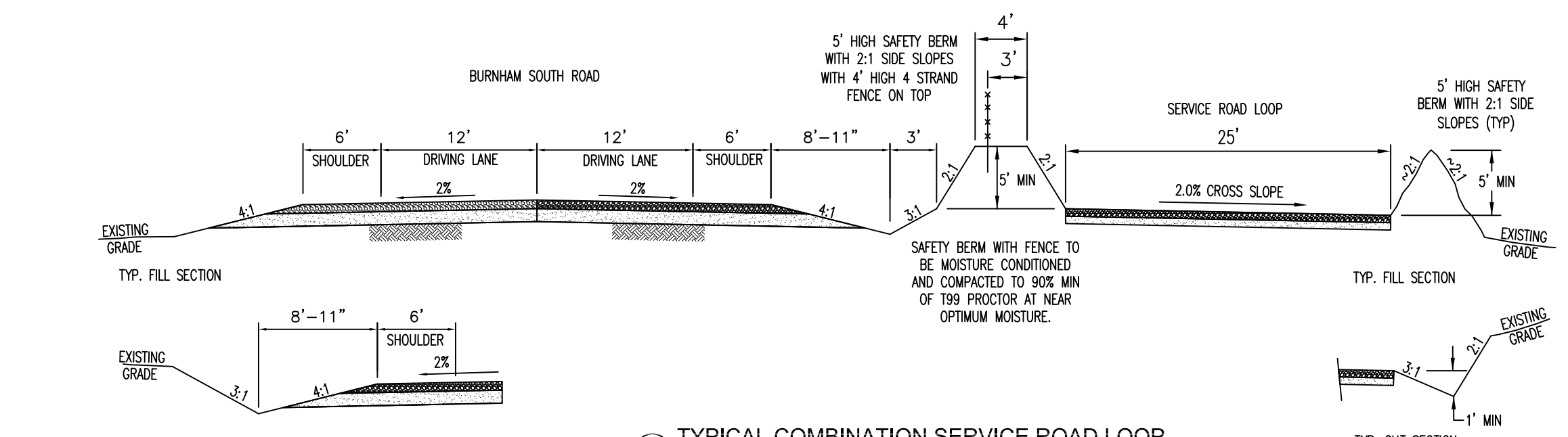


SERVICE ROAD LOOP NOTES:
 1. ALL EMBANKMENT AND SUB-GRADE TO BE COMPACTED PER NMDOT SECTION 207.
 2. NATIVE SUB-GRADE TO BE SCARIFIED, MOISTURE CONDITIONED AND COMPACTED TO 95% MIN OF 199 PROCTOR AT NEAR OPTIMUM MOISTURE.
 3. SURFACE COURSE TO BE AGGREGATE BASE COURSE COMPACTED TO 95% MIN OF 1180 PROCTOR AT NEAR OPTIMUM MOISTURE.
 4. CROSS-SLOPE DIRECTION TO BE AS INDICATED ON THE PLAN. TYPICAL CROSS-SLOPE IS TO THE INSIDE OF CURVES.

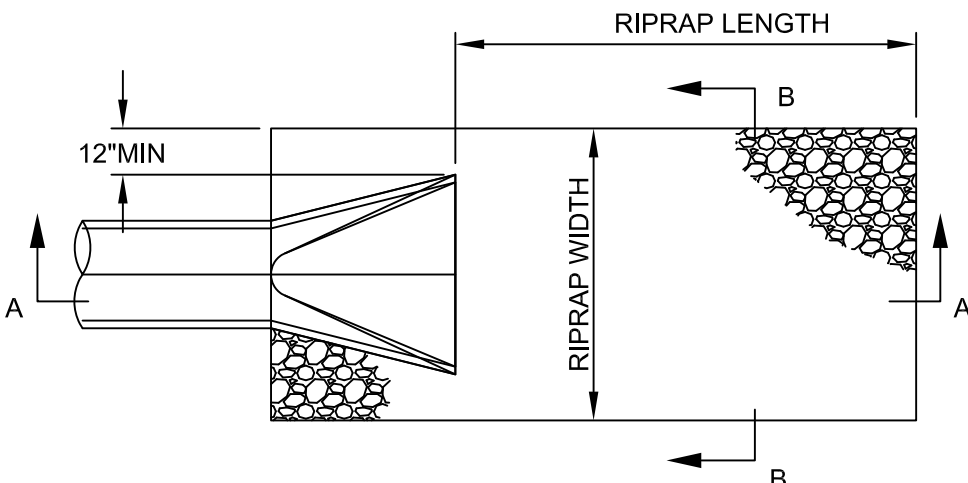
2 TYPICAL SERVICE ROAD LOOP SECTION
N.T.S.



4 TYPICAL COMBINATION EAST HAUL ROAD & SERVICE ROAD & BURNHAM SOUTH ROAD SECTION
N.T.S.
SEE TYPICAL SECTIONS 1 & 2 FOR ADDITIONAL NOTES



5 TYPICAL COMBINATION SERVICE ROAD LOOP & BURNHAM SOUTH ROAD SECTION
N.T.S.
SEE TYPICAL SECTION 2 FOR ADDITIONAL NOTES

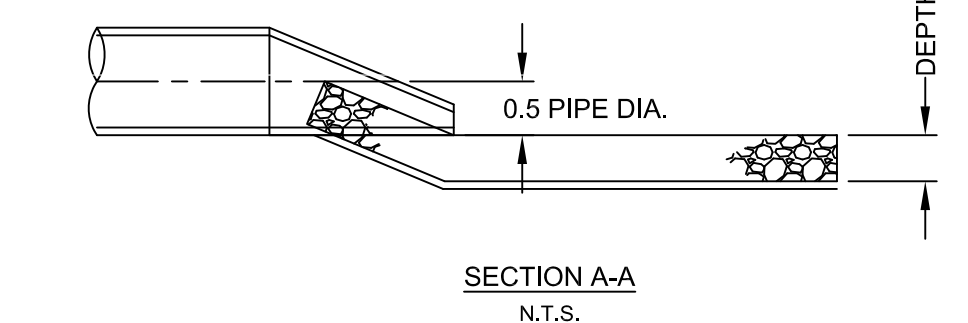


RIPRAP TABLE - CLASS 2 (6")

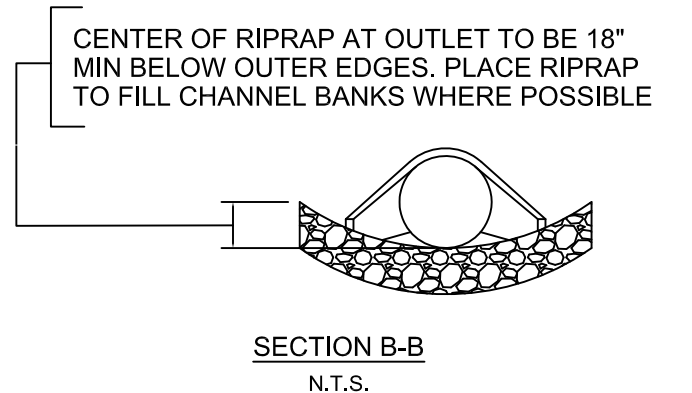
Culvert No.	Road Station	Depth (ft)	Length (ft)	Width @ End (ft)	Riprap (cy)
CP-408	189+89	1.7	8	11	5.5
CP-411	251+84	1.7	28	39	66.5
CP-412	274+66	1.7	17	24	24.9
CP-414	15+00	1.7	21	29	37.4

RIPRAP TABLE - CLASS 4 (14")

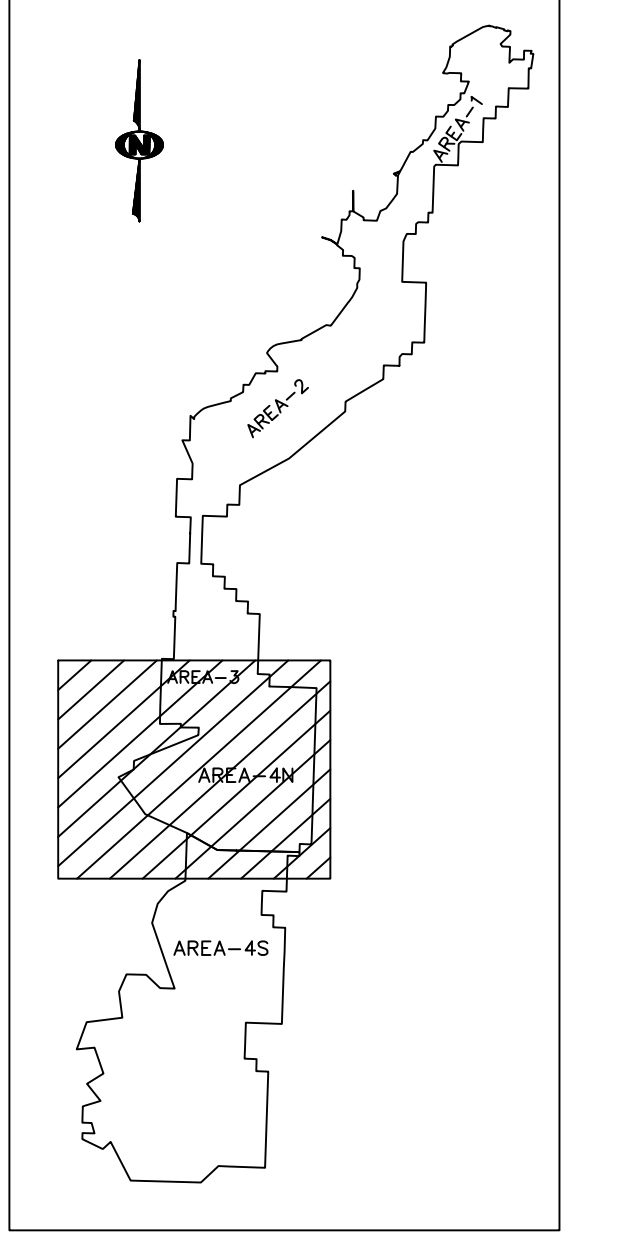
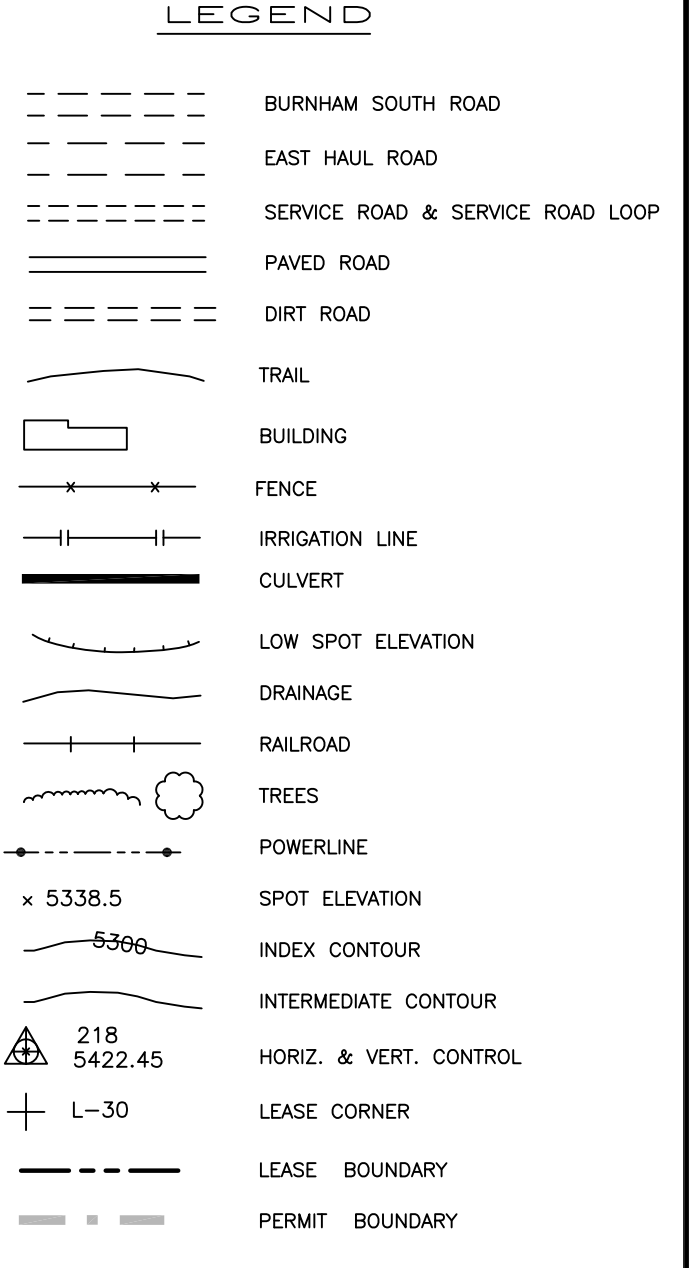
Culvert No.	Road Station	Depth (ft)	Length (ft)	Width @ End (ft)	Riprap (cy)
CP-407	167+20	2.6	42	49	199.6
CP-409	200+62	2.6	30	35	97.8
CP-410	211+31	2.6	42	48	191.6



PIPE OUTLET RIPRAP DETAIL
N.T.S.



PIPE BEDDING DETAIL
N.T.S.



CERTIFICATION STATEMENT
 I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT INC.
 915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

REV. NO.	DATE	COMMENTS
1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL

EXHIBIT 23.2-2

bhpbilliton

BHP Navajo Coal Company
 P.O. Box 1717 Fruitland, New Mexico, 87416 Phone: 505-598-4200 Fax: 505-598-1361

PINABETE PERMIT

TYPICAL ROAD SECTIONS, GUARDRAIL TABLE & DETAILS, CULVERT TABLE & DRAINAGE DETAILS

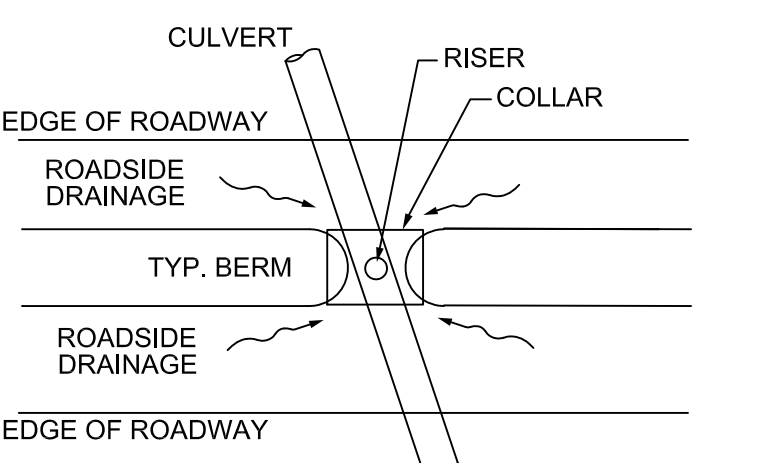
SHEET: 12 OF 13

PREPARED BY: BT&PR DRAWN BY: BT&PR SCALE: AS SHOWN
 APPROVED BY: GM DATE: 02-07-2012

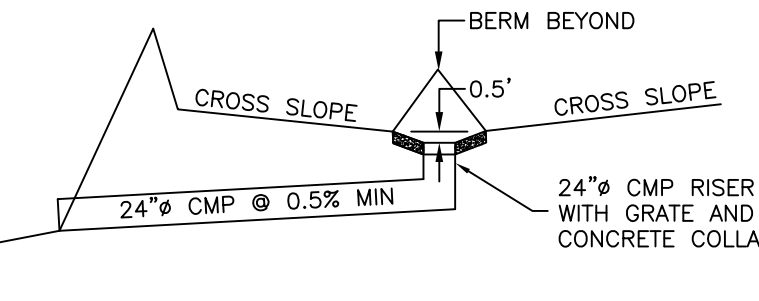
GEOMAT PROJECT NO. 112-1434

RELIEF DITCH LOCATIONS

RELIEF DITCH NUMBER	ROAD STATION	DEPTH FT.	D50 IN.	RIPRAP CYDS.
EHR-RD1	167+85	2.3	12	28
EHR-RD2	190+85	2.0	9	47
EHR-RD3	200+50	2.3	12	39
EHR-RD4	205+15	2.0	9	30
EHR-RD5	214+50	2.0	9	24
EHR-RD6	276+60	2.0	9	24
SRL-RD7	00+90	2.0	9	27
SRL-RD8	16+10	2.3	12	27
SRL-RD9	24+85	1.7	6	80



TYP. DROP INLET
N.T.S.



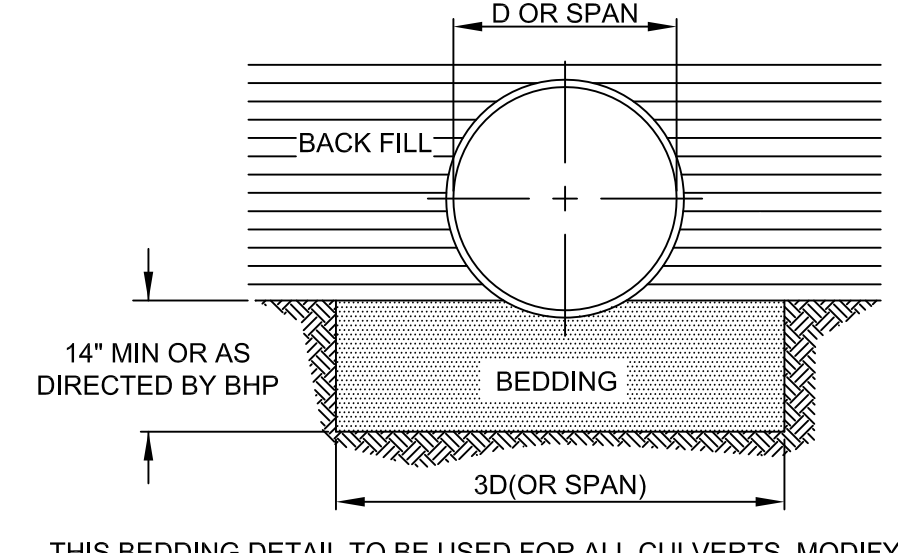
TYP. DOWN DRAIN
N.T.S.

DOWN DRAIN NOTES:
 1. PROVIDE DOWN DRAINS AT LOCATIONS SHOWN ON THE PLANS.
 2. REMOVE 10'+/- OF THE SAFETY BERM TO INSTALL THE DOWN DRAIN. GRADE AREA TO DRAIN TO GRATE.
 3. 24" RISER TO BE FACTORY FABRICATED AS AN INTEGRAL PART OF THE DRAIN.
 4. CONCRETE COLLAR TO BE 10' SQUARE x 8" THICK WITH #5 BARS AT 12" E.W. CONCRETE SHALL ATTAIN A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI @ 28 DAYS AND SHALL BE PLACED WITH AN AIR CONTENT OF 5-8% AND A MAX. SLUMP OF 4".

DROP INLET NOTES:
 1. PROVIDE DROP INLETS AT LOCATIONS SHOWN ON THE PLANS.
 2. REMOVE 10'+/- OF THE SAFETY BERM TO INSTALL THE DROP INLET. GRADE AREA TO DRAIN TO GRATE.
 3. 24" RISER TO BE FACTORY FABRICATED AS AN INTEGRAL PART OF THE CULVERT.
 4. CONCRETE COLLAR TO BE 10' SQUARE x 8" THICK WITH #5 BARS AT 12" E.W. CONCRETE SHALL ATTAIN A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI @ 28 DAYS AND SHALL BE PLACED WITH AN AIR CONTENT OF 5-8% AND A MAX. SLUMP OF 4".

CULVERT NOTES:

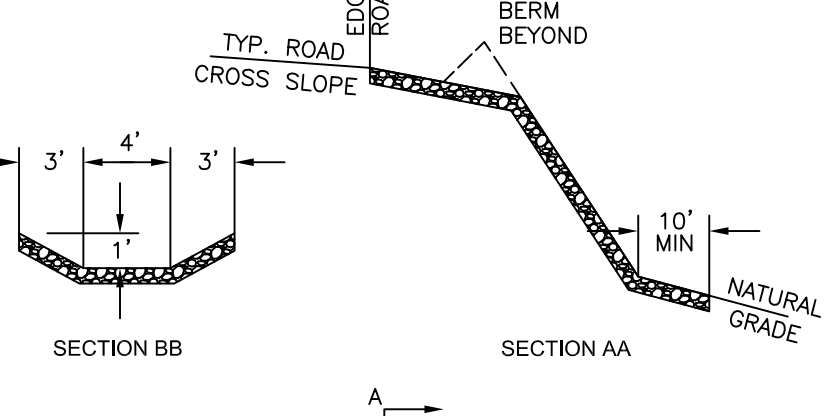
- ALL DRAINAGE STRUCTURES SHALL BE STAKED AND GRADED TO DRAIN TO THE CONSTRUCTION LIMITS. EARTHEN DITCH BLOCKS, DIKES AND DITCHES MAY BE ADDED AT LOCATIONS DESIGNATED BY BHP AND/OR AS SHOWN ON THESE PLANS.
- ALL CULVERTS ARE TO BE INSTALLED AT THE NATURAL FLOWLINE OF THE WASH, ARROYO OR DITCH. IF PLAN ELEVATIONS DO NOT MATCH FIELD CONDITIONS CONTACT BNCC FOR DIRECTION BEFORE PROCEEDING.
- SHAPE AND GRADE DRAINAGE CHANNELS AS NECESSARY TO PROVIDE A SMOOTH CONNECTION BETWEEN FORD OR CULVERT AND EXISTING FEATURE.
- ALL CULVERTS ARE TO INCLUDE FLARED END SECTIONS AT BOTH ENDS UNLESS OTHERWISE NOTED. CULVERTS 3'-0 AND SMALLER TO INCLUDE SAFETY SLOPE END SECTIONS AT BOTH ENDS
- RIPRAP IS TO BE INSTALLED AT THE OUTLET END OF CULVERTS PER THE RIPRAP SCHEDULE IMMEDIATELY UPON COMPLETION OF CULVERT INSTALLATION.
- RIPRAP TO BE NON-ENCLOSED WITH MINIMUM DIMENSION AS SHOWN AND INSTALLED ON ENGINEERING FABRIC WITH A MINIMUM UNIT WEIGHT OF 8 OZ/SY.
- IN LIEU OF RIPRAP SHOWN CONTRACTOR MAY USE WIRE ENCLOSE RIPRAP CLASS A PER NMDOT STANDARD DRAWING 602-01-1/1.
- COST OF FABRIC, BEDDING AND BACKFILL TO BE CONSIDERED INCIDENTAL TO CULVERT INSTALLATION.



PIPE BEDDING DETAIL
N.T.S.

EAST HAUL ROAD - CULVERT TABLE

Culvert No.	Road	Station	Area (Ac)	Discharge (cfs)	Size (ft-in)	Corrugation (in)	Corner Radius (in)	Gage	Minimum Cover (in)	Inlet Invert Elev.	Outlet Invert Elev.	Headwater Elev.	Barrels	Skew Angle	Run Length (ft)	Total Length (ft)	Outlet Velocity (ft/sec)	Outflow Protection
CP-406	BURNHAM SOUTH ROAD	115+90	9.629	12.36	2'-6	2-2/3 X 1/2	N/A	16	24	5380.95	5380.00	5382.89	1	68	180	180	5.42	N/A
CP-407	EAST HAUL ROAD	167+20	448.365	218.40	5	2-2/3 X 1/2	N/A	12	4'	5274.48	5270.70	5278.91	2	90	220	440	9.79	RIPRAP
CP-408	EAST HAUL ROAD	189+89	6.728	11.14	2	2-2/3 X 1/2	N/A	16	2'	5303.63	5292.87	5305.39	1	102	252	252	7.83	RIPRAP
CP-409	EAST HAUL ROAD	200+62	148.159	116.30	3'-6	2-2/3 X 1/2	N/A	16	4.5	5301.62	5296.71	5305.37	2	70	227	454	9.08	RIPRAP
CP-410	EAST HAUL ROAD	211+31	248.872	192.94	4	2-2/3 X 1/2	N/A	14	4'	5305.03	5301.11	5308.64	3	91	216	648	8.76	RIPRAP
CP-411	EAST HAUL ROAD	251+84	266.740	176.20	4	2-2/3 X 1/2	N/A	14	4'	5323.96	5321.71	5327.64	3	79	217	651	7.82	RIPRAP
CP-412	EAST HAUL ROAD	274+66	76.550	52.01	3	2-2/3 X 1/2	N/A	14	2.5'	5352.89	5351.39	5355.52	2	73	177	354	6.55	RIPRAP
CP-413	SERVICE ROAD LOOP	3+40	4.112	6.54	2	2-2/3 X 1/2	N/A	16	24	5332.33	5331.06	5333.73	1	77	98	98	4.73	N/A
CP-414	SERVICE ROAD LOOP	15+00	156.076	90.31	3	2-2/3 X 1/2	N/A	16	24	5335.84	5334.94	5338.70	3	90	97	291	6.90	RIPRAP

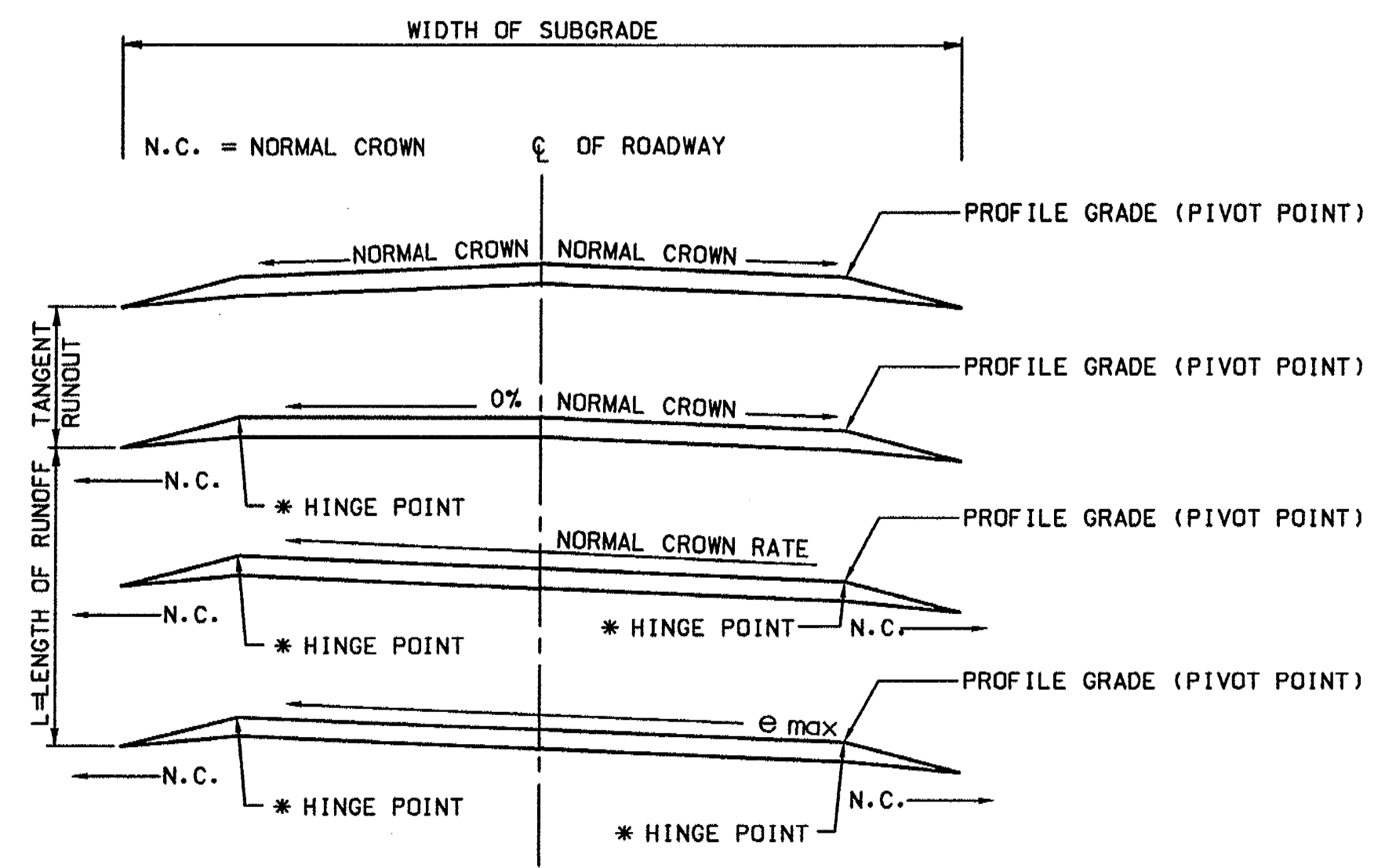
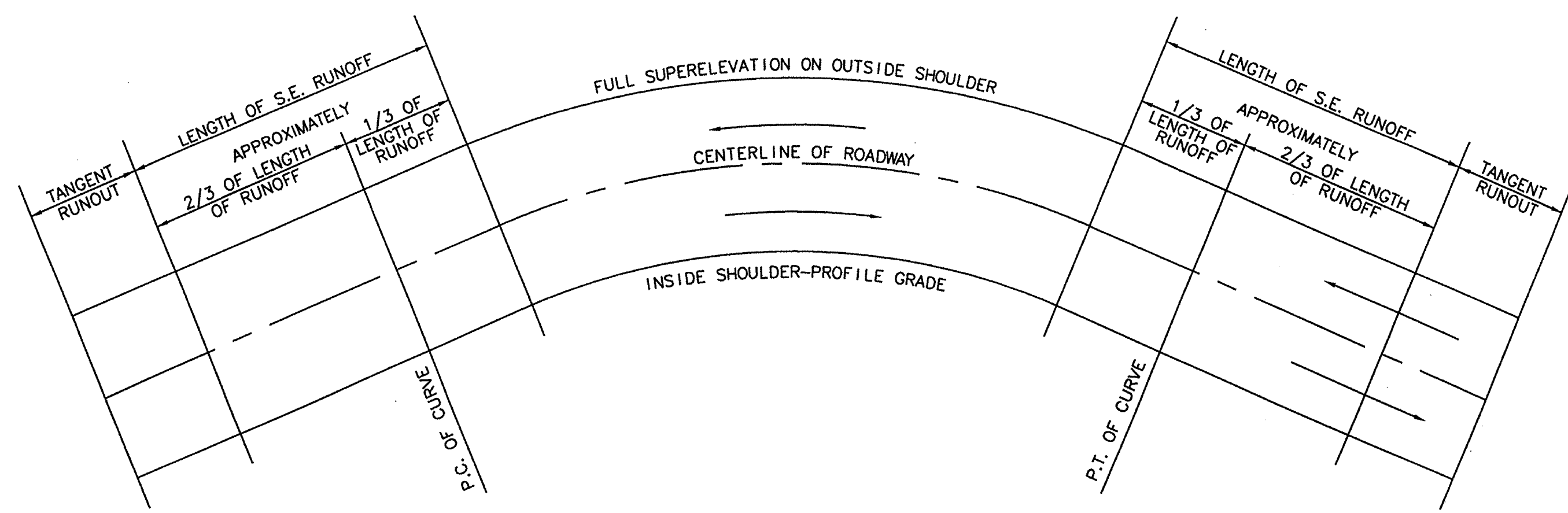


TYP. RIPRAP RUNDOWN
N.T.S.

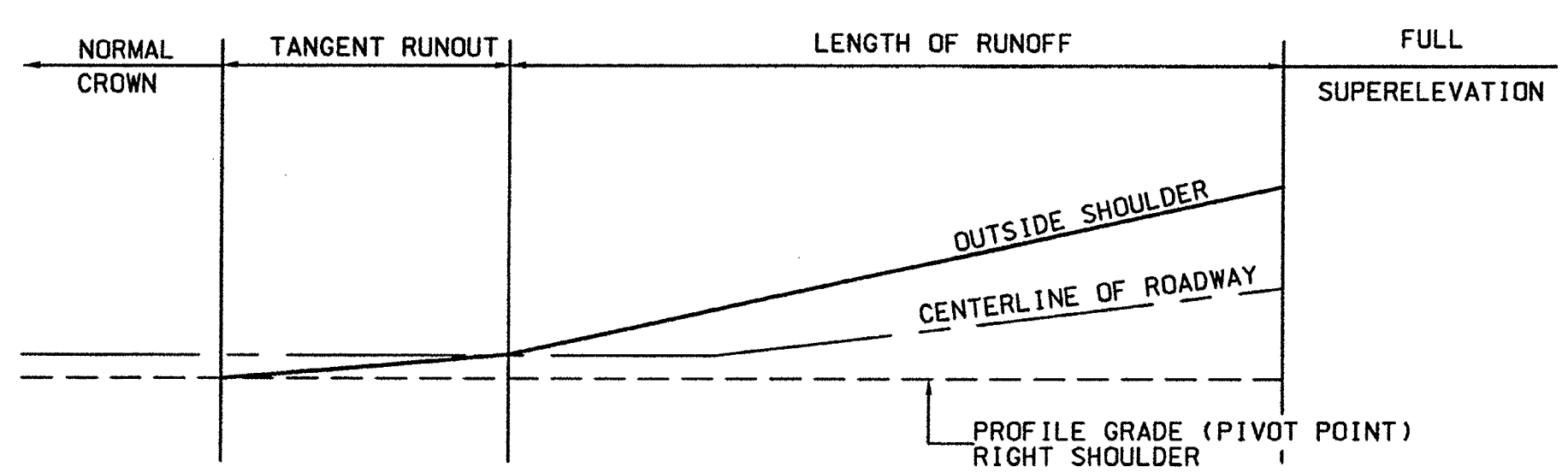
RIPRAP RUNDOWN NOTES:
 1. PROVIDE RIPRAP RUNDOWN AT LOCATIONS SHOWN ON THE PLANS.
 2. REMOVE 10'+/- OF THE SAFETY BERM TO INSTALL THE RIPRAP RUNDOWN. GRADE AREA TO DRAIN TO RUNDOWN.
 3. DIMENSIONS TO BE AS SHOWN UNLESS OTHERWISE SHOWN ON THE PLANS.

THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

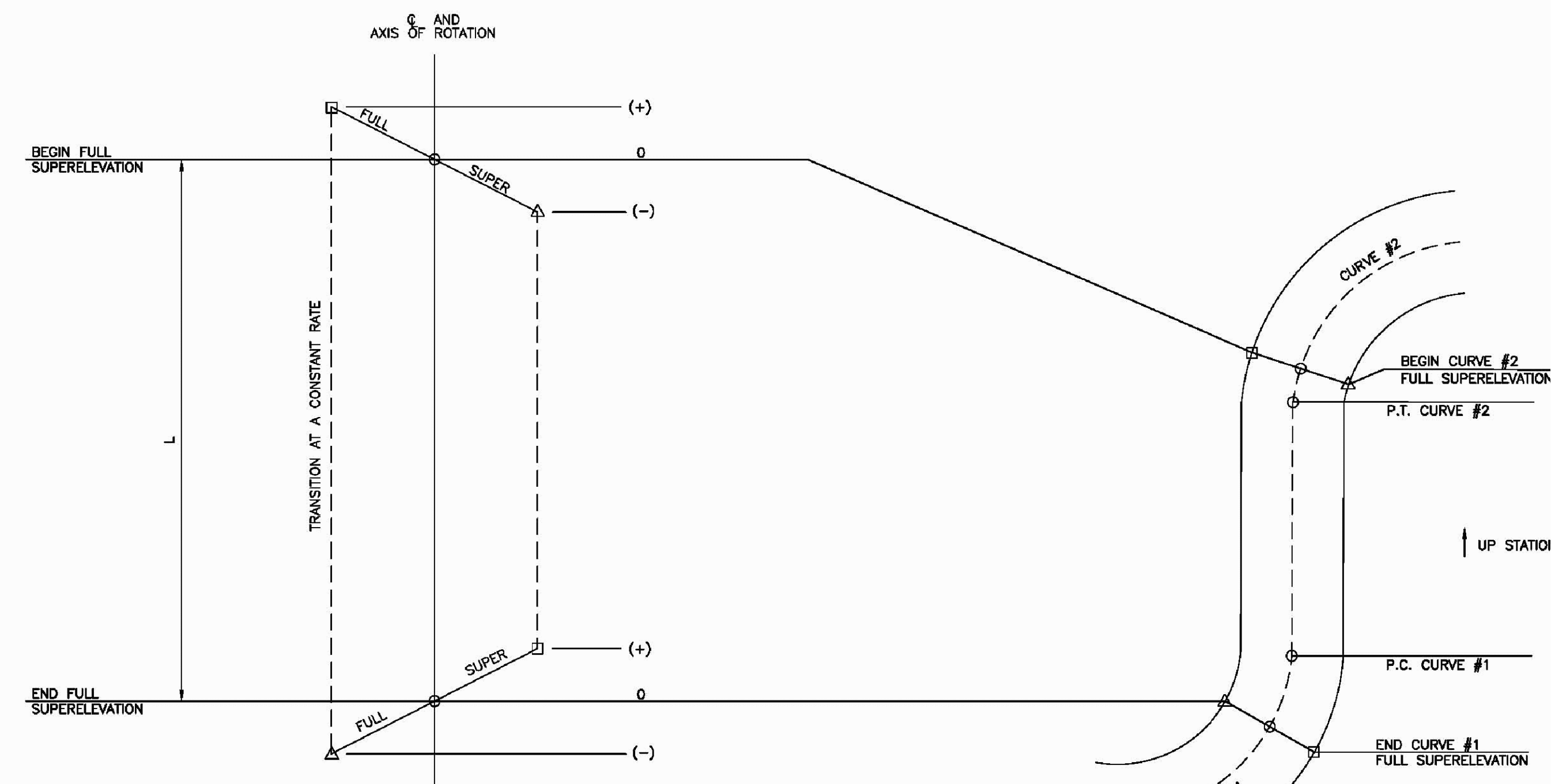
NOT ISSUED FOR CONSTRUCTION



CASE I - TWO-LANE ROADWAY



CASE I - TWO-LANE ROADWAY
(CURVE TO RIGHT; CURVE TO LEFT OPPOSITE HAND)
NOTE: SEE PLANS FOR ACTUAL TYPICAL SECTION



CASE 2
SEE NOTE 1

NOTES

- CASE 2 EXISTS WHEN THE TANGENT LENGTH BETWEEN TWO CURVES IS SHORTER THAN THE TANGENT RUNOUT DISTANCE REQUIRED FOR TRANSITIONING BETWEEN SUPERELEVATIONS FOR THOSE CURVES. WHEN THIS CASE EXISTS, TRANSITION AT A CONSTANT RATE FROM ONE SUPERELEVATION TO THE NEXT AS SHOWN.
- BUILD SUPERELEVATION INTO SUBGRADE AND CARRY THROUGH SHOULDERS
- L IS THE TRANSITION LENGTH BETWEEN FULL SUPERELEVATION AND FULL SUPERELEVATION.

