DESIGN REPORT

Temporary Sedimentation Structure

N6-K

Black Mesa Mine

Navajo County, Arizona

for

PEABODY WESTERN COAL COMPANY

APPROVED
MAR 1997

Registered Professional Engineer (Civil)
CERTIFICATE NO.
18782
JAMES GARL SCHLENVOGT
Date Signed
ARIZONA, U.S.A.

JAN 20 1997

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INTRODUCTION

Sedimentation structure N6-K is a partially incised structure with an earthen embankment, designed by Peabody Western Coal Company as a temporary sedimentation structure to control runoff and sediment from the proposed N-6 mining area at the Black Mesa Mine. The location of structure N6-K and its watershed boundary is shown on Drawing No. 85400 (Sheets K-7, and L-7) and Drawing No. 85405. The site-specific general construction plans of the proposed structure are shown on the attached Exhibit 1.

This design report contains information specific to proposed structure N6-K, which is located in series with existing sedimentation structure N6-K1 and proposed sedimentation structure N6-L. Mine-wide design, construction, and reclamation information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody Western Coal Company", December, 1985 (PAP), Chapter 6, Attachment D, Volume 2, along with the methods and results of analyses used for slope stability, hydrology, and hydraulics, and in Chapter 6, Pages 11 to 42, "Sediment and Water Control Facility Plan".

INSPECTION

The construction site of the proposed structure N6-K was inspected by a Registered Professional Engineer from Peabody Western Coal Company, to ensure that the location was suitable and no adverse conditions existed. A detailed geotechnical investigation was not performed, rather, the information in Chapter 6, Attachment D was utilized for embankment design.

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SITE DESCRIPTION

Land Use

The N6-K1, N6-K, and N6-L structures have a 402.6 acre combined drainage area and are located on a tributary to Coal Mine Wash. The 135.4 acre watershed contributing directly to the N6-K structure is classified as 43% disturbed spoil, and 57% reclaimed. Based on the mine plan, the N-6 pit will intercept a significant portion of the N6-K watershed. As the mining and reclamation activities progress closer to the pond, the above "worst case" assumptions will apply.

DESIGN ANALYSES

General

Structure N6-K was designed under the direct supervision of a Registered Professional Engineer from Peabody Western Coal Company. The design was performed in accordance with applicable 30 CFR 780 and 816 regulations of the United States Department of Interior, Office of Surface Mining (OSM) and included a review of available project files. The most current information contained in the Peabody Western Coal Company files includes topographic maps developed from aerial photography flown in 1992 for Peabody Western Coal Company and was used in the analyses of the structure.

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Stability

A homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 15 feet wide on top will be constructed. An upstream slope of 4.5H:1V and a downstream slope of 4.5H:1V were assumed. Based on a total embankment height of 21 feet, these slopes are flatter than the recommended "worst case" embankment/foundation condition slopes in Table 3-6, Attachment D, Chapter 6; therefore, the embankment will be stable. The emergency spillway will be a minimum 40-foot wide riprap-lined trapezoidal channel.

Hydrology

The hydrologic analysis was completed using the computer program SEDCAD+ (see Appendices A, B, and C). Structure N6-K is located in series with existing structure N6-K1 and proposed structure N6-L. Structure N6-K is classified as a low hazard structure (see Drawing No. 85408). The mine area is sparsely populated with no one living in the downstream flood plain. The earthen embankment structure impounds less than 20 acre-feet and is less than 20 vertical feet in height from the upstream toe of embankment of the natural stream elevation to the emergency spillway elevation. The three structures have a combined capacity greater than 20 acre-feet; therefore, the spillway was analyzed using the 100-year, 6-hour storm event in lieu of the 25-year, 6-hour storm. Structures N6-K1, N6-K, and N6-L were conservatively assumed to be full to the emergency spillway at the time of 100-year storm event. The storage capacity of structure N6-K was analyzed using the 10-year, 24-hour storm event. The combined ponds in series were verified to completely contain the 10-year, 24-hour storm event, and provide adequate sediment storage volume, without discharging downstream into Coal Mine Wash.

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The following parameters were used in the hydrologic analysis:

		10-Year 24-Hour Storm*	100-Year 6-Hour Storm
1.	Water Course length, L	0.805 mi	---------
2.	Elevation Difference, H	257 ft	---------
3.	Time of Concentration, T_c	0.238 hr	---------
4.	SCS Curve Number	83	---------
5.	Rainfall Depth	2.1 in	2.4 in
6.	Drainage Area	135.4 acres	382.4 acres

*Values reported for the 10-year, 24-hour storm event represent the watershed which drains directly to Pond N6-K. Hydrologic input parameters for additional tributaries routed through upstream and downstream structures are presented in Appendix A.

Muskingum routing parameters were utilized to route hydrographs between the N6-K1, N6-K, and N6-L structures. The routing parameters are presented in Appendices A, B, and C, and are shown on a subwatershed basis.

Hydraulics

The SEDCAD+ and Flow Master computer programs were used to evaluate inflow to the sedimentation structure, outflow from the structure and the resulting water surface elevations. The 10-year and the 100-year storms were routed through the upstream Structure N6-K1 into Structure N6-K. The initial conditions and results of the analysis are summarized in the following table (supporting calculations are presented in Appendix A, B, and C).

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N6-K SEDIMENTATION POND HYDRAULICS TABLE

	Units	10-Yr, 24-Hr Storm	100-Yr, 6-Hr Storm
Initial Reservoir Volume Condition		Empty	Full to emergency spillway
Inflow			
Peak Flow	cfs	91.6	281.2
Volume	ac-ft	8.6*	31.3
Storage			
Peak Stage	msl	N/A	6514.9
Emerg. Spillway Elev.	msl	6513.0	6513.0
Peak Storage	ac-ft	N/A	23.3
Storage Capacity	ac-ft	19.9	19.9
Outflow			
Peak Flow	cfs	N/A	263.5
Spillway Elevation	msl	6513.0	6513.0
Embankment Crest Elev.	msl	6516.0	6516.0
Peak Stage	msl	--	6514.9
Freeboard	ft	--	1.1
Emergency Spillway Channel			
Flow Depth	ft	--	1.9
Critical Velocity	fps	--	5.7
Mannings "n"	--	--	.035
Width	ft	--	40
Outflow Channel			
Maximum Slope	%	--	25
Normal Velocity	fps	--	9.1
Normal Depth	ft	--	0.7
Mannings "n"	--	--	.062
Riprap D_{50}	in	--	9

* Inflow volume for the drainage area between Structure N6-K1 and N6-K.

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Emergency Spillway and Outlet Channel

The emergency spillway and outlet channel for N6-K will be a trapezoidal channel, the alignment and dimensions are shown on Exhibit 1 and includes the following dimensions:

Minimum Channel Depth	(Spillway)	2.9	ft
	(Outflow)	1.7	ft
Channel Width		40	ft
Channel Length	(Spillway)	40	ft
	(Outflow)	100	ft
Side Slopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25	%
Spillway Elevation		6513 ft	

A minimum 15-foot long riprap lined channel has been constructed beyond the toe of the embankment as a transition into the downstream sedimentation structure N6-L.

Storage Capacity

The impoundment stage-capacity table (see Exhibit 1) is based on design topography. The total storage capacity of structure N6-K is designed to contain approximately 19.91 acre-feet.

The calculations for the sediment load entering structure N6-K were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.27
3.	Slope Factor, LS	4.12
4.	Cover Factor, C	0.85
5.	Erosion Control Factor, P	0.63

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The hydrologic analysis gives the storage volume required to contain the 10-year, 24-hour storm, and the remaining storage volume available for storing sediment. Structure N6-K does not have sufficient storage to contain the 10-year, 24 hour storm by itself; however, in series with structures N6-K1 and N6-L, sufficient storage is achieved. The combined sediment storage capacity was determined for the three structures in series and the results of the analysis are presented in the following table.

Combined Storage for Structures N6-K1, N6-K, and N6-L

	N6-K1	N6-K	N6-L	Combined
Total Storage Capacity	24.85	19.91	19.74	64.50 acre-ft
10-Year, 24-Hour Storm Inflow	15.73	8.62	1.56	25.91 acre-ft
Available Sediment Storage Capacity	----	----	----	38.59 acre-ft
Sediment Inflow Rate/Year	1.92	1.39	0.17	3.48 acre-ft
Sediment Storage Life	----	----	----	11.1 years

The following appendices and drawing are attached and complete this design report.

Appendix A - Hydrology, Hydraulic, and Sedimentation Calculations
Appendix B - SEDCAD+ (Input and Output) 10-Year, 24-Hour Storm Event
Appendix C - SEDCAD+ (Input and Output) 100-Year, 6-Hour Storm Event

Exhibit 1 - Proposed N6-L & N6-K Sedimentation Pond Design

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: N6-K Pond

TIME OF CONCENTRATION:

Start Elevation (ft) =	6752
End Elevation (ft) =	6495
Elevation Difference, E (ft) =	257
Watercourse Length (ft) =	4250
Watercourse Length, L (mi) =	0.805
Tc = (11.9L^3/E)^0.385 =	0.238 hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland Method in SEDCAD+. Input and output parameters are shown on the SEDCAD+ printouts in Appendices B and C.

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Reclaimed	C	81	76.8	6223.23
Spoil	B	86	58.6	5037.02
TOTAL:			135.4	11260.25

Weighted CN = Total CN*Area/ Total Area = 83

DRAINAGE BASIN AREA:

135.4 Acres

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CALCULATED SEDIMENTOLOGY DATA

PROJECT: N6-K Pond

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area (acres)	K*Area
Reclaimed	0.38	76.8	29.20
Spoil	0.12	58.6	7.03
TOTAL:		135.4	36.22

Weighted K = Total K*Area/ Total Area = 0.27

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
300	30	10.0%	0.5	5.7	2.38
250	40	16.0%	0.6	9.1	4.52
190	40	21.1%	0.6	11.9	5.27
250	50	20.0%	0.6	11.3	5.87
300	40	13.3%	0.6	7.6	4.03
420	40	9.5%	0.5	5.4	2.63

Average LS = 4.12

The LS Factor was calculated by:

LS = (Slope Length/72.6)^m(10.8*sin(slope angle) + 0.03) for Slopes < 9%*

LS = (Slope Length/72.6)^m(16.8*sin(slope angle) - 0.5) for Slopes > 9%*

Where:

Slope < 3%	*m = 0.3*
Slope = 4%	*m = 0.4*
5% > Slope < 10%	*m = 0.5*
Slope > 10%	*m = 0.6*

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OVER AND PRACTICE FACTORS:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C*Area	Practice Factor, P	P*Area
Reclaimed Spoil	-- 0%	-- 0%	76.8 58.6	0.73 1.00	56.09 58.57	0.34 1.00	26.12 58.57
TOTAL:			135.4		114.66		84.69

Weighted C = Total C*Area/ Total Area = 0.85

Weighted P = Total P*Area/ Total Area = 0.63

RAINFALL FACTOR:

R = 40

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CALCULATED SEDIMENT YIELD

PROJECT: N6-K Pond

The following spreadsheet calculates the predicted sediment yield for the project area. The gross sediment yield is determined according to the Revised Universal Soil Loss Equation.

