BARBER BY-PASS ROAD

ROADWAY SIDE DITCH DESIGN

See Exhibits 11-100 – 11-100B for road location, sections, and profiles

November 2002

Barber By-pass Road

Roadway side ditch design. See attached Figure A for watershed area and Sedcad model.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

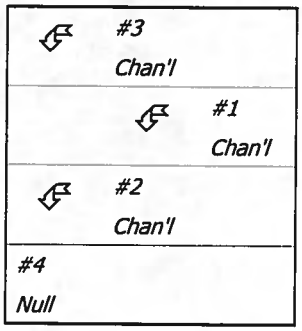
General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	5 yr - 6 hr
Rainfall Depth:	1.100 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.112	0.367	Rt side ditch @ 6% max
Channel	#2	==>	#4	0.000	0.000	Rt side ditch @ 1.6 %
Channel	#3	==>	#4	0.000	0.000	Lt side ditch @ 1.6 %
Null	#4	==>	End	0.000	0.000	



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	2.47	47.00	1,900.00	4.71	0.112
#1	**Muskingum K:**					**0.112**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	16.700	16.700	3.66	0.24
#1	9.500	9.500	7.25	0.28
#2	26.100	35.600	11.72	0.65
#4	0.000	52.300	15.39	0.90

Structure Detail:

Structure #3 (Erodible Channel)

Lt side ditch @ 1.6 %

Triangular Erodible Channel Inputs:

Material: Spoils w/sandstones cobbles

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	4.0:1	1.6	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.66 cfs	
Depth:	0.64 ft	1.64 ft
Top Width:	3.86 ft	9.86 ft
Velocity:	2.95 fps	
X-Section Area:	1.24 sq ft	
Hydraulic Radius:	0.305	
Froude Number:	0.92	

Structure #1 (Riprap Channel)

Rt side ditch @ 6% max

Triangular Riprap Channel Inputs:

Material: Riprap

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.0:1	2.0:1	6.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.25 cfs	
Depth:	0.39 ft	1.39 ft
Top Width:	2.35 ft	8.35 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.46 sq ft	
Hydraulic Radius:	0.186	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

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

Structure #2 (Erodible Channel)

Rt side ditch @ 1.6 %

Triangular Erodible Channel Inputs:

Material: Spoils w/sandstone cobbles

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
4.0:1	2.0:1	1.6	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.72 cfs	
Depth:	1.00 ft	2.00 ft
Top Width:	5.97 ft	11.97 ft
Velocity:	3.94 fps	
X-Section Area:	2.97 sq ft	
Hydraulic Radius:	0.472	
Froude Number:	0.98	

Structure #4 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	16.700	0.159	0.000	0.000	83.000	M	3.66	0.242
	Σ	**16.700**						**3.66**	**0.242**
#1	1	9.500	0.055	0.000	0.000	89.000	M	7.25	0.276
	Σ	**9.500**						**7.25**	**0.276**
#2	1	26.100	0.194	0.000	0.000	83.000	M	5.38	0.379
	Σ	**35.600**						**11.72**	**0.654**
#4	Σ	**52.300**						**15.39**	**0.896**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	10.31	33.00	320.00	3.210	0.027
		8. Large gullies, diversions, and low flowing streams	5.21	37.00	710.00	6.840	0.028
#1	**1**	**Time of Concentration:**					**0.055**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	4.89	43.00	880.01	2.210	0.110
		8. Large gullies, diversions, and low flowing streams	1.39	15.00	1,080.00	3.530	0.084
#2	**1**	**Time of Concentration:**					**0.194**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	12.14	85.00	700.00	3.480	0.055
		8. Large gullies, diversions, and low flowing streams	1.61	23.00	1,430.00	3.800	0.104
#3	**1**	**Time of Concentration:**					**0.159**

General Information

Storm Information:

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

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	16.700	16.700	5.80	0.38
#1	9.500	9.500	9.67	0.38
#2	26.100	35.600	17.05	0.97
#4	0.000	52.300	22.85	1.35

Structure Detail:

Structure #3 (Erodible Channel)

Lt side ditch @ 1.6 %

Triangular Erodible Channel Inputs:

Material: Spoils w/sandstones cobbles

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	4.0:1	1.6	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.80 cfs	
Depth:	0.76 ft	1.76 ft
Top Width:	4.59 ft	10.59 ft
Velocity:	3.31 fps	
X-Section Area:	1.76 sq ft	
Hydraulic Radius:	0.363	
Froude Number:	0.94	

Structure #1 (Riprap Channel)

Rt side ditch @ 6% max

Triangular Riprap Channel Inputs:

Material: Riprap

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.0:1	2.0:1	6.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.67 cfs	
Depth:	0.43 ft	1.43 ft
Top Width:	2.57 ft	8.57 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.55 sq ft	
Hydraulic Radius:	0.203	
Froude Number*:		
Manning's n*:		
Dmin:	5.00 in	
D50:	15.00 in	
Dmax:	18.75 in	

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

Structure #2 (Erodible Channel)

Rt side ditch @ 1.6 %

Triangular Erodible Channel Inputs:

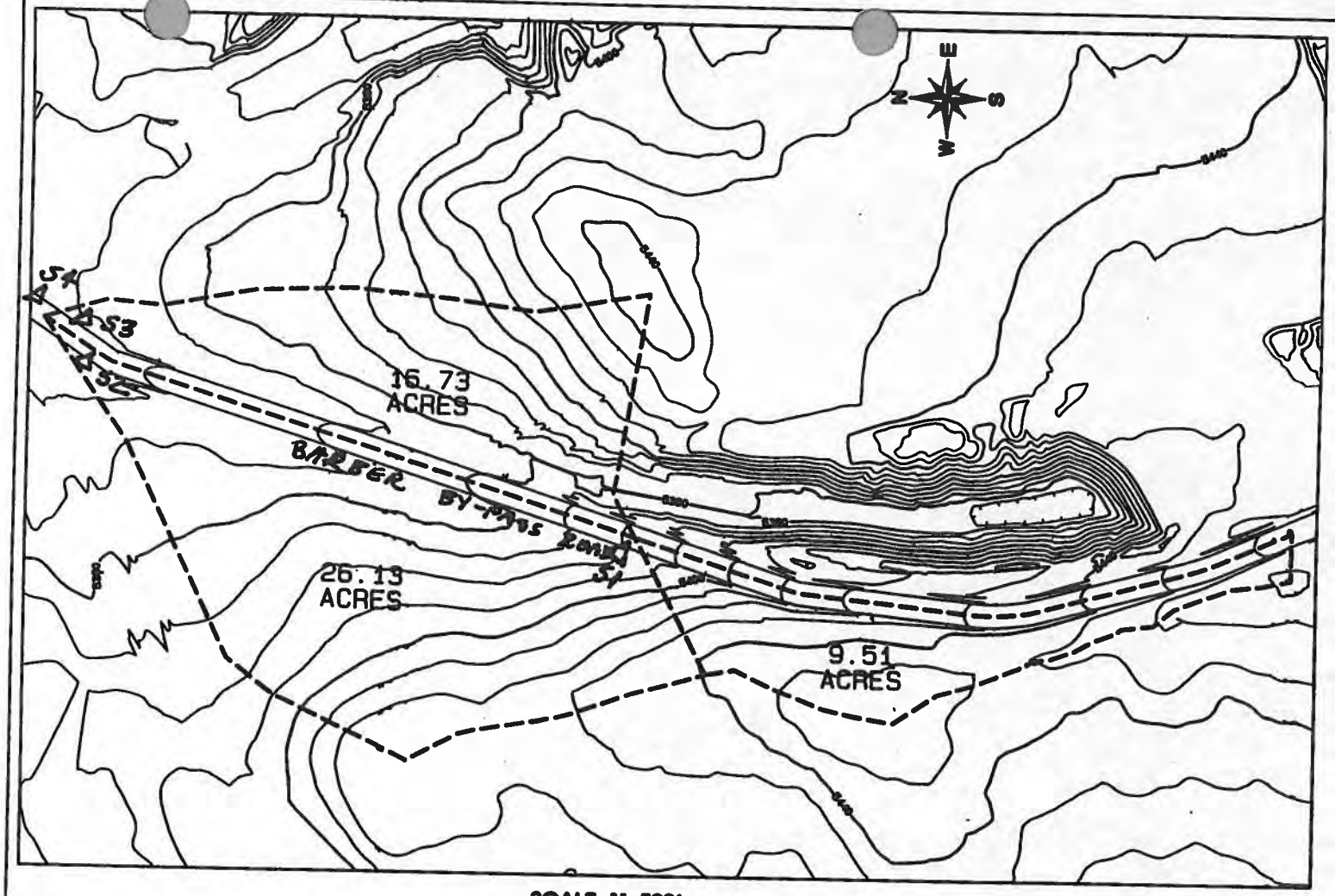
Material: Spoils w/sandstone cobbles

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
4.0:1	2.0:1	1.6	0.0290	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	17.05 cfs	
Depth:	1.15 ft	2.15 ft
Top Width:	6.87 ft	12.87 ft
Velocity:	4.33 fps	
X-Section Area:	3.94 sq ft	
Hydraulic Radius:	0.543	
Froude Number:	1.01	

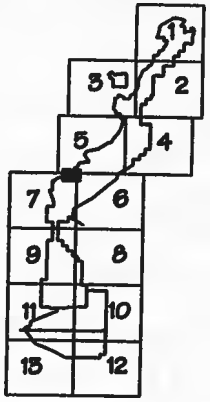
Structure #4 (Null)



SCALE: 1"=500'

LEGEND

- PAVED ROAD
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5290 INTERMEDIATE CONTOUR
- WATERSHED



REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	DWN.	E.S.	P.E.	P.E.	APPROVED
A	04-15-02	RY	SUBMITTED TO OSM FOR APPROVAL		MC	LR	CN	SF

FIGURE A

NAVAJO COAL COMPANY

NAVAJO MINE

P.O. BOX 199 FARMINGTON, NEW MEXICO 87419

BARBER BYPASS ROAD SIDE DITCH WATERSHEDS

PREPARED BY RY	DRAWN BY RY	SCALE AS NOTED
APPROVED BY LR	DATE 11-19-02	REF DWG

DWG LOC C:\Ray\Terramodel\Barber Bypass FIG A.pro