LEGEND

- CENTERLINE/POINT OF ROTATION
- ◻ INSIDE EDGE OF PAVEMENT
- ◻ OUTSIDE EDGE OF PAVEMENT

GENERAL NOTES

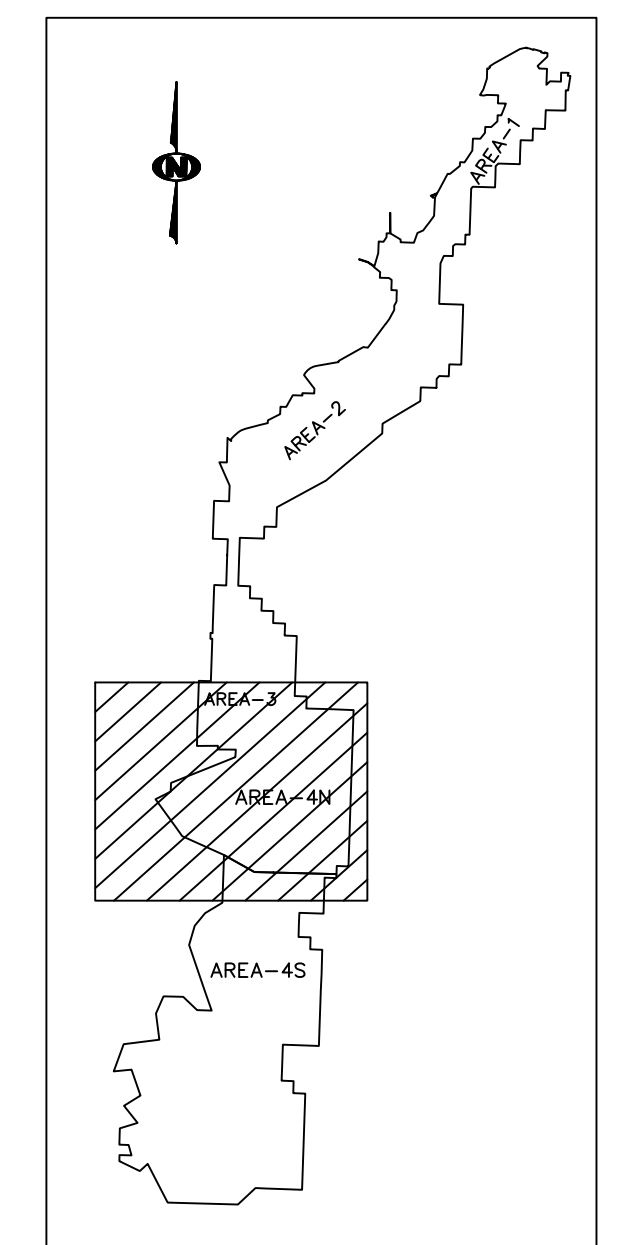
- TANGENT RUNOUT - LENGTH OF HIGHWAY NEEDED TO ACCOMPLISH THE CHANGE IN CROSS SLOPE FROM A NORMAL CROWN SECTION TO A SECTION WITH THE ADVERSE CROWN REMOVED OR VICE VERSA.
- SUPERELEVATION RUNOFF - LENGTH OF HIGHWAY NEEDED TO ACCOMPLISH THE CHANGE IN CROSS SLOPE FROM A SECTION WITH ADVERSE CROWN REMOVED TO A FULLY SUPERELEVATED SECTION OR VICE VERSA.
- THE MAXIMUM SUPERELEVATION RATE TO BE USED IS ESTABLISHED FOR EACH INDIVIDUAL CURVE AND IS SHOWN IN THE PLANS. ANY DEVIATION IN THE PLACEMENT OF S.E. RUNOFF AND TANGENT RUNOUT DUE TO REVERSE CURVES OR COMPOUND CURVES WILL BE SPECIFIED IN THE PLANS.
- CASE 1: ON FINISHED GRADE AND SUBGRADE. (TANGENT RUNOUT) PIVOT SUPERELEVATION ABOUT CENTERLINE UNTIL RATE OF SLOPE EQUALS CROWN SLOPE THEN PIVOT ABOUT THE INSIDE SHOULDER.
- THE OUTSIDE DITCH ON SUPERELEVATION SECTIONS IS TO BE MODIFIED WHERE NECESSARY TO PROVIDE DRAINAGE. OTHERWISE THE DITCH SHALL CONFORM TO THE NORMAL DITCH SECTION SHOWN ON THE TYPICAL SECTION.
- CURVES SHALL BE WIDENED ACCORDING TO THE PAVEMENT WIDENING CHART IN THE AASHTO GUIDELINES. THE SUPERELEVATION RATE SHALL BE CONTINUOUS THROUGHOUT THE TOP WIDTH OF SURFACING.
- FOR MULTILANE DIVIDED HIGHWAYS WITH INDEPENDENT PROFILE CURVES AND/OR MEDIANS OVER 60 FT. THE SUPERELEVATION RATE FOR EACH ROADWAY SHALL BE DEVELOPED USING CASE 1.
- REFER TO CURRENT AASHTO GUIDELINES FOR APPROPRIATE RUNOFF LENGTH. ADJUSTMENTS NEED TO BE MADE FOR ADDITIONAL LANES AS REQUIRED BY CURRENT AASHTO GUIDELINES.
- TANGENT RUNOUT = $L \left(\frac{NC}{2e - NC} \right)$ ROUND UP TO NEAREST 10 FT.
WHERE NC = NORMAL CROWN
e = MAX. SUPERELEVATION
L = LENGTH OF SUPERELEVATION RUNOFF

CURVE NO.	SUPER (e)	BEGIN TRANSITION STATION	ADVERSE CROWN STATION	REVERSE CROWN STATION	BEGIN FULL SUPER STATION	END FULL SUPER STATION	REVERSE CROWN STATION	ADVERSE CROWN STATION	END TRANSITION STATION
C1 (1)	3.30%	154+05.03	155+43.40	156+81.76	157+71.70	163+25.03	-	-	-
C2 (1)	3.80%	-	-	-	167+54.52	174+30.56	175+61.60	177+07.19	178+52.79
C3 (1)	3.20%	182+18.60	183+55.35	184+92.10	185+74.15	190+92.70	-	-	-
C4 (1)	2.90%	-	-	-	192+43.31	198+00.75	198+59.93	199+91.45	201+22.97
C5 (2)	3.30%	202+11.38	203+49.75	204+88.11	205+78.05	214+70.17	215+60.11	-	-
C6 (2)	3.10%	-	218+83.72	220+18.79	220+93.08	226+30.18	227+04.47	228+39.55	229+74.62
C8	3.80%	324+14.80	325+60.40	327+05.99	328+37.03	342+26.74	343+57.78	345+03.37	346+48.97

- COMPOUND CURVE
- REVERSE CURVE

LEGEND

- BURNHAM SOUTH ROAD
- EAST HAUL ROAD
- SERVICE ROAD & SERVICE ROAD LOOP
- PAVED ROAD
- DIRT ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- LOW SPOT ELEVATION
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5360 INDEX CONTOUR
- 218 5422.45 INTERMEDIATE CONTOUR
- △ 218 5422.45 HORIZ. & VERT. CONTROL
- + L-30 LEASE CORNER
- LEASE BOUNDARY
- PERMIT BOUNDARY



CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT inc.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

REV. NO.	DATE	DESCRIPTION
1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL

EXHIBIT 23.2-2

bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717 • Fruitland, New Mexico, 87416 • Phone: 505-598-4200
Fruitland, New Mexico, 87416 • Fax: 505-598-1361

PINABETE PERMIT
SUPER ELEVATION TABLE AND DETAILS

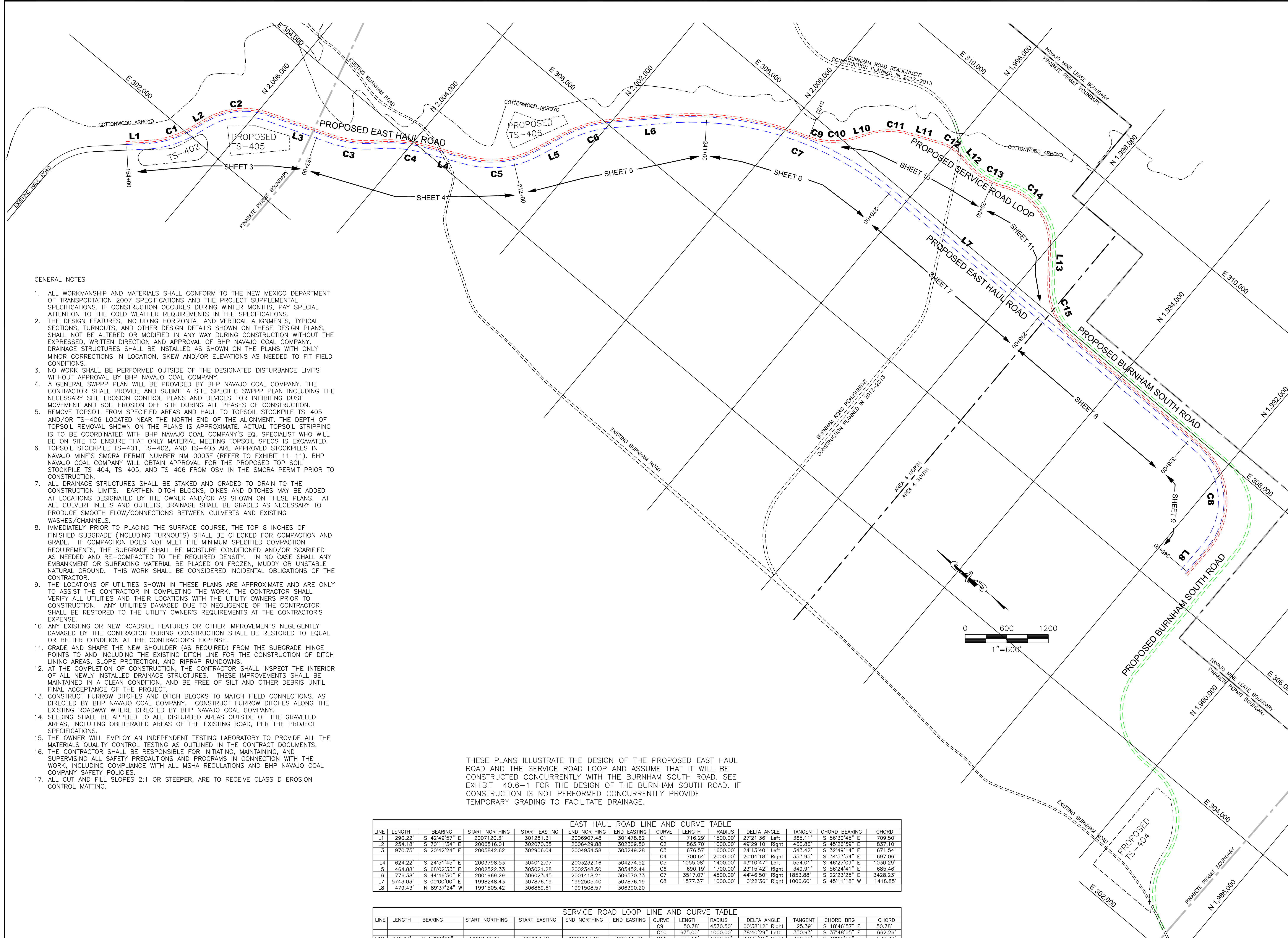
SHEET: 13 OF 13

PREPARED BY: BT&PR DRAWN BY: BT&PR SCALE: AS SHOWN
APPROVED BY: GM DATE: 02-07-2012

GEOMAT PROJECT NO. 112-1434

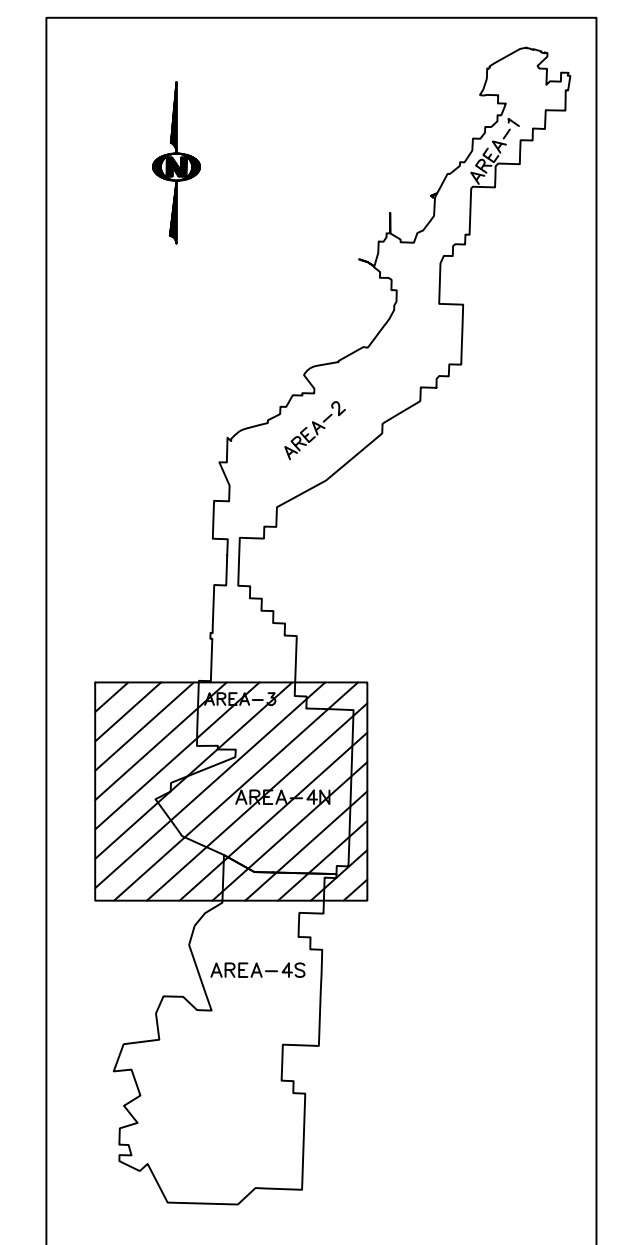
THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

NOT ISSUED FOR CONSTRUCTION



LEGEND

- BURNHAM SOUTH ROAD
- EAST HAUL ROAD
- SERVICE ROAD & SERVICE ROAD LOOP
-
 PAVED ROAD
-
 DIRT ROAD
-
 TRAIL
-
 BUILDING
-
 FENCE
-
 IRRIGATION LINE
-
 CULVERT
-
 LOW SPOT ELEVATION
-
 DRAINAGE
-
 RAILROAD
-
 TREES
-
 POWERLINE
- ×
 SPOT ELEVATION
-
 INDEX CONTOUR
-
 INTERMEDIATE CONTOUR
- △
 HORIZ. & VERT. CONTROL
- +
 LEASE CORNER
-
 LEASE BOUNDARY
-
 PERMIT BOUNDARY



- GENERAL NOTES**
- ALL WORKMANSHIP AND MATERIALS SHALL CONFORM TO THE NEW MEXICO DEPARTMENT OF TRANSPORTATION 2007 SPECIFICATIONS AND THE PROJECT SUPPLEMENTAL SPECIFICATIONS. IF CONSTRUCTION OCCURS DURING WINTER MONTHS, PAY SPECIAL ATTENTION TO THE COLD WEATHER REQUIREMENTS IN THE SPECIFICATIONS.
 - THE DESIGN FEATURES, INCLUDING HORIZONTAL AND VERTICAL ALIGNMENTS, TYPICAL SECTIONS, TURNOUTS, AND OTHER DESIGN DETAILS SHOWN ON THESE DESIGN PLANS, SHALL NOT BE ALTERED OR MODIFIED IN ANY WAY DURING CONSTRUCTION WITHOUT THE EXPRESSED, WRITTEN DIRECTION AND APPROVAL OF BHP NAVAJO COAL COMPANY. DRAINAGE STRUCTURES SHALL BE INSTALLED AS SHOWN ON THE PLANS WITH ONLY MINOR CORRECTIONS IN LOCATION, SKEW AND/OR ELEVATIONS AS NEEDED TO FIT FIELD CONDITIONS.
 - NO WORK SHALL BE PERFORMED OUTSIDE OF THE DESIGNATED DISTURBANCE LIMITS WITHOUT APPROVAL BY BHP NAVAJO COAL COMPANY.
 - A GENERAL SWPPP PLAN WILL BE PROVIDED BY BHP NAVAJO COAL COMPANY. THE CONTRACTOR SHALL PROVIDE AND SUBMIT A SITE SPECIFIC SWPPP PLAN INCLUDING THE NECESSARY SITE EROSION CONTROL PLANS AND DEVICES FOR INHIBITING DUST MOVEMENT AND SOIL EROSION OFF SITE DURING ALL PHASES OF CONSTRUCTION.
 - REMOVE TOPSOIL FROM SPECIFIED AREAS AND HAUL TO TOPSOIL STOCKPILE TS-405 AND/OR TS-406 LOCATED NEAR THE NORTH END OF THE ALIGNMENT. THE DEPTH OF TOPSOIL REMOVAL SHOWN ON THE PLANS IS APPROXIMATE. ACTUAL TOPSOIL STRIPPING IS TO BE COORDINATED WITH BHP NAVAJO COAL COMPANY'S EQ. SPECIALIST WHO WILL BE ON SITE TO ENSURE THAT ONLY MATERIAL MEETING TOPSOIL SPECS IS EXCAVATED.
 - TOPSOIL STOCKPILE TS-401, TS-402, AND TS-403 ARE APPROVED STOCKPILES IN NAVAJO MINE'S SMCRA PERMIT NUMBER NM-0003F (REFER TO EXHIBIT 11-11). BHP NAVAJO COAL COMPANY WILL OBTAIN APPROVAL FOR THE PROPOSED TOP SOIL STOCKPILE TS-404, TS-405, AND TS-406 FROM OSM IN THE SMCRA PERMIT PRIOR TO CONSTRUCTION.
 - ALL DRAINAGE STRUCTURES SHALL BE STAKED AND GRADED TO DRAIN TO THE CONSTRUCTION LIMITS. EARTHEN DITCH BLOCKS, DIKES AND DITCHES MAY BE ADDED AT LOCATIONS DESIGNATED BY THE OWNER AND/OR AS SHOWN ON THESE PLANS. AT ALL CULVERT INLETS AND OUTLETS, DRAINAGE SHALL BE GRADED AS NECESSARY TO PRODUCE SMOOTH FLOW/CONNECTIONS BETWEEN CULVERTS AND EXISTING WASHES/CHANNELS.
 - IMMEDIATELY PRIOR TO PLACING THE SURFACE COURSE, THE TOP 8 INCHES OF FINISHED SUBGRADE (INCLUDING TURNOUTS) SHALL BE CHECKED FOR COMPACTION AND GRADE. IF COMPACTION DOES NOT MEET THE MINIMUM SPECIFIED COMPACTION REQUIREMENTS, THE SUBGRADE SHALL BE MOISTURE CONDITIONED AND/OR SCARIFIED AS NEEDED AND RE-COMPACTED TO THE REQUIRED DENSITY. IN NO CASE SHALL ANY EMBANKMENT OR SURFACING MATERIAL BE PLACED ON FROZEN, MUDDY OR UNSTABLE NATURAL GROUND. THIS WORK SHALL BE CONSIDERED INCIDENTAL OBLIGATIONS OF THE CONTRACTOR.
 - THE LOCATIONS OF UTILITIES SHOWN IN THESE PLANS ARE APPROXIMATE AND ARE ONLY TO ASSIST THE CONTRACTOR IN COMPLETING THE WORK. THE CONTRACTOR SHALL VERIFY ALL UTILITIES AND THEIR LOCATIONS WITH THE UTILITY OWNERS PRIOR TO CONSTRUCTION. ANY UTILITIES DAMAGED DUE TO NEGLIGENCE OF THE CONTRACTOR SHALL BE RESTORED TO THE UTILITY OWNER'S REQUIREMENTS AT THE CONTRACTOR'S EXPENSE.
 - ANY EXISTING OR NEW ROADSIDE FEATURES OR OTHER IMPROVEMENTS NEGLIGENTLY DAMAGED BY THE CONTRACTOR DURING CONSTRUCTION SHALL BE RESTORED TO EQUAL OR BETTER CONDITION AT THE CONTRACTOR'S EXPENSE.
 - GRADE AND SHAPE THE NEW SHOULDER (AS REQUIRED) FROM THE SUBGRADE HINGE POINTS TO AND INCLUDING THE EXISTING DITCH LINE FOR THE CONSTRUCTION OF DITCH LINING AREAS, SLOPE PROTECTION, AND RIPRAP RUNDOWNS.
 - AT THE COMPLETION OF CONSTRUCTION, THE CONTRACTOR SHALL INSPECT THE INTERIOR OF ALL NEWLY INSTALLED DRAINAGE STRUCTURES. THESE IMPROVEMENTS SHALL BE MAINTAINED IN A CLEAN CONDITION, AND BE FREE OF SILT AND OTHER DEBRIS UNTIL FINAL ACCEPTANCE OF THE PROJECT.
 - CONSTRUCT FURROW DITCHES AND DITCH BLOCKS TO MATCH FIELD CONNECTIONS, AS DIRECTED BY BHP NAVAJO COAL COMPANY. CONSTRUCT FURROW DITCHES ALONG THE EXISTING ROADWAY WHERE DIRECTED BY BHP NAVAJO COAL COMPANY.
 - SEEDING SHALL BE APPLIED TO ALL DISTURBED AREAS OUTSIDE OF THE GRAVELED AREAS, INCLUDING OBLITERATED AREAS OF THE EXISTING ROAD, PER THE PROJECT SPECIFICATIONS.
 - THE OWNER WILL EMPLOY AN INDEPENDENT TESTING LABORATORY TO PROVIDE ALL THE MATERIALS QUALITY CONTROL TESTING AS OUTLINED IN THE CONTRACT DOCUMENTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INITIATING, MAINTAINING, AND SUPERVISING ALL SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK, INCLUDING COMPLIANCE WITH ALL MSHA REGULATIONS AND BHP NAVAJO COAL COMPANY SAFETY POLICIES.
 - ALL CUT AND FILL SLOPES 2:1 OR STEEPER, ARE TO RECEIVE CLASS D EROSION CONTROL MATTING.

THESE PLANS ILLUSTRATE THE DESIGN OF THE PROPOSED EAST HAUL ROAD AND THE SERVICE ROAD LOOP AND ASSUME THAT IT WILL BE CONSTRUCTED CONCURRENTLY WITH THE BURNHAM SOUTH ROAD. SEE EXHIBIT 40.6-1 FOR THE DESIGN OF THE BURNHAM SOUTH ROAD. IF CONSTRUCTION IS NOT PERFORMED CONCURRENTLY PROVIDE TEMPORARY GRADING TO FACILITATE DRAINAGE.

EAST HAUL ROAD LINE AND CURVE TABLE

LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING	CURVE	LENGTH	RADIUS	DELTA ANGLE	TANGENT	CHORD BEARING	CHORD
L1	290.22'	S 42°49'57" E	2007120.31	301281.31	2006907.48	301476.62	C1	716.29'	1500.00'	27°21'36" Left	365.11'	S 56°30'45" E	709.50'
L2	254.18'	S 70°11'34" E	2006516.01	302070.35	2006429.88	302309.50	C2	863.70'	1000.00'	49°29'10" Right	460.86'	S 45°26'59" E	837.10'
L3	970.75'	S 20°42'24" E	2005842.62	302906.04	2004934.58	303249.28	C3	676.57'	1600.00'	24°13'40" Left	343.42'	S 32°49'14" E	671.54'
L4	624.22'	S 24°51'45" E	2003798.53	304012.07	2003322.16	304274.52	C4	700.64'	2000.00'	20°04'18" Right	353.95'	S 34°53'54" E	697.06'
L5	464.88'	S 68°02'33" E	2002522.33	305021.28	2002348.50	305452.44	C5	690.19'	1700.00'	23°15'42" Right	349.91'	S 56°24'41" E	685.46'
L6	776.38'	S 44°46'50" E	2001969.29	306023.45	2001418.21	306570.33	C6	3617.07'	4500.00'	44°46'50" Right	1853.88'	S 22°23'25" E	3428.23'
L7	5743.03'	S 00°00'00" E	1998248.43	307876.19	1992505.40	307876.19	C7	1577.37'	1000.00'	0°22'36" Right	1006.60'	S 45°11'18" W	1418.85'
L8	479.43'	N 89°37'24" W	1991505.42	306869.61	1991508.57	306390.20	C8						

SERVICE ROAD LOOP LINE AND CURVE TABLE

LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING	CURVE	LENGTH	RADIUS	DELTA ANGLE	TANGENT	CHORD BRG	CHORD
L10	230.93'	S 57°08'20" E	1999172.68	308117.32	1999047.38	308311.30	C9	50.78'	4570.50'	00°38'12" Right	25.39'	S 18°46'57" E	50.78'
L11	489.30'	S 23°29'59" E	1998606.14	308886.76	1998157.42	308880.86	C10	675.00'	1000.00'	38°40'29" Left	350.93'	S 37°48'05" E	662.26'
L12	182.81'	S 08°54'56" W	1997825.19	308923.38	1997644.59	308895.05	C11	587.11'	1000.00'	33°38'21" Right	302.29'	S 40°19'09" E	578.72'
L13	524.07'	S 51°49'39" W	1995992.63	308739.28	1995668.73	308327.29	C12	339.45'	600.00'	32°24'55" Left	174.40'	S 07°17'32" E	334.94'
							C13	607.90'	996.42'	34°57'20" Left	313.74'	S 08°33'44" E	598.52'
							C14	1177.05'	863.58'	78°05'34" Right	700.48'	S 13°00'23" W	1088.03'
							C15	901.32'	986.42'	51°49'39" Left	484.13'	S 25°54'48" W	870.90'

THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

NOT ISSUED FOR CONSTRUCTION

CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT inc.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

REV. NO.	DATE	COMMENTS
1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL

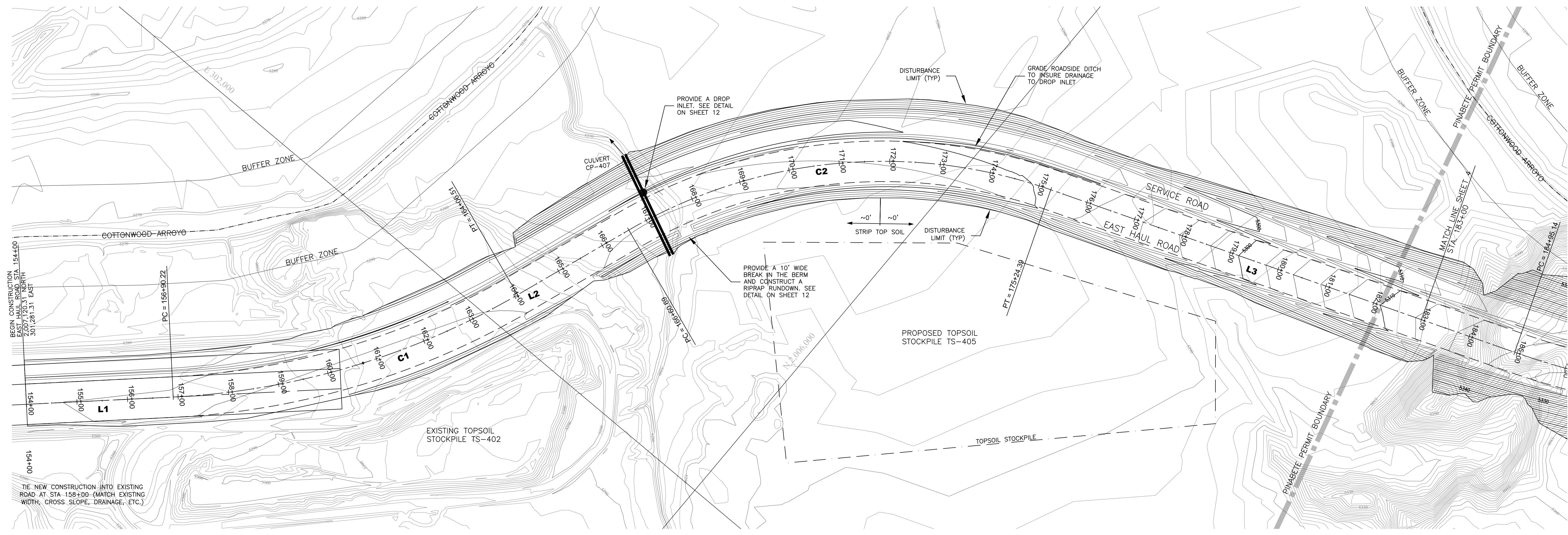
EXHIBIT 23.2-2

bhpbilliton
BHP Navajo Coal Company
P.O. Box 1717 • Farmington, New Mexico, 87416 • Phone: 505-598-4200
Fac: 505-598-1361

PINABETE PERMIT

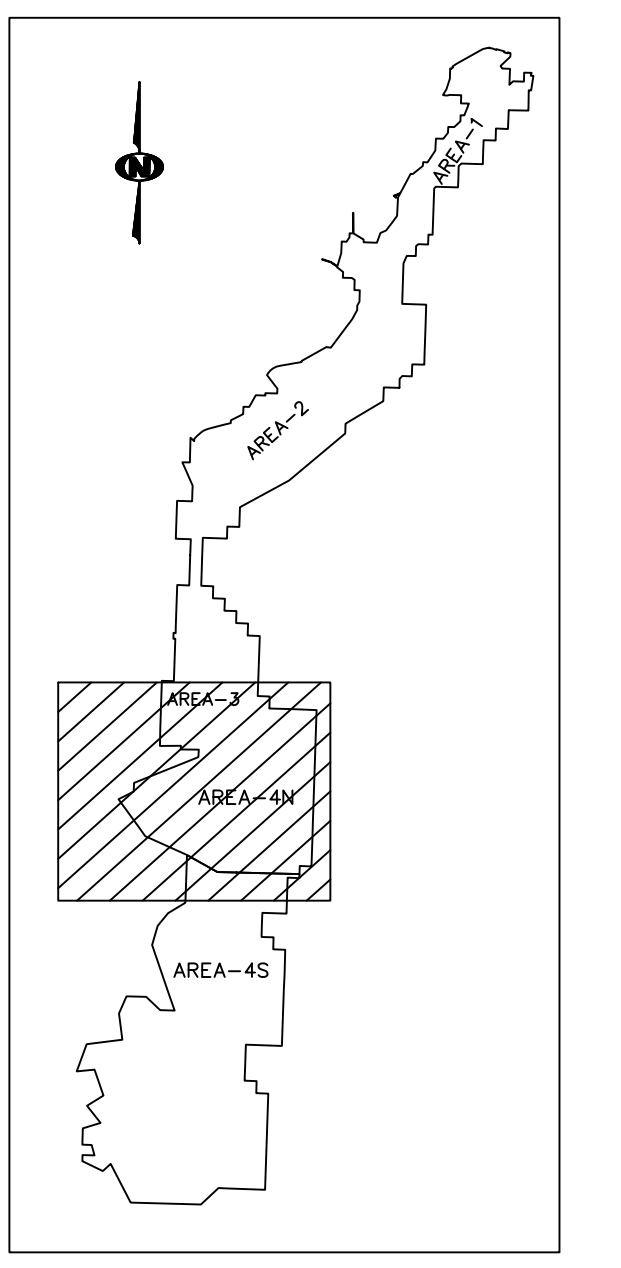
EAST HAUL ROAD DESIGN
SITE PLAN, GENERAL NOTES
AND CURVE TABLE
SHEET: 2 OF 13

PREPARED BY: BT&PR DRAWN BY: BT&PR SCALE: AS SHOWN
APPROVED BY: GM DATE: 02-07-2012
GEOMAT PROJECT NO. 112-1434



LEGEND

- BURNHAM SOUTH ROAD
- EAST HAUL ROAD
- SERVICE ROAD & SERVICE ROAD LOOP
- PAVED ROAD
- DIRT ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- LOW SPOT ELEVATION
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- △ 218 5422.45 HORIZ. & VERT. CONTROL
- + L-30 LEASE CORNER
- LEASE BOUNDARY
- PERMIT BOUNDARY



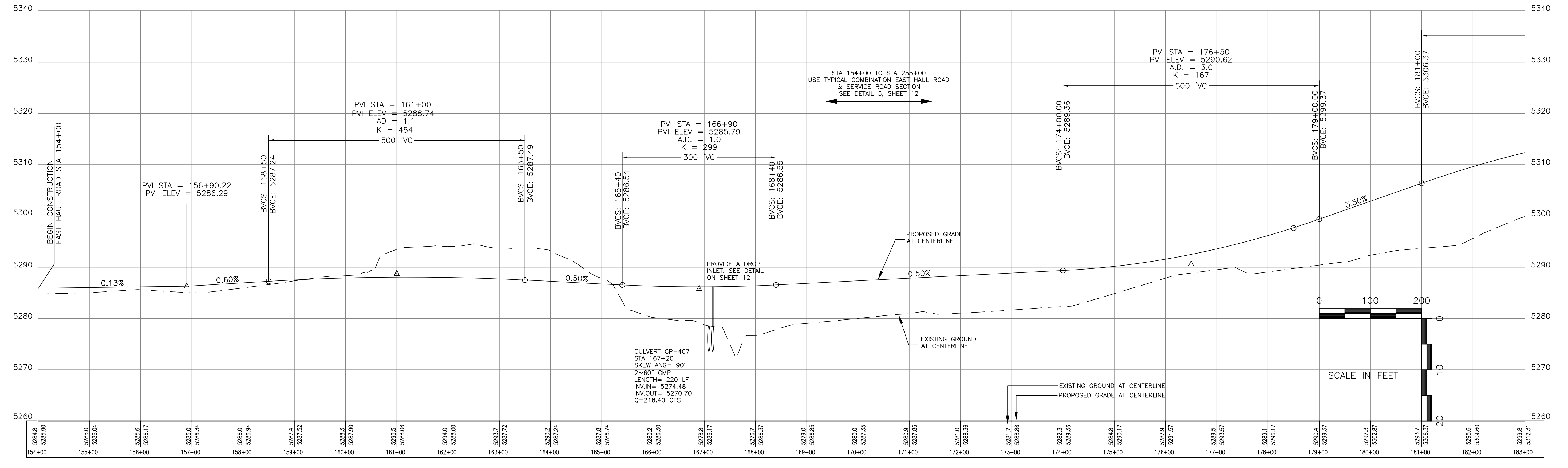
NOTE: CULVERTS ARE TO BE INSTALLED AT EXISTING GRADE - NOT BURIED.