PARAMETER DESCRIPTION	VALUE	
Annual Rainfall Factor	40.00	
Soil Erodibility Factor	0.27	
Length Slope Factor	4.12	
Cover Factor	0.85	
Practice Factor	0.63	
Gross Annual Sediment Yield	23.34	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0114	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0103	acre-feet/acre/year
Watershed Area	135.4	acres
Watershed Annual Sediment Yield	1.39	acre-feet/year
Number of years	1	years
Calculated Sediment Volume	1.39	acre-feet

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Peabody Western Coal Company
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\808\n6-l\n6.fm2
Worksheet	N6-K Spillway
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.018028	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	40.00	ft
Discharge	263.54	cfs

Results		
Depth	1.07	ft
Flow Area	46.46	ft²
Wetted Perimeter	46.80	ft
Top Width	46.45	ft
Critical Depth	1.07	ft
Critical Slope	0.018029	ft/ft
Velocity	5.67	ft/s
Velocity Head	0.50	ft
Specific Energy	1.57	ft
Froude Number	1.00	
Flow is subcritical.		

Notes:

Spillway Channel set to critical slope to determine critical velocity

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SEDCAD+ RIPRAP CHANNEL DESIGN

N6-K Spillway Outslope

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	263.54 cfs	
Slope	25.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	40.00 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.69 ft
with Freeboard	1.69 ft
Top Width	44.15 ft
with Freeboard	50.15 ft
Velocity	9.06 fps
Cross Sectional Area	29.07 sq ft
Hydraulic Radius	0.66 ft
Manning's n	0.062
Froude Number	1.97
Dmax	0.938 ft (11.25 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

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APPENDIX B

SEDCAD+ (Input and Output) 10-Year, 24-Hour Storm Event

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

BLACK MESA MINE - TEMPORARY SEDIMENTATION PONDS N6-K1, N6-K, N6-L

by

Name: K. Kammerzell

Company Name: ACZ, INC.
File Name: C:\808\N6-L\N6-L

Date: 01-14-1997

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Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:33
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
GENERAL INPUT TABLE
==========

Detailed Between Structure Routing:

J	B	To S	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	Muskingum X
1	1	2	1	8	1400.32	2.14	4.39	0.09		
			2	8	300.17	3.33	5.48	0.02	0.103	0.364
1	1	3	1	8	300.17	3.33	5.48	0.02	0.015	0.381

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Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:33
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	247.00	83	F	0.306	0.000	0.000	0.0	15.73	153.55
		Type: Pond Label: N6-K1								
111	Structure	247.00							15.73	
111	Total IN	247.00							15.73	153.55
111	Total OUT								15.73	98.65
112	1	135.40	83	F	0.238	0.000	0.000	0.0	8.62	91.62
		Type: Pond Label: N6-K								
	Structure	135.40							24.36	
112	Total IN	382.40							24.36	144.30
112	Total OUT								24.35	132.40
111 to 112 Routing						0.103	0.364			
113	1	20.20	86	F	0.080	0.000	0.000	0.0	1.56	19.89
		Type: Pond Label: N6-L								
113	Structure	20.20							25.91	
113	Total IN	402.60							25.91	136.48
113	Total OUT								25.91	128.91
112 to 113 Routing						0.015	0.381			

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APPENDIX C

SEDCAD+ (Input and Output) 100-Year, 6-Hour Storm Event

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

BLACK MESA MINE - TEMPORARY SEDIMENTATION PONDS N6-K1, N6-K, N6-L

by

Name: K. Kammerzell

Company Name: ACZ, INC.
File Name: C:\808\N6-L\N6-L

Date: 01-14-1997

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Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:36
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
GENERAL INPUT TABLE
==========

Detailed Between Structure Routing:

J	B	To S	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	Muskingum X
1	1	2	1	8	1400.32	2.14	4.39	0.09		
			2	8	300.17	3.33	5.48	0.02	0.103	0.364
1	1	3	1	8	300.17	3.33	5.48	0.02	0.015	0.381

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Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:36
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	247.00	83	F	0.306	0.000	0.000	0.0	20.19	280.51
		Type: Pond Label: N6-K1								
111	Structure	247.00							20.19	
111	Total IN	247.00							20.19	280.51
111	Total OUT								20.19	195.66
112	1	135.40	83	F	0.238	0.000	0.000	0.0	11.07	168.06
		Type: Pond Label: N6-K								
112	Structure	135.40							31.26	
112	Total IN	382.40							31.26	281.21
112	Total OUT								31.26	263.54
111 to 112 Routing						0.103	0.364			
113	1	20.20	86	F	0.080	0.000	0.000	0.0	1.96	36.24
		Type: Pond Label: N6-L								
113	Structure	20.20							33.22	
113	Total IN	402.60							33.22	270.96
113	Total OUT								33.22	261.14
112 to 113 Routing						0.015	0.381			

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Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:36
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
POND INPUT/OUTPUT TABLE
==========

J1, B1, S1
N6-K1

Drainage Area from J1, B1, S1, SWS(s)1: 247.0 acres
Total Contributing Drainage Area: 247.0 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6571.4
Crest Length (ft)	30.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	20.0

POND RESULTS:

Permanent Pool (ac-ft)
24.8

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	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	20.19	280.51
OUT	20.19	195.66

Peak Elevation	Hydrograph Detention Time (hrs)
6573.6	0.01

****

J1, B1, S2
N6-K

Drainage Area from J1, B1, S2, SWS(s)1: 135.4 acres
Total Contributing Drainage Area: 382.4 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6513.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	40.0

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POND RESULTS:

	Permanent Pool (ac-ft)

=========
19.9

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	31.26	281.21
OUT	31.26	263.54

Peak Elevation	Hydrograph Detention Time (hrs)
6514.9	0.13

****

J1, B1, S3
N6-L

Drainage Area from J1, B1, S3, SWS(s)1: 20.2 acres
Total Contributing Drainage Area: 402.6 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6512.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	40.0

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POND RESULTS:

Permanent

Pool (ac-ft)
19.7

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	33.22	270.96
OUT	33.22	261.14

Peak Elevation	Hydrograph Detention Time (hrs)
6513.8	0.13

****

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Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:36
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
ELEVATION-AREA-CAPACITY-DISCHARGE TABLE
==========

J1, B1, S1
N6-K1

Drainage Area from J1, B1, S1, SWS(s)1: 247.0 acres
Total Contributing Drainage Area: 247.0 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6552.60	0.00	0.00	0.00	0.00	
6554.60	2.00	0.29	0.20	0.00	
6556.60	4.00	0.74	1.20	0.00	
6558.60	6.00	1.08	3.01	0.00	
6560.60	8.00	1.30	5.39	0.00	
6562.60	10.00	1.49	8.18	0.00	
6564.60	12.00	1.67	11.33	0.00	
6566.60	14.00	1.85	14.84	0.00	
6568.60	16.00	2.06	18.74	0.00	
6570.60	18.00	2.23	23.04	0.00	
6571.40	18.80	2.29	24.85	0.00	Stage of SW#1
6572.10	19.50	2.35	26.47	22.76	
6572.20	19.60	2.35	26.70	29.38	
6572.30	19.70	2.36	26.94	36.62	
6572.40	19.80	2.37	27.18	44.45	
6572.60	20.00	2.38	27.65	63.85	
6572.90	20.30	2.42	28.37	97.92	
6573.40	20.80	2.47	29.59	159.73	
6573.63	21.03	2.49	30.16	195.66	Peak Stage
6573.90	21.30	2.52	30.84	239.45	
6574.40	21.80	2.58	32.12	337.51	
6574.60	22.00	2.60	32.63	381.05	
6574.90	22.30	2.62	33.42	451.00	
6575.40	22.80	2.65	34.73	580.13	
6575.90	23.30	2.68	36.07	725.18	
6576.00	23.40	2.69	36.34	756.12	

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****

J1, B1, S2
N6-K

Drainage Area from J1, B1, S2, SWS(s)1: 135.4 acres
Total Contributing Drainage Area: 382.4 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6[illegible].00	0.00	0.57	0.00	0.00	
6497.00	2.00	0.67	1.24	0.00	
6499.00	4.00	0.78	2.68	0.00	
6501.00	6.00	0.89	4.36	0.00	
6503.00	8.00	1.01	6.26	0.00	
6505.00	10.00	1.14	8.42	0.00	
6507.00	12.00	1.28	10.85	0.00	
6509.00	14.00	1.43	13.56	0.00	
6511.00	16.00	1.59	16.58	0.00	
6513.00	18.00	1.74	19.91	0.00	Stage of SW#1
6513.70	18.70	1.80	21.15	40.75	
6513.80	18.80	1.81	21.33	53.23	
6513.90	18.90	1.82	21.51	66.86	
6514.00	19.00	1.83	21.70	81.58	
6514.50	19.50	1.87	22.62	179.01	
6514.86	19.86	1.91	23.30	263.54	Peak Stage
6515.00	20.00	1.92	23.57	297.43	
6515.50	20.50	1.97	24.54	432.03	
6516.00	21.00	2.01	25.54	604.94	
6516.50	21.50	2.06	26.55	801.89	
6517.00	22.00	2.10	27.59	1036.65	
6517.50	22.50	2.15	28.66	1267.13	
6518.00	23.00	2.20	29.75	1535.41	

****

J1, B1, S3
N6-L

Drainage Area from J1, B1, S3, SWS(s)1: 20.2 acres
Total Contributing Drainage Area: 402.6 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6490.00	0.00	0.34	0.00	0.00	
6492.00	2.00	0.42	0.76	0.00	
6494.00	4.00	0.51	1.69	0.00	
6496.00	6.00	0.61	2.81	0.00	
6498.00	8.00	0.71	4.12	0.00	
6500.00	10.00	0.82	5.65	0.00	
6502.00	12.00	0.90	7.37	0.00	
6504.00	14.00	0.98	9.25	0.00	
6506.00	16.00	1.12	11.35	0.00	
6508.00	18.00	1.31	13.78	0.00	
6510.00	20.00	1.50	16.58	0.00	
6512.00	22.00	1.67	19.74	0.00	Stage of SW#1
6512.70	22.70	1.73	20.93	40.75	
6512.80	22.80	1.74	21.11	53.23	
[illegible].90	22.90	1.75	21.28	66.86	
[illegible].00	23.00	1.75	21.46	81.58	
6513.50	23.50	1.80	22.34	179.01	
6513.85	23.85	1.83	22.98	261.14	Peak Stage
6514.00	24.00	1.84	23.25	297.43	
6514.50	24.50	1.92	24.19	432.03	

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6515.00	25.00	2.00	25.17	604.94
6515.50	25.50	2.08	26.19	801.89
6516.00	26.00	2.16	27.25	1036.65
6516.50	26.50	2.29	28.36	1267.13
6517.00	27.00	2.41	29.54	1535.41

