Appendix 26.B

Pond 416

Hydrologic Analysis and Design

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NAVAJO MINE PINABETE PERMIT POND 416

The location of the pond and the associated watershed are presented on Exhibit 26.1-1.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

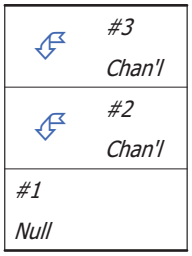
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 416
Channel	#2	==>	#1	0.002	0.422	North Inlet
Channel	#3	==>	#1	0.002	0.426	South Inlet



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	9.41	8.00	85.00	9.20	0.002
#2	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	10.67	8.00	75.00	9.79	0.002
#3	**Muskingum K:**					**0.002**

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	94.000	94.000	115.00	6.43
#2	27.100	27.100	61.93	2.32
#1	4.800	125.900	156.21	9.16

Structure Detail:

Structure #3 (Riprap Channel)

South Inlet

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)
16.00	2.0:1	2.0:1	10.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	115.00 cfs	
Depth:	0.62 ft	1.62 ft
Top Width:	18.49 ft	22.49 ft
Velocity*:		
X-Section Area:	10.71 sq ft	
Hydraulic Radius:	0.570 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

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

Structure #2 (Riprap Channel)

North Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	2.0:1	2.0:1	9.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	61.93 cfs	
Depth:	0.46 ft	1.46 ft
Top Width:	13.85 ft	17.85 ft
Velocity*:		
X-Section Area:	5.97 sq ft	
Hydraulic Radius:	0.425 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

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

Structure #1 (Null)

POND 416

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	94.000	0.301	0.000	0.000	89.000	M	115.00	6.435
	Σ	**94.000**						**115.00**	**6.435**
#2	1	27.100	0.114	0.000	0.000	89.000	M	61.93	2.318
	Σ	**27.100**						**61.93**	**2.318**
#1	1	4.800	0.026	0.000	0.000	89.000	M	10.97	0.411
	Σ	**125.900**						**156.21**	**9.163**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.00	200.00	2.230	0.024
		8. Large gullies, diversions, and low flowing streams	32.31	42.00	130.00	17.050	0.002
#1	**1**	**Time of Concentration:**					**0.026**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.33	10.00	300.00	1.820	0.045
		8. Large gullies, diversions, and low flowing streams	3.62	52.00	1,435.00	5.710	0.069
#2	**1**	**Time of Concentration:**					**0.114**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	3.25	20.00	616.00	1.800	0.095
		8. Large gullies, diversions, and low flowing streams	2.57	92.00	3,576.00	4.810	0.206
#3	**1**	**Time of Concentration:**					**0.301**

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NAVAJO MINE PINABETE PERMIT
POND 416

The location of the pond and the associated watershed are presented on Exhibit 26.1-1.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

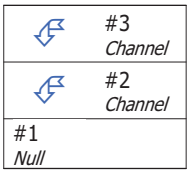
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 416
Channel	#2	==>	#1	0.002	0.422	North Inlet
Channel	#3	==>	#1	0.002	0.426	South Inlet



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	9.41	8.00	85.00	9.20	0.002
#2	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	10.67	8.00	75.00	9.79	0.002
#3	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	94.000	94.000	79.72	5.54
#2	27.100	27.100	45.10	1.60
#1	4.800	125.900	106.82	7.42

Structure Detail:

Structure #3 (Riprap Channel)

South Inlet

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)
16.00	2.0:1	2.0:1	10.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.46 ft	1.46 ft
Top Width:	17.86 ft	21.86 ft
Velocity*:		
X-Section Area:	7.86 sq ft	
Hydraulic Radius:	0.435	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

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

Structure #2 (Riprap Channel)

North Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	2.0:1	2.0:1	9.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.36 ft	1.36 ft
Top Width:	13.43 ft	17.43 ft
Velocity*:		
X-Section Area:	4.56 sq ft	
Hydraulic Radius:	0.335	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

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

Structure #1 (Null)

POND 416

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	94.000	0.301	0.000	0.000	89.000	M	79.72	5.54
	S	**94.000**						**79.72**	**5.54**
#2	1	27.100	0.114	0.000	0.000	89.000	M	45.10	1.60
	S	**27.100**						**45.10**	**1.60**
#1	1	4.800	0.026	0.000	0.000	89.000	M	7.99	0.28
	S	**125.900**						**106.82**	**7.42**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.00	200.00	2.230	0.024
		8. Large gullies, diversions, and low flowing streams	32.31	42.00	130.00	17.050	0.002
#1	**1**	**Time of Concentration:**					**0.026**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.33	10.00	300.00	1.820	0.045
		8. Large gullies, diversions, and low flowing streams	3.62	52.00	1,435.00	5.710	0.069
#2	**1**	**Time of Concentration:**					**0.114**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	3.25	20.00	616.00	1.800	0.095
		8. Large gullies, diversions, and low flowing streams	2.57	92.00	3,576.00	4.810	0.206
#3	**1**	**Time of Concentration:**					**0.301**