THESE PLANS ILLUSTRATE THE DESIGN OF THE PROPOSED EAST HAUL ROAD AND SERVICE ROAD LOOP AND ASSUME THAT THEY WILL BE CONSTRUCTED CONCURRENTLY WITH THE BURNHAM SOUTH ROAD. SEE EXHIBIT 40.6-1 FOR THE DESIGN OF THE BURNHAM SOUTH ROAD. IF CONSTRUCTION IS NOT PERFORMED CONCURRENTLY PROVIDE TEMPORARY GRADING TO FACILITATE DRAINAGE.

EAST HAUL ROAD
STA 154+00 TO 183+00
SCALE: 1" = 100'

EAST HAUL ROAD LINE AND CURVE TABLE

LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING	CURVE	LENGTH	RADIUS	DELTA ANGLE	TANGENT	CHORD BEARING	CHORD
L1	290.22'	S 42°49'57" E	2007120.31	301291.31	2006907.48	301476.62	C1	716.29'	1500.00'	27°21'36" Left	365.11'	S 56°30'45" E	709.50'
L2	254.18'	S 70°11'34" E	2006516.01	302070.35	2006429.88	303209.50	C2	863.70'	1000.00'	49°29'10" Right	460.86'	S 45°28'59" E	837.10'
L3	970.75'	S 20°42'24" E	2005842.62	302906.04	2004934.58	303249.28	C3	676.57'	1600.00'	24°13'40" Left	343.42'	S 32°49'14" E	671.54'
L4	624.22'	S 24°51'45" E	2003798.53	304012.07	2003232.16	304274.52	C4	700.64'	2000.00'	20°04'18" Right	353.95'	S 34°53'54" E	697.06'
L5	464.88'	S 68°02'33" E	2002522.33	305021.28	2002348.50	305452.44	C5	890.19'	1700.00'	23°15'42" Right	349.91'	S 56°24'41" E	685.46'
L6	776.38'	S 44°46'50" E	2001969.29	306023.45	2001418.21	306570.33	C7	3517.07'	4500.00'	44°46'50" Right	1853.88'	S 22°23'25" E	3428.23'
L7	5743.03'	S 00°00'00" E	1998248.43	307876.19	1998250.45	307876.19	C8	1577.37'	1000.00'	90°22'36" Right	1006.60'	S 45°11'18" W	1418.85'
L8	479.43'	N 89°37'24" W	1991505.42	306869.61	1991508.57	306390.20							



EAST HAUL ROAD
STA 154+00 TO 183+00
SCALE: 1" = 100' H, 1" = 10' V

THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

NOT ISSUED FOR CONSTRUCTION

CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT INC.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL
REV. NO.	DATE	COMMENT

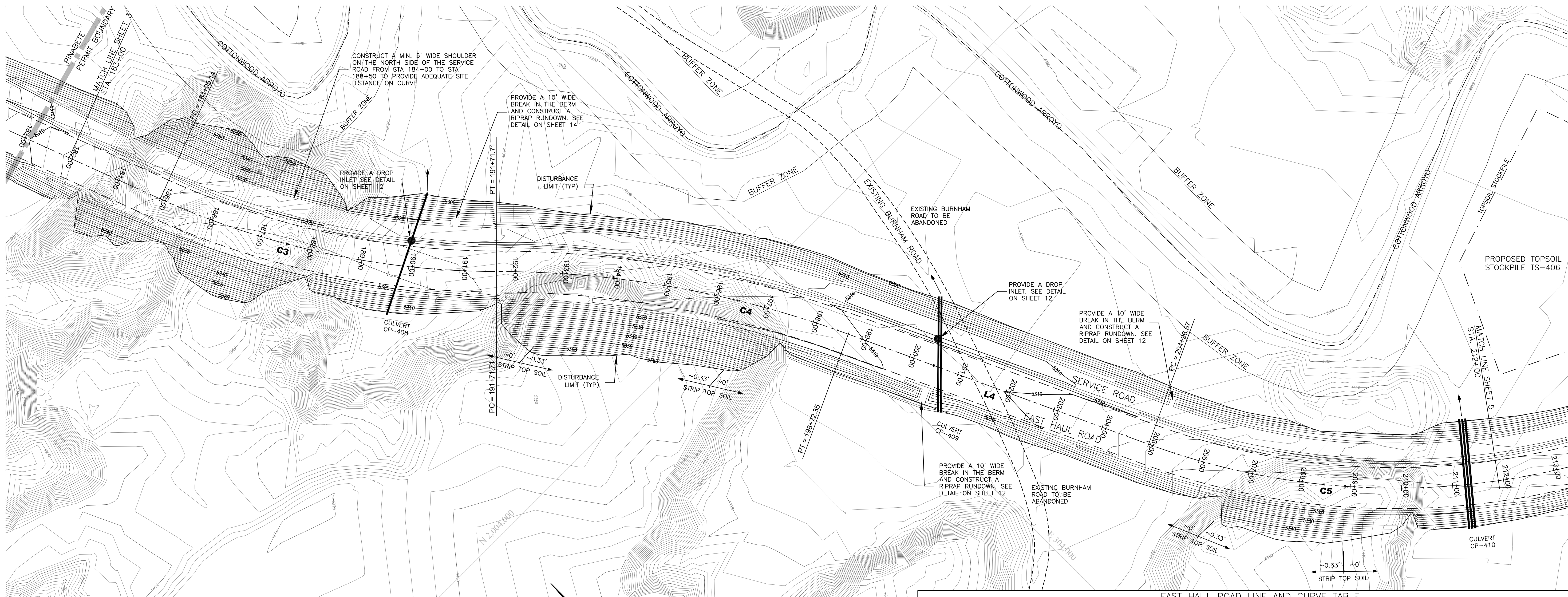
EXHIBIT 23.2-2

bhpbilliton
BHP Navajo Coal Company
P.O. Box 1717 • Fruitland, New Mexico, 87416 • Phone: 505-598-4200
Fruitland, New Mexico, 87416 • Fax: 505-598-1361

PINABETE PERMIT

PLAN & PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 154+00 TO 183+00
SHEET: 3 OF 13

PREPARED BY: BT&PR DRAWN BY: BT&PR SCALE: AS SHOWN
APPROVED BY: GM DATE: 02-07-2012
GEOMAT PROJECT NO. 112-1434

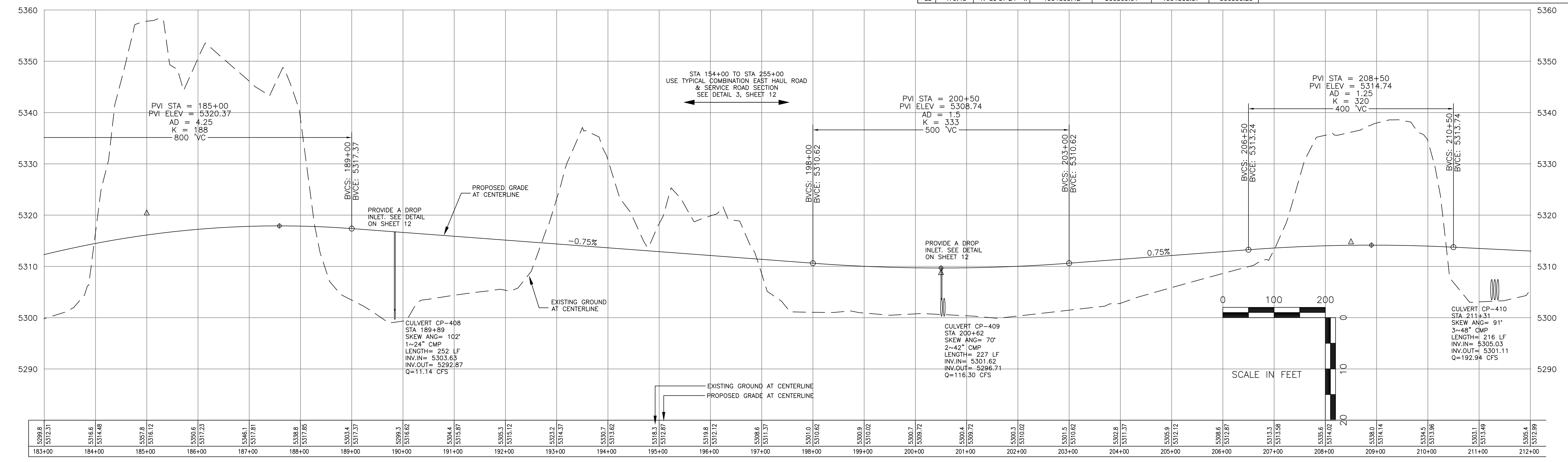


NOTE: CULVERTS ARE TO BE INSTALLED AT EXISTING GRADE - NOT BURIED.

THESE PLANS ILLUSTRATE THE DESIGN OF THE PROPOSED EAST HAUL ROAD AND SERVICE ROAD LOOP AND ASSUME THAT THEY WILL BE CONSTRUCTED CONCURRENTLY WITH THE BURNHAM SOUTH ROAD. SEE EXHIBIT 40.6-1 FOR THE DESIGN OF THE BURNHAM SOUTH ROAD. IF CONSTRUCTION IS NOT PERFORMED CONCURRENTLY PROVIDE TEMPORARY GRADING TO FACILITATE DRAINAGE.

EAST HAUL ROAD
STA 183+00 TO 212+00
SCALE: 1" = 100'

LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING	CURVE	LENGTH	RADIUS	DELTA ANGLE	TANGENT	CHORD BEARING	CHORD
L1	290.22'	S 42°49'57" E	2007120.31	301281.31	2006907.48	301478.62	C1	716.29'	1500.00'	27°21'36" Left	365.11'	S 56°30'45" E	709.50'
L2	254.18'	S 70°11'34" E	2006516.01	302070.35	2006429.88	302309.50	C2	863.70'	1000.00'	49°29'10" Right	460.86'	S 45°26'59" E	837.10'
L3	970.75'	S 20°42'24" E	2005842.62	302906.04	2004934.58	303249.28	C3	676.57'	1600.00'	24°13'40" Left	343.42'	S 32°49'14" E	671.54'
L4	824.22'	S 24°51'45" E	2003798.53	304012.07	2003232.16	304274.52	C4	700.64'	2000.00'	20°04'18" Right	353.95'	S 34°53'54" E	697.06'
L5	464.88'	S 68°02'33" E	2002522.33	305021.28	2002348.50	305452.44	C5	1055.08'	1400.00'	43°10'47" Left	554.01'	S 46°27'09" E	1030.29'
L6	776.38'	S 44°46'50" E	2001869.29	306023.45	2001418.21	306570.33	C6	690.19'	1700.00'	23°15'42" Right	349.91'	S 56°24'41" E	685.46'
L7	5743.03'	S 00°00'00" E	1998248.43	307876.19	1992505.40	307876.19	C7	3517.07'	4500.00'	44°46'50" Right	1853.88'	S 22°23'25" E	3428.23'
L8	479.43'	N 89°37'24" W	1991505.42	306869.61	1991508.57	306390.20	C8	1577.37'	1000.00'	90°22'36" Right	1006.60'	S 45°11'18" W	1418.85'

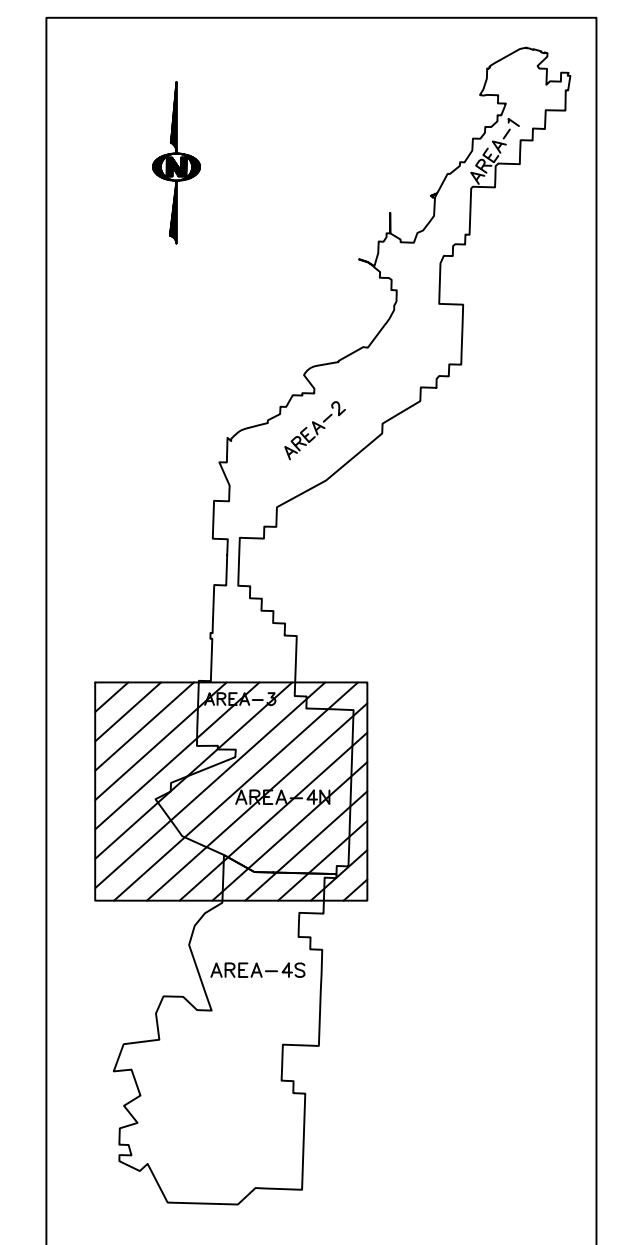


EAST HAUL ROAD
STA 183+00 TO 212+00
1"=100'H 1"=10'V

THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

NOT ISSUED FOR CONSTRUCTION

- LEGEND**
- BURNHAM SOUTH ROAD
 - EAST HAUL ROAD
 - SERVICE ROAD & SERVICE ROAD LOOP
 - PAVED ROAD
 - DIRT ROAD
 - TRAIL
 - BUILDING
 - FENCE
 - IRRIGATION LINE
 - CULVERT
 - LOW SPOT ELEVATION
 - DRAINAGE
 - RAILROAD
 - TREES
 - POWERLINE
 - × 5338.5 SPOT ELEVATION
 - 5300 INDEX CONTOUR
 - INTERMEDIATE CONTOUR
 - △ 218 5422.45 HORIZ. & VERT. CONTROL
 - + L-30 LEASE CORNER
 - LEASE BOUNDARY
 - PERMIT BOUNDARY



CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT INC.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL

EXHIBIT 23.2-2

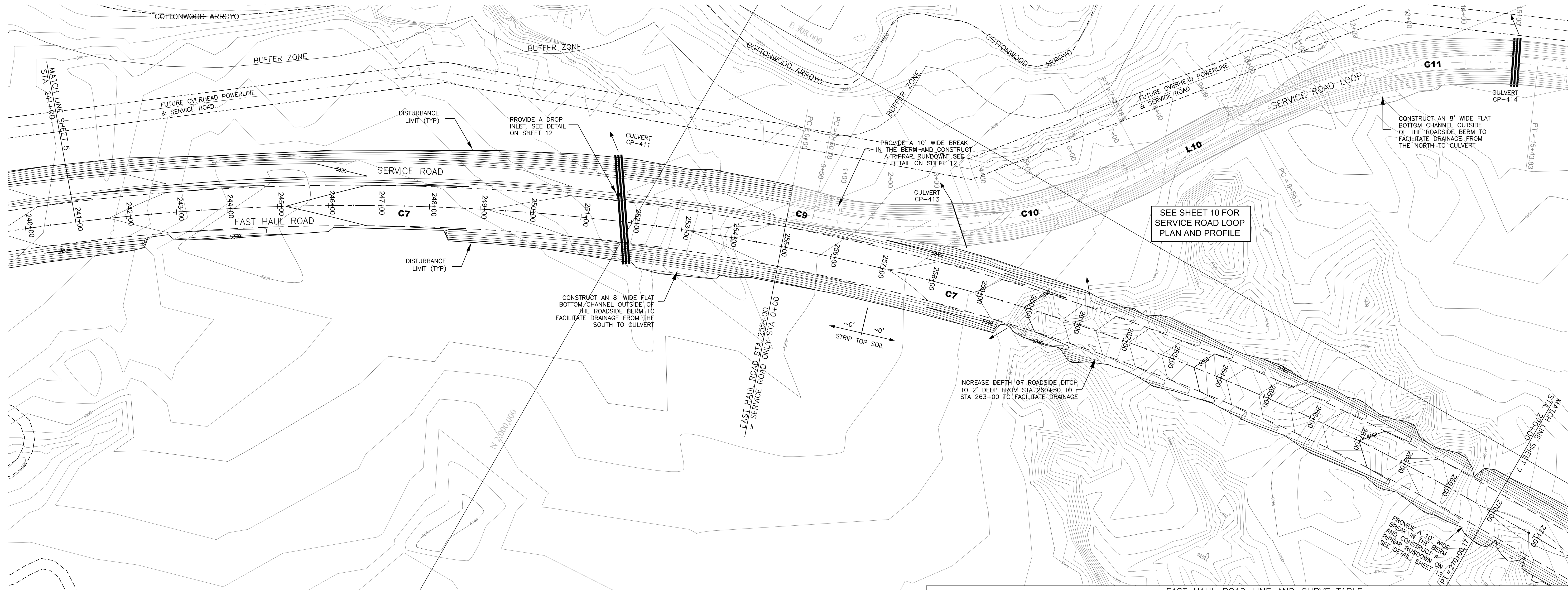


BHP Navajo Coal Company
P.O. Box 1717 Tropic, New Mexico, 87416 Phone: 505-598-4200 Fax: 505-598-1361

PINABETE PERMIT

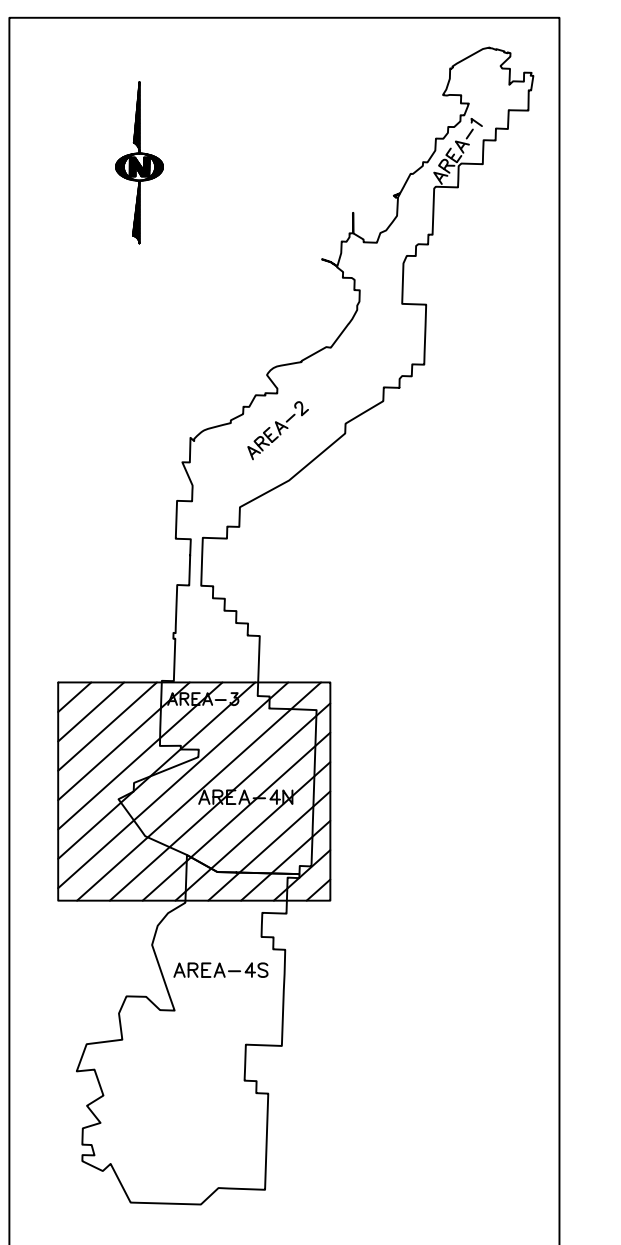
PLAN & PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 183+00 TO 212+00
SHEET: 4 OF 13

PREPARED BY: BT&PR DRAWN BY: BT&PR SCALE: AS SHOWN
APPROVED BY: GM DATE: 02-07-2012
GEOMAT PROJECT NO. 112-1434



LEGEND

- BURNHAM SOUTH ROAD
- EAST HAUL ROAD
- SERVICE ROAD & SERVICE ROAD LOOP
- PAVED ROAD
- DIRT ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- LOW SPOT ELEVATION
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- △ 218 5422.45 HORIZ. & VERT. CONTROL
- + L-30 LEASE CORNER
- LEASE BOUNDARY
- PERMIT BOUNDARY



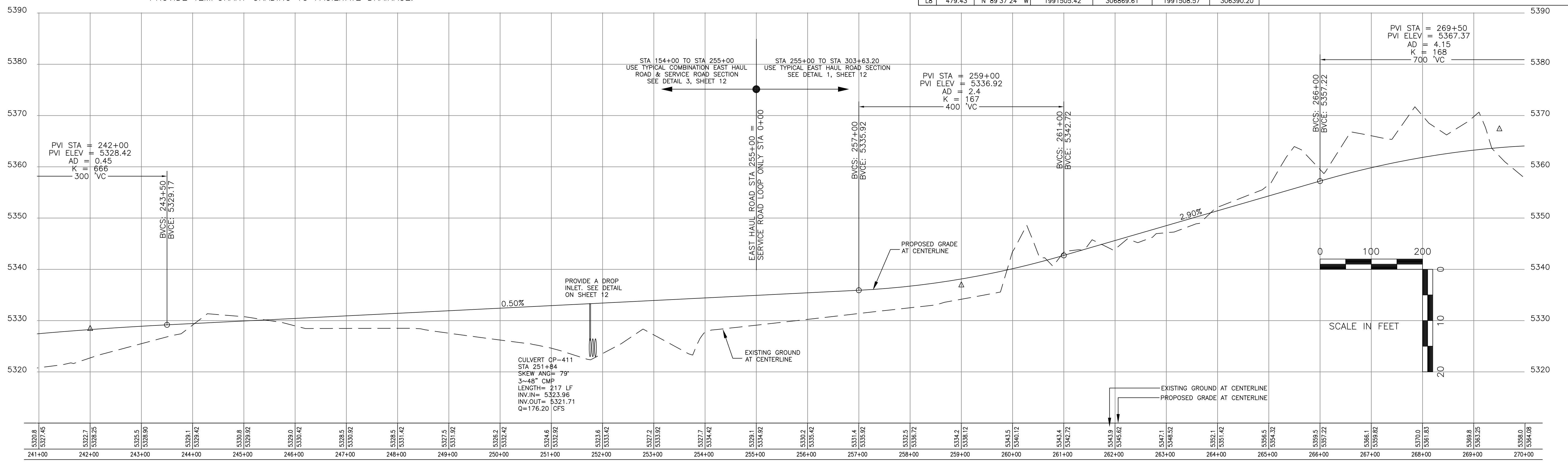
NOTE: CULVERTS ARE TO BE INSTALLED AT EXISTING GRADE - NOT BURIED.

THESE PLANS ILLUSTRATE THE DESIGN OF THE PROPOSED EAST HAUL ROAD AND SERVICE ROAD LOOP AND ASSUME THAT THEY WILL BE CONSTRUCTED CONCURRENTLY WITH THE BURNHAM SOUTH ROAD. IF CONSTRUCTION IS NOT PERFORMED CONCURRENTLY PROVIDE TEMPORARY GRADING TO FACILITATE DRAINAGE.



EAST HAUL ROAD LINE AND CURVE TABLE

LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING	CURVE	LENGTH	RADIUS	DELTA ANGLE	TANGENT	CHORD BEARING	CHORD
L1	290.22'	S 42°49'57" E	2007120.31	301281.31	2006907.48	301478.62	C1	716.29'	1500.00'	27°21'36" Left	365.11'	S 56°30'45" E	709.50'
L2	254.18'	S 70°11'34" E	2006516.01	302070.35	2006429.88	302309.50	C2	863.70'	1000.00'	49°29'10" Right	460.86'	S 45°26'59" E	837.10'
L3	970.75'	S 20°42'24" E	2005842.62	302906.04	2004934.58	303249.28	C3	676.57'	1600.00'	24°13'40" Left	343.42'	S 32°49'14" E	671.54'
L4	624.22'	S 24°51'45" E	2003798.53	304012.07	2003232.16	304274.52	C4	700.64'	2000.00'	20°04'18" Right	353.95'	S 34°53'54" E	697.06'
L5	484.88'	S 68°02'33" E	2002522.33	305021.28	2002348.50	305452.44	C5	1055.08'	1400.00'	43°10'47" Left	554.01'	S 46°27'09" E	1030.29'
L6	776.38'	S 44°46'50" E	2001969.29	306023.45	2001418.21	306570.33	C6	690.19'	1700.00'	23°15'42" Right	349.91'	S 56°24'41" E	685.46'
L7	5743.03'	S 00°00'00" E	1998248.43	307876.19	1992505.40	307876.19	C7	3517.07'	4500.00'	44°46'50" Right	1853.88'	S 22°23'25" E	3428.23'
L8	479.43'	N 89°37'24" W	1991505.42	306889.61	1991508.57	306390.20	C8	1577.37'	1000.00'	90°22'36" Right	1006.60'	S 45°11'18" W	1418.85'



**EAST HAUL ROAD
STA 241+00 TO 270+00**
1"=100'H 1"=10'V

THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

NOT ISSUED FOR CONSTRUCTION

CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT inc.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

REV. NO.	DATE	COMMENTS
1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL

EXHIBIT 23.2-2



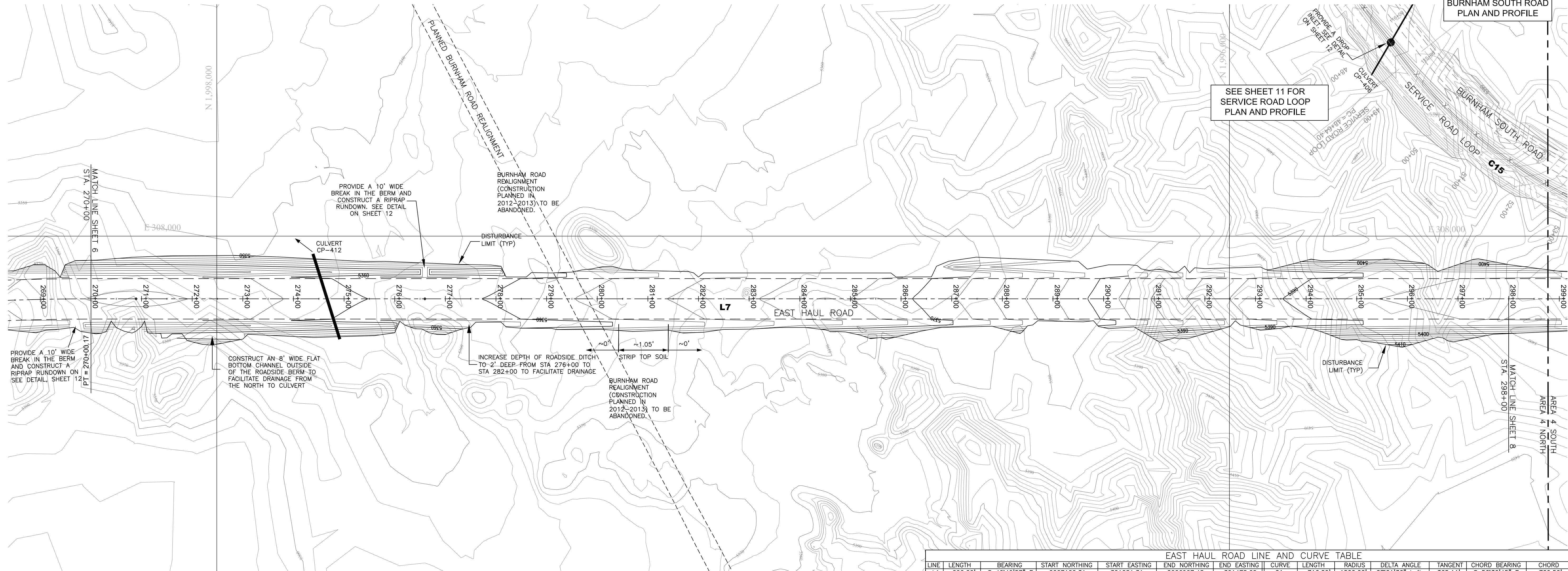
BHP Navajo Coal Company
P.O. Box 1717 Fruitland, New Mexico, 87416 Phone: 505-598-4200 Fax: 505-598-3561

PINABETE PERMIT

PLAN & PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 241+00 TO 270+00

SHEET: 6 OF 13

PREPARED BY: BT&PR DRAWN BY: BT&PR SCALE: AS SHOWN
APPROVED BY: GM DATE: 02-07-2012
GEOMAT PROJECT NO. 112-1434



SEE SHEET 11 FOR SERVICE ROAD LOOP PLAN AND PROFILE

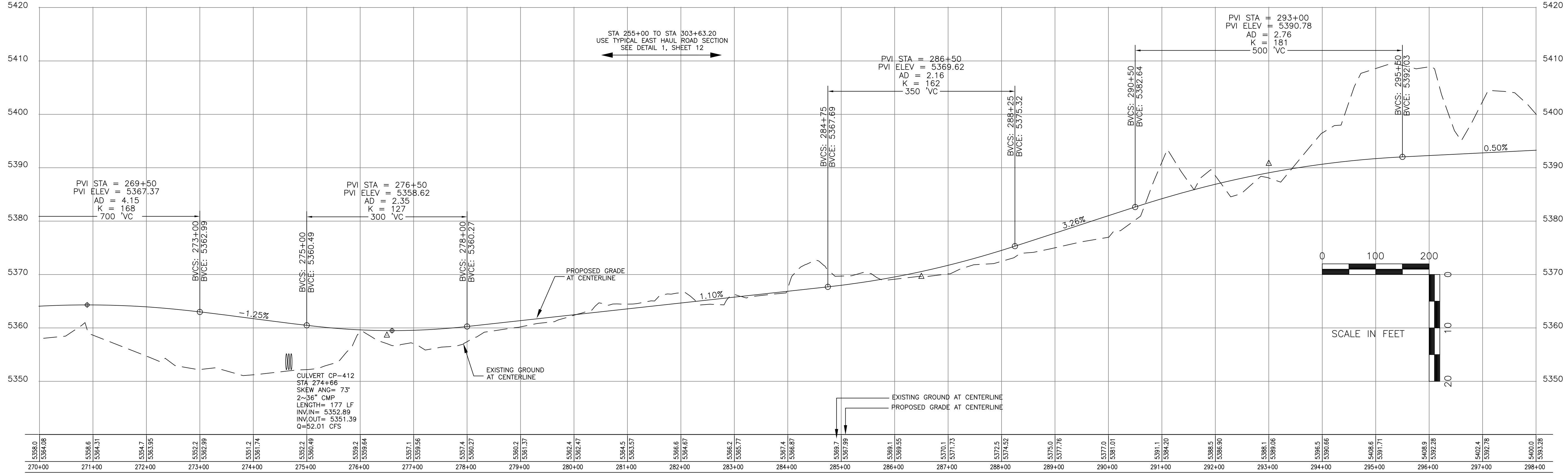
SEE EXHIBIT 40.6-1 FOR BURNHAM SOUTH ROAD PLAN AND PROFILE

LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING	CURVE	LENGTH	RADIUS	DELTA ANGLE	TANGENT	CHORD BEARING	CHORD
L1	290.22'	S 42°49'57" E	2007120.31	301281.31	2006907.48	301478.62	C1	716.29'	1500.00'	27°21'36" Left	365.11'	S 56°30'45" E	709.50'
L2	254.18'	S 70°11'34" E	2006516.01	302070.35	2006429.88	302309.50	C2	863.70'	1000.00'	49°29'10" Right	460.86'	S 45°26'59" E	837.10'
L3	970.75'	S 20°42'24" E	2005842.62	302906.04	2004934.58	303249.28	C3	676.57'	1600.00'	24°13'40" Left	343.42'	S 32°49'14" E	671.54'
L4	674.22'	S 24°51'45" E	2003798.53	304012.07	2003232.16	304274.52	C4	700.64'	2000.00'	20°04'18" Right	353.95'	S 34°53'54" E	697.06'
L5	464.88'	S 68°02'33" E	2002522.33	305021.28	2002348.50	305452.44	C5	1025.08'	1400.00'	43°10'47" Left	554.01'	S 48°27'09" E	1030.29'
L6	776.38'	S 44°46'50" E	2001969.29	306023.45	2001418.21	306570.33	C6	690.19'	1700.00'	23°15'42" Right	349.91'	S 56°24'41" E	685.46'
L7	5743.03'	S 00°00'00" E	1998248.43	307876.19	1992505.40	307876.19	C7	3517.37'	4500.00'	44°46'50" Right	1853.88'	S 22°23'25" E	3428.23'
L8	479.43'	N 89°37'24" W	1991505.42	306869.61	1991508.57	306390.20	C8	1577.37'	1000.00'	90°22'36" Right	1006.60'	S 45°11'18" W	1418.85'

NOTE: CULVERTS ARE TO BE INSTALLED AT EXISTING GRADE - NOT BURIED.

THESE PLANS ILLUSTRATE THE DESIGN OF THE PROPOSED EAST HAUL ROAD AND SERVICE ROAD LOOP AND ASSUME THAT THEY WILL BE CONSTRUCTED CONCURRENTLY WITH THE BURNHAM SOUTH ROAD. IF CONSTRUCTION IS NOT PERFORMED CONCURRENTLY PROVIDE TEMPORARY GRADING TO FACILITATE DRAINAGE.