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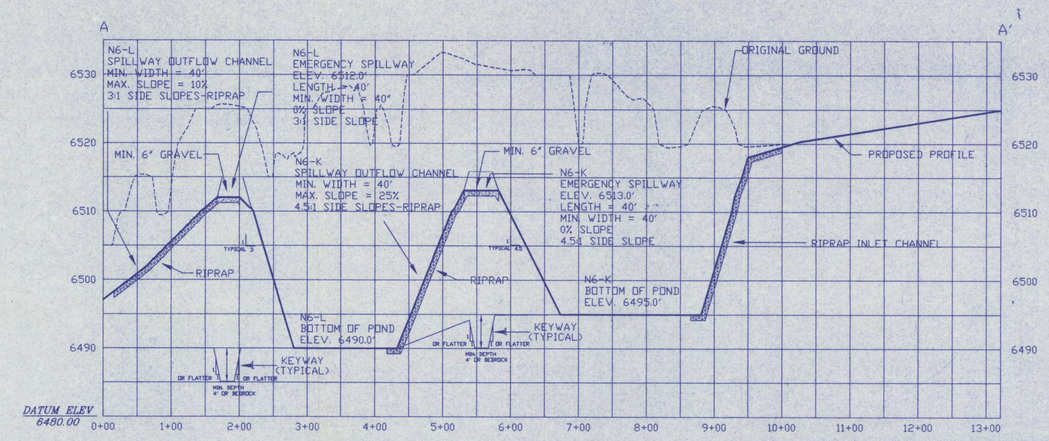
N6-K POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (AC.)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6495	0.00	0.57	0.00	0.00	BOTTOM OF POND
6496	1.00	0.62	0.60	0.60	
6498	3.00	0.72	0.70	1.94	
6500	5.00	0.84	0.80	3.50	
6502	7.00	0.95	0.92	5.29	
6504	9.00	1.08	1.04	7.32	
6506	11.00	1.21	1.18	9.62	
6508	13.00	1.36	1.32	12.19	
6510	15.00	1.50	1.47	15.05	
6512	17.00	1.66	1.62	18.21	
6513	18.00	1.74	1.70	19.91	EMERGENCY SPILLWAY
6514	19.00	1.83	1.79	21.70	
6516	21.00	2.01	1.96	25.54	TOP OF EMBANKMENT

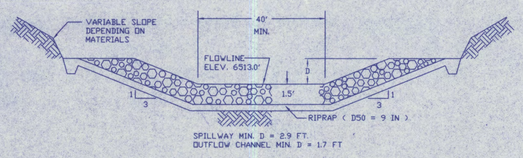
N6-L POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (AC.)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6490	0.00	0.34	0.00	0.00	BOTTOM OF POND
6492	2.00	0.42	0.40	0.76	
6494	4.00	0.51	0.49	1.69	
6496	6.00	0.61	0.58	2.80	
6498	8.00	0.71	0.69	4.12	
6500	10.00	0.82	0.80	5.65	
6502	12.00	0.90	0.88	7.37	
6504	14.00	0.98	0.97	9.26	
6506	16.00	1.12	1.07	11.33	
6508	18.00	1.31	1.26	13.75	
6510	20.00	1.51	1.46	16.56	
6512	22.00	1.67	1.63	19.74	EMERGENCY SPILLWAY
6514	24.00	1.84	1.80	23.26	
6515	25.00	2.00	1.91	25.17	TOP OF EMBANKMENT

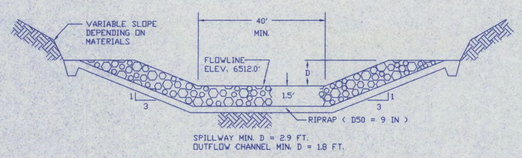


SECTION A - A'

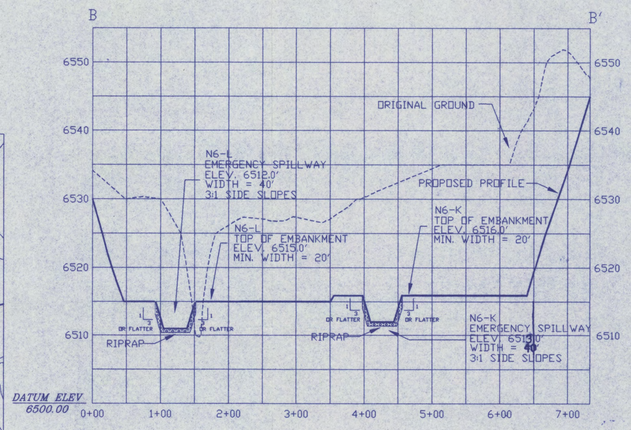
SCALE: HORIZ. 1"=100'
VERT. 1"=10'



PROPOSED N6-K POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)

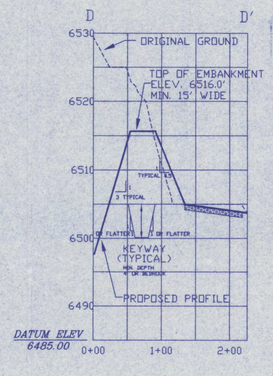


PROPOSED N6-L POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)



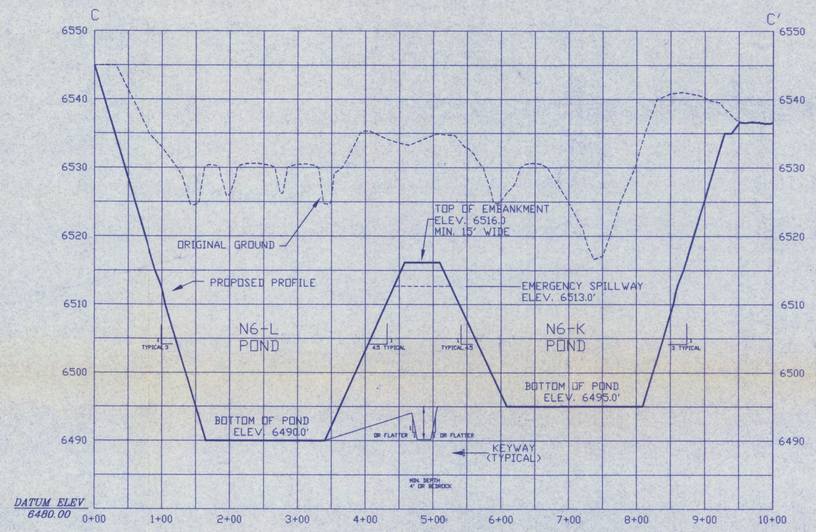
SECTION B - B'

SCALE: HORIZ. 1"=100'
VERT. 1"=10'



SECTION D - D'

SCALE: HORIZ. 1"=100'
VERT. 1"=10'



SECTION C - C'

SCALE: HORIZ. 1"=100'
VERT. 1"=10'

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ENGINEER'S CERTIFICATION

JAMES G. SCHLEWDOT
Company Engineering Manager
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: MAR 18 1997

NOTES:
1) General location, see Drawing No. 85400, Sheet K-7 and Drawing No. 85405.
2) See Chapter 6, Black Mesa PAP for Construction Specifications.
3) See Vol. 2, Chapter 6, Attachment D, Sections 1-3 for description of Geotechnical Evaluation.
4) Salvage topsoil in accordance with approved topsoil salvage plan.
5) Reclamation of the distrubed area above the high waterline shall be in accordance with the approved reclamation plan.
6) Ponding area side slopes, typical 3:1 slope or flatter and blend into natural topography.

EXHIBIT NO. 1

PROPOSED N6-L & N6-K SEDIMENTATION POND DESIGN

BLACK MESA MINE

PEABODY WESTERN 1300 S. YALE FLAGSTAFF, AZ 86001

DESIGNED BY: PWCC	SCALE: 1"=100'
DRAWN BY: PWCC	DRAWING DATE: 01-17-97
CHECKED BY: JGS	PHOTO DATE: 07-01-92
DWG FILE: N6KPOND.DWG	CONTOUR INTERVAL: 5FT.

DESIGN REPORT

Temporary Sedimentation Structure

N6-L

Black Mesa Mine

Navajo County, Arizona

for

PEABODY WESTERN COAL COMPANY

APPROVED
MAR 1997

Registered Professional Engineer (Civil)
CERTIFICATE NO.
18782
JAMES GARY
SCHLENVOGT
Date Signed
ARIZONA, U.S.A.

JAN 20 1997

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Storage Capacity 6

APPENDIX A Hydrology and Hydraulic Calculations
APPENDIX B SEDCAD+ (Input and Output) 10-Year, 24-Hour Storm Event
APPENDIX C SEDCAD+ (Input and Output) 100-Year, 6-Hour Storm Event

EXHIBIT 1 Proposed N6-L & N6-K Sedimentation Pond Design

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INTRODUCTION

Sedimentation structure N6-L is a partially incised structure with an earthen embankment, designed by Peabody Western Coal Company as a temporary sedimentation structure to control runoff and sediment from the proposed N-6 mining area at the Black Mesa Mine. The location of structure N6-L and its watershed boundary are shown on Drawing No. 85400 (Sheets K-7, and L-7) and Drawing No. 85405. The site-specific general construction plans of the proposed structure are shown on the attached Exhibit 1.

This design report contains information specific to proposed structure N6-L, which is located in series with existing sedimentation structure N6-K1 and proposed sedimentation structure N6-K. Mine-wide design, construction, and reclamation information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody Western Coal Company", December, 1985 (PAP), Chapter 6, Attachment D, Volume 2, along with the methods and results of analyses used for slope stability, hydrology, and hydraulics, and in Chapter 6, Pages 11 to 42, "Sediment and Water Control Facility Plan".

INSPECTION

The construction site of the proposed structure N6-L was inspected by a Registered Professional Engineer from Peabody Western Coal Company, to ensure that the location was suitable and no adverse conditions existed. A detailed geotechnical investigation was not performed, rather, the information in Chapter 6, Attachment D was utilized for embankment design.

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SITE DESCRIPTION

Land Use

The N6-K1, N6-K, and N6-L structures have a 402.6 acre combined drainage area and are located on a tributary to Coal Mine Wash. The 20.2 acre watershed contributing directly to the N6-L structure is classified as 93% disturbed spoil, and 7% reclaimed. Based on the mine plan, the N-6 pit will intercept a significant portion of the N6-L watershed. As the mining and reclamation activities progress closer to the pond, the above "worst case" assumptions will apply.

DESIGN ANALYSES

General

Structure N6-L was designed under the direct supervision of a Registered Professional Engineer from Peabody Western Coal Company. The design was performed in accordance with applicable 30 CFR 780 and 816 regulations of the United States Department of Interior, Office of Surface Mining (OSM) and included a review of available project files. The most current information contained in the Peabody Western Coal Company files includes topographic maps developed from aerial photography flown in 1992 for Peabody Western Coal Company and was used in the analyses of the structure.

Stability

A homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 15 feet wide on top will be constructed. An upstream slope of 3.0H:1V and a downstream slope of 4.5H:1V were assumed. Based on a total embankment height of 25 feet, these slopes are flatter than the recommended "worst case" embankment/foundation condition slopes in Table 3-6, Attachment D, Chapter 6; therefore, the embankment will be stable. The emergency spillway will be a minimum 40-foot wide riprap-lined trapezoidal channel.

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Hydrology

The hydrologic analysis was completed using the computer program SEDCAD+ (see Appendices A, B, and C). Structure N6-L is located in series with existing structure N6-K1 and proposed structure N6-K. Structure N6-L is classified as a low hazard structure (see Drawing No. 85408). The mine area is sparsely populated with no one living in the downstream flood plain. The earthen embankment structure impounds less than 20 acre-feet and is less than 20 vertical feet in height from the upstream toe of embankment of the natural stream elevation to the emergency spillway elevation. The three structures have a combined capacity greater than 20 acre-feet; therefore, the spillway was analyzed using the 100-year, 6-hour storm event in lieu of the 25-year, 6-hour storm. Structures N6-K1, N6-K, and N6-L were conservatively assumed to be full to the emergency spillway at the time of 100-year storm event. The storage capacity of structure N6-L was analyzed using the 10-year, 24-hour storm event. The combined ponds in series were verified to completely contain the 10-year, 24-hour storm event, and provide adequate sediment storage volume, without discharging downstream into Coal Mine Wash.

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The following parameters were used in the hydrologic analysis:

		10-Year 24-Hour Storm*	100-Year 6-Hour Storm
1.	Water Course length, L	0.265 mi	--------
2.	Elevation Difference, H	155 ft	--------
3.	Time of Concentration, T_c	0.080 hr	--------
4.	SCS Curve Number	86	--------
5.	Rainfall Depth	2.1 in	2.4 in
6.	Drainage Area	20.2 acres	402.6 acres

*Values reported for the 10-year, 24-hour storm event represent the watershed which drains directly to Pond N6-L. Hydrologic input parameters for additional tributaries routed through upstream structures are presented in Appendix A.

Muskingum routing parameters were utilized to route hydrographs between the N6-K1, N6-K, and N6-L structures. The routing parameters are presented in Appendices A, B, and C, and are shown on a subwatershed basis.

Hydraulics

The SEDCAD+ and Flow Master computer programs were used to evaluate inflow to the sedimentation structure, outflow from the structure and the resulting water surface elevations. The 10-year and 100-year storms were routed through the upstream Structures, N6-K1 and N6-K into Structure N6-L. The initial conditions and results of the analysis are summarized in the following table (supporting calculations are presented in Appendix A, B, and C).

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N6-L SEDIMENTATION POND HYDRAULICS TABLE

	Units	10-Yr, 24-Hr Storm	100-Yr, 6-Hr Storm
Initial Reservoir Volume Condition		Empty	Full to emergency spillway
Inflow			
Peak Flow	cfs	19.9	271.0
Volume	ac-ft	1.6*	33.2
Storage			
Peak Stage	msl	N/A	6513.9
Emerg. Spillway Elev.	msl	6512.0	6512.0
Peak Storage	ac-ft	N/A	23.0
Storage Capacity	ac-ft	19.7	19.7
Outflow			
Peak Flow	cfs	N/A	261.1
Spillway Elevation	msl	6512.0	6512.0
Embankment Crest Elev.	msl	6515.0	6515.0
Peak Stage	msl	--	6513.9
Freeboard	ft	--	1.1
Emergency Spillway Channel			
Flow Depth	ft	--	1.9
Critical Velocity	fps	--	5.7
Mannings "n"	--	--	.035
Width	ft	--	40
Outflow Channel			
Maximum Slope	%	--	10
Normal Velocity	fps	--	7.5
Normal Depth	ft	--	0.8
Mannings "n"	--	--	.053
Riprap D_{50}	in	--	6

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* Inflow volume for the drainage area between Structure N6-K and N6-L.

Emergency Spillway and Outlet Channel

The emergency spillway and outlet channel for N6-L will be a trapezoidal channel, the alignment and dimensions are shown on Exhibit 1 and includes the following dimensions:

Minimum Channel Depth	(Spillway)	2.9	ft
	(Outflow)	1.8	ft
Channel Width		40	ft
Channel Length	(Spillway)	40	ft
	(Outflow)	150	ft
Side Slopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	10	%
Spillway Elevation		6512 ft	

A minimum 15-foot long riprap lined channel has been constructed beyond the toe of the embankment as a transition into the downstream sedimentation structure N6-L.

Storage Capacity

The impoundment stage-capacity table (see Exhibit 1) is based on design topography. The total storage capacity of structure N6-L is designed to contain approximately 19.74 acre-feet.

The calculations for the sediment load entering structure N6-L were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.14
3.	Slope Factor, LS	3.68
4.	Cover Factor, C	0.98
5.	Erosion Control Factor, P	0.95

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The hydrologic analysis gives the storage volume required to contain the 10-year, 24-hour storm, and the remaining storage volume available for storing sediment. Structure N6-L does not have sufficient storage to contain the 10-year, 24 hour storm by itself; however, in series with structures N6-K1 and N6-K, sufficient storage is achieved. The combined sediment storage capacity was determined for the three structures in series and the results of the analysis are presented in the following table.

Combined Storage for Structures N6-K1, N6-K, and N6-L

	N6-K1	N6-K	N6-L	Combined
Total Storage Capacity	24.85	19.91	19.74	64.50 acre-ft
10-Year, 24-Hour Storm Inflow	15.73	8.62	1.56	25.91 acre-ft
Available Sediment Storage Capacity	----	----	----	38.59 acre-ft
Sediment Inflow Rate/Year	1.92	1.39	0.17	3.48 acre-ft
Sediment Storage Life	----	----	----	11.1 years

The following appendices and drawing are attached and complete this design report.

Appendix A - Hydrology, Hydraulic, and Sedimentation Calculations
Appendix B - SEDCAD+ (Input and Output) 10-Year, 24-Hour Storm Event
Appendix C - SEDCAD+ (Input and Output) 100-Year, 6-Hour Storm Event

Exhibit 1 - Proposed N6-L & N6-K Sedimentation Pond Design

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: N6-L Pond

TIME OF CONCENTRATION:

Start Elevation (ft) =	6645
End Elevation (ft) =	6490
Elevation Difference, E (ft) =	155
Watercourse Length (ft) =	1400
Watercourse Length, L (mi) =	0.265
Tc = (11.9L^3/E)^0.385 =	0.080 hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland Method in SEDCAD+. Input and output parameters are shown on the SEDCAD+ printouts in Appendices B and C.

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Reclaimed	C	81	1.41	114.21
Spoil	B	86	18.8	1616.8
TOTAL:			20.21	1731.01

Weighted CN = Total CN*Area/ Total Area = 86

DRAINAGE BASIN AREA:

20.2 Acres

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT: N6-L Pond

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area (acres)	K*Area
Reclaimed	0.38	1.41	0.54
Spoil	0.12	18.8	2.26
TOTAL:		20.21	2.79

Weighted K = Total K*Area/ Total Area = 0.14

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
80	20	25.0%	0.6	14.0	3.79
230	30	13.0%	0.6	7.4	3.34
70	20	28.6%	0.6	15.9	4.03
210	30	14.3%	0.6	8.1	3.55

Average LS = 3.68

The LS Factor was calculated by:

LS = (Slope Length/72.6)^m(10.8*sin(slope angle) + 0.03) for Slopes < 9%*

LS = (Slope Length/72.6)^m(16.8*sin(slope angle) - 0.5) for Slopes > 9%*

Where:

Slope < 3%	*m = 0.3*
Slope = 4%	*m = 0.4*
5% > Slope < 10%	*m = 0.5*
Slope > 10%	*m = 0.6*

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COVER AND PRACTICE FACTORS:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C*Area	Practice Factor, P	P*Area
Reclaimed	0%	0%	1.41	0.73	1.02	0.34	0.47
Spoil	0%	0%	18.8	1.00	18.80	1.00	18.80
TOTAL:			20.21		19.82		19.27

Weighted C = Total C*Area/ Total Area = 0.981

Weighted P = Total P*Area/ Total Area = 0.954

RAINFALL FACTOR:

R = 40

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: N6-L Pond

The following spreadsheet calculates the predicted sediment yield for the project area. The gross sediment yield is determined according to the Revised Universal Soil Loss Equation.

PARAMETER DESCRIPTION	VALUE	
Annual Rainfall Factor	40.00	
Soil Erodibility Factor	0.14	
Length Slope Factor	3.68	
Cover Factor	0.98	
Practice Factor	0.95	
Gross Annual Sediment Yield	19.00	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0093	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0084	acre-feet/acre/year
Watershed Area	20.21	acres
Watershed Annual Sediment Yield	0.17	acre-feet/year
Number of years	1	years
Calculated Sediment Volume	0.17	acre-feet

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Peabody Western Coal Company
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\808\n6-l\n6.fm2
Worksheet	N6-L Spillway
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.018061	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	40.00	ft
Discharge	261.14	cfs

Results		
Depth	1.07	ft
Flow Area	46.16	ft²
Wetted Perimeter	46.76	ft
Top Width	46.41	ft
Critical Depth	1.07	ft
Critical Slope	0.018061	ft/ft
Velocity	5.66	ft/s
Velocity Head	0.50	ft
Specific Energy	1.57	ft
Froude Number	1.00	
Flow is supercritical.		

Notes:

Spillway Channel set to critical slope to determine critical velocity

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SEDCAD+ RIPRAP CHANNEL DESIGN

N6-L Spillway Outslope

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	261.14 cfs	
Slope	10.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	40.00 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.82 ft
with Freeboard	1.82 ft
Top Width	44.93 ft
with Freeboard	50.93 ft
Velocity	7.48 fps
Cross Sectional Area	34.90 sq ft
Hydraulic Radius	0.77 ft
Manning's n	0.053
Froude Number	1.50
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

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APPENDIX B

SEDCAD+ (Input and Output) 10-Year, 24-Hour Storm Event

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

BLACK MESA MINE - TEMPORARY SEDIMENTATION PONDS N6-K1, N6-K, N6-L

by

Name: K. Kammerzell

Company Name: ACZ, INC.
File Name: C:\808\N6-L\N6-L

Date: 01-14-1997

MAR 1997
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Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:33
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Detailed Between Structure Routing:

J	B	To S	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	Muskingum X
1	1	2	1	8	1400.32	2.14	4.39	0.09		
			2	8	300.17	3.33	5.48	0.02	0.103	0.364
1	1	3	1	8	300.17	3.33	5.48	0.02	0.015	0.381

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Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:33
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	247.00	83	F	0.306	0.000	0.000	0.0	15.73	153.55
			Type: Pond Label: N6-K1							
111	Structure	247.00							15.73	
111	Total IN	247.00							15.73	153.55
111	Total OUT								15.73	98.65
112	1	135.40	83	F	0.238	0.000	0.000	0.0	8.62	91.62
			Type: Pond Label: N6-K							
112	Structure	135.40							24.36	
112	Total IN	382.40							24.36	144.30
112	Total OUT								24.35	132.40
111 to 112 Routing						0.103	0.364			
113	1	20.20	86	F	0.080	0.000	0.000	0.0	1.56	19.89
			Type: Pond Label: N6-L							
113	Structure	20.20							25.91	
113	Total IN	402.60							25.91	136.48
113	Total OUT								25.91	128.91
112 to 113 Routing						0.015	0.381			