EAST HAUL ROAD
STA 270+00 TO 298+00
SCALE: 1" = 100'

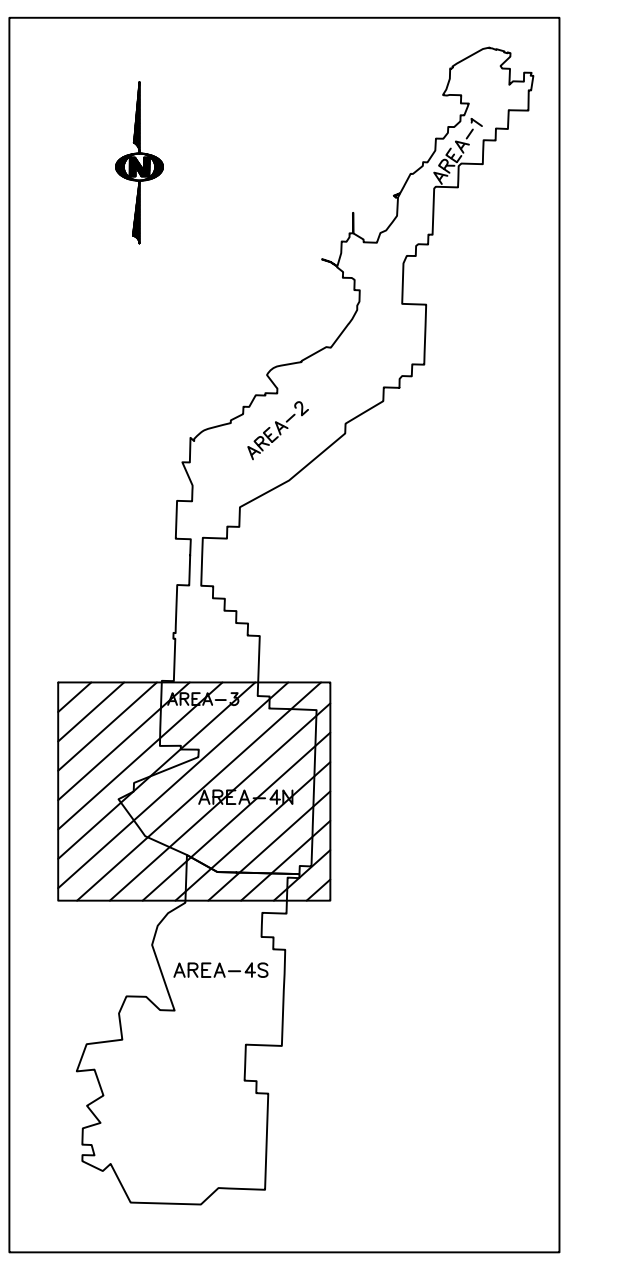


EAST HAUL ROAD
STA 270+00 TO 298+00
SCALE: 1"=100'H 1"=10'V

THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

NOT ISSUED FOR CONSTRUCTION

- LEGEND**
- BURNHAM SOUTH ROAD
 - EAST HAUL ROAD
 - SERVICE ROAD & SERVICE ROAD LOOP
 - PAVED ROAD
 - DIRT ROAD
 - TRAIL
 - BUILDING
 - FENCE
 - IRRIGATION LINE
 - CULVERT
 - LOW SPOT ELEVATION
 - DRAINAGE
 - RAILROAD
 - TREES
 - POWERLINE
 - 5338.5
 - SPOT ELEVATION
 - INDEX CONTOUR
 - INTERMEDIATE CONTOUR
 - 218 5422.45
 - HORIZ. & VERT. CONTROL
 - L-30
 - LEASE CORNER
 - LEASE BOUNDARY
 - PERMIT BOUNDARY



CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT INC.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

REV. NO.	DATE	COMMENTS
1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL

EXHIBIT 23.2-2

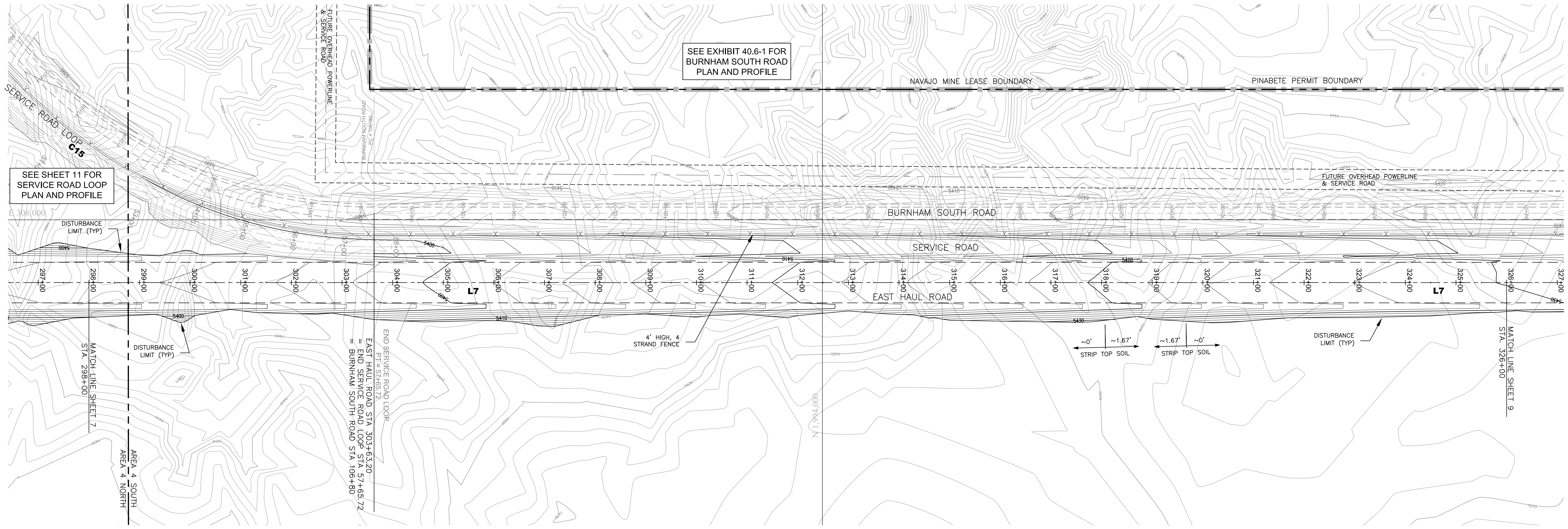
bhpbilliton

BHP Navajo Coal Company
P.O. Box 1717 • Farmington, NM 87401 • Phone: 505-598-4200
Tucson, New Mexico, 87416 • Fax: 505-598-1361

PINABETE PERMIT
PLAN & PROFILE:
EAST HAUL ROAD
STA 270+00 TO 298+00

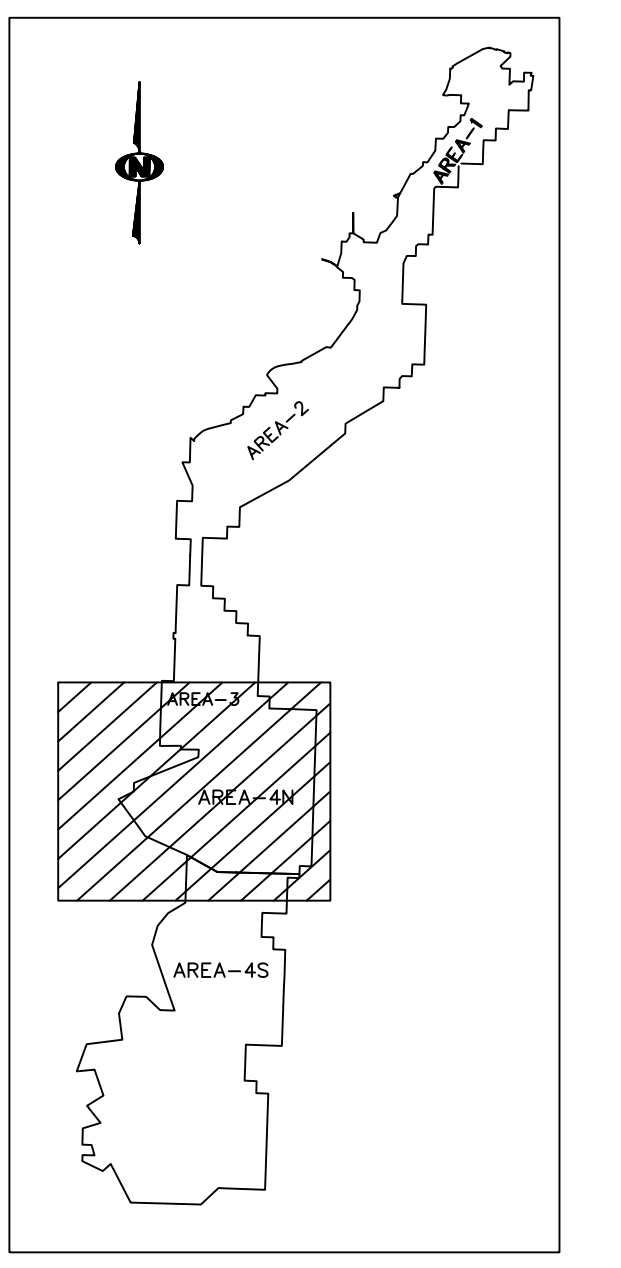
SHEET: 7 OF 13
PREPARED BY: BT&PR DRAWN BY: BT&PR SCALE: AS SHOWN
APPROVED BY: GM DATE: 02-07-2012

GEOMAT PROJECT NO. 112-1434



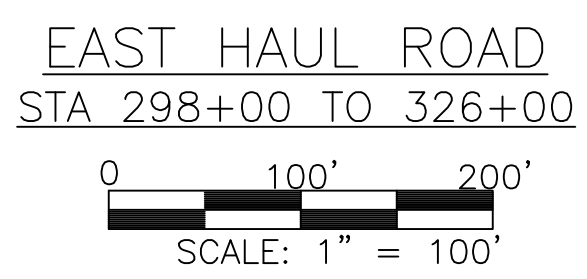
LEGEND

- BURNHAM SOUTH ROAD
- EAST HAUL ROAD
- SERVICE ROAD & SERVICE ROAD LOOP
- PAVED ROAD
- DIRT ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- LOW SPOT ELEVATION
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- × 5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- △ 218 5422.45 HORIZ. & VERT. CONTROL
- + L-30 LEASE CORNER
- LEASE BOUNDARY
- PERMIT BOUNDARY



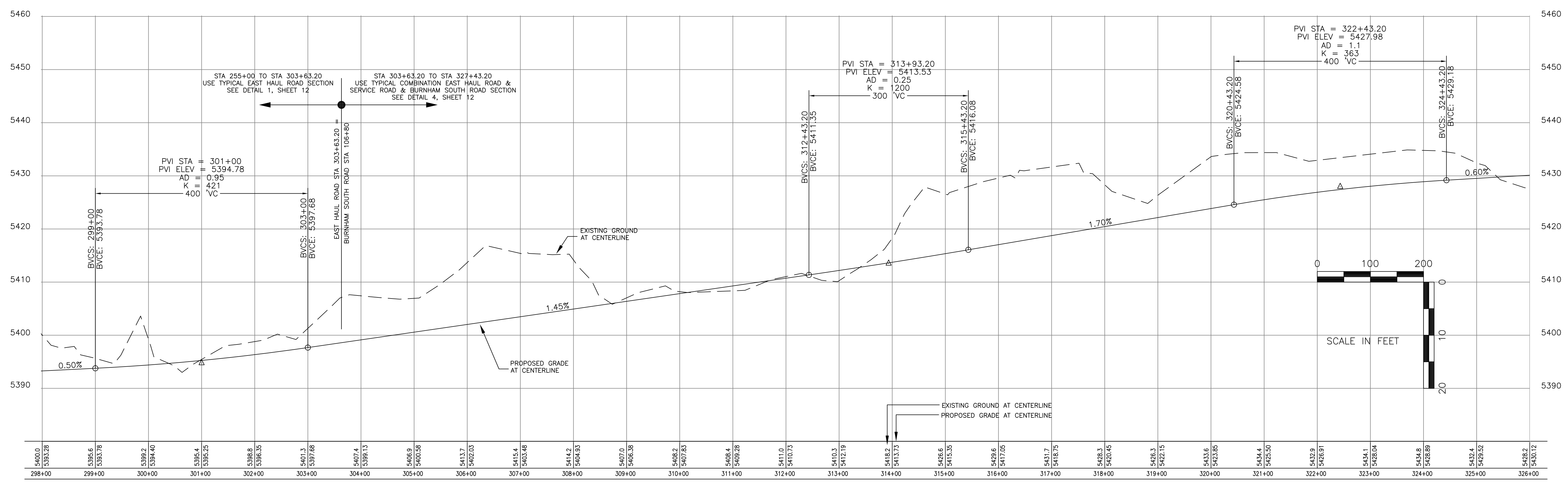
NOTE: CULVERTS ARE TO BE INSTALLED AT EXISTING GRADE - NOT BURIED.

THESE PLANS ILLUSTRATE THE DESIGN OF THE PROPOSED EAST HAUL ROAD AND SERVICE ROAD LOOP AND ASSUME THAT THEY WILL BE CONSTRUCTED CONCURRENTLY WITH THE BURNHAM SOUTH ROAD. SEE EXHIBIT 40.6-1 FOR THE DESIGN OF THE BURNHAM SOUTH ROAD. IF CONSTRUCTION IS NOT PERFORMED CONCURRENTLY PROVIDE TEMPORARY GRADING TO FACILITATE DRAINAGE.



EAST HAUL ROAD LINE AND CURVE TABLE

LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING	CURVE	LENGTH	RADIUS	DELTA ANGLE	TANGENT	CHORD BEARING	CHORD
L1	290.22'	S 42°49'57" E	2007120.31	301281.31	2006907.48	301478.62	C1	716.29'	1500.00'	27°21'36" Left	365.11'	S 56°30'45" E	709.50'
L2	254.18'	S 70°11'34" E	2006516.01	302070.35	2006429.88	302309.50	C2	863.70'	1000.00'	49°29'10" Right	460.86'	S 45°26'59" E	837.10'
L3	970.75'	S 20°42'24" E	2005842.62	302906.04	2004934.58	303249.28	C3	676.57'	1600.00'	24°13'40" Left	343.42'	S 32°49'14" E	671.54'
L4	624.22'	S 24°51'45" E	2003798.53	304012.07	2003232.16	304274.52	C4	700.64'	2000.00'	20°04'18" Right	353.95'	S 34°53'54" E	697.06'
L5	464.88'	S 68°02'33" E	2002522.33	305021.28	2002348.50	305452.44	C5	1055.08'	1400.00'	43°10'42" Left	554.01'	S 48°27'09" E	1030.29'
L6	776.38'	S 44°46'50" E	2001969.29	306023.45	2001418.21	306570.33	C7	3517.07'	4500.00'	44°46'50" Right	1853.88'	S 22°23'25" E	3428.23'
L7	5743.03'	S 00°00'00" E	1998248.43	307876.19	19982505.40	307876.19	C8	1577.37'	1000.00'	90°22'36" Right	1006.60'	S 45°11'18" W	1418.85'
L8	479.43'	N 89°37'24" W	1991505.42	306869.61	1991508.57	306390.20							



EAST HAUL ROAD
STA 298+00 TO 326+00
1"=100'H 1"=10'V

THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

NOT ISSUED FOR CONSTRUCTION

CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



GEOMAT INC.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

REV. NO.	DATE	COMMENTS
1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL

EXHIBIT 23.2-2



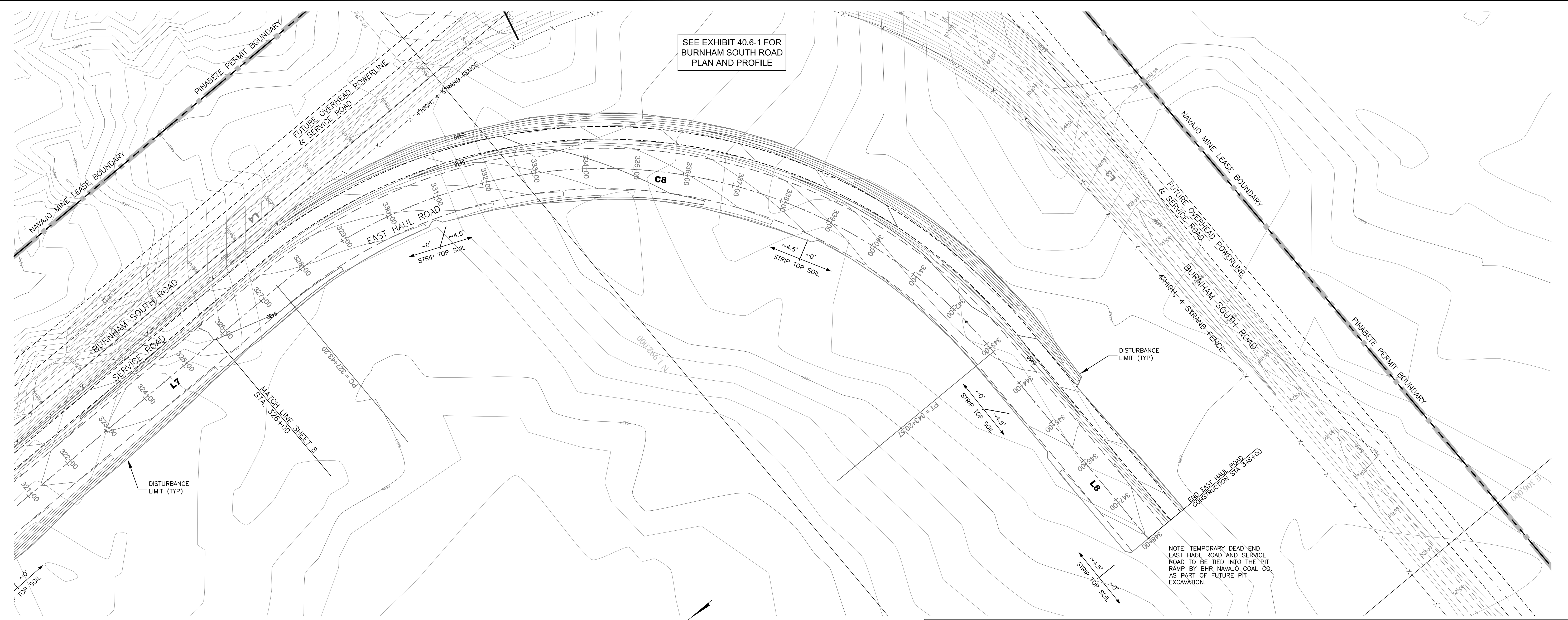
BHP Navajo Coal Company
P.O. Box 1717 • Farmington, NM 87416 • Phone: 505-598-4200
Fruition, New Mexico, 87416 • Fax: 505-598-3361

PINABETE PERMIT

PLAN & PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 298+00 TO 326+00

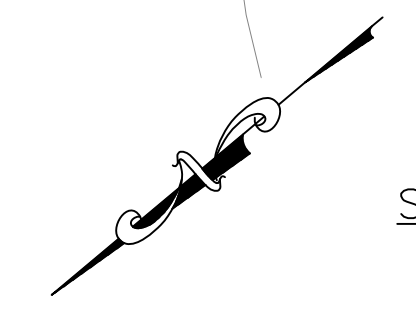
SHEET: 8 OF 13

APPROVED BY: GM DATE: 02-07-2012
DRAWN BY: BT&PR SCALE: AS SHOWN
GEOMAT PROJECT NO. 112-1434



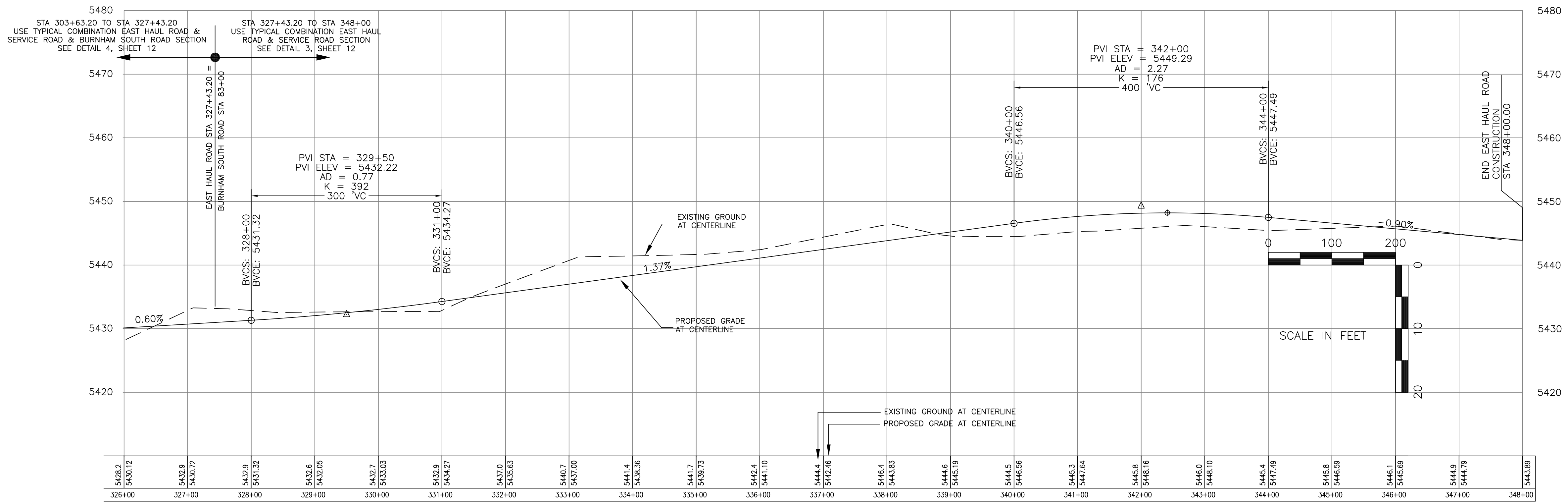
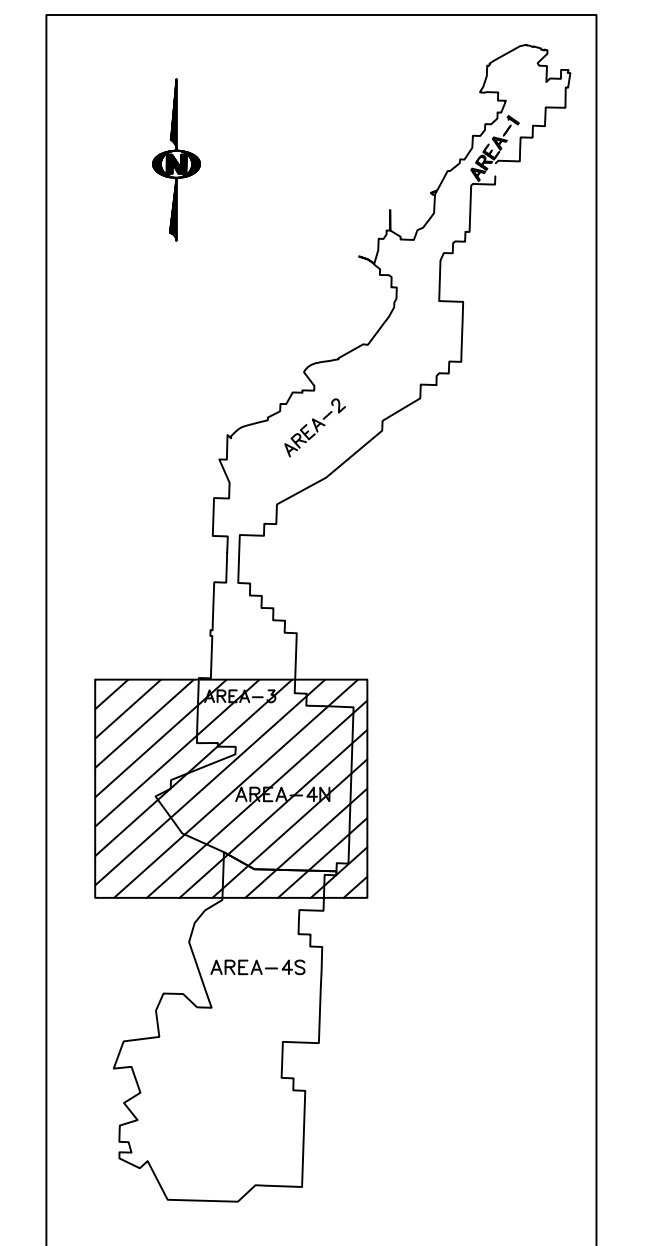
NOTE: CULVERTS ARE TO BE INSTALLED AT EXISTING GRADE - NOT BURIED.

THESE PLANS ILLUSTRATE THE DESIGN OF THE PROPOSED EAST HAUL ROAD AND SERVICE ROAD LOOP AND ASSUME THAT THEY WILL BE CONSTRUCTED CONCURRENTLY WITH THE BURNHAM SOUTH ROAD. SEE EXHIBIT 40.6-1 FOR THE DESIGN OF THE BURNHAM SOUTH ROAD. IF CONSTRUCTION IS NOT PERFORMED CONCURRENTLY PROVIDE TEMPORARY GRADING TO FACILITATE DRAINAGE.



EAST HAUL ROAD
STA 326+00 TO 348+00
SCALE: 1" = 100'

LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING	CURVE	LENGTH	RADIUS	DELTA ANGLE	TANGENT	CHORD BEARING	CHORD
L1	290.22'	S 42°49'57" E	2007120.31	301281.31	2006907.48	301478.62	C1	716.29'	1500.00'	27°21'36" Left	365.11'	S 56°30'45" E	709.50'
L2	254.18'	S 70°11'54" E	2006516.01	302070.35	2006429.88	302309.50	C2	863.70'	1000.00'	49°29'10" Right	460.86'	S 45°26'59" E	837.10'
L3	970.75'	S 20°42'24" E	2005842.62	302906.04	2004934.58	303249.28	C3	676.53'	1800.00'	24°13'40" Left	343.42'	S 32°49'14" E	671.54'
L4	624.22'	S 24°51'45" E	2003798.53	304012.07	2003232.16	304274.52	C5	1055.08'	1400.00'	43°10'47" Left	554.01'	S 46°27'09" E	1030.29'
L5	464.88'	S 68°02'33" E	2002522.33	305021.28	2002348.50	305452.44	C6	690.19'	1700.00'	23°15'42" Right	349.91'	S 56°24'41" E	685.46'
L6	776.38'	S 44°46'50" E	2001969.29	306023.45	2001418.21	306570.33	C7	3517.07'	4500.00'	44°46'50" Right	1853.88'	S 22°23'25" E	3428.23'
L7	5743.03'	S 07°00'00" E	1998248.43	307876.19	1992505.40	307876.19	C8	1577.37'	1000.00'	90°22'36" Right	1006.60'	S 45°11'18" W	1418.85'
L8	479.43'	N 89°37'24" W	1991505.42	306869.61	1991508.57	306390.20							



CERTIFICATION STATEMENT
I, GEORGE A. MADRID, P.E., HEREBY CERTIFY THAT THIS DRAWING WAS REVIEWED BY ME AND THAT THE INFORMATION SHOWN IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

GEORGE A. MADRID
NEW MEXICO
REGISTERED PROFESSIONAL ENGINEER
9110
3/15/12

GEOMAT INC.
915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

1	03-15-12	REVISED TITLE & TITLE BLOCK
0	02-07-12	INITIAL PERMIT SUBMITTAL

EXHIBIT 23.2-2

bhpbilliton

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

PINABETE PERMIT

PLAN & PROFILE: EAST HAUL ROAD & SERVICE ROAD STA 326+00 TO 348+00

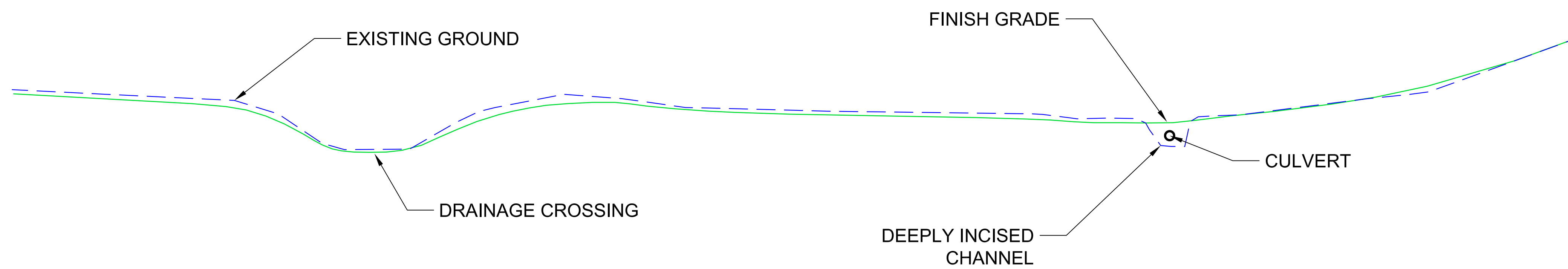
SHEET: 9 OF 13

APPROVED BY: GM DATE: 02-07-2012 SCALE: AS SHOWN

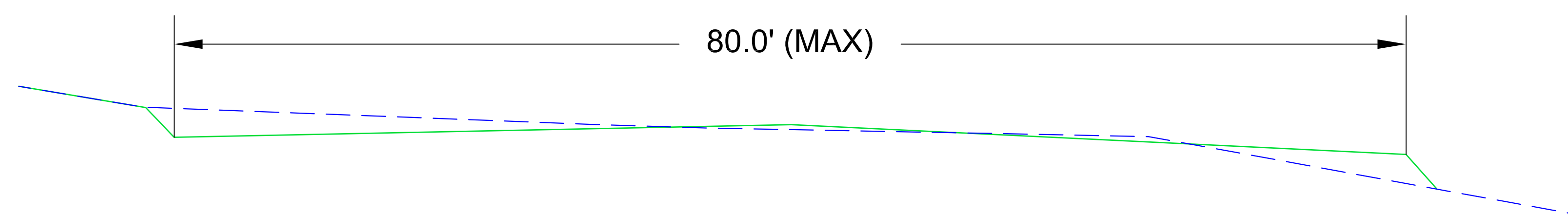
GEOMAT PROJECT NO. 112-1434

THE DESIGN FEATURES SHOWN ON THESE DESIGN PLANS ARE REASONABLE REPRESENTATIONS OF THE PROPOSED WORK BASED ON THE INFORMATION AVAILABLE AT THE TIME OF SUBMITTAL OF THIS PERMIT PACKAGE. ACTUAL CONSTRUCTION DETAILS MAY VARY FROM THOSE SHOWN.

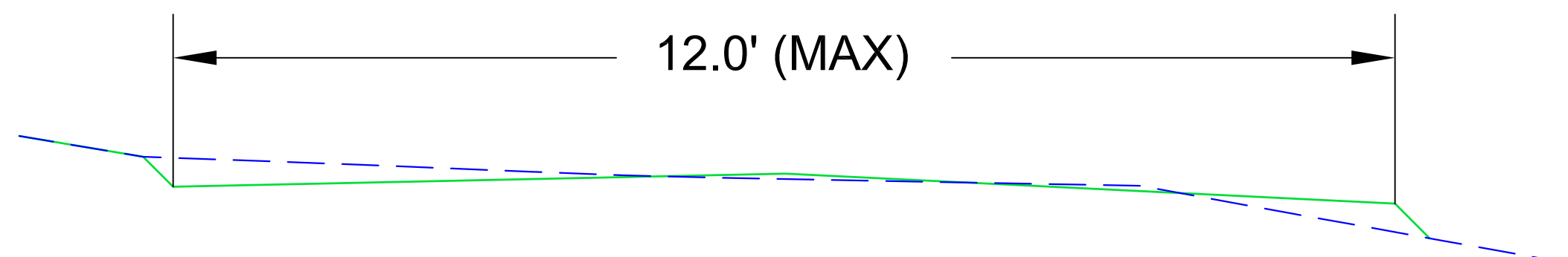
NOT ISSUED FOR CONSTRUCTION



TYPICAL PROFILE
N.T.S



NEW ANCILLARY ROAD
FOR TOPSOIL HAULAGE
TYPICAL SECTION
N.T.S.



NEW ANCILLARY ROAD
FOR SMALL VEHICLES
TYPICAL SECTION
N.T.S



EXISTING TWO TRACK ROADS
CLASSIFIED AS ANCILLARY ROADS
TYPICAL SECTION
N.T.S

Original certified signed exhibits are maintained at the mine site and at OSM.
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.



DATE SUBMITTED:	REVISION
PROJECT MANAGER: CN	REV
ENGR. #/RECORD: 0083	REV
SUPV.#/RECORD:	REV. NO.

bhpbilliton
BHP NAVAJO COAL COMPANY
PINABETE PERMIT
PO BOX 1717 FRUITLAND, NEW MEXICO 87416 PHONE 505-598-4200 FAX 505-598-4229

PROJECT: POST-2016
DATE: 8/19/11
DESIGNED BY: LR
DRAWN BY: RY
CHECKED BY: RY
APPROVED BY: RY

TYPICAL SECTIONS
AND PROFILES

EXHIBIT 23.3-1
TYPICAL
ANCILLARY ROADS
DESIGN

DRAWING

SHEET 1
OF 1

Appendix 23.A

Slope Stability Analysis



915 Malta Avenue ♦ Farmington, NM 87401 ♦ Tel (505) 327-7928 ♦ Fax (505) 326-5721

September 21, 2011

Ron C. Van Valkenburg, P.E.

BHP Billiton

BHP Navajo Coal Company

P.O. Box 1717

Fruitland, New Mexico 87416

RE: Slope Stability Evaluation
Navajo Mine Area 4 Coal Haulage Road
Fruitland, New Mexico
GEOMAT Project No. 112-1388

As you requested, GEOMAT Inc. has completed geotechnical engineering analyses to evaluate the stability of selected cut and fill slopes of the proposed coal haulage road to be constructed in Area 4 at Navajo Mine. Our analyses were based on the following understandings:

- Cut and Fill slopes: generally 2:1 Horizontal:Vertical (H:V), except that the slopes of the shoulders of the haul road will be 4:1 H:V,
- Slope of the roadway: 2 % to the shoulders from the center of the roadway
- Roadway and existing grade elevations: based on the roadway profile drawings Sheets 11 and 12 titled West Haulroad dated July 07.
- As requested, the cut slope used in the analysis is at station 460+00, where the cut will be approximately 57 ft,
- As requested, the fill slope used in the analysis is at station 520+90, where the fill will be approximately 60 ft,
- Where coal exists in the cut slope, for fire control purposes, the coal will be removed for an approximate horizontal distance of 20 feet and replaced with compacted fill,
- Strength properties of the native soils and the compacted fill material were based on information from the geotechnical engineering reports by Converse (Soil and Foundation Investigation Report, Converse Project No. 07-53190-01 dated July 10, 2008) and GEOMAT (Preliminary Geotechnical Engineering Report-BHP Navajo Mine Extension Project, GEOMAT Project No. 72-0466 and dated May 18, 2007)
- Strengths of the coal were estimated based on properties of the coal indicated in the above-referenced geotechnical engineering reports,
- A pseudo static seismic force of 0.1g was used in the analyses,
- The embankments were not considered to retain water or to be submerged,
- The loaded weight of the haul trucks (Kress 200C) and dragline (Model 8750 Walking Dragline) were simulated by dividing the weight of the vehicle over the area of the base of the wheels/tracks.
- OSM regulations require a minimum static safety factor of 1.3 for primary road embankments.
- The properties shown in the attached diagrams for cohesion, unit weight, and internal angle of friction of the compacted fill portion of the embankments are based upon laboratory values in the aforementioned Converse report. The actual compacted fill material used for the embankments should be sampled and tested to verify it conforms at a minimum to these properties.

Selection, placement and compaction of the fill soils should be as recommended in the aforementioned Converse report.

Slope stability analyses were performed with Galena Slope Stability Analysis System software, v4.02 and v5.02. Properties of the soil and rock materials that are expected to exist in the cut and fill sections are noted on the slope stability analysis sheets that are attached to this report.


The results of the analyses are summarized in the following table. Individual sheets showing the details of the calculations and the configuration of the slope used in the calculations are attached.

Slope	Pseudo Static Earthquake (%g)	Calculated Factor of Safety
Fill Slope w/o vehicle load	0.1	1.5
Fill Slope w/ Kress haul truck	0.1	1.4
Fill Slope w/ dragline	0.1	1.5
Cut Slope w/o vehicle loading	0.1	1.4
Cut Slope w/ dragline @ toe	0.1	1.4

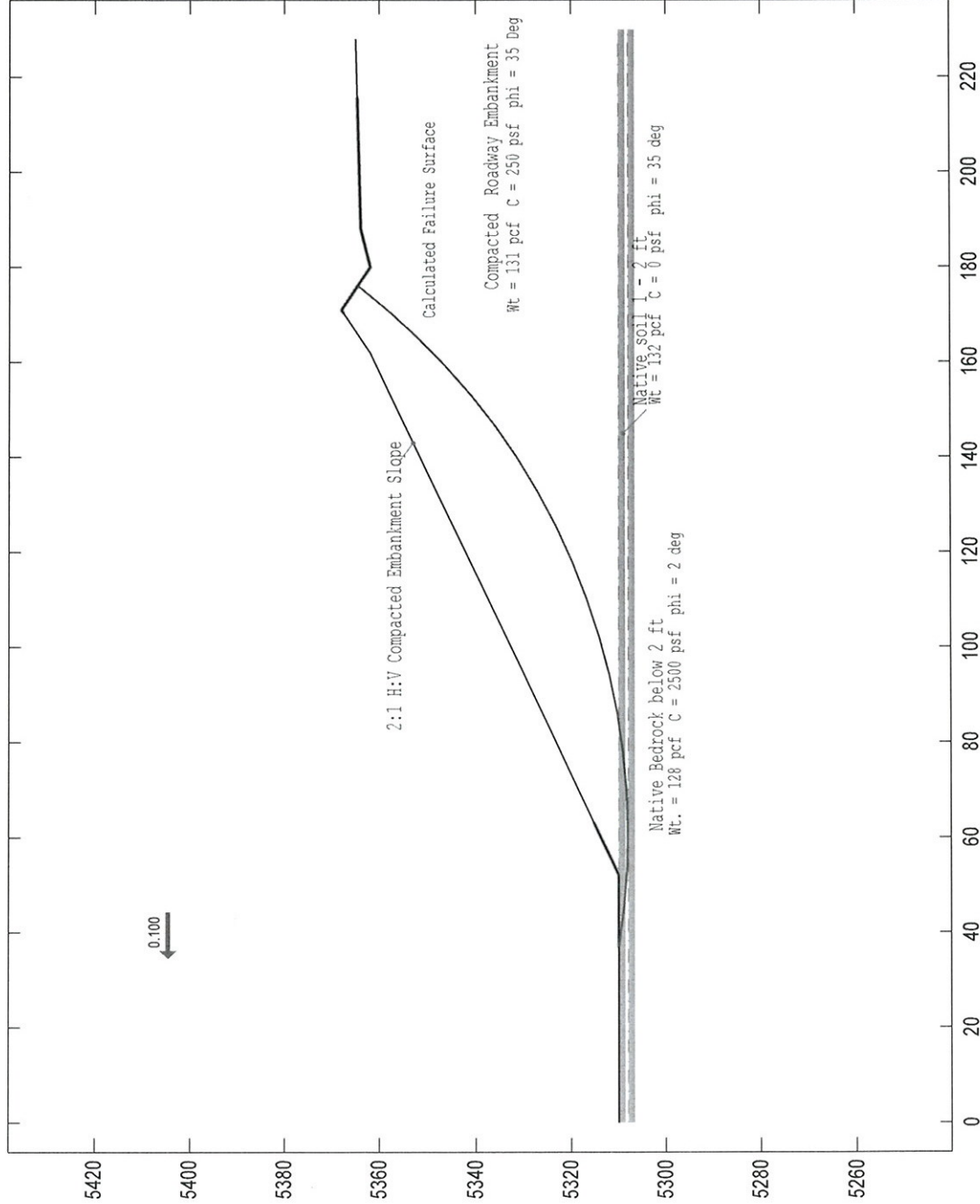
As shown in the table, the calculated factors of safety for both the cut and fill slopes are either 1.4 or 1.5. Based on the required factor of safety of 1.3, both the cut and fill slopes are considered to have adequate factors of safety for the conditions analyzed.

The nature and variation of materials may not become evident until construction. If variations then appear, it will be necessary to reevaluate the information in this report. Likewise, in the event that any changes in the nature, design, or location of the cut or fill 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.

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, P.E.
President, Principal Engineer
9-21-11

Attachments



Analysis: 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical (minimum)

Factor of Safety: 1.58

Edited: 21 Sep 2011 Processed: 21 Sep 2011

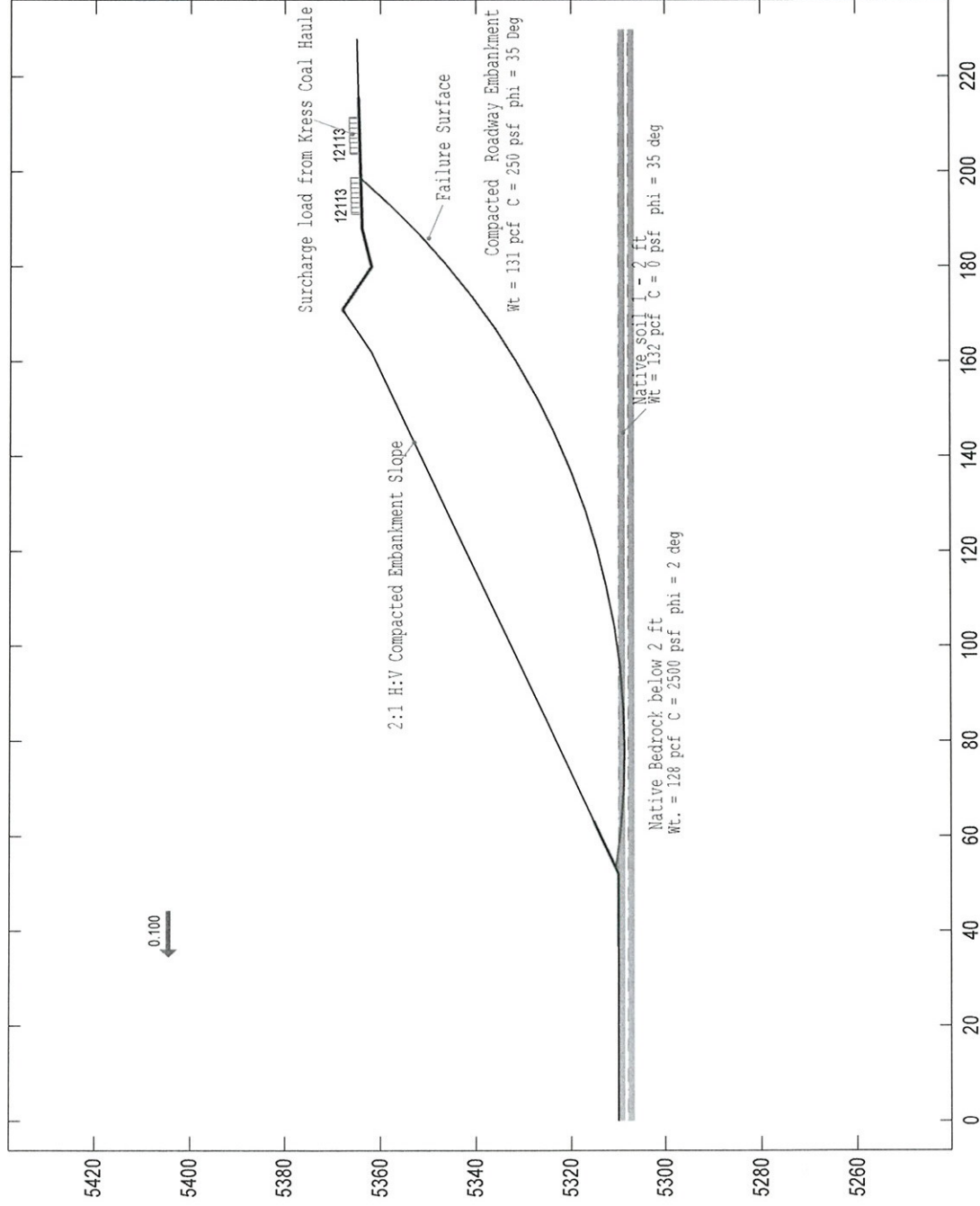


Project: BHP Haul Road

BHP Haul Road - Fill Slope w/o Vehicle Loads

File: P:\Eng\PROJEC-2\118BA3-1\GALENA-1\Final\BHP Haul Road Fill Slope w- No Vehicle Surcharge.gmf

Licensed to: GEOMAT Inc.



Analysis: 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical (minimum)

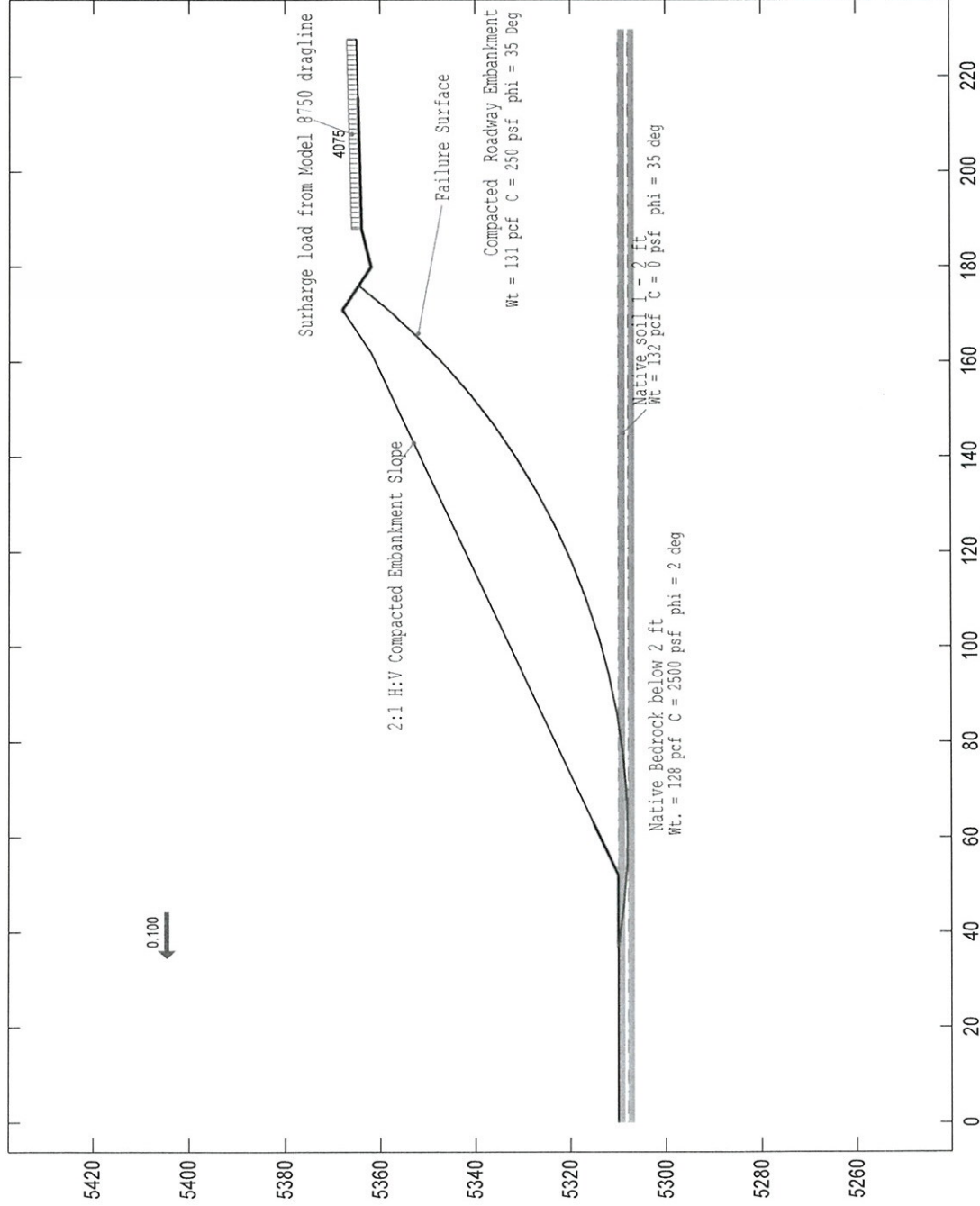
Factor of Safety: 1.46

Edited: 21 Sep 2011 Processed: 21 Sep 2011



Project: BHP Haul Road
BHP Haul Road - Fill Slope w/ Kress Truck
File: P:\Eng\PROJEC-2\118BA3~1\GALENA~1\Final\BHP Haul Road Fill Slope w- Kress Coal Hauler.gmf

Licensed to: GEOMAT Inc.



Analysis: 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical (minimum)

Factor of Safety: 1.58

Edited: 21 Sep 2011 Processed: 21 Sep 2011

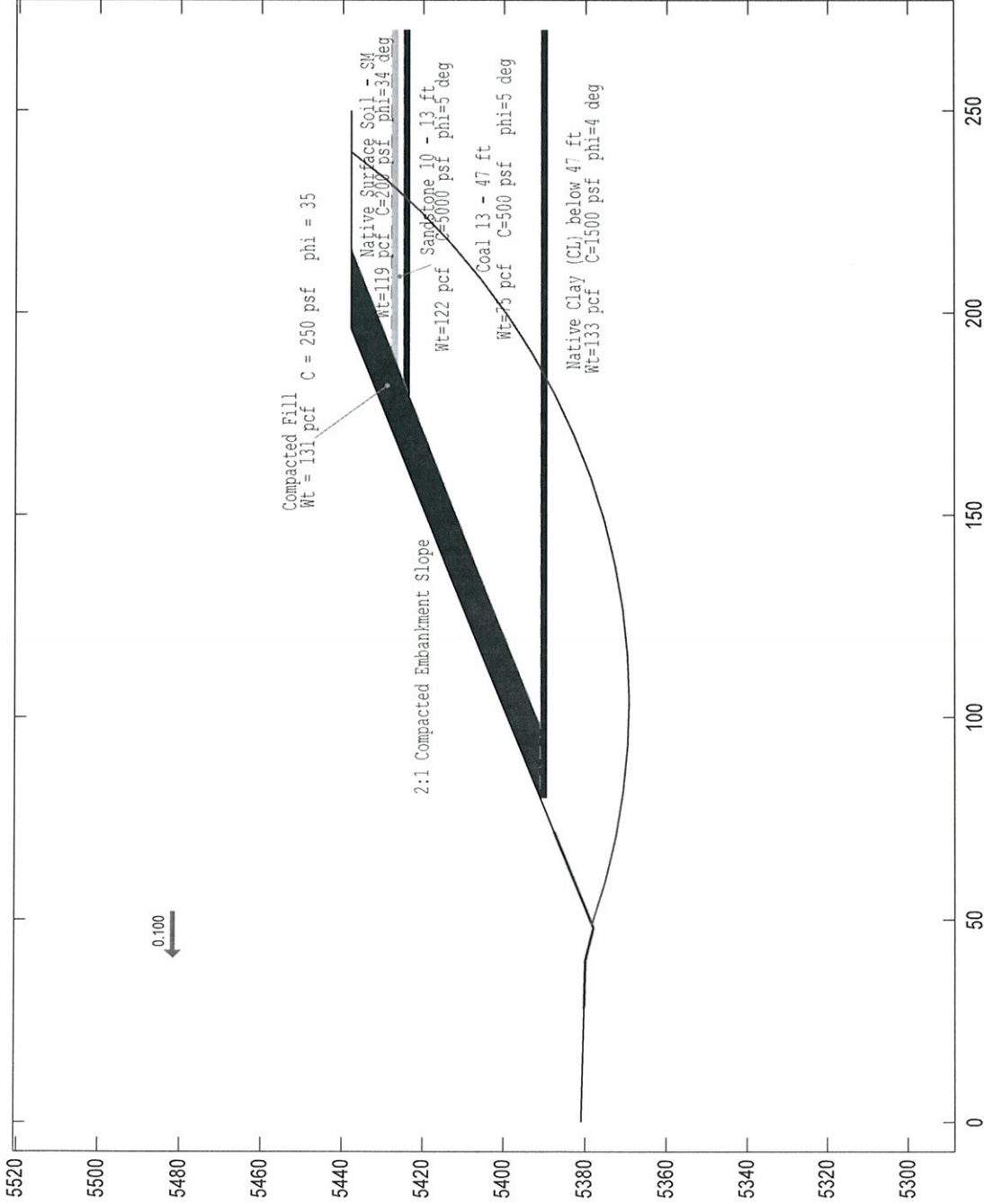


Project: BHP Haul Road

BHP Haul Road - Fill Slope w/ 8750 Dragline

File: P:\Eng\PROJEC-21118BA3~1\GALENA~1\Final\BHP Haul Road Fill Slope w- Dragline.gmf

Licensed to: GEOMAT Inc.



Analysis: 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical (minimum)

Factor of Safety: 1.49

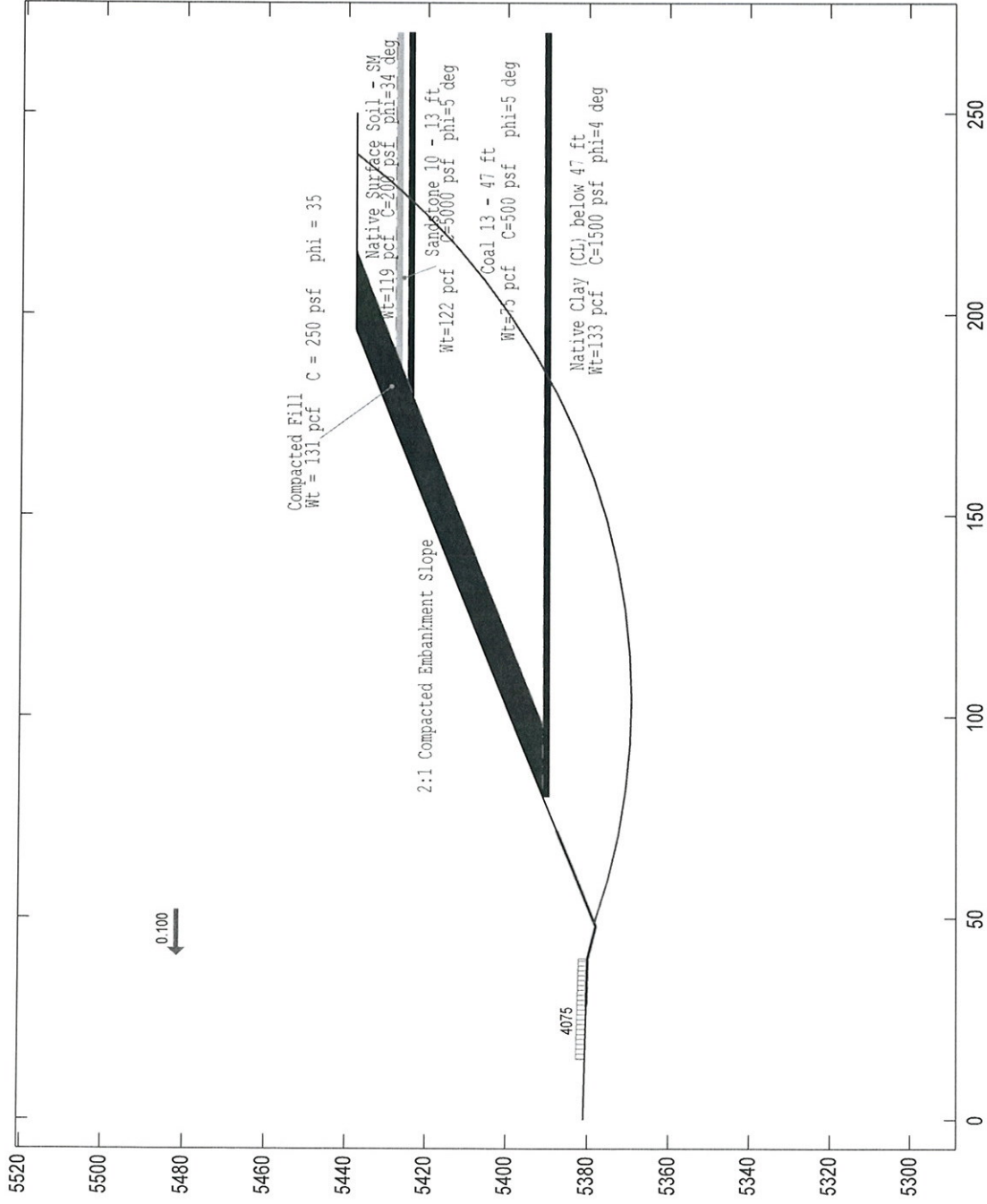
Edited: 21 Sep 2011 Processed: 21 Sep 2011



Project: BHP Haul Road Slope Analysis with Haul Truck Load
BHP Haul Road - Cut Slope w/o Vehicle Load

File: P:\Eng\PROJEC-2\118BA3~1\GALENA~1\Final\BHP Haul Rd Cut Slope w- No Vehicle Load.gmf

Licensed to: GEOMAT Inc.



Analysis: 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical (minimum)

Factor of Safety: 1.49

Edited: 21 Sep 2011 Processed: 21 Sep 2011



Project: BHP Haul Road Slope Analysis with Haul Truck Load
BHP Haul Road - Cut Slope w/ Dragline at Toe

File: P:\Eng\PROJECT-21118BA3~1\GALENA~1\Final\BHP Haul Rd Cut Slope w- Dragline.gmf

Licensed to: GEOMAT Inc.

Appendix 23.B

East Haul Road Culverts – Hydrologic Analysis and Design

EAST HAULROAD
25-YR 24-HR STORM

CULVERT CP-407

STATION 167+20

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

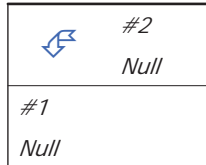
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.060 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CULVERT CP-407
Null	#2	==>	#1	0.000	0.000	CP-407 DROP INLET



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	4.905	4.905	6.60	0.36
#1	443.460	448.365	218.40	21.91

Structure Detail:

Structure #2 (Null)

CP-407 DROP INLET

Structure #1 (Null)

CULVERT CP-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)
#2	1	4.905	0.135	0.000	0.000	89.000	M	6.60	0.358
	Σ	4.905						6.60	0.358
#1	1	443.460	0.662	0.000	0.000	82.900	M	216.89	21.550
	Σ	448.365						218.40	21.908

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	1.74	164.21	9,425.68	3.950	0.662
#1	1	Time of Concentration:					0.662
#2	1	8. Large gullies, diversions, and low flowing streams	2.18	46.86	2,152.76	4.420	0.135
#2	1	Time of Concentration:					0.135

HY-8 Culvert Analysis Report

CULVERT CP-407 – STATION 167+20

Culvert Data Summary - Culvert CP-407

Barrel Shape: Circular
Barrel Diameter: 5.00 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Inlet Type: Conventional
Inlet Edge Condition: Square Edge with Headwall
Inlet Depression: None

Site Data - Culvert CP-407

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 5274.48 ft
Outlet Station: 220.00 ft
Outlet Elevation: 5270.70 ft
Number of Barrels: 2

Table 1 - Culvert Summary Table: Culvert CP-407

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	5274.48	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
21.84	21.84	5275.69	1.210	0.0*	1-S2n	0.785	0.881	0.801	1.460	5.222	3.848
43.68	43.68	5276.22	1.743	0.0*	1-S2n	1.140	1.269	1.159	1.890	6.275	4.516
65.52	65.52	5276.65	2.167	0.0*	1-S2n	1.412	1.581	1.420	2.191	7.106	4.976
87.36	87.36	5277.01	2.530	0.0*	1-S2n	1.641	1.833	1.643	2.432	7.751	5.334
109.20	109.20	5277.36	2.879	0.0*	1-S2n	1.850	2.068	1.858	2.636	8.202	5.632
131.04	131.04	5277.69	3.209	0.0*	1-S2n	2.051	2.269	2.059	2.815	8.591	5.889
152.88	152.88	5278.00	3.523	0.0*	1-S2n	2.232	2.470	2.239	2.976	8.970	6.116
174.72	174.72	5278.31	3.829	0.0*	1-S2n	2.413	2.643	2.413	3.123	9.309	6.320
196.56	196.56	5278.61	4.129	0.0*	1-S2n	2.588	2.811	2.601	3.258	9.526	6.506
218.40	218.40	5278.91	4.430	0.0*	1-S2n	2.760	2.978	2.768	3.403	9.793	6.597

* theoretical depth is impractical. Depth reported is corrected.

 Inlet Elevation (invert): 5274.48 ft, Outlet Elevation (invert): 5270.70 ft
 Culvert Length: 220.00 ft, Culvert Slope: 0.0172

Roadway Data for Crossing: Culvert CP-407

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	5286.50
2	50.00	5286.30
3	100.00	5286.20
4	150.00	5286.17
5	200.00	5286.23
6	250.00	5286.37
7	300.00	5286.60

Roadway Surface: Gravel

Roadway Top Width: 123.00 ft

Table 2 - Downstream Channel Rating Curve (Crossing: Culvert CP-407)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	5270.70	0.00	0.00	0.00	0.00
21.84	5272.16	1.46	3.85	1.42	0.80
43.68	5272.59	1.89	4.52	1.84	0.84
65.52	5272.89	2.19	4.98	2.13	0.86
87.36	5273.13	2.43	5.33	2.37	0.87
109.20	5273.33	2.64	5.63	2.57	0.88
131.04	5273.51	2.82	5.89	2.74	0.89
152.88	5273.67	2.98	6.12	2.90	0.90
174.72	5273.82	3.12	6.32	3.04	0.91
196.56	5273.95	3.26	6.51	3.17	0.92
218.40	5274.10	3.40	6.60	3.31	0.92

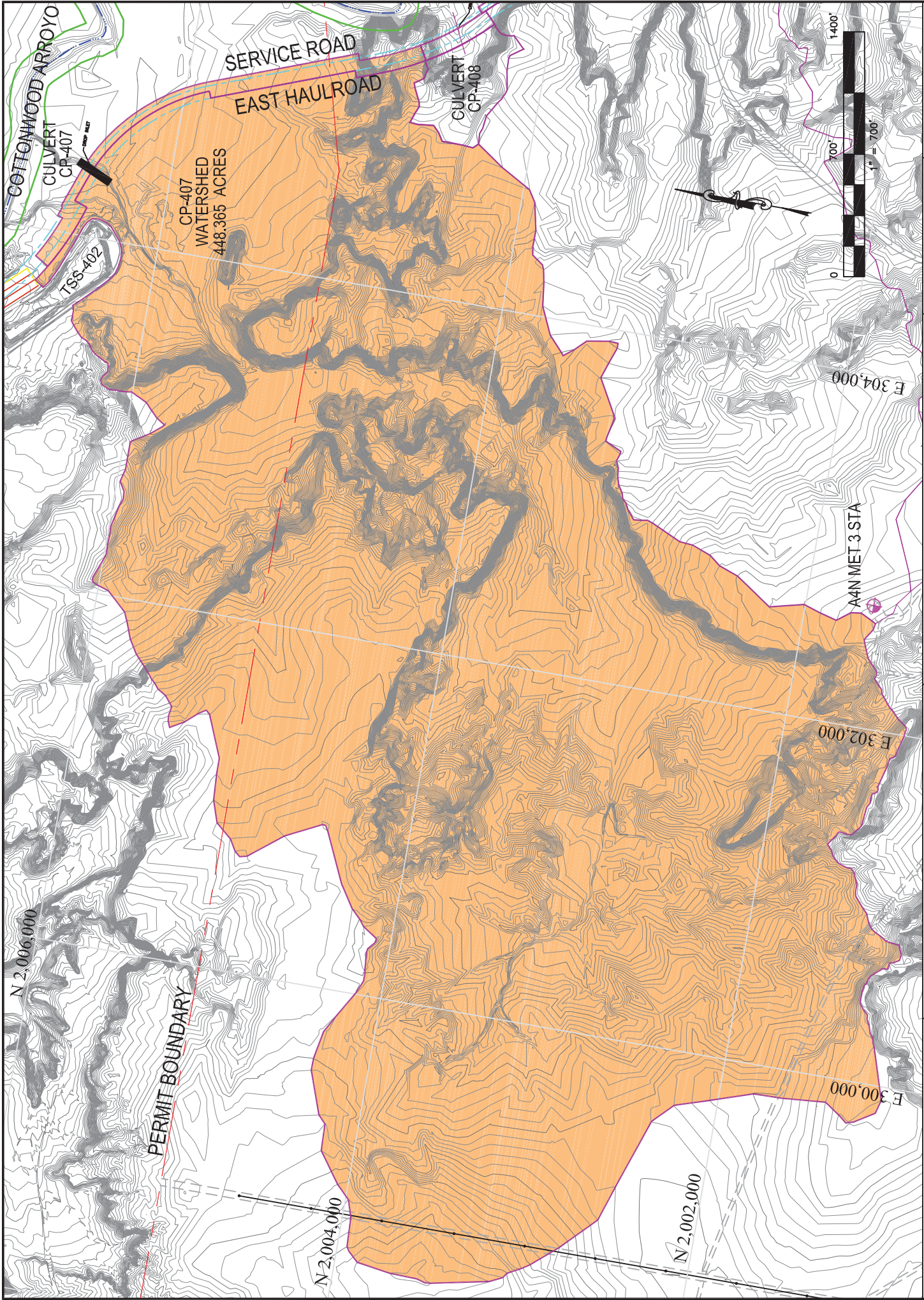
Tailwater Channel Data - Culvert CP-407

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0156

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	5278.00	0.0370
2	81.52	5278.00	0.0370
3	113.44	5278.21	0.0370
4	138.45	5278.00	0.0370
5	145.82	5276.00	0.0370
6	151.19	5274.00	0.0370
7	156.86	5272.00	0.0370
8	160.00	5270.70	0.0370
9	163.79	5272.00	0.0370
10	170.85	5274.00	0.0370
11	189.13	5276.00	0.0370
12	300.00	5276.92	0.0370



COTTONWOOD ARROYO
CULVERT CP-407

SERVICE ROAD
EAST HAULROAD

CULVERT CP-408

CP-407
WATERSHED
448.365 ACRES

TSS-402

PERMIT BOUNDARY

A4N MET 3 STA

E 304,000

E 302,000

E 300,000

N 2,006,000

N 2,004,000

N 2,002,000

DRAWN BY: PR & BT
PREPARED BY: PR & BT
DATE: JAN. 27, 2012

CULVERT CP-407 WATERSHED
EAST HAULROAD STA 167+20

NAVAJO COAL COMPANY
EAST HAULROAD DESIGN

GEOMAT inc.
915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928

EAST HAULROAD
25-YR 24-HR STORM

CULVERT CP-408

STATION 189+89

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

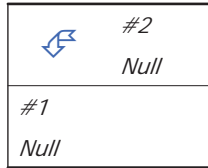
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.060 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CULVERT CP-408
Null	#2	==>	#1	0.000	0.000	CP-408 DROP INLET



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	0.917	0.917	1.89	0.08
#1	5.811	6.728	11.14	0.43

Structure Detail:

Structure #2 (Null)

CP-408 DROP INLET

Structure #1 (Null)

CULVERT CP-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)
#2	1	0.917	0.011	0.000	0.000	89.000	M	1.89	0.078
	Σ	0.917						1.89	0.078
#1	1	5.811	0.019	0.000	0.000	82.900	M	9.25	0.354
	Σ	6.728						11.14	0.432

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	10.36	70.06	676.11	9.650	0.019
#1	1	Time of Concentration:					0.019
#2	1	8. Large gullies, diversions, and low flowing streams	6.24	19.70	315.57	7.490	0.011
#2	1	Time of Concentration:					0.011

HY-8 Culvert Analysis Report

CULVERT CP-408 – STATION 189+89

Culvert Data Summary - Culvert CP-408

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Inlet Type: Conventional
Inlet Edge Condition: Square Edge with Headwall
Inlet Depression: None

Site Data - Culvert CP-408

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 5303.63 ft
Outlet Station: 252.00 ft
Outlet Elevation: 5292.87 ft
Number of Barrels: 1

Table 1 - Culvert Summary Table: Culvert CP-408

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	5303.63	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
1.11	1.11	5304.10	0.475	0.0*	1-S2n	0.269	0.354	0.274	0.213	4.141	1.526
2.23	2.23	5304.31	0.684	0.0*	1-S2n	0.400	0.510	0.401	0.276	4.972	1.815
3.34	3.34	5304.48	0.853	0.0*	1-S2n	0.482	0.635	0.484	0.321	5.642	2.009
4.46	4.46	5304.62	0.991	0.0*	1-S2n	0.563	0.736	0.565	0.357	6.078	2.159
5.57	5.57	5304.76	1.132	0.0*	1-S2n	0.634	0.830	0.639	0.389	6.472	2.282
6.68	6.68	5304.89	1.264	0.0*	1-S2n	0.696	0.911	0.701	0.416	6.779	2.389
7.80	7.80	5305.02	1.391	0.0*	1-S2n	0.758	0.993	0.762	0.441	7.087	2.483
8.91	8.91	5305.14	1.514	0.0*	1-S2n	0.818	1.062	0.821	0.464	7.350	2.567
10.03	10.03	5305.27	1.635	0.0*	1-S2n	0.871	1.129	0.878	0.485	7.545	2.644
11.14	11.14	5305.39	1.756	0.0*	1-S2n	0.925	1.197	0.926	0.504	7.826	2.714

* theoretical depth is impractical. Depth reported is corrected.

 Inlet Elevation (invert): 5303.63 ft, Outlet Elevation (invert): 5292.87 ft
 Culvert Length: 252.00 ft, Culvert Slope: 0.0427

Roadway Data for Crossing: Culvert CP-408

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	5317.68
2	50.00	5317.37
3	300.00	5315.49

Roadway Surface: Gravel

Roadway Top Width: 123.00 ft

Table 2 - Downstream Channel Rating Curve (Crossing: Culvert CP-408)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	5292.87	0.00	0.00	0.00	0.00
1.11	5293.08	0.21	1.53	0.38	0.83
2.23	5293.15	0.28	1.82	0.50	0.86
3.34	5293.19	0.32	2.01	0.58	0.88
4.46	5293.23	0.36	2.16	0.64	0.90
5.57	5293.26	0.39	2.28	0.70	0.91
6.68	5293.29	0.42	2.39	0.75	0.92
7.80	5293.31	0.44	2.48	0.80	0.93
8.91	5293.33	0.46	2.57	0.84	0.94
10.03	5293.35	0.48	2.64	0.87	0.95
11.14	5293.37	0.50	2.71	0.91	0.95

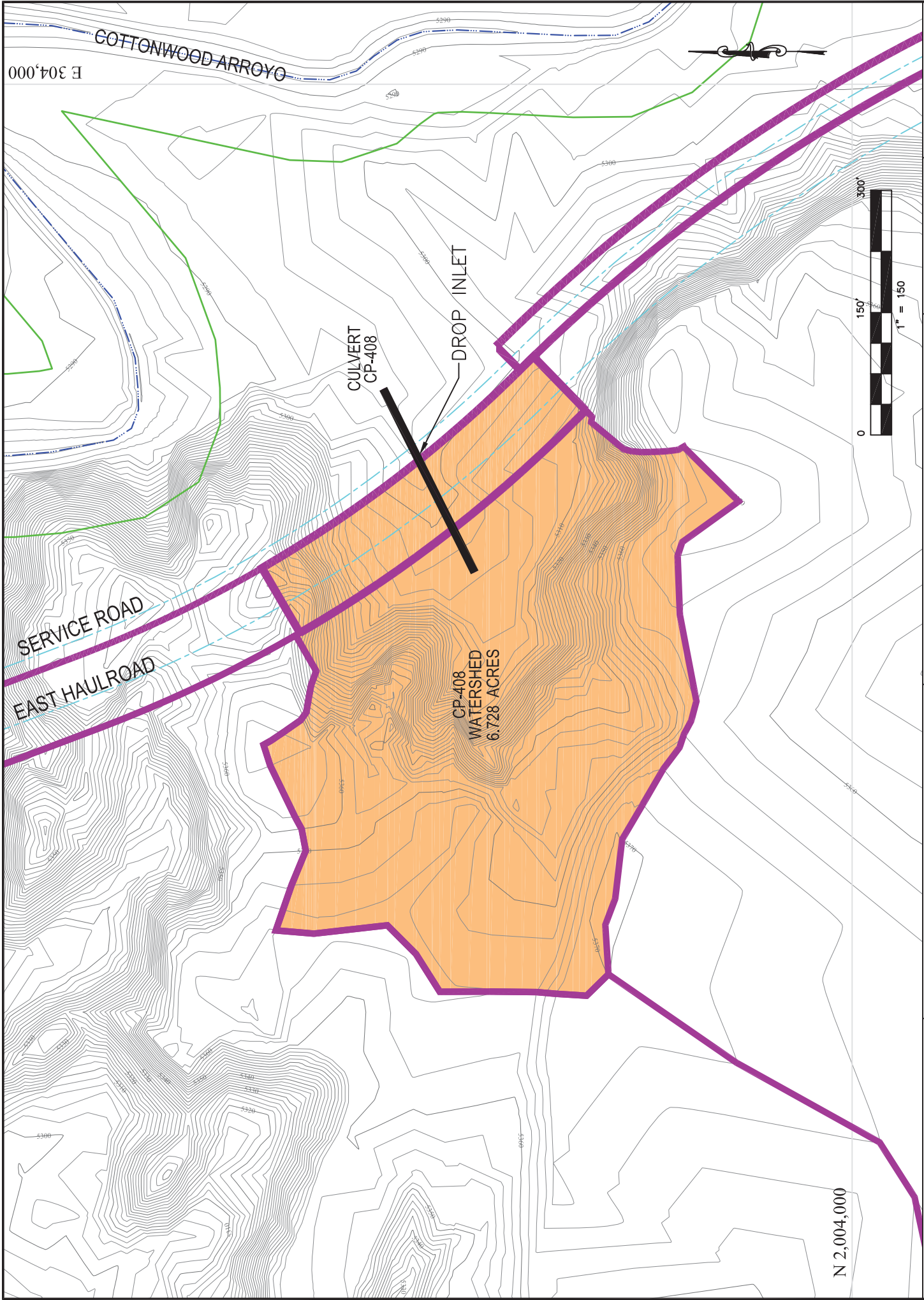
Tailwater Channel Data - Culvert CP-408

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0289

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	5330.00	0.0370
2	66.39	5300.00	0.0370
3	72.66	5298.00	0.0370
4	108.05	5296.00	0.0370
5	146.54	5294.00	0.0370
6	150.00	5292.87	0.0370
7	183.05	5294.00	0.0370
8	231.67	5296.00	0.0370
9	276.81	5298.00	0.0370
10	300.00	5300.00	0.0000



E 304,000

COTTONWOOD ARROYO

SERVICE ROAD
EAST HAULROAD

CULVERT
CP-408

DROP INLET

CP-408
WATERSHED
6.728 ACRES



N 2,004,000

<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>CULVERT CP-408 WATERSHED EAST HAULROAD STA 189+89</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT DATE: JAN. 27, 2012</p>
			<p>PLATE 4</p>

EAST HAULROAD
25-YR 24-HR STORM

CULVERT CP-409

STATION 200+62

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

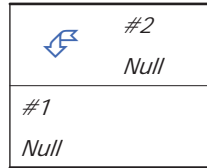
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.060 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CULVERT CP-409
Null	#2	==>	#1	0.000	0.000	CP-409 DROP INLET



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	1.245	1.245	2.57	0.11
#1	146.914	148.159	116.30	7.27

Structure Detail:

Structure #2 (Null)

CP-409 DROP INLET

Structure #1 (Null)

CULVERT CP-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)
#2	1	1.245	0.057	0.000	0.000	89.000	M	2.57	0.112
	Σ	1.245						2.57	0.112
#1	1	146.914	0.286	0.000	0.000	82.900	M	116.15	7.160
	Σ	148.159						116.30	7.272

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	2.53	124.72	4,923.45	4.770	0.286
#1	1	Time of Concentration:					0.286
#2	1	8. Large gullies, diversions, and low flowing streams	2.22	20.55	924.87	4.470	0.057
#2	1	Time of Concentration:					0.057

HY-8 Culvert Analysis Report

CULVERT CP-409 – STATION 200+62

Culvert Data Summary - Culvert CP-409

Barrel Shape: Circular
Barrel Diameter: 3.50 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Inlet Type: Conventional
Inlet Edge Condition: Square Edge with Headwall
Inlet Depression: None

Site Data - Culvert CP-409

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 5301.62 ft
Outlet Station: 227.00 ft
Outlet Elevation: 5296.71 ft
Number of Barrels: 2

Table 1 - Culvert Summary Table: Culvert CP-409

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	5301.62	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
11.63	11.63	5302.60	0.977	0.0*	1-S2n	0.620	0.720	0.629	0.461	4.870	1.842
23.26	23.26	5303.02	1.400	0.0*	1-S2n	0.885	1.031	0.891	0.598	5.972	2.191
34.89	34.89	5303.36	1.737	0.0*	1-S2n	1.103	1.265	1.104	0.696	6.691	2.425
46.52	46.52	5303.67	2.054	0.0*	1-S2n	1.283	1.475	1.285	0.775	7.245	2.605
58.15	58.15	5303.97	2.348	0.0*	1-S2n	1.454	1.658	1.457	0.843	7.668	2.755
69.78	69.78	5304.25	2.628	0.0*	1-S2n	1.609	1.826	1.616	0.903	8.032	2.883
81.41	81.41	5304.52	2.902	0.0*	1-S2n	1.764	1.978	1.764	0.956	8.375	2.997
93.04	93.04	5304.80	3.176	0.0*	1-S2n	1.911	2.126	1.916	1.005	8.634	3.098
104.67	104.67	5305.08	3.456	0.0*	1-S2n	2.059	2.255	2.064	1.051	8.867	3.191
116.30	116.30	5305.37	3.748	0.0*	5-S2n	2.211	2.384	2.213	1.093	9.081	3.276

* theoretical depth is impractical. Depth reported is corrected.