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APPENDIX C

SEDCAD+ (Input and Output) 100-Year, 6-Hour Storm Event

MAR 1997
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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

BLACK MESA MINE - TEMPORARY SEDIMENTATION PONDS N6-K1, N6-K, N6-L

by

Name: K. Kammerzell

Company Name: ACZ, INC.
File Name: C:\808\N6-L\N6-L

Date: 01-14-1997

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Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:36
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
GENERAL INPUT TABLE
==========

Detailed Between Structure Routing:

J	B	To S	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	X
1	1	2	1	8	1400.32	2.14	4.39	0.09		
			2	8	300.17	3.33	5.48	0.02	0.103	0.364
1	1	3	1	8	300.17	3.33	5.48	0.02	0.015	0.381

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Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:36
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	247.00	83	F	0.306	0.000	0.000	0.0	20.19	280.51
		Type: Pond Label: N6-K1								
111	Structure	247.00							20.19	
111	Total IN	247.00							20.19	280.51
111	Total OUT								20.19	195.66
112	1	135.40	83	F	0.238	0.000	0.000	0.0	11.07	168.06
		Type: Pond Label: N6-K								
112	Structure	135.40							31.26	
112	Total IN	382.40							31.26	281.21
112	Total OUT								31.26	263.54
111 to 112 Routing						0.103	0.364			
113	1	20.20	86	F	0.080	0.000	0.000	0.0	1.96	36.24
		Type: Pond Label: N6-L								
113	Structure	20.20							33.22	
113	Total IN	402.60							33.22	270.96
113	Total OUT								33.22	261.14
112 to 113 Routing						0.015	0.381			

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Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:36
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
POND INPUT/OUTPUT TABLE
==========

J1, B1, S1
N6-K1

Drainage Area from J1, B1, S1, SWS(s)1: 247.0 acres
Total Contributing Drainage Area: 247.0 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6571.4
Crest Length (ft)	30.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	20.0

POND RESULTS:

Permanent Pool (ac-ft)
24.8

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	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	20.19	280.51
OUT	20.19	195.66

Peak Elevation	Hydrograph Detention Time (hrs)
6573.6	0.01

****

J1, B1, S2
N6-K

Drainage Area from J1, B1, S2, SWS(s)1: 135.4 acres
Total Contributing Drainage Area: 382.4 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6513.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	40.0

POND RESULTS:

Permanent Pool (ac-ft)

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=========
19.9

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	31.26	281.21
OUT	31.26	263.54

Peak Elevation	Hydrograph Detention Time (hrs)
6514.9	0.13

****

J1, B1, S3
N6-L

Drainage Area from J1, B1, S3, SWS(s)1: 20.2 acres
Total Contributing Drainage Area: 402.6 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6512.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	40.0

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POND RESULTS:

Permanent

Pool (ac-ft)
19.7

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	33.22	270.96
OUT	33.22	261.14

Peak Elevation	Hydrograph Detention Time (hrs)
6513.8	0.13

****

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Company Name: ACZ, INC.
Filename: C:\808\N6-L\N6-L User: K. Kammerzell
Date: 01-14-1997 Time: 09:32:36
Black Mesa Mine - Temporary Sedimentation Ponds N6-K1, N6-K, N6-L
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
ELEVATION-AREA-CAPACITY-DISCHARGE TABLE
==========

J1, B1, S1
N6-K1

Drainage Area from J1, B1, S1, SWS(s)1: 247.0 acres
Total Contributing Drainage Area: 247.0 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6552.60	0.00	0.00	0.00	0.00	
6554.60	2.00	0.29	0.20	0.00	
6556.60	4.00	0.74	1.20	0.00	
6558.60	6.00	1.08	3.01	0.00	
6560.60	8.00	1.30	5.39	0.00	
6562.60	10.00	1.49	8.18	0.00	
6564.60	12.00	1.67	11.33	0.00	
6566.60	14.00	1.85	14.84	0.00	
6568.60	16.00	2.06	18.74	0.00	
6570.60	18.00	2.23	23.04	0.00	
6571.40	18.80	2.29	24.85	0.00	Stage of SW#1
6572.10	19.50	2.35	26.47	22.76	
6572.20	19.60	2.35	26.70	29.38	
6572.30	19.70	2.36	26.94	36.62	
6572.40	19.80	2.37	27.18	44.45	
6572.60	20.00	2.38	27.65	63.85	
6572.90	20.30	2.42	28.37	97.92	
6573.40	20.80	2.47	29.59	159.73	
6573.63	21.03	2.49	30.16	195.66	Peak Stage
6573.90	21.30	2.52	30.84	239.45	
6574.40	21.80	2.58	32.12	337.51	
6574.60	22.00	2.60	32.63	381.05	
6574.90	22.30	2.62	33.42	451.00	
6575.40	22.80	2.65	34.73	580.13	
6575.90	23.30	2.68	36.07	725.18	
6576.00	23.40	2.69	36.34	756.12	

****

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J1, B1, S2
N6-K

Drainage Area from J1, B1, S2, SWS(s)1: 135.4 acres
Total Contributing Drainage Area: 382.4 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
64[illegible].00	0.00	0.57	0.00	0.00	
6497.00	2.00	0.67	1.24	0.00	
6499.00	4.00	0.78	2.68	0.00	
6501.00	6.00	0.89	4.36	0.00	
6503.00	8.00	1.01	6.26	0.00	
6505.00	10.00	1.14	8.42	0.00	
6507.00	12.00	1.28	10.85	0.00	
6509.00	14.00	1.43	13.56	0.00	
6511.00	16.00	1.59	16.58	0.00	
6513.00	18.00	1.74	19.91	0.00	Stage of SW#1
6513.70	18.70	1.80	21.15	40.75	
6513.80	18.80	1.81	21.33	53.23	
6513.90	18.90	1.82	21.51	66.86	
6514.00	19.00	1.83	21.70	81.58	
6514.50	19.50	1.87	22.62	179.01	
6514.86	19.86	1.91	23.30	263.54	Peak Stage
6515.00	20.00	1.92	23.57	297.43	
6515.50	20.50	1.97	24.54	432.03	
6516.00	21.00	2.01	25.54	604.94	
6516.50	21.50	2.06	26.55	801.89	
6517.00	22.00	2.10	27.59	1036.65	
6517.50	22.50	2.15	28.66	1267.13	
6518.00	23.00	2.20	29.75	1535.41	

J1, B1, S3
N6-L

Drainage Area from J1, B1, S3, SWS(s)1: **20.2** acres
Total Contributing Drainage Area: 402.6 **acres**

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6490.00	0.00	0.34	0.00	0.00	
6492.00	2.00	0.42	0.76	0.00	
6494.00	4.00	0.51	1.69	0.00	
6496.00	6.00	0.61	2.81	0.00	
6498.00	8.00	0.71	4.12	0.00	
6500.00	10.00	0.82	5.65	0.00	
6502.00	12.00	0.90	7.37	0.00	
6504.00	14.00	0.98	9.25	0.00	
6506.00	16.00	1.12	11.35	0.00	
6508.00	18.00	1.31	13.78	0.00	
6510.00	20.00	1.50	16.58	0.00	
6512.00	22.00	1.67	19.74	0.00	Stage of SW#1
6512.70	22.70	1.73	20.93	40.75	
6512.80	22.80	1.74	21.11	53.23	
[illegible].90	22.90	1.75	21.28	66.86	
[illegible]3.00	23.00	1.75	21.46	81.58	
6513.50	23.50	1.80	22.34	179.01	
6513.85	23.85	1.83	22.98	261.14	Peak Stage
6514.00	24.00	1.84	23.25	297.43	
6514.50	24.50	1.92	24.19	432.03	

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6515.00	25.00	2.00	25.17	604.94
6515.50	25.50	2.08	26.19	801.89
6516.00	26.00	2.16	27.25	1036.65
6516.50	26.50	2.29	28.36	1267.13
6517.00	27.00	2.41	29.54	1535.41

****

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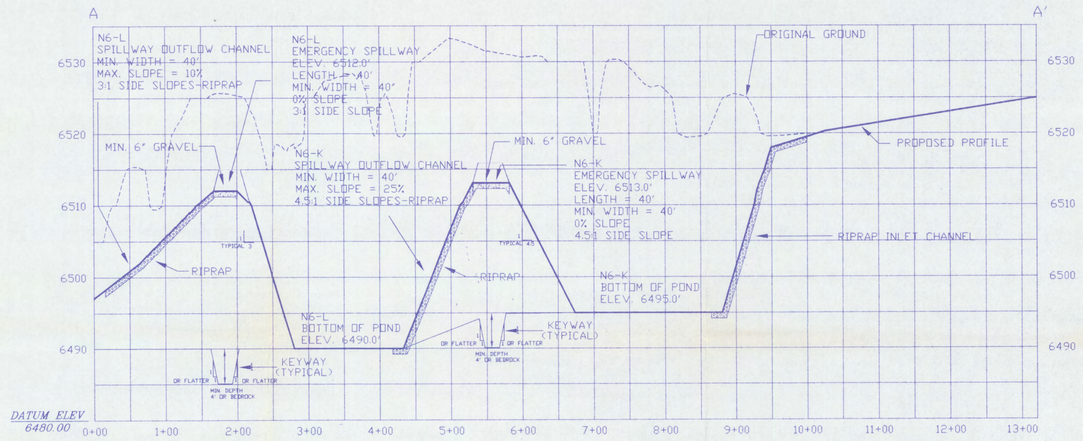
N6-K POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (AC.)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6495	0.00	0.57	0.00	0.00	BOTTOM OF POND
6496	1.00	0.62	0.60	0.60	
6498	3.00	0.72	0.70	1.94	
6500	5.00	0.84	0.80	3.50	
6502	7.00	0.95	0.92	5.29	
6504	9.00	1.08	1.04	7.32	
6506	11.00	1.21	1.18	9.62	
6508	13.00	1.36	1.32	12.19	
6510	15.00	1.50	1.47	15.05	
6512	17.00	1.66	1.62	18.21	
6513	18.00	1.74	1.70	19.91	EMERGENCY SPILLWAY
6514	19.00	1.83	1.79	21.70	
6516	21.00	2.01	1.96	25.54	TOP OF EMBANKMENT

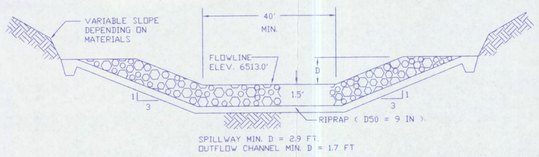
N6-L POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (AC.)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6490	0.00	0.34	0.00	0.00	BOTTOM OF POND
6492	2.00	0.42	0.40	0.76	
6494	4.00	0.51	0.49	1.69	
6496	6.00	0.61	0.58	2.80	
6498	8.00	0.71	0.69	4.12	
6500	10.00	0.82	0.80	5.65	
6502	12.00	0.90	0.88	7.37	
6504	14.00	0.98	0.97	9.26	
6506	16.00	1.12	1.07	11.33	
6508	18.00	1.31	1.26	13.75	
6510	20.00	1.51	1.46	16.56	
6512	22.00	1.67	1.63	19.74	EMERGENCY SPILLWAY
6514	24.00	1.84	1.80	23.26	
6515	25.00	2.00	1.91	25.17	TOP OF EMBANKMENT