 Inlet Elevation (invert): 5301.62 ft, Outlet Elevation (invert): 5296.71 ft
 Culvert Length: 227.00 ft, Culvert Slope: 0.0216

Roadway Data for Crossing: Culvert CP-409

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	5310.02
2	50.00	5309.83
3	100.00	5309.72
4	150.00	5309.68
5	200.00	5309.72
6	250.00	5309.83
7	300.00	5310.02

Roadway Surface: Gravel

Roadway Top Width: 123.00 ft

Table 2 - Downstream Channel Rating Curve (Crossing: Culvert CP-409)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	5296.71	0.00	0.00	0.00	0.00
11.63	5297.17	0.46	1.84	0.43	0.68
23.26	5297.31	0.60	2.19	0.56	0.71
34.89	5297.41	0.70	2.42	0.65	0.72
46.52	5297.49	0.78	2.61	0.72	0.74
58.15	5297.55	0.84	2.75	0.78	0.75
69.78	5297.61	0.90	2.88	0.84	0.76
81.41	5297.67	0.96	3.00	0.89	0.76
93.04	5297.72	1.01	3.10	0.93	0.77
104.67	5297.76	1.05	3.19	0.98	0.78
116.30	5297.80	1.09	3.28	1.02	0.78

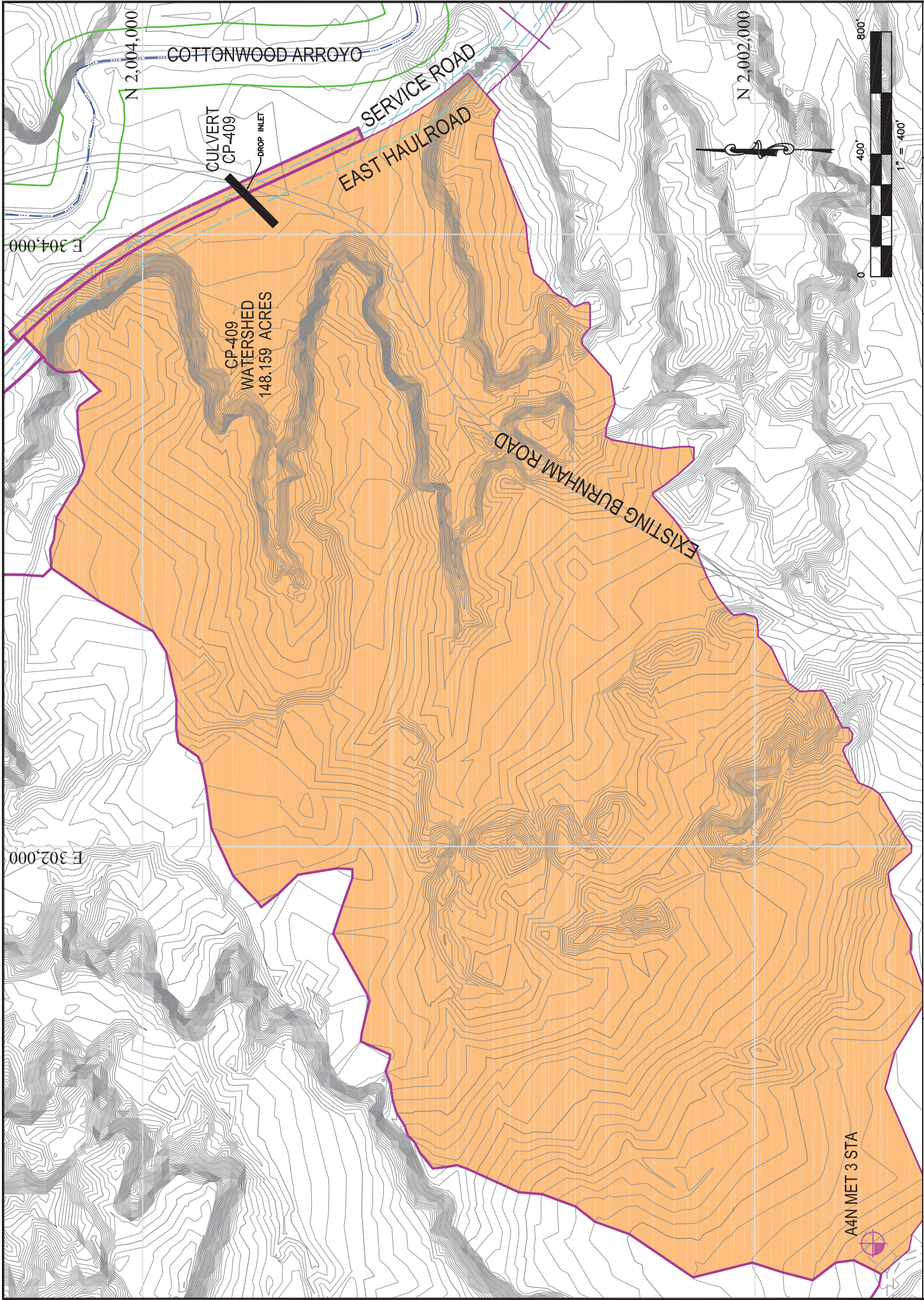
Tailwater Channel Data - Culvert CP-409

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0149

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	5310.00	0.0370
2	34.44	5300.00	0.0370
3	50.00	5298.90	0.0370
4	67.66	5298.00	0.0370
5	110.00	5296.71	0.0370
6	144.29	5298.00	0.0370
7	250.00	5298.97	0.0370
8	265.09	5300.00	0.0370
9	300.00	5310.00	0.0000



<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>CULVERT CP-409 WATERSHED EAST HAULROAD STA 200+62</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT REVISIONS: DATE: JAN. 27, 2012</p>
--	---	--	--

EAST HAULROAD
25-YR 24-HR STORM

CULVERT CP-410

STATION 211+31

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.060 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CULVERT CP-410

#1 Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	248.872	248.872	192.94	12.12

Structure Detail:

Structure #1 (Null)

CULVERT CP-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	248.872	0.300	0.000	0.000	82.900	M	192.94	12.123
	Σ	248.872						192.94	12.123

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	2.37	118.54	4,992.52	4.620	0.300
#1	1	Time of Concentration:					0.300

HY-8 Culvert Analysis Report

CULVERT CP-410 – STATION 211+31

Culvert Data Summary - Culvert CP-410

Barrel Shape: Circular
Barrel Diameter: 4.00 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Inlet Type: Conventional
Inlet Edge Condition: Square Edge with Headwall
Inlet Depression: None

Site Data - Culvert CP-410

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 5305.03 ft
Outlet Station: 216.00 ft
Outlet Elevation: 5301.11 ft
Number of Barrels: 3

Table 1 - Culvert Summary Table: Culvert CP-410

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	5305.03	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
19.29	19.29	5306.01	0.983	0.0*	1-S2n	0.642	0.718	0.658	0.424	4.640	1.925
38.59	38.59	5306.44	1.414	0.0*	1-S2n	0.929	1.031	0.930	0.550	5.750	2.290
57.88	57.88	5306.79	1.758	0.0*	1-S2n	1.155	1.283	1.162	0.640	6.351	2.534
77.18	77.18	5307.09	2.055	0.0*	1-S2n	1.339	1.490	1.340	0.713	6.948	2.723
96.47	96.47	5307.37	2.340	0.0*	1-S2n	1.513	1.677	1.516	0.775	7.349	2.879
115.76	115.76	5307.64	2.609	0.0*	1-S2n	1.675	1.843	1.682	0.830	7.687	3.014
135.06	135.06	5307.90	2.867	0.0*	1-S2n	1.825	2.007	1.827	0.879	8.044	3.132
154.35	154.35	5308.15	3.117	0.0*	1-S2n	1.975	2.145	1.975	0.920	8.319	3.271
173.65	173.65	5308.39	3.364	0.0*	1-S2n	2.119	2.283	2.122	0.957	8.551	3.406
192.94	192.94	5308.64	3.612	0.0*	1-S2n	2.261	2.418	2.267	0.993	8.757	3.531

* theoretical depth is impractical. Depth reported is corrected.

 Inlet Elevation (invert): 5305.03 ft, Outlet Elevation (invert): 5301.11 ft
 Culvert Length: 216.00 ft, Culvert Slope: 0.0181

Roadway Data for Crossing: Culvert CP-410

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	5313.96
2	50.00	5313.74
3	300.00	5312.49

Roadway Surface: Gravel

Roadway Top Width: 40.00 ft

Table 2 - Downstream Channel Rating Curve (Crossing: Culvert CP-410)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	5301.11	0.00	0.00	0.00	0.00
19.29	5301.54	0.42	1.93	0.48	0.74
38.59	5301.66	0.55	2.29	0.62	0.77
57.88	5301.75	0.64	2.53	0.73	0.79
77.18	5301.82	0.71	2.72	0.81	0.80
96.47	5301.89	0.77	2.88	0.88	0.82
115.76	5301.94	0.83	3.01	0.94	0.82
135.06	5301.99	0.88	3.13	1.00	0.83
154.35	5302.03	0.92	3.27	1.04	0.84
173.65	5302.07	0.96	3.41	1.09	0.85
192.94	5302.10	0.99	3.53	1.13	0.86

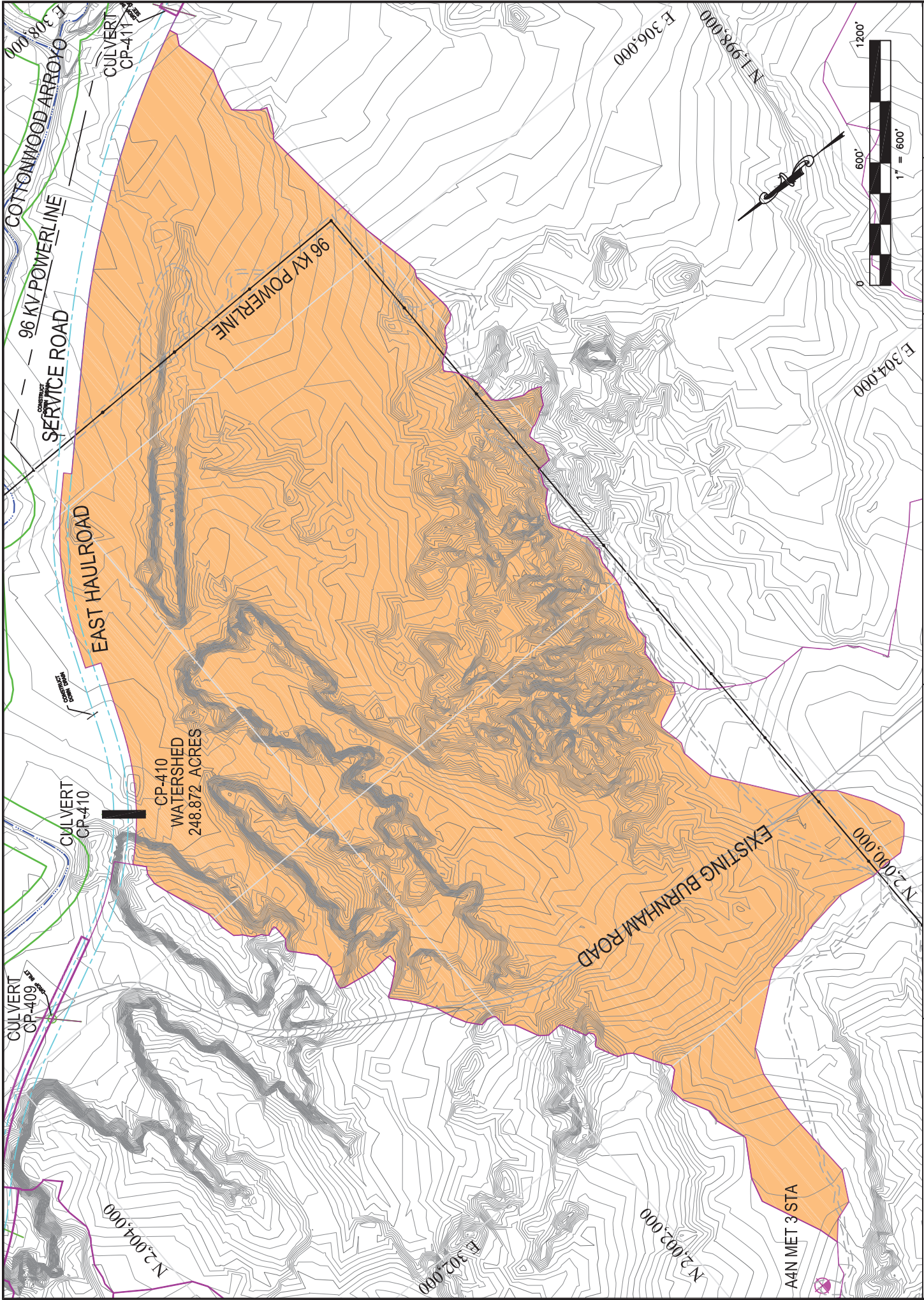
Tailwater Channel Data - Culvert CP-410

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0182

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	5314.00	0.0370
2	4.14	5314.00	0.0370
3	17.39	5312.00	0.0370
4	28.14	5310.00	0.0370
5	38.70	5308.00	0.0370
6	49.14	5306.00	0.0370
7	60.10	5304.00	0.0370
8	69.26	5302.00	0.0370
9	100.00	5301.11	0.0370
10	168.36	5302.00	0.0370
11	250.00	5304.00	0.0000



<p>GEOMAT inc. 915 Malita Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>CULVERT CP-410 WATERSHED EAST HAULROAD STA 211+31</p>	<p>PLATE 6 DRAWN BY: PR & BT PREPARED BY: PR & BT REVISIONS: DATE: JAN. 27, 2012</p>
--	--	---	--

EAST HAULROAD
25-YR 24-HR STORM

CULVERT CP-411
STATION 251+84

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

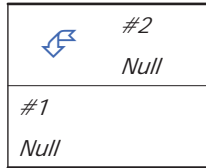
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.060 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CULVERT CP-411
Null	#2	==>	#1	0.000	0.000	CP-411 DROP INLET



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	1.541	1.541	3.18	0.14
#1	265.199	266.740	176.20	13.06

Structure Detail:

Structure #2 (Null)

CP-411 DROP INLET

Structure #1 (Null)

CULVERT CP-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)
#2	1	1.541	0.064	0.000	0.000	89.000	M	3.18	0.138
	Σ	1.541						3.18	0.138
#1	1	265.199	0.412	0.000	0.000	82.900	M	176.01	12.923
	Σ	266.740						176.20	13.061

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	1.69	98.05	5,792.98	3.900	0.412
#1	1	Time of Concentration:					0.412
#2	1	8. Large gullies, diversions, and low flowing streams	2.04	20.35	996.52	4.280	0.064
#2	1	Time of Concentration:					0.064

HY-8 Culvert Analysis Report

CULVERT CP-411 – STATION 251+84

Culvert Data Summary - Culvert CP-411

Barrel Shape: Circular
Barrel Diameter: 4.00 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Inlet Type: Conventional
Inlet Edge Condition: Square Edge with Headwall
Inlet Depression: None

Site Data - Culvert CP-411

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 5323.96 ft
Outlet Station: 217.00 ft
Outlet Elevation: 5321.71 ft
Number of Barrels: 3

Table 1 - Culvert Summary Table: Culvert CP-411

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	5323.96	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
17.62	17.62	5325.01	0.942	1.047	2-M2c	0.719	0.678	0.702	0.234	3.962	1.340
35.24	35.24	5325.46	1.358	1.503	2-M2c	1.023	0.982	1.000	0.302	4.780	1.619
52.86	52.86	5325.84	1.691	1.878	2-M2c	1.274	1.229	1.232	0.347	5.357	1.875
70.48	70.48	5326.15	1.967	2.188	2-M2c	1.484	1.418	1.430	0.386	5.822	2.077
88.10	88.10	5326.43	2.234	2.474	2-M2c	1.681	1.606	1.606	0.421	6.224	2.245
105.72	105.72	5326.70	2.487	2.740	2-M2c	1.862	1.757	1.766	0.452	6.586	2.392
123.34	123.34	5326.95	2.727	2.988	2-M2c	2.042	1.908	1.915	0.482	6.919	2.521
140.96	140.96	5327.18	2.959	3.221	2-M2c	2.214	2.049	2.053	0.510	7.233	2.638
158.58	158.58	5327.41	3.187	3.451	2-M2c	2.386	2.176	2.184	0.536	7.532	2.744
176.20	176.20	5327.64	3.412	3.678	2-M2c	2.564	2.302	2.308	0.560	7.822	2.842

* theoretical depth is impractical. Depth reported is corrected.

 Inlet Elevation (invert): 5323.96 ft, Outlet Elevation (invert): 5321.71 ft
 Culvert Length: 217.00 ft, Culvert Slope: 0.0104

Roadway Data for Crossing: Culvert CP-411

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	5332.17
2	175.00	5333.04
3	350.00	5333.92

Roadway Surface: Gravel

Roadway Top Width: 123.00 ft

Table 2 - Downstream Channel Rating Curve (Crossing: Culvert CP-411)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	5321.71	0.00	0.00	0.00	0.00
17.62	5321.95	0.23	1.34	0.28	0.69
35.24	5322.01	0.30	1.62	0.37	0.72
52.86	5322.06	0.35	1.87	0.42	0.75
70.48	5322.10	0.39	2.08	0.47	0.77
88.10	5322.13	0.42	2.25	0.51	0.78
105.72	5322.16	0.45	2.39	0.55	0.80
123.34	5322.19	0.48	2.52	0.58	0.81
140.96	5322.22	0.51	2.64	0.62	0.82
158.58	5322.25	0.54	2.74	0.65	0.82
176.20	5322.27	0.56	2.84	0.68	0.83

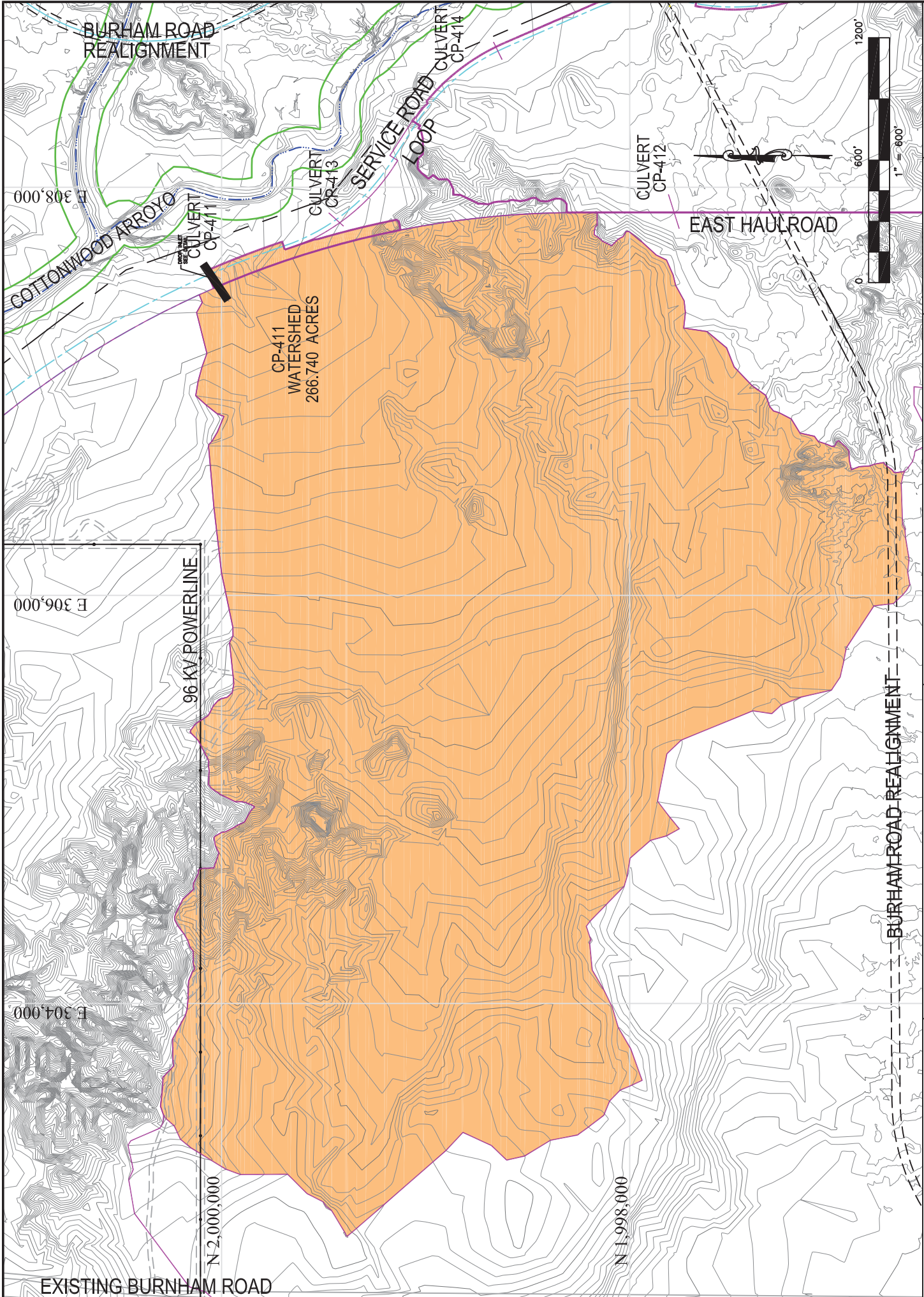
Tailwater Channel Data - Culvert CP-411

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0194

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	5323.04	0.0370
2	75.64	5322.00	0.0370
3	200.00	5321.71	0.0370
4	310.81	5324.00	0.0370
5	350.00	5324.00	0.0370



<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>CULVERT CP-411 WATERSHED EAST HAULROAD STA 251+84</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT DATE: JAN. 27, 2012</p>
			<p>PLATE 7</p>

EAST HAULROAD
25-YR 24-HR STORM

CULVERT CP-412

STATION 274+66

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

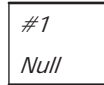
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.060 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CULVERT CP-412



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	76.550	76.550	52.00	3.73

Structure Detail:

Structure #1 (Null)

CULVERT CP-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)
#1	1	76.550	0.395	0.000	0.000	82.900	M	52.00	3.726
	Σ	76.550						52.00	3.726

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	1.53	80.82	5,281.84	3.710	0.395
#1	1	Time of Concentration:					0.395

HY-8 Culvert Analysis Report

CULVERT CP-412 – STATION 274+66

Culvert Data Summary - Culvert CP-412

Barrel Shape: Circular
Barrel Diameter: 3.00 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Inlet Type: Conventional
Inlet Edge Condition: Square Edge with Headwall
Inlet Depression: None

Site Data - Culvert CP-412

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 5352.89 ft
Outlet Station: 177.00 ft
Outlet Elevation: 5351.39 ft
Number of Barrels: 2

Table 1 - Culvert Summary Table: Culvert CP-412

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	5352.89	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
5.20	5.20	5353.64	0.672	0.750	2-M2c	0.557	0.480	0.501	0.243	3.345	1.275
10.40	10.40	5353.96	0.971	1.071	2-M2c	0.790	0.701	0.714	0.315	4.032	1.516
15.60	15.60	5354.22	1.205	1.330	2-M2c	0.981	0.876	0.880	0.367	4.515	1.678
20.80	20.80	5354.44	1.404	1.554	2-M2c	1.147	1.012	1.021	0.407	4.903	1.819
26.00	26.00	5354.65	1.589	1.761	2-M2c	1.298	1.140	1.146	0.440	5.237	1.955
31.20	31.20	5354.84	1.766	1.945	2-M2c	1.441	1.255	1.260	0.470	5.538	2.072
36.40	36.40	5355.01	1.934	2.123	2-M2c	1.581	1.359	1.366	0.497	5.810	2.175
41.60	41.60	5355.18	2.096	2.294	2-M2c	1.717	1.462	1.465	0.523	6.067	2.268
46.80	46.80	5355.35	2.253	2.462	2-M2c	1.855	1.554	1.558	0.547	6.312	2.352
52.00	52.00	5355.52	2.408	2.630	2-M2c	1.996	1.640	1.646	0.570	6.545	2.428

* theoretical depth is impractical. Depth reported is corrected.

 Inlet Elevation (invert): 5352.89 ft, Outlet Elevation (invert): 5351.39 ft
 Culvert Length: 177.00 ft, Culvert Slope: 0.0085

Roadway Data for Crossing: Culvert CP-412

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	5362.37
2	150.00	5360.49
3	200.00	5359.97
4	250.00	5359.64
5	300.00	5359.50

Roadway Surface: Gravel

Roadway Top Width: 40.00 ft

Table 2 - Downstream Channel Rating Curve (Crossing: Culvert CP-412)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	5351.00	0.00	0.00	0.00	0.00
5.20	5351.24	0.24	1.28	0.25	0.64
10.40	5351.31	0.31	1.52	0.33	0.67
15.60	5351.37	0.37	1.68	0.38	0.69
20.80	5351.41	0.41	1.82	0.43	0.70
26.00	5351.44	0.44	1.96	0.46	0.72
31.20	5351.47	0.47	2.07	0.49	0.73
36.40	5351.50	0.50	2.18	0.52	0.74
41.60	5351.52	0.52	2.27	0.55	0.74
46.80	5351.55	0.55	2.35	0.57	0.75
52.00	5351.57	0.57	2.43	0.60	0.76

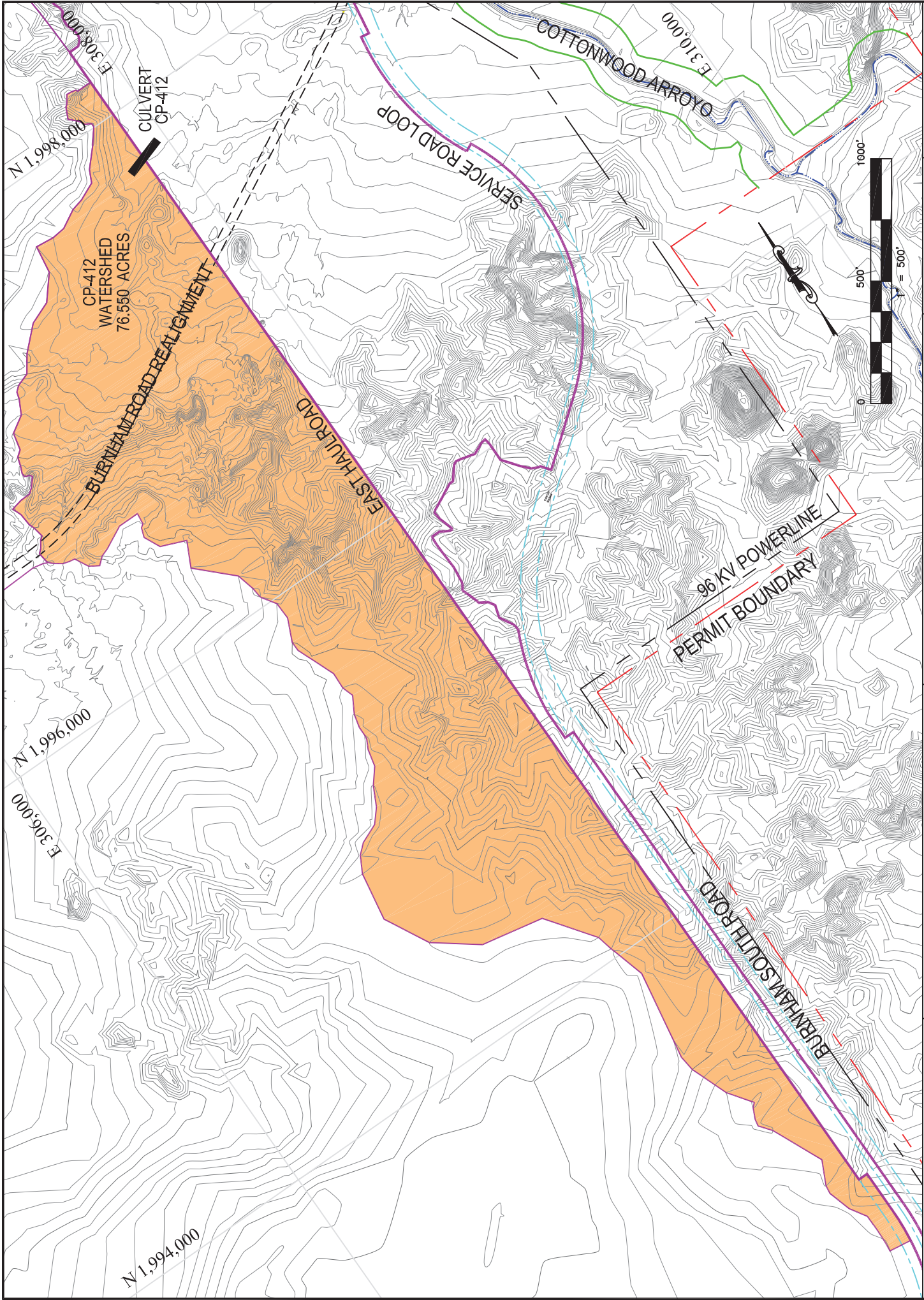
Tailwater Channel Data - Culvert CP-412

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0168

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	5366.00	0.0370
2	36.74	5351.00	0.0370
3	90.00	5351.39	0.0370
4	132.50	5352.00	0.0370
5	167.20	5352.61	0.0370
6	206.10	5352.00	0.0370
7	232.50	5352.00	0.0370
8	300.00	5353.53	0.0000



<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>CULVERT CP-412 WATERSHED EAST HAULROAD STA 274+66</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT DATE: JAN. 27, 2012</p>
---	---	--	---

EAST HAULROAD
SERVICE ROAD LOOP
25-YR 24-HR STORM

CULVERT CP-413

STATION 3+40

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.060 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CULVERT CP-413

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	4.112	4.112	6.54	0.25

Structure Detail:

Structure #1 (Null)

CULVERT CP-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)
#1	1	4.112	0.068	0.000	0.000	82.900	M	6.54	0.250
	Σ	4.112						6.54	0.250

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	2.65	31.95	1,207.13	4.880	0.068
#1	1	Time of Concentration:					0.068

HY-8 Culvert Analysis Report

CULVERT CP-413 – STATION 3+40

Culvert Data Summary - Culvert CP-413

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Inlet Type: Conventional
Inlet Edge Condition: Square Edge with Headwall
Inlet Depression: None

Site Data - Culvert CP-413

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 5332.33 ft
Outlet Station: 98.00 ft
Outlet Elevation: 5331.06 ft
Number of Barrels: 1

Table 1 - Culvert Summary Table: Culvert CP-413

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	5332.33	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
0.65	0.65	5332.74	0.369	0.407	2-M2c	0.278	0.262	0.277	0.171	2.480	0.976
1.31	1.31	5332.93	0.534	0.597	2-M2c	0.411	0.393	0.395	0.222	2.980	1.161
1.96	1.96	5333.06	0.657	0.731	2-M2c	0.498	0.477	0.486	0.258	3.327	1.284
2.62	2.62	5333.19	0.766	0.856	2-M2c	0.584	0.558	0.563	0.288	3.606	1.380
3.27	3.27	5333.29	0.867	0.963	2-M2c	0.654	0.628	0.632	0.313	3.841	1.459
3.92	3.92	5333.39	0.952	1.062	2-M2c	0.720	0.688	0.694	0.335	4.049	1.527
4.58	4.58	5333.49	1.037	1.157	2-M2c	0.787	0.748	0.752	0.355	4.238	1.587
5.23	5.23	5333.58	1.120	1.247	2-M2c	0.846	0.806	0.806	0.373	4.415	1.641
5.89	5.89	5333.66	1.200	1.327	2-M2c	0.903	0.853	0.857	0.390	4.576	1.690
6.54	6.54	5333.73	1.277	1.404	2-M2c	0.961	0.901	0.906	0.405	4.729	1.735

* theoretical depth is impractical. Depth reported is corrected.