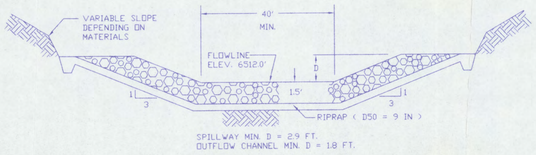
SECTION A - A'

SCALE: HORIZ. 1"=100'
VERT. 1"=10'



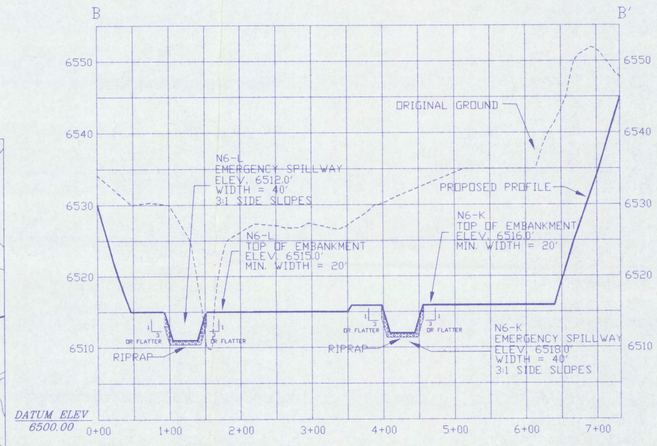
SPILLWAY MIN. D = 2.9 FT.
OUTFLOW CHANNEL MIN. D = 1.7 FT

PROPOSED N6-K POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)



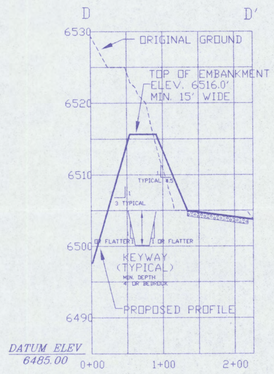
SPILLWAY MIN. D = 2.9 FT.
OUTFLOW CHANNEL MIN. D = 1.8 FT.

PROPOSED N6-L POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)



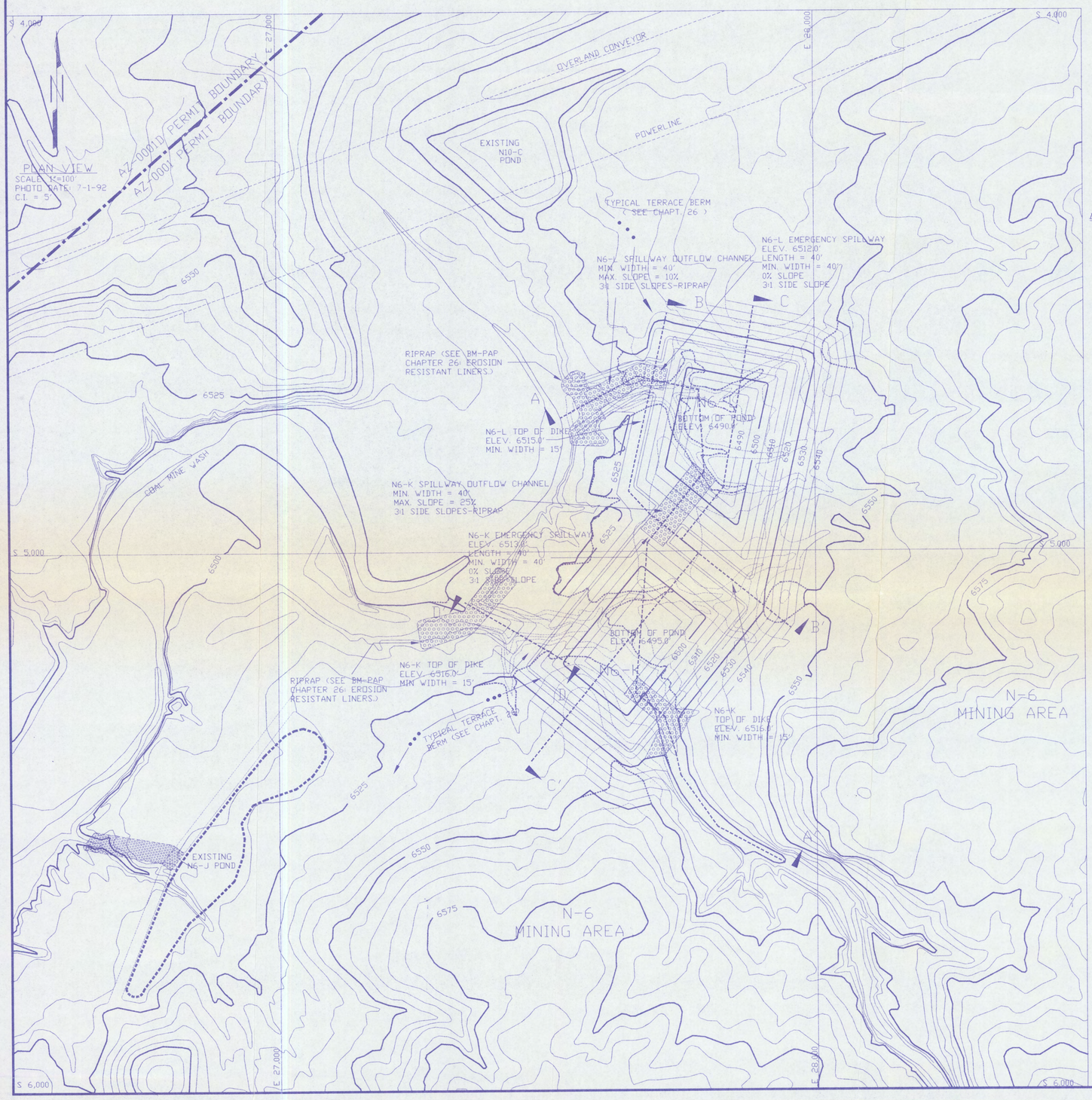
SECTION B - B'

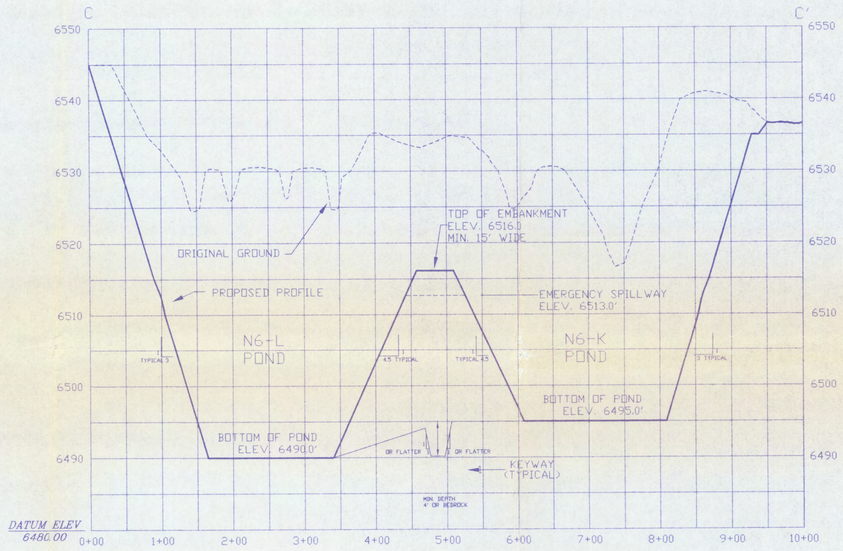
SCALE: HORIZ. 1"=100'
VERT. 1"=10'



SECTION D - D'

SCALE: HORIZ. 1"=100'
VERT. 1"=10'





SECTION C - C'

SCALE: HORIZ. 1"=100'
VERT. 1"=10'

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ENGINEER'S CERTIFICATION

Registered Professional Engineer (Civil) CERTIFICATE NO. 18782 JAMES GARY SCHLEWOGT Date Signed ARIZONA, U.S.A.

JAMES G. SCHLEWOGT
Company Engineering Manager
Peabody Western Coal Company

ARIZONA P.E. 18782

Date JAN 20 1997

NOTES:
1) General location, see Drawing No. 85400, Sheet K-7 and Drawing No. 85405.
2) See Chapter 6, Black Mesa PAP for Construction Specifications.
3) See Vol. 2, Chapter 6, Attachment D, Sections 1-3 for description of Geotechnical Evaluation.
4) Salvage topsoil in accordance with approved topsoil salvage plan.
5) Reclamation of the distrubed area above the high waterline shall be in accordance with the approved reclamation plan.
6) Ponding area side slopes; typical 3:1 slope or flatter and blend into natural topography.

EXHIBIT NO. 1

PROPOSED N6-L & N6-K SEDIMENTATION POND DESIGN

BLACK MESA MINE

PEABODY WESTERN 1300 S. YALE FLAGSTAFF, AZ 86001

DESIGNED BY: PWCC	SCALE: 1"=100'
DRAWN BY: PWCC	DRAWING DATE: 01-17-97
CHECKED BY: JGS	PHOTO DATE: 07-01-92
DWG FILE: N6KPOND.DWG	CONTOUR INTERVAL: 5FT.

DESIGN REPORT

Temporary Sedimentation Structure

N6-M

Black Mesa Mine

Navajo County, Arizona

for

PEABODY WESTERN COAL COMPANY

APPROVED
DEC 1996

Registered Professional Engineer
CERTIFICATE NO. 18782
JAMES G. SCHLENVOGT
Date Signed
ARIZONA, U.S.A.

NOV 15 1996

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INTRODUCTION

Sedimentation structure N6-M will be an earthen embankment, designed and constructed by Peabody Western Coal Company as a temporary sedimentation structure to control runoff and sediment from portions of the N-6 disturbed surface mining area at the Black Mesa Mine. The location of structure N6-M and its watershed boundary is shown on Drawing No. 85400 (Sheets K-7 and L-7) and Drawing No. 85405. The site specific general construction plans are shown on the attached Exhibit 1.

This design report contains information specific to structure N6-M. Mine-wide design, construction, and reclamation information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody Western Coal Company", December, 1985 (PAP), Chapter 6, Attachment D, Volume 2, along with the methods and results of analyses used for slope stability, hydrology, and hydraulics, and in Chapter 6, Pages 11 to 42, "Sediment and Water Control Facility Plan".

INSPECTION

The construction site of structure N6-M was inspected by a Registered Professional Engineer from Peabody Western Coal Company, to ensure that the site is suitable and no adverse conditions exist to prevent the successful construction of the structure. A detailed geotechnical investigation was not performed, rather, the information in Chapter 6, Attachment D was utilized for embankment design and will be utilized during construction to construct a stable embankment.