 Inlet Elevation (invert): 5332.33 ft, Outlet Elevation (invert): 5331.06 ft
 Culvert Length: 98.00 ft, Culvert Slope: 0.0130

Roadway Data for Crossing: Culvert CP-413

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	5336.10
2	25.00	5336.35
3	50.00	5336.61
4	75.00	5336.90
5	100.00	5337.19

Roadway Surface: Gravel

Roadway Top Width: 50.00 ft

Table 2 - Downstream Channel Rating Curve (Crossing: Culvert CP-413)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	5331.06	0.00	0.00	0.00	0.00
0.65	5331.23	0.17	0.98	0.17	0.59
1.31	5331.28	0.22	1.16	0.22	0.61
1.96	5331.32	0.26	1.28	0.25	0.63
2.62	5331.35	0.29	1.38	0.28	0.64
3.27	5331.37	0.31	1.46	0.31	0.65
3.92	5331.39	0.33	1.53	0.33	0.66
4.58	5331.41	0.35	1.59	0.35	0.66
5.23	5331.43	0.37	1.64	0.37	0.67
5.89	5331.45	0.39	1.69	0.38	0.67
6.54	5331.46	0.41	1.74	0.40	0.68

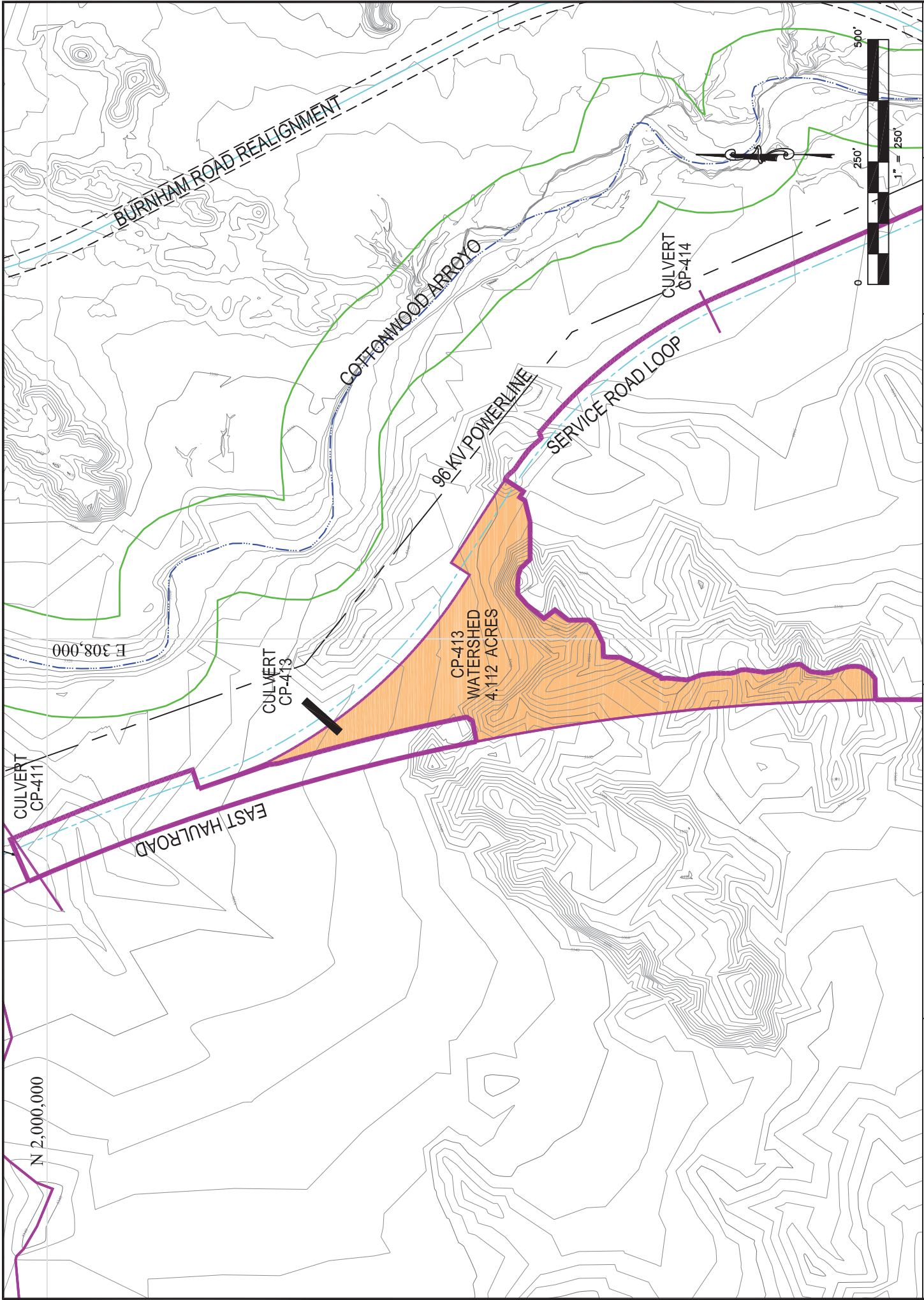
Tailwater Channel Data - Culvert CP-413

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0157

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	5336.00	0.0370
2	26.35	5332.00	0.0370
3	50.00	5331.06	0.0370
4	69.54	5332.00	0.0370
5	89.31	5334.00	0.0370
6	100.00	5335.09	0.0370



<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NJ 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>CULVERT CP-413 WATERSHED SERVICE ROAD LOOP STA 3+40</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT DATE: JAN. 27, 2012</p>
			<p>PLATE 9</p>

EAST HAULROAD
SERVICE ROAD LOOP
25-YR 24-HR STORM

CULVERT CP-414

STATION 15+00

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

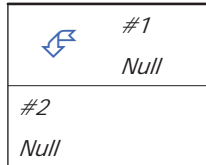
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.060 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.117	0.330	CULVERT CP-412
Null	#2	==>	End	0.000	0.000	CULVERT CP-414



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	1.21	16.78	1,388.63	3.29	0.117
#1	Muskingum K:					0.117

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	76.550	76.550	52.00	3.73
#2	79.526	156.076	90.31	7.59

Structure Detail:

Structure #1 (Null)

CULVERT CP-412

Structure #2 (Null)

CULVERT CP-414

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	76.550	0.395	0.000	0.000	82.900	M	52.00	3.726
	Σ	76.550						52.00	3.726
#2	1	79.526	0.636	0.000	0.000	82.900	M	40.01	3.861
	Σ	156.076						90.31	7.587

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	1.53	80.82	5,281.84	3.710	0.395
#1	1	Time of Concentration:					0.395
#2	1	8. Large gullies, diversions, and low flowing streams	1.46	121.29	8,297.59	3.620	0.636
#2	1	Time of Concentration:					0.636

HY-8 Culvert Analysis Report

CULVERT CP-414 – STATION 15+00

Culvert Data Summary - Culvert CP-414

Barrel Shape: Circular
Barrel Diameter: 3.00 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Inlet Type: Conventional
Inlet Edge Condition: Square Edge with Headwall
Inlet Depression: None

Site Data - Culvert CP-414

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 5335.84 ft
Outlet Station: 97.00 ft
Outlet Elevation: 5334.94 ft
Number of Barrels: 3

Table 1 - Culvert Summary Table: Culvert CP-414

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	5335.84	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
9.03	9.03	5336.65	0.727	0.813	2-M2c	0.594	0.525	0.540	0.217	3.478	1.024
18.06	18.06	5337.00	1.047	1.159	2-M2c	0.836	0.756	0.770	0.262	4.198	1.344
27.09	27.09	5337.28	1.306	1.438	2-M2c	1.034	0.944	0.949	0.297	4.707	1.575
36.12	36.12	5337.52	1.520	1.684	2-M2c	1.215	1.093	1.101	0.329	5.118	1.761
45.16	45.16	5337.74	1.728	1.903	2-M2c	1.374	1.234	1.237	0.357	5.475	1.919
54.19	54.19	5337.95	1.924	2.110	2-M2c	1.531	1.353	1.360	0.383	5.796	2.059
63.22	63.22	5338.14	2.111	2.305	2-M2c	1.682	1.472	1.475	0.407	6.093	2.184
72.25	72.25	5338.33	2.292	2.492	2-M2c	1.834	1.577	1.581	0.430	6.375	2.298
81.28	81.28	5338.52	2.471	2.682	2-M2c	1.991	1.676	1.682	0.451	6.642	2.403
90.31	90.31	5338.70	2.649	2.861	2-M2c	2.156	1.776	1.777	0.472	6.902	2.501

* theoretical depth is impractical. Depth reported is corrected.

 Inlet Elevation (invert): 5335.84 ft, Outlet Elevation (invert): 5334.94 ft
 Culvert Length: 97.00 ft, Culvert Slope: 0.0093

Roadway Data for Crossing: Culvert CP-414

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	5341.29
2	50.00	5341.01
3	100.00	5340.78
4	150.00	5340.63
5	200.00	5340.57

Roadway Surface: Gravel

Roadway Top Width: 50.00 ft

Table 2 - Downstream Channel Rating Curve (Crossing: Culvert CP-414)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	5334.76	0.00	0.00	0.00	0.00
9.03	5334.98	0.22	1.02	0.23	0.62
18.06	5335.02	0.26	1.34	0.28	0.66
27.09	5335.06	0.30	1.57	0.32	0.69
36.12	5335.09	0.33	1.76	0.35	0.71
45.16	5335.12	0.36	1.92	0.39	0.72
54.19	5335.14	0.38	2.06	0.41	0.74
63.22	5335.17	0.41	2.18	0.44	0.75
72.25	5335.19	0.43	2.30	0.46	0.76
81.28	5335.21	0.45	2.40	0.49	0.76
90.31	5335.23	0.47	2.50	0.51	0.77

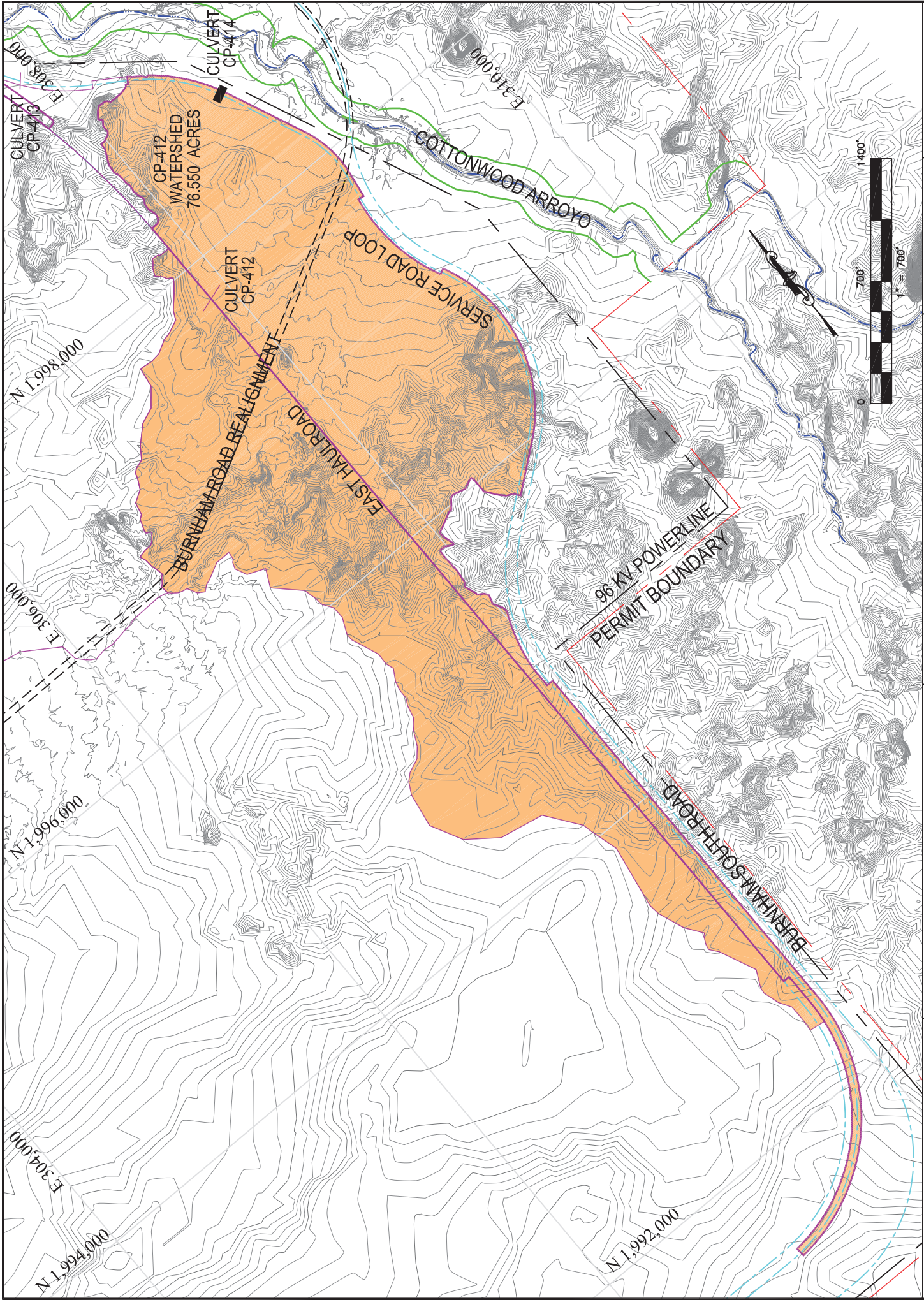
Tailwater Channel Data - Culvert CP-414

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0173

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	5344.00	0.0370
2	34.66	5336.00	0.0370
3	50.00	5334.76	0.0370
4	100.00	5334.94	0.0370
5	150.00	5334.94	0.0370
6	167.78	5336.00	0.0370
7	200.00	5344.00	0.0370



Appendix 23.C

East Haul Road Relief Ditches – Hydrologic Analysis and Design

EAST HAULROAD
10-YR 6-HR STORM

RELIEF DITCH EHR-RD1
STATION 167+65

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

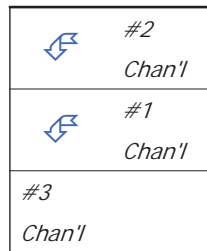
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.000	0.000	ROAD SIDE DITCH
Channel	#2	==>	#3	0.000	0.000	ROAD SIDE DITCH
Channel	#3	==>	End	0.000	0.000	RELIEF DITCH EHR-RD1



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	0.415	0.415	0.52	0.02
#1	2.612	2.612	3.30	0.10
#3	0.000	3.027	3.82	0.12

Structure Detail:

Structure #2 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	2.0:1	0.3	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.52 cfs	
Depth:	0.39 ft	0.69 ft
Top Width:	1.94 ft	3.44 ft
Velocity:	1.38 fps	
X-Section Area:	0.38 sq ft	
Hydraulic Radius:	0.180 ft	
Froude Number:	0.55	

Structure #1 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	2.0:1	0.3	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.30 cfs	
Depth:	0.77 ft	1.07 ft
Top Width:	3.87 ft	5.37 ft
Velocity:	2.20 fps	
X-Section Area:	1.50 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.360 ft	
Froude Number:	0.62	

Structure #3 (Riprap Channel)

RELIEF DITCH EHR-RD1

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	33.3	0.30		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.82 cfs	
Depth:	0.05 ft	0.35 ft
Top Width:	4.30 ft	6.10 ft
Velocity*:		
X-Section Area:	0.21 sq ft	
Hydraulic Radius:	0.049 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

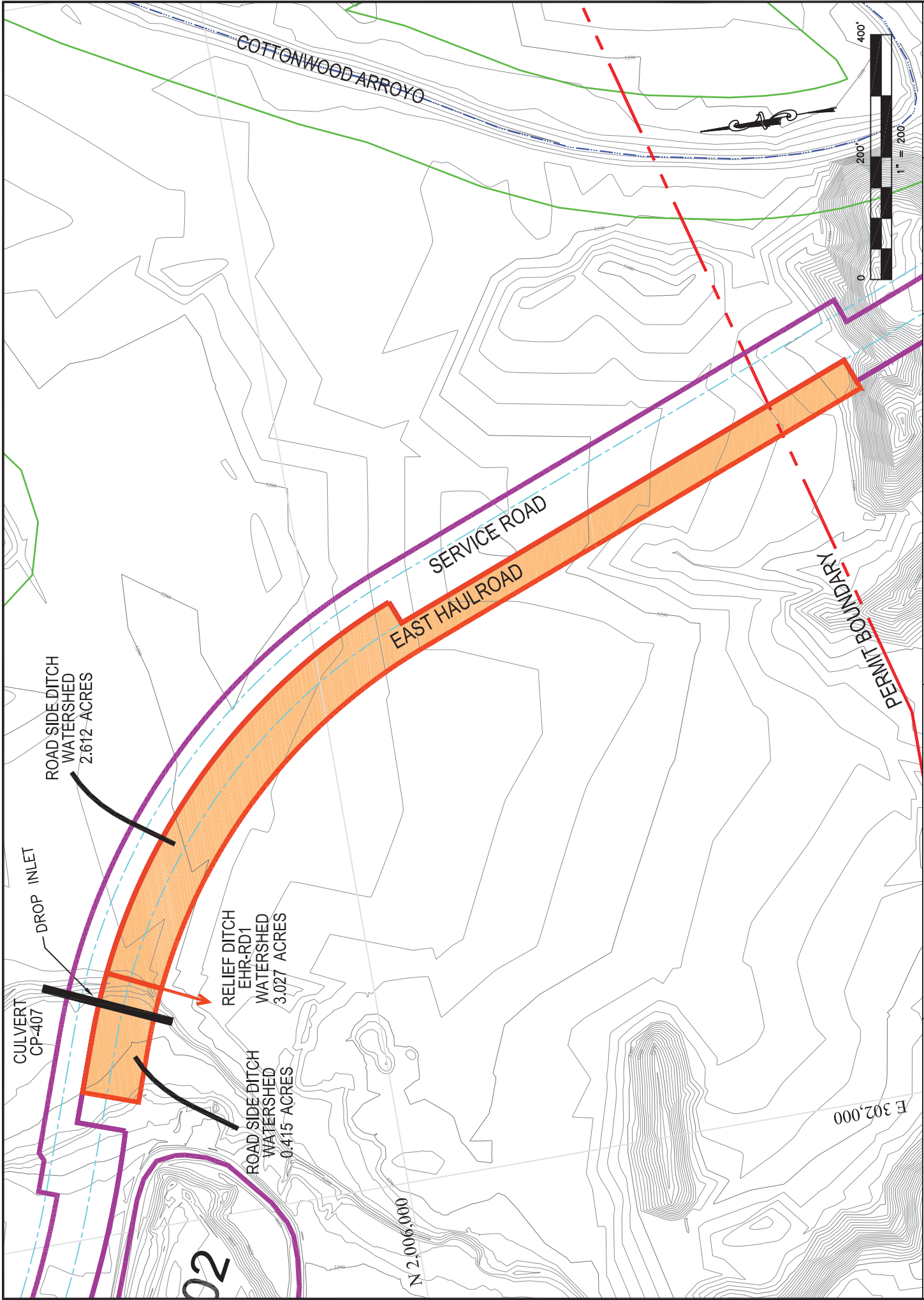
Velocity and Manning's n calculations may not apply for this method.

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	0.415	0.023	0.000	0.000	89.000	M	0.52	0.015
	Σ	0.415						0.52	0.015
#1	1	2.612	0.110	0.000	0.000	89.000	M	3.30	0.102
	Σ	2.612						3.30	0.102
#3	Σ	3.027						3.82	0.117

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	1.82	29.15	1,600.76	4.040	0.110
#1	1	Time of Concentration:					0.110
#2	1	8. Large gullies, diversions, and low flowing streams	0.85	1.99	233.51	2.760	0.023
#2	1	Time of Concentration:					0.023



CULVERT
CP-407

DROP INLET

ROAD SIDE DITCH
WATERSHED
2.612 ACRES

RELIEF DITCH
EHR-RD1
WATERSHED
3.027 ACRES

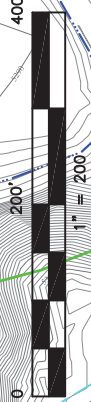
ROAD SIDE DITCH
WATERSHED
0.415 ACRES

COTTONWOOD ARROYO

SERVICE ROAD

EAST HAULROAD

PERMIT BOUNDARY



<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>EHR-RD1 WATERSHED EAST HAULROAD STA 167+65</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT REVISD: PR & BT DATE: JAN. 27, 2012</p>
--	---	---	---

PLATE 11

EAST HAULROAD
10-YR 6-HR STORM

RELIEF DITCH EHR-RD2
STATION 190+85

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

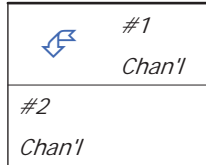
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	ROAD SIDE DITCH
Channel	#2	==>	End	0.000	0.000	EHR-RD2



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	0.273	0.273	0.34	0.01
#2	0.000	0.273	0.34	0.01

Structure Detail:

Structure #1 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

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	50.0:1	0.8	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.34 cfs	
Depth:	0.12 ft	0.42 ft
Top Width:	5.98 ft	21.58 ft
Velocity:	0.99 fps	
X-Section Area:	0.34 sq ft	
Hydraulic Radius:	0.057 ft	
Froude Number:	0.72	

Structure #2 (Riprap Channel)

EHR-RD2

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	33.3	0.30		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.34 cfs	
Depth:	0.02 ft	0.32 ft
Top Width:	4.12 ft	5.92 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.08 sq ft	
Hydraulic Radius:	0.020 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

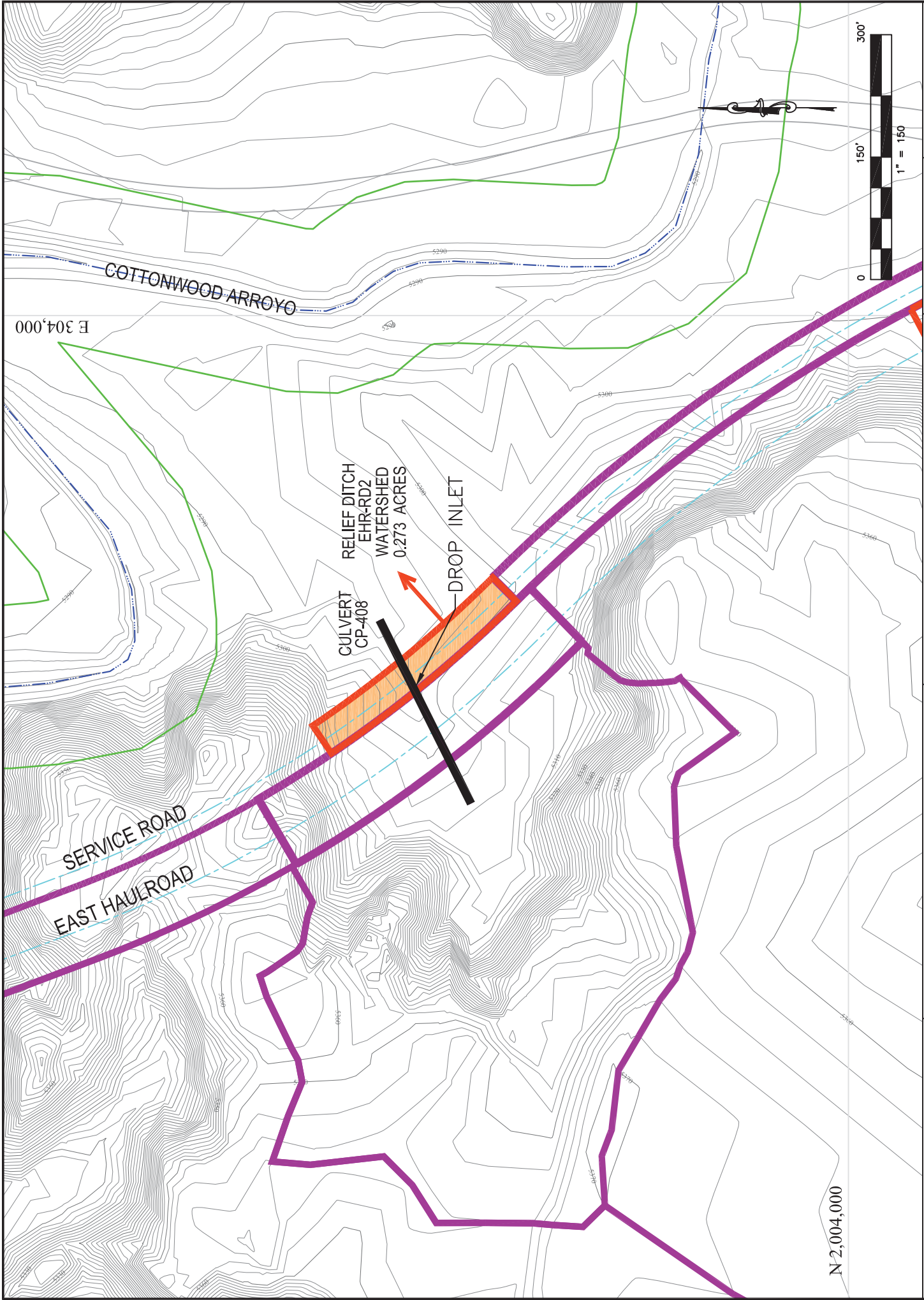
Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.273	0.014	0.000	0.000	89.000	M	0.34	0.010
	Σ	0.273						0.34	0.010
#2	Σ	0.273						0.34	0.010

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	2.16	5.10	236.63	4.400	0.014
#1	1	Time of Concentration:					0.014



N 2,004,000

<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>EHR-RD2 WATERSHED EAST HAULROAD STA 190+85</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT DATE: JAN. 27, 2012</p>
---	---	---	---

EAST HAULROAD
10-YR 6-HR STORM

RELIEF DITCH EHR-RD3
STATION 200+50

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

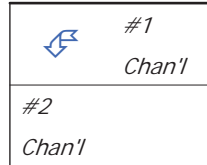
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	ROAD SIDE DITCH
Channel	#2	==>	End	0.000	0.000	EHR-RD3



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	2.170	2.170	2.74	0.08
#2	0.000	2.170	2.74	0.08

Structure Detail:

Structure #1 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	2.0:1	0.6	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.74 cfs	
Depth:	0.65 ft	0.95 ft
Top Width:	3.23 ft	4.73 ft
Velocity:	2.63 fps	
X-Section Area:	1.04 sq ft	
Hydraulic Radius:	0.300 ft	
Froude Number:	0.81	

Structure #2 (Riprap Channel)

EHR-RD3

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	33.3	0.30		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.74 cfs	
Depth:	0.04 ft	0.34 ft
Top Width:	4.25 ft	6.05 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.17 sq ft	
Hydraulic Radius:	0.040 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

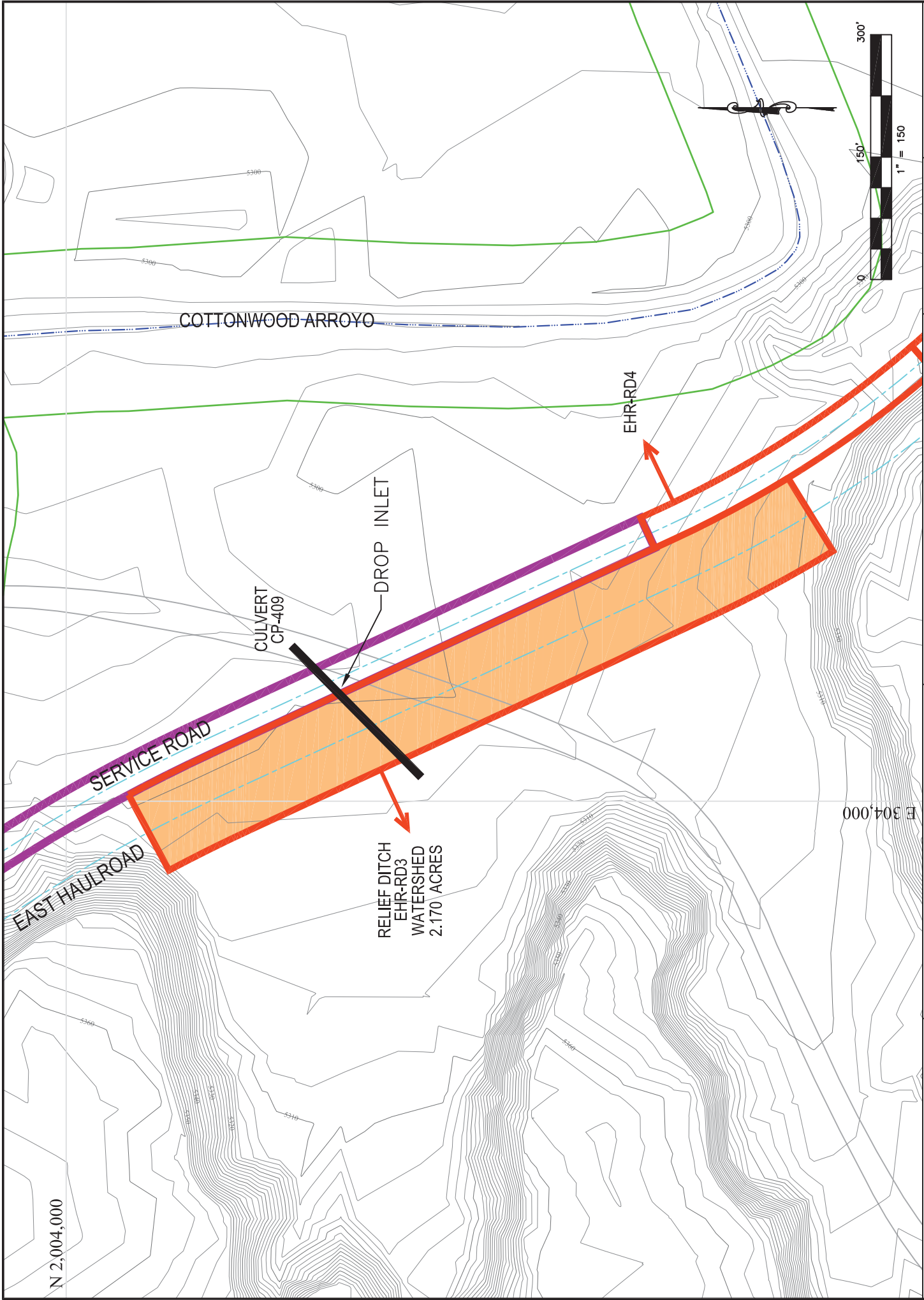
Velocity and Manning's n calculations may not apply for this method.

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	2.170	0.068	0.000	0.000	89.000	M	2.74	0.085
	Σ	2.170						2.74	0.085
#2	Σ	2.170						2.74	0.085

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	0.91	6.48	710.03	2.860	0.068
#1	1	Time of Concentration:					0.068



N 2,004,000

E 304,000

<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>EHR-RD3 WATERSHED EAST HAULROAD STA 200+50</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT DATE: JAN. 27, 2012</p>
--	---	---	---

EAST HAULROAD
10-YR 6-HR STORM

RELIEF DITCH EHR-RD4
STATION 205+15

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

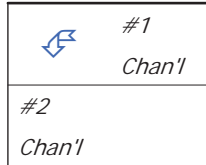
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	ROAD SIDE DITCH
Channel	#2	==>	End	0.000	0.000	EHR-RD4



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	0.377	0.377	0.48	0.01
#2	0.000	0.377	0.48	0.01

Structure Detail:

Structure #1 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
50.0:1	2.0:1	0.6	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.48 cfs	
Depth:	0.14 ft	0.44 ft
Top Width:	7.15 ft	22.75 ft
Velocity:	0.96 fps	
X-Section Area:	0.49 sq ft	
Hydraulic Radius:	0.069 ft	
Froude Number:	0.65	

Structure #2 (Riprap Channel)

EHR-RD4

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	33.3	0.30		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.48 cfs	
Depth:	0.02 ft	0.32 ft
Top Width:	4.13 ft	5.93 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.09 sq ft	
Hydraulic Radius:	0.022 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

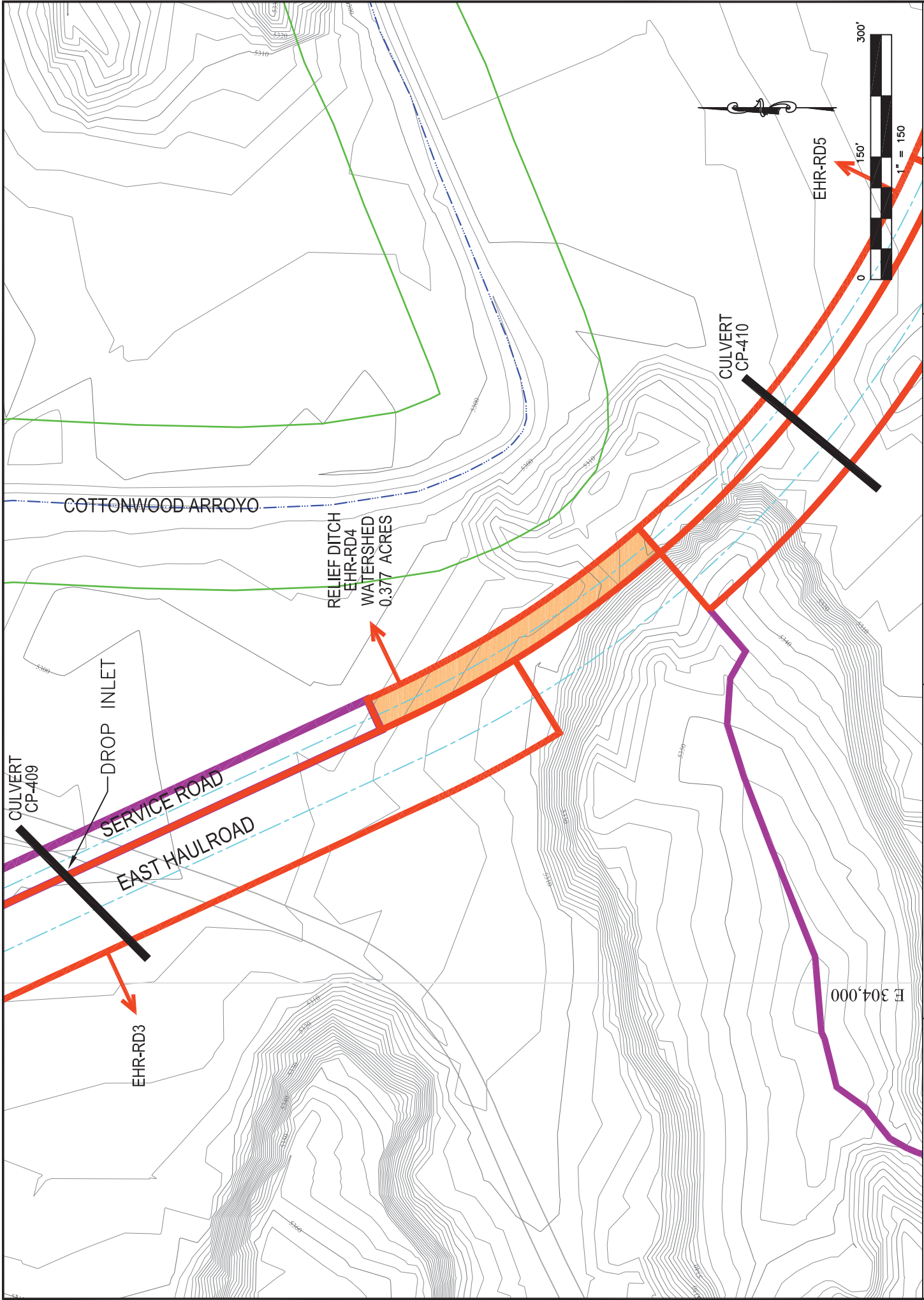
Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.377	0.029	0.000	0.000	89.000	M	0.48	0.014
	Σ	0.377						0.48	0.014
#2	Σ	0.377						0.48	0.014

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	1.41	5.41	383.77	3.560	0.029
#1	1	Time of Concentration:					0.029



<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>EHR-RD4 WATERSHED EAST HAULROAD STA 205+15</p>	<p>PLATE 14 DRAWN BY: PR & BT PREPARED BY: PR & BT REVISOR: PR & BT DATE: JAN. 27, 2012</p>
---	---	---	---

EAST HAULROAD
10-YR 6-HR STORM

RELIEF DITCH EHR-RD5
STATION 214+50

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

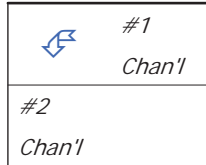
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	ROAD SIDE DITCH
Channel	#2	==>	End	0.000	0.000	EHR-RD5



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	0.544	0.544	0.69	0.02
#2	0.000	0.544	0.69	0.02

Structure Detail:

Structure #1 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

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	50.0:1	0.5	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.69 cfs	
Depth:	0.16 ft	0.46 ft
Top Width:	8.40 ft	24.00 ft
Velocity:	1.01 fps	
X-Section Area:	0.68 sq ft	
Hydraulic Radius:	0.081 ft	
Froude Number:	0.63	

Structure #2 (Riprap Channel)

EHR-RD5

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	33.3	0.30		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.69 cfs	
Depth:	0.02 ft	0.32 ft
Top Width:	4.14 ft	5.94 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.10 sq ft	
Hydraulic Radius:	0.023 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