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SITE DESCRIPTION

LAND USE

Structure N6-M has a 77.4-acre tributary drainage area and is located on a tributary upstream of Coal Mine Wash at the Black Mesa Mine. The watershed is classified as 100% disturbed spoil as a conservative estimate of run-off and sediment loading and as the anticipated "worst case" watershed disturbance based on the current mine plan.

DESIGN ANALYSES

GENERAL

Structure N6-M was designed under the supervision of a Registered Professional Engineer from Peabody Western Coal Company. The design was performed in accordance with applicable 30 CFR 780 and 816 regulations of the United States Department of Interior, Office of Surface Mining (OSM) and included a review of available project files. In anticipation of this area of the Black Mesa Mine becoming part of the permanent permit program, the permanent program regulations were utilized. The most current information contained in the Peabody Western Coal Company files includes topographic maps developed from aerial photography flown in 1992 for Peabody Western Coal Company and was used in the analyses of the structure.

STABILITY

A homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 15 feet wide on top will be constructed. An upstream slope of 3:1 (horizontal to vertical) and a downstream slope of 3:1 were assumed. Based on the total embankment height of 5 feet (10 feet incised), these slopes are equal to or flatter than the recommended "worst case" embankment/foundation condition slopes in Table 3-6,

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Attachment D, Chapter 6; therefore, the embankment will be stable. The emergency spillway will be a minimum 15 foot wide riprap-lined trapezoidal channel.

HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD+ (see Appendices A, B, and C). Structure N6-M is classified as a low hazard structure (see Drawing No. 85408). In addition, the mine area is sparsely populated with no one living in the downstream flood plain. The structure will impound less than 20 acre-feet and be less than 20 vertical feet in height from the upstream toe of embankment of the natural stream elevation to the emergency spillway elevation. The spillway for the N6-M pond was analyzed using the 25-year, 6-hour storm. The storage capacity of structure N6-M was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.631	mi
2.	Elevation Difference, H	191	ft
3.	Time of Concentration, T_c	0.202	hr
4.	SCS Curve Number	86	
5.	Rainfall Depth, 10-year, 24-hour storm	2.1	in
	25-year, 6-hour storm	1.9	in
6.	Drainage Area	77.4	acres

HYDRAULICS

The SEDCAD+ and Flow Master computer programs were used to evaluate inflow to the sedimentation structure, outflow from the structure and the resulting water surface elevations. The initial conditions and results of the analysis are summarized in the following table (supporting calculations are presented in Appendix A).

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N6-M SEDIMENTATION POND HYDRAULICS TABLE

	Units	10-Yr, 24-Hr Storm	25-Yr, 6-Hr Storm
Initial Reservoir Volume Condition		Empty	Full to emergency spillway
Inflow			
Peak Flow	cfs	66.57	78.92
Volume	ac-ft	5.97	
Storage			
Peak Stage	msl	N/A	6546.7
Emerg. Spillway Elev..	msl	6546.0	6546.0
Peak Storage	ac-ft	N/A	13.2
Storage Capacity	ac-ft	10.6	10.6
Outflow			
Peak Flow	cfs	N/A	15.2
Spillway Elevation	msl	6546.0	6546.0
Embankment Crest Elev.	msl	6549.0	6549.0
Peak Stage	msl	--	6546.7
Freeboard	ft	--	2.3
Emergency Spillway Channel			
Flow Depth	ft	--	0.7
Critical Velocity	fps	--	3.1
Mannings "n"	--	--	.037
Width	ft	--	15
Outflow Channel			
Slope	%	--	20
Normal Velocity	fps	--	4.5
Normal Depth	ft	--	0.2
Mannings "n"	--	--	0.051
Riprap D_{50}	in		3 in

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for N6-M will be a trapezoidal channel, the alignment and dimensions are shown on Exhibit 1 and includes the following dimensions:

Minimum Channel Depth	(Spillway)	1.7	ft
	(Outflow)	1.2	ft
Channel Width		15	ft
Channel Length	(Spillway)	40	ft
	(Outflow)	150	ft
Side Slopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	20	%
Spillway Elevation		6546.0	ft

A minimum 15-foot long riprap lined channel will be constructed beyond the toe of the embankment as a transition into the downstream channel.

STORAGE CAPACITY

The impoundment stage-capacity table (see Exhibit 1) is based on the 1992 aerial topographic mapping conducted for Peabody Western Coal Company. Structure N6-M is designed to contain approximately 10.59 acre-feet.

The calculations for the sediment load entering structure N6-M were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

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1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.25*
3.	Slope Factor, L	3.56
4.	Cover Factor	1.0
5.	Erosion Control Factor, P	1.0

* Soil erodibility factor taken as average spoil and reclaimed conditions to simulate staged

reclamation.

The hydrologic analysis gives the storage volume required to contain the 10-year, 24-hour storm, and the remaining storage volume available for storing sediment. The storage capacity for N6-M is shown on Exhibit 1, N6-M Stage Capacity Table, and the results of the sediment inflow analysis are summarized in the following table.

N6-M STORAGE

Total Storage Capacity	10.59	acre-ft
10-year, 24-hour Storm Inflow	5.97	acre-ft
Available Sediment Storage Capacity	4.62	acre-ft
Sediment Inflow Rate	1.2	acre-ft/yr
Sediment Storage Life	3.8	years

* * *

The following appendices and drawing are attached and complete this design report.

Appendix A - Hydrology, Hydraulic, and Sedimentation Calculations

Appendix B - SEDCAD+ (Input and Output) 10-Year, 24-Hour Storm Event

Appendix C - SEDCAD+ (Input and Output) 25-Year, 6-Hour Storm Event

Exhibit 1 - Proposed Temporary N6-M Sedimentation Pond Design

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: N6-M Pond

TIME OF CONCENTRATION:

Start Elevation (ft) =	6732
End Elevation (ft) =	6541
Elevation Difference, E (ft) =	191
Watercourse Length (ft) =	3330
Watercourse Length, L (mi) =	0.631
Tc = (11.9L^3/E)^0.385 =	0.202 hours

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Disturbed Spoil	B	86	77.4	6656.4
TOTAL:			77.4	6656.4

Weighted CN = Total CN*Area/ Total Area = 86

DRAINAGE BASIN AREA:

77.4 Acres

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT: N6-M Pond

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area (acres)	K*Area
Spoil - Reclaimed	0.25	77.4	19.35
TOTAL:		77.4	19.35

Erodibility factor average of spoil to reclamed condition to simulate various stages of reclamation.

Weighted K = Total K*Area/ Total Area = 0.25

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
430	40	9.3%	0.5	5.3	2.57
230	30	13.0%	0.6	7.4	3.34
450	30	6.7%	0.5	3.8	1.86
175	40	22.9%	0.6	12.9	5.50
250	70	28.0%	0.6	15.6	8.46
130	20	15.4%	0.6	8.7	2.91
410	40	9.8%	0.5	5.6	2.69
150	20	13.3%	0.6	7.6	2.66
380	30	7.9%	0.5	4.5	2.01

Average LS = 3.56

The LS Factor was calculated by:

LS = (Slope Length/72.6)^m(10.8*sin(slope angle) + 0.03) for Slopes < 9%*

LS = (Slope Length/72.6)^m(16.8*sin(slope angle) - 0.5) for Slopes ≥ 9%*

Where:

Slope ≤ 3%	*m = 0.3*
Slope = 4%	*m = 0.4*
5% > Slope ≤ 10%	*m = 0.5*
Slope > 10%	*m = 0.6*

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT: N6-M Pond

COVER AND PRACTICE FACTORS:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C*Area	Practice Factor, P	P*Area
Disturbed Spoil	0%	0%	77.4	1.00	77.4	1.00	77.4
TOTAL:			77.4		77.4		77.4

Weighted C = Total C*Area/ Total Area = 1.00

Weighted P = Total P*Area/ Total Area = 1.00

RAINFALL FACTOR:

R = 40

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: N6-M Pond

The following spreadsheet calculates the predicted sediment yield for the project area. The gross sediment yield is determined according to the Revised Universal Soil Loss Equation.

PARAMETER DESCRIPTION	VALUE	
Annual Rainfall Factor	40.00	
Soil Erodibility Factor	0.25	
Length Slope Factor	3.56	
Cover Factor	1.00	
Practice Factor	1.00	
Gross Annual Sediment Yield	35.57	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0174	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0156	acre-feet/acre/year
Watershed Area	77.4	acres
Watershed Annual Sediment Yield	1.2104	acre-feet/year
Approx. Number of Years of Storage	3.8	years
Available Pond Sediment Storage	4.62	acre-feet

SEDCAD+ RIPRAP CHANNEL DESIGN

N6-M Pond Outslope

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	15.22 cfs	
Slope	20.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	15.00 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.21 ft
with Freeboard	1.21 ft
Top Width	16.29 ft
with Freeboard	22.29 ft
Velocity	4.54 fps
Cross Sectional Area	3.35 sq ft
Hydraulic Radius	0.20 ft
Manning's n	0.051
Froude Number	1.76
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

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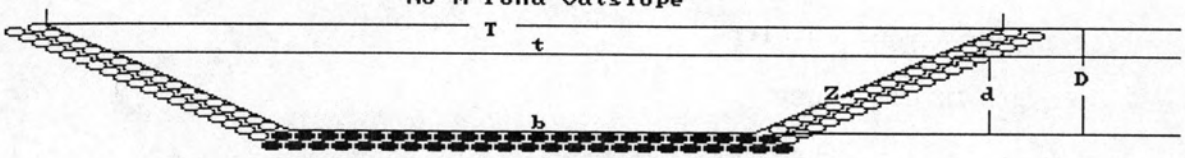
SEDCAD+ CHANNEL DESIGN
N6-M Pond Outslope



Riprap - Steep Slope Design - PADER Method

					w/ Freeboard:
Discharge	= 15.22 cfs		Depth (d)	= 0.21	(D = 1.21) ft
Bottom (b)	= 15.00 ft		Top width (t)	= 16.29	(T = 22.29) ft
Side slopes (Z)	= 3.0:1(L)	3.0:1(R)	Velocity	= 4.54 fps	
Bed Slope	= 20.00 %		Hydraulic Radius	= 0.20 ft	
Manning's n	= 0.051		Froude number	= 1.76	

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

N6-M Spillway
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\808\n6-m\n6-m.fm2
Worksheet	N6-M Spillway
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.037	
Channel Slope	0.030255	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	15.00	ft
Discharge	15.22	cfs

Results		
Depth	0.31	ft
Flow Area	4.95	ft²
Wetted Perimeter	16.97	ft
Top Width	16.86	ft
Critical Depth	0.31	ft
Critical Slope	0.030253	ft/ft
Velocity	3.07	ft/s
Velocity Head	0.15	ft
Specific Energy	0.46	ft
Froude Number	1.00	
Flow is supercritical.		