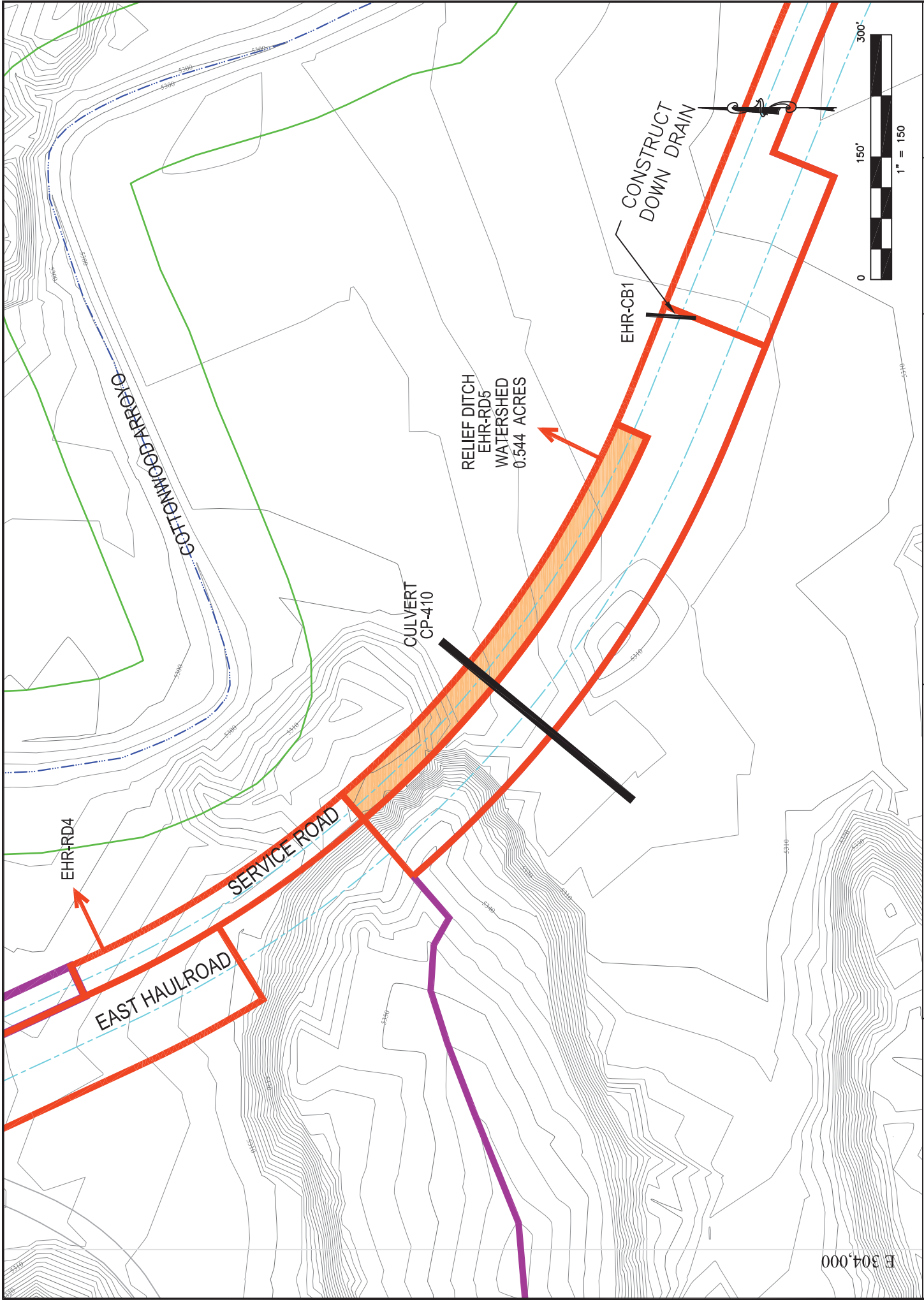
Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.544	0.055	0.000	0.000	89.000	M	0.69	0.021
	Σ	0.544						0.69	0.021
#2	Σ	0.544						0.69	0.021

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	1.02	6.15	604.83	3.020	0.055
#1	1	Time of Concentration:					0.055



E 304,000

<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>EHR-RD5 WATERSHED EAST HAULROAD STA 214+50</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT DATE: JAN. 27, 2012</p>
---	---	---	---

EAST HAULROAD
10-YR 6-HR STORM

DRAINAGE DITCH EHR-CB1
STATION 216+60

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

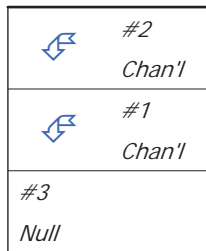
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.000	0.000	ROAD SIDE DITCH
Channel	#2	==>	#3	0.000	0.000	ROAD SIDE DITCH
Null	#3	==>	End	0.000	0.000	DRAINAGE DITCH EHR-CB1



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	2.243	2.243	1.71	0.07
#1	1.770	1.770	2.23	0.07
#3	0.000	4.013	3.71	0.14

Structure Detail:

Structure #2 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	3.0:1	0.1	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.71 cfs	
Depth:	0.66 ft	0.96 ft
Top Width:	3.98 ft	5.78 ft
Velocity:	1.29 fps	
X-Section Area:	1.32 sq ft	
Hydraulic Radius:	0.315 ft	
Froude Number:	0.39	

Structure #1 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	3.0:1	0.1	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.23 cfs	
Depth:	0.73 ft	1.03 ft
Top Width:	4.41 ft	6.21 ft
Velocity:	1.38 fps	
X-Section Area:	1.62 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:		0.348 ft
Froude Number:		0.40

Structure #3 (Null)

DRAINAGE DITCH EHR-CB1

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	2.243	0.171	0.000	0.000	89.000	M	1.71	0.071
	Σ	2.243						1.71	0.071
#1	1	1.770	0.085	0.000	0.000	89.000	M	2.23	0.069
	Σ	1.770						2.23	0.069
#3	Σ	4.013						3.71	0.141

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	0.82	6.84	832.68	2.710	0.085
#1	1	Time of Concentration:					0.085
#2	1	8. Large gullies, diversions, and low flowing streams	0.58	8.18	1,410.46	2.280	0.171
#2	1	Time of Concentration:					0.171

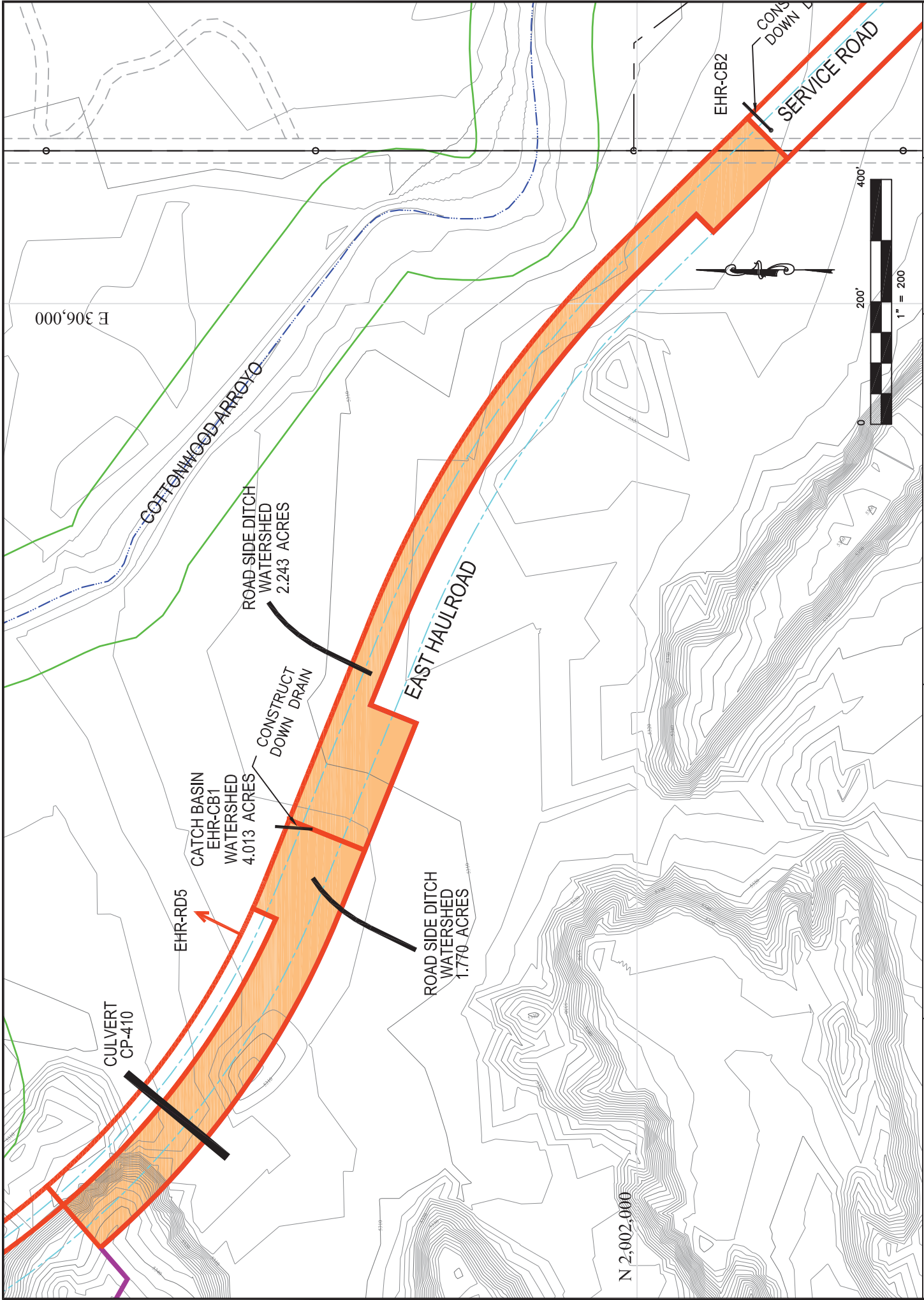


PLATE 16
 REVISIONS:
 DATE: JAN. 27, 2012

DRAWN BY: PR & BT
 PREPARED BY: PR & BT

NAVAJO COAL COMPANY
 EAST HAULROAD DESIGN

EHR-CB1 WATERSHED
 EAST HAULROAD STA 216+60

GEOMAT inc.
 915 Malta Avenue • Farmington, NM 87401 • (505) 327-7928

EAST HAULROAD
25-YR 24-HR STORM

CATCH BASIN EHR-CB2

STATION 230+23

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.060 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CATCH BASIN EHR-CB2

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	4.628	4.628	5.84	0.33

Structure Detail:

Structure #1 (Null)

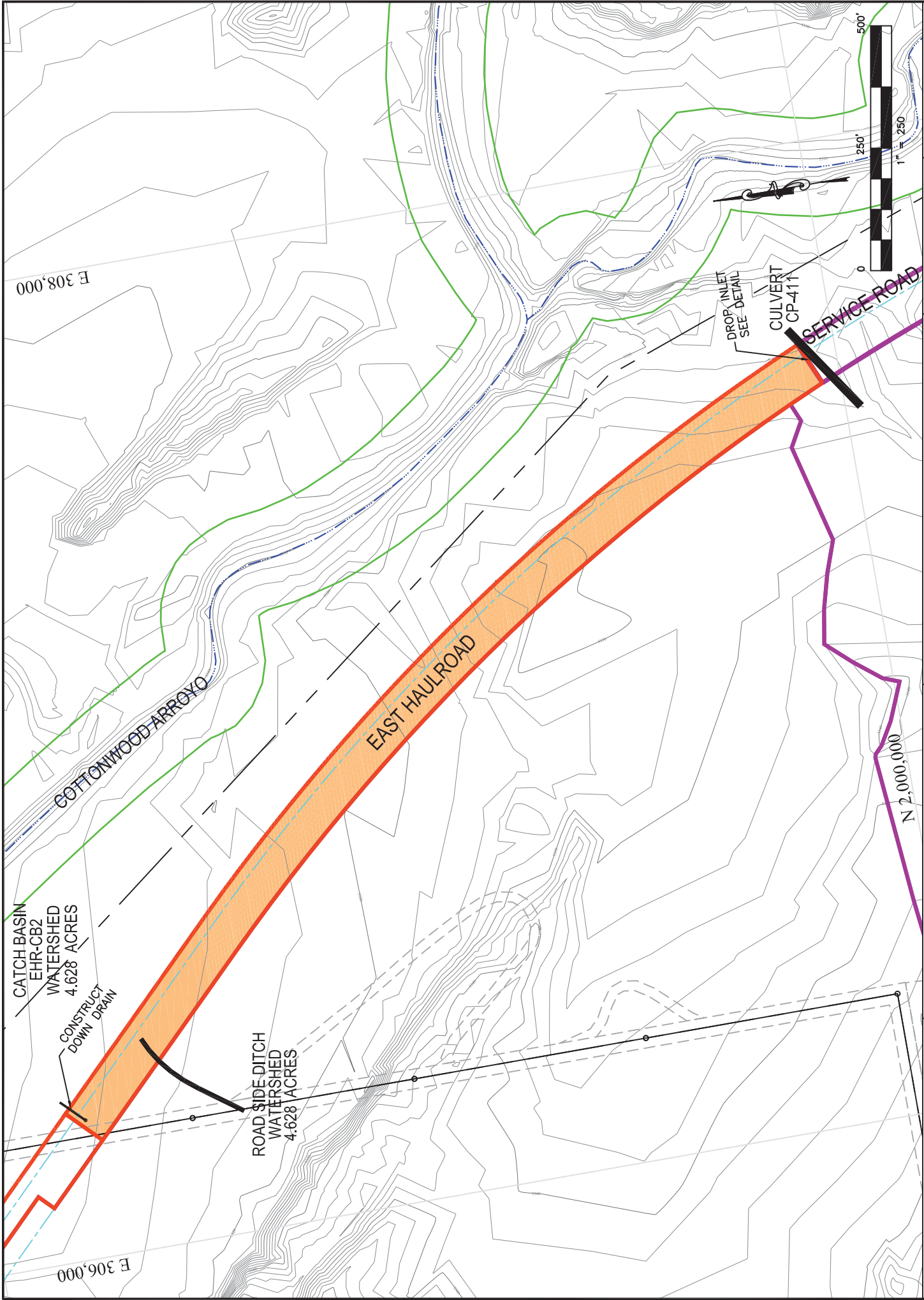
CATCH BASIN EHR-CB2

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	4.628	0.217	0.000	0.000	89.000	M	5.84	0.333
	Σ	4.628						5.84	0.333

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	0.89	19.60	2,204.72	2.820	0.217
#1	1	Time of Concentration:					0.217



<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>EHR-CB2 WATERSHED EAST HAULROAD STA 230+23</p>	<p>PLATE 17 DRAWN BY: PR & BT PREPARED BY: PR & BT REVISIONS: DATE: JAN. 27, 2012</p>
---	--	--	---

EAST HAULROAD
10-YR 6-HR STORM

RELIEF DITCH EHR-RD6
STATION 276+60

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

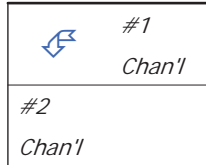
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	ROAD SIDE DITCH
Channel	#2	==>	End	0.000	0.000	EHR-RD6



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	0.877	0.877	1.11	0.03
#2	0.000	0.877	1.11	0.03

Structure Detail:

Structure #1 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

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	50.0:1	0.1	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.11 cfs	
Depth:	0.29 ft	0.59 ft
Top Width:	15.11 ft	30.71 ft
Velocity:	0.50 fps	
X-Section Area:	2.20 sq ft	
Hydraulic Radius:	0.145 ft	
Froude Number:	0.23	

Structure #2 (Riprap Channel)

EHR-RD6

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	33.3	0.30		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.11 cfs	
Depth:	0.03 ft	0.33 ft
Top Width:	4.17 ft	5.97 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.11 sq ft	
Hydraulic Radius:	0.027 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

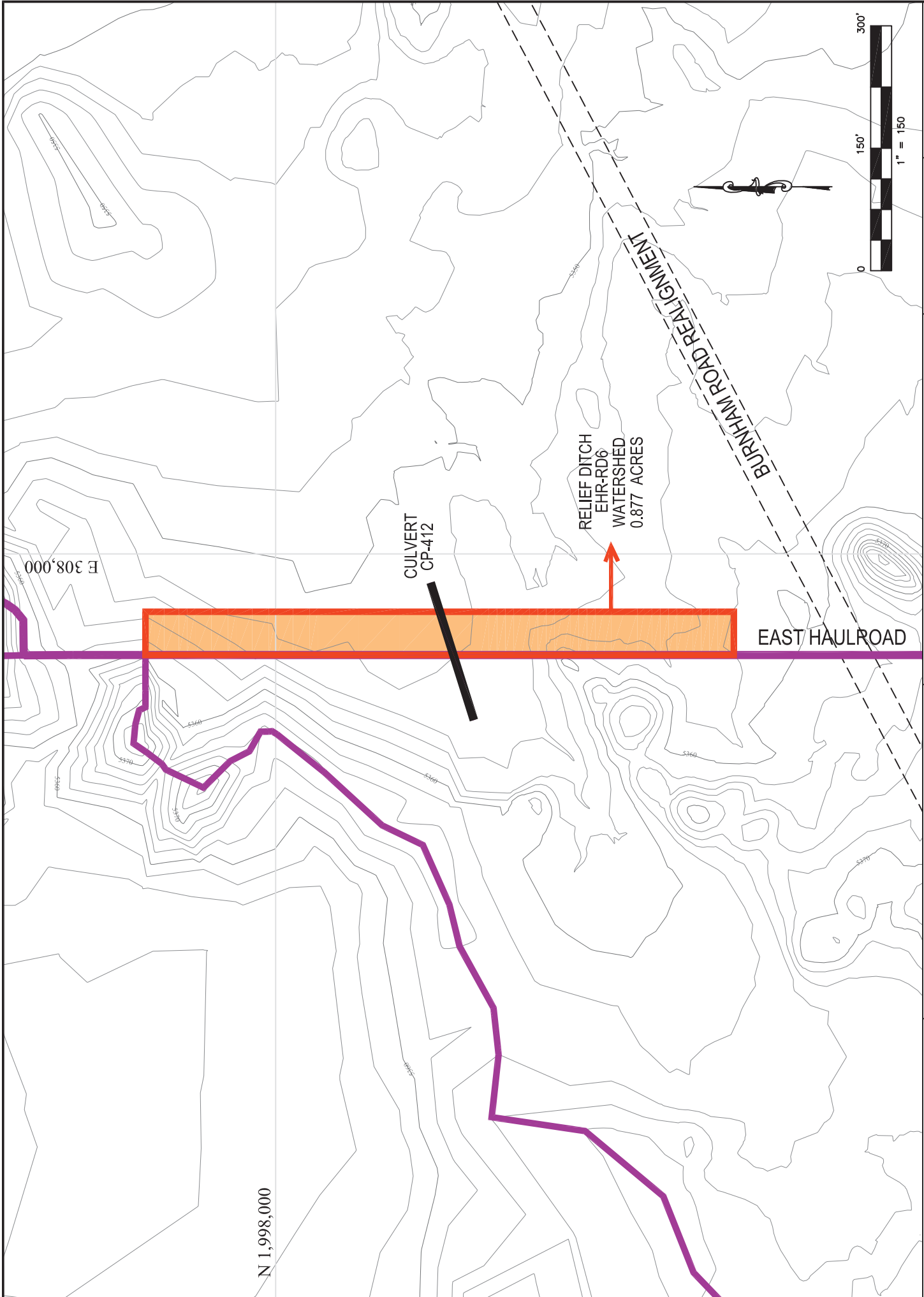
Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.877	0.054	0.000	0.000	89.000	M	1.11	0.034
	Σ	0.877						1.11	0.034
#2	Σ	0.877						1.11	0.034

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	1.08	6.62	613.84	3.110	0.054
#1	1	Time of Concentration:					0.054



<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>EHR-RD6 WATERSHED EAST HAULROAD STA 276+60</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT REVISOR: PR & BT DATE: JAN. 27, 2012</p>
			<p>PLATE 18</p>

SERVICE ROAD LOOP
10-YR 6-HR STORM

RELIEF DITCH SRL-RD7
STATION 00+90

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

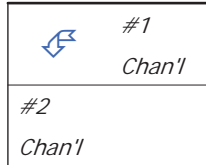
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	ROAD SIDE DITCH
Channel	#2	==>	End	0.000	0.000	RELIEF DITCH SRL-RD7



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	0.718	0.718	0.91	0.03
#2	0.000	0.718	0.91	0.03

Structure Detail:

Structure #1 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
50.0:1	2.0:1	0.5	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.91 cfs	
Depth:	0.18 ft	0.48 ft
Top Width:	9.39 ft	24.99 ft
Velocity:	1.07 fps	
X-Section Area:	0.85 sq ft	
Hydraulic Radius:	0.090 ft	
Froude Number:	0.63	

Structure #2 (Riprap Channel)

RELIEF DITCH SRL-RD7

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	33.3	0.30		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.91 cfs	
Depth:	0.03 ft	0.33 ft
Top Width:	4.15 ft	5.95 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.10 sq ft	
Hydraulic Radius:	0.025 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

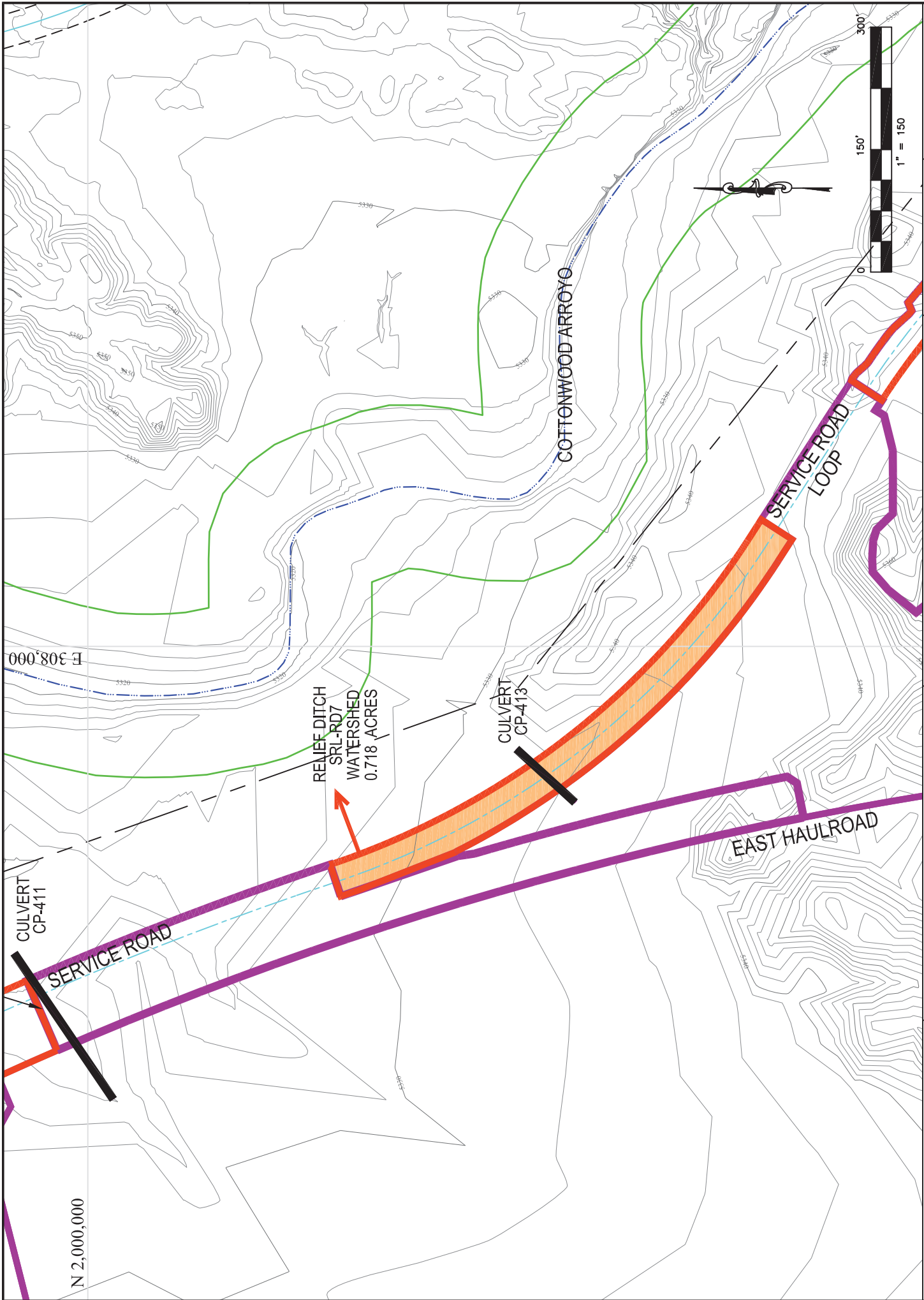
Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.718	0.047	0.000	0.000	89.000	M	0.91	0.028
	Σ	0.718						0.91	0.028
#2	Σ	0.718						0.91	0.028

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	1.82	12.61	693.69	4.040	0.047
#1	1	Time of Concentration:					0.047



<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>SRL-RD7 WATERSHED SERVICE ROAD LOOP STA 00+90</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT DATE: JAN. 27, 2012</p>
---	--	---	---

SERVICE ROAD LOOP
10-YR 6-HR STORM

RELIEF DITCH SRL-RD8

STATION 16+10

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

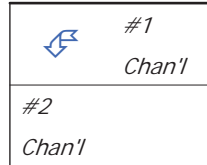
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	ROAD SIDE DITCH
Channel	#2	==>	End	0.000	0.000	RELIEF DITCH SRL-RD8



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	1.413	1.413	1.78	0.06
#2	0.000	1.413	1.78	0.06

Structure Detail:

Structure #1 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

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	50.0:1	0.0	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.78 cfs	
Depth:	0.40 ft	0.70 ft
Top Width:	20.58 ft	36.18 ft
Velocity:	0.44 fps	
X-Section Area:	4.07 sq ft	
Hydraulic Radius:	0.198 ft	
Froude Number:	0.17	

Structure #2 (Riprap Channel)

RELIEF DITCH SRL-RD8

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	33.3	0.30		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.78 cfs	
Depth:	0.03 ft	0.33 ft
Top Width:	4.20 ft	6.00 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.14 sq ft	
Hydraulic Radius:	0.033 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

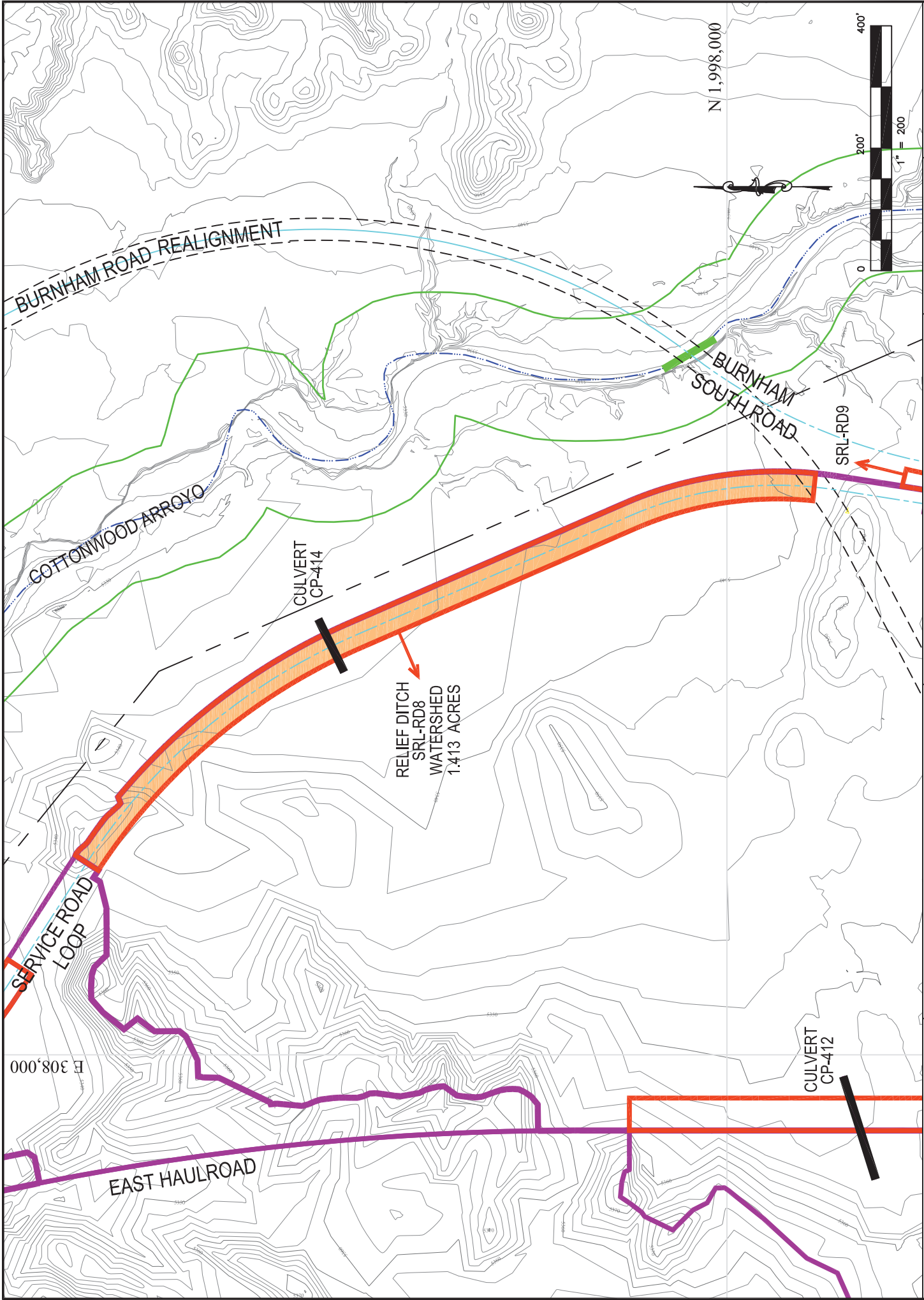
Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	1.413	0.065	0.000	0.000	89.000	M	1.78	0.055
	Σ	1.413						1.78	0.055
#2	Σ	1.413						1.78	0.055

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	1.16	8.80	758.60	3.230	0.065
#1	1	Time of Concentration:					0.065



RELIEF DITCH
SRL-RD8
WATERSHED
1.413 ACRES

DRAWN BY: PR & BT PREPARED BY: PR & BT DATE: JAN. 27, 2012	SRL-RD8 WATERSHED SERVICE ROAD LOOP STA 16+10	NAVAJO COAL COMPANY EAST HAULROAD DESIGN	GEOMAT, INC. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928
--	--	---	--

PLATE 20

SRL-RD8 WATERSHED
SERVICE ROAD LOOP STA 16+10

NAVAJO COAL COMPANY
EAST HAULROAD DESIGN

GEOMAT, INC.
915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928

SERVICE ROAD LOOP
10-YR 6-HR STORM

RELIEF DITCH SRL-RD9

STATION 24+85

BHP Billiton

GEOMAT Inc.
915 Malta Avenue
Farmington, NM 87401

Phone: (505) 327-7928

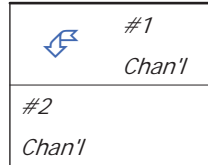
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	ROAD SIDE DITCH
Channel	#2	==>	End	0.000	0.000	RELIEF DITCH SRL-RD9



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	3.170	3.170	2.43	0.10
#2	0.000	3.170	2.43	0.10

Structure Detail:

Structure #1 (Erodible Channel)

ROAD SIDE DITCH

Triangular Erodible Channel Inputs:

Material: Silt loam noncolloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
50.0:1	2.0:1	0.5	0.0200	0.30			3.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.43 cfs	
Depth:	0.27 ft	0.57 ft
Top Width:	13.81 ft	29.41 ft
Velocity:	1.33 fps	
X-Section Area:	1.83 sq ft	
Hydraulic Radius:	0.133 ft	
Froude Number:	0.64	

Structure #2 (Riprap Channel)

RELIEF DITCH SRL-RD9

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	3.6	0.30		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.43 cfs	
Depth:	0.17 ft	0.47 ft
Top Width:	5.05 ft	6.85 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.79 sq ft	
Hydraulic Radius:	0.155 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

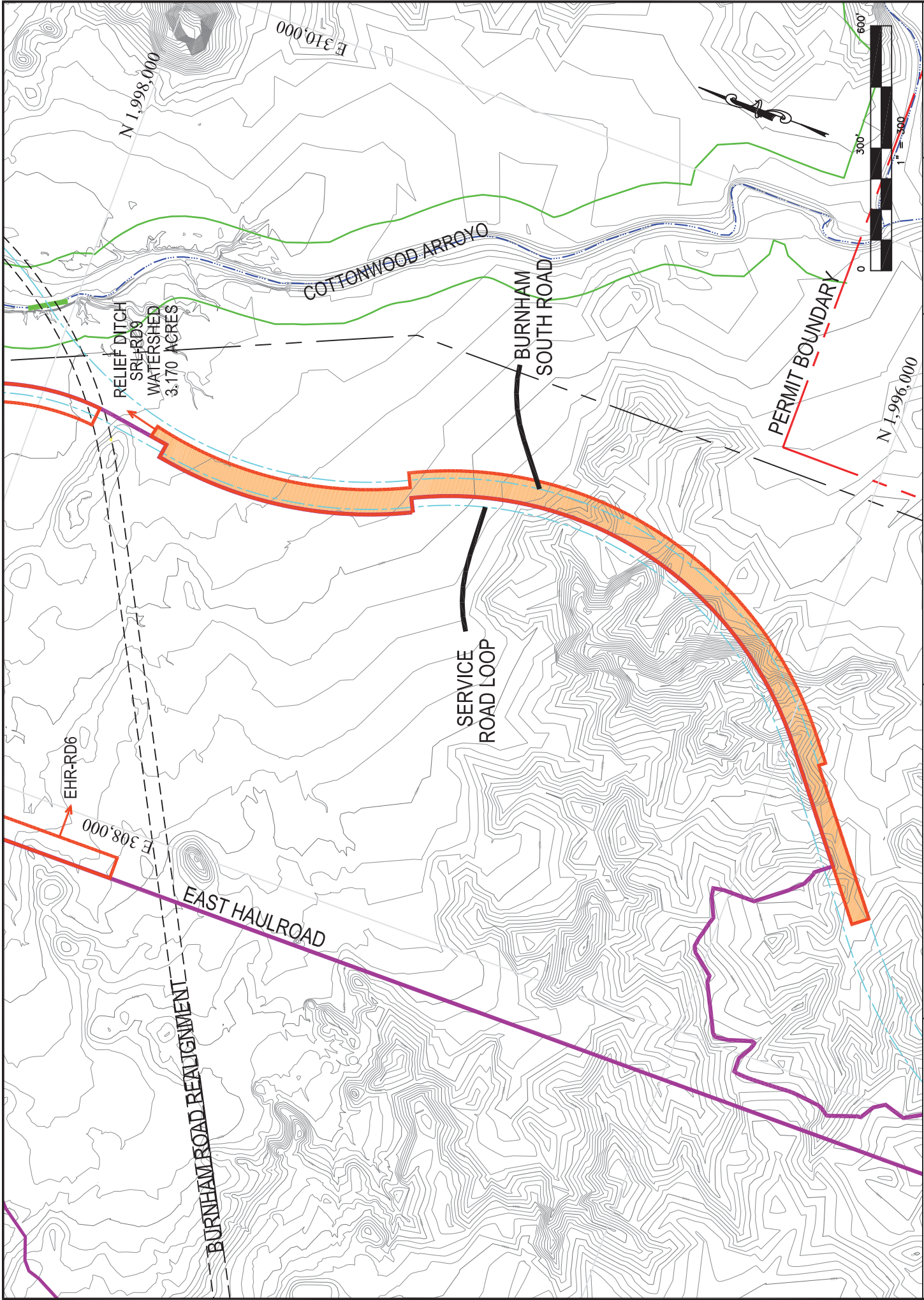
Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	3.170	0.166	0.000	0.000	89.000	M	2.43	0.101
	Σ	3.170						2.43	0.101
#2	Σ	3.170						2.43	0.101

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	1.76	41.75	2,373.54	3.970	0.166
#1	1	Time of Concentration:					0.166



<p>GEOMAT inc. 915 Malta Avenue ♦ Farmington, NM 87401 ♦ (505) 327-7928</p>	<p>NAVAJO COAL COMPANY EAST HAULROAD DESIGN</p>	<p>SRL-RD9 WATERSHED SERVICE ROAD LOOP STA 24+85</p>	<p>DRAWN BY: PR & BT PREPARED BY: PR & BT DATE: JAN. 27, 2012</p>
---	--	---	---