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APPENDIX B

SEDCAD+ (Input and Output) 10-Year, 24-Hour Storm Event

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SEDIMENTATION POND N6-M

by

Name: K. Kammerzell

Company Name: ACZ, INC.
File Name: C:\808\N6-M\N6-M

Date: 11-13-1996

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Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: ACZ, INC.
Filename: C:\808\N6-M\N6-M User: K. Kammerzell
Date: 11-13-1996 Time: 09:40:33
Sedimentation Pond N6-M
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	77.40	86	F	0.202	0.000	0.000	0.0	5.97	66.57
			Type: Pond			Label: N6-M				
111	Structure	77.40							5.97	
111	Total IN	77.40							5.97	66.57
111	Total OUT								5.97	14.12

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: ACZ, INC.
Filename: C:\808\N6-M\N6-M User: K. Kammerzell
Date: 11-13-1996 Time: 09:40:33
Sedimentation Pond N6-M
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
POND INPUT/OUTPUT TABLE
==========

J1, B1, S1
N6-M

Drainage Area from J1, B1, S1, SWS(s)1: 77.4 acres
Total Contributing Drainage Area: 77.4 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6546.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	15.0

RESULTS:

	Permanent Pool (acft)
	10.6

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	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	5.97	66.57
OUT	5.97	14.12

Peak Elevation	Hydrograph Detention Time (hrs)
6546.6	0.00

****

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Company Name: ACZ, INC.
Filename: C:\808\N6-M\N6-M User: K. Kammerzell
Date: 11-13-1996 Time: 09:40:33
Sedimentation Pond N6-M
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
ELEVATION-AREA-CAPACITY-DISCHARGE TABLE
==========

J1, B1, S1
N6-M

Drainage Area from J1, B1, S1, SWS(s)1: 77.4 acres
Total Contributing Drainage Area: 77.4 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6540.00	0.00	0.25	0.00	0.00	
6541.00	1.00	0.58	0.40	0.00	
6542.00	2.00	1.02	1.19	0.00	
6543.00	3.00	1.60	2.49	0.00	
6544.00	4.00	2.31	4.44	0.00	
6545.00	5.00	3.15	7.16	0.00	
6546.00	6.00	3.72	10.59	0.00	Stage of SW#1
6546.62	6.62	4.12	13.04	14.12	Peak Stage
6546.70	6.70	4.16	13.34	15.87	
6546.80	6.80	4.22	13.76	20.88	
6546.90	6.90	4.29	14.19	26.41	
6547.00	7.00	4.35	14.62	32.45	
6547.50	7.50	4.68	16.88	73.80	
6548.00	8.00	5.02	19.30	126.65	
6548.50	8.50	5.38	21.90	189.37	
6549.00	9.00	5.74	24.68	273.29	
6549.50	9.50	6.13	27.65	372.65	
6550.00	10.00	6.51	30.81	495.41	

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APPENDIX C

SEDCAD+ (Input and Output) 25-Year, 6-Hour Storm Event

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DEC 1996

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SEDIMENTATION POND N6-M

by

Name: K. Kammerzell

Company Name: ACZ, INC.
File Name: C:\808\N6-M\N6-M

Date: 11-13-1996

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Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: ACZ, INC.
Filename: C:\808\N6-M\N6-M User: K. Kammerzell
Date: 11-13-1996 Time: 09:40:34
Sedimentation Pond N6-M
Storm: 1.90 inches, 25 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	77.40	86	F	0.202	0.000	0.000	0.0	4.99	78.92
			Type: Pond		Label: N6-M					
111	Structure	77.40							4.99	
111	Total IN	77.40							4.99	78.92
111	Total OUT								4.99	15.22

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: ACZ, INC.
Filename: C:\808\N6-M\N6-M User: K. Kammerzell
Date: 11-13-1996 Time: 09:40:34
Sedimentation Pond N6-M
Storm: 1.90 inches, 25 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
POND INPUT/OUTPUT TABLE
==========

J1, B1, S1
N6-M

Drainage Area from J1, B1, S1, SWS(s)1: 77.4 acres
Total Contributing Drainage Area: 77.4 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6546.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	15.0

RESULTS:

Permanent Pool (ac-ft)
10.6

APPROVED DEC 1996

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	4.99	78.92
OUT	4.99	15.22

Peak Elevation	Hydrograph Detention Time (hrs)
6546.7	0.00

****

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: ACZ, INC.
Filename: C:\808\N6-M\N6-M User: K. Kammerzell
Date: 11-13-1996 Time: 09:40:34
Sedimentation Pond N6-M
Storm: 1.90 inches, 25 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
ELEVATION-AREA-CAPACITY-DISCHARGE TABLE
==========

J1, B1, S1
N6-M

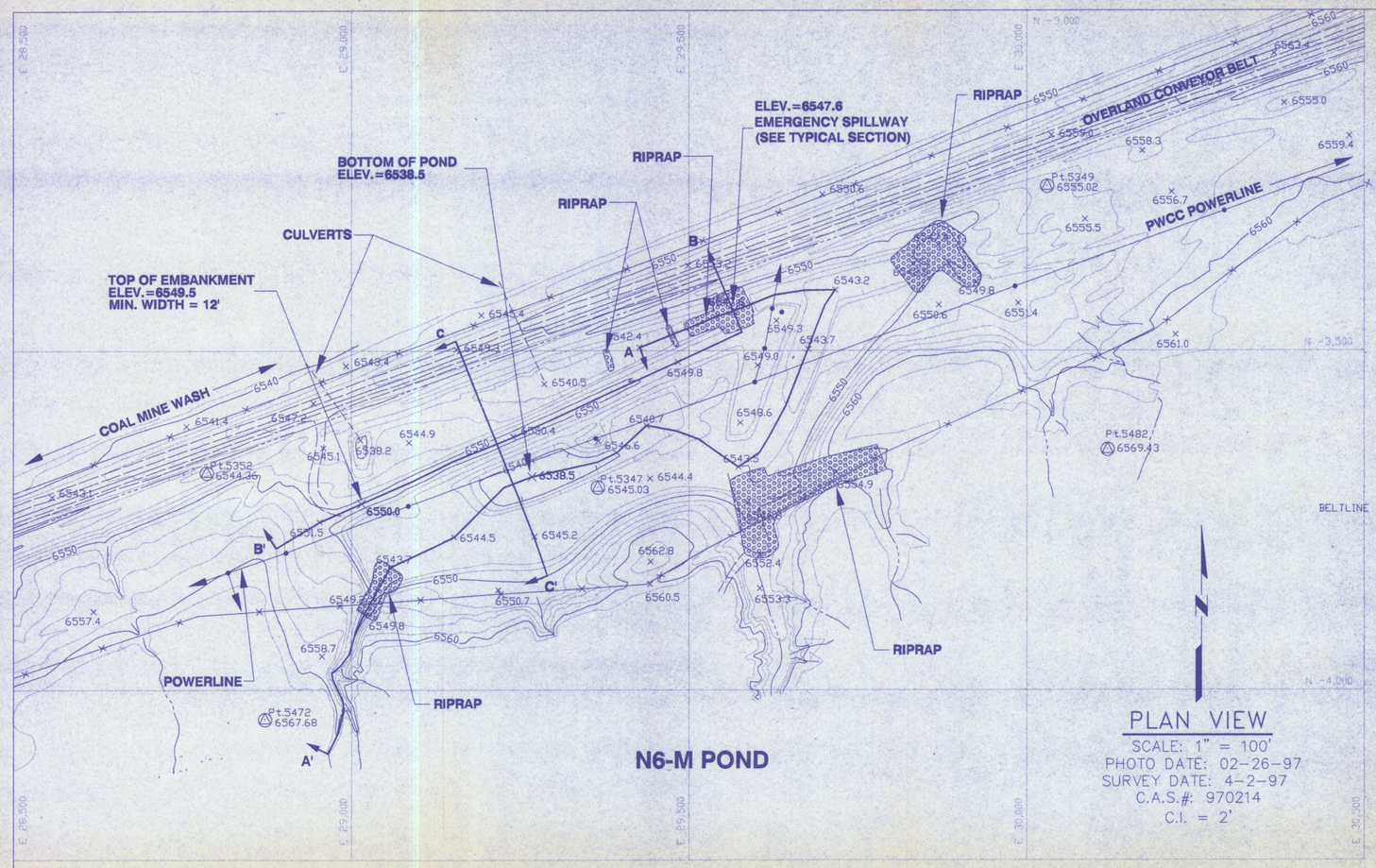
Drainage Area from J1, B1, S1, SWS(s)1: 77.4 acres
Total Contributing Drainage Area: 77.4 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6540.00	0.00	0.25	0.00	0.00	
6541.00	1.00	0.58	0.40	0.00	
6542.00	2.00	1.02	1.19	0.00	
6[illegible].00	3.00	1.60	2.49	0.00	
6[illegible].00	4.00	2.31	4.44	0.00	
6545.00	5.00	3.15	7.16	0.00	
6546.00	6.00	3.72	10.59	0.00	Stage of SW#1
6546.67	6.67	4.14	13.23	15.22	Peak Stage
6546.70	6.70	4.16	13.34	15.87	
6546.80	6.80	4.22	13.76	20.88	
6546.90	6.90	4.29	14.19	26.41	
6547.00	7.00	4.35	14.62	32.45	
6547.50	7.50	4.68	16.88	73.80	
6548.00	8.00	5.02	19.30	126.65	
6548.50	8.50	5.38	21.90	189.37	
6549.00	9.00	5.74	24.68	273.29	
6549.50	9.50	6.13	27.65	372.65	
6550.00	10.00	6.51	30.81	495.41	

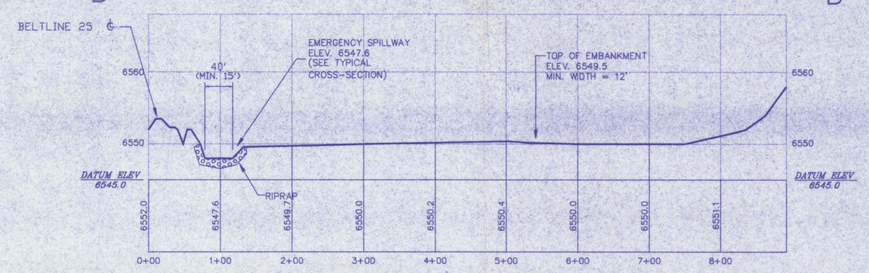
****

DEC 1996
APPROVED



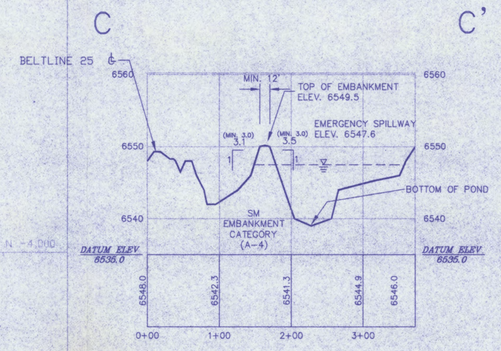
PLAN VIEW

SCALE: 1" = 100'
PHOTO DATE: 02-26-97
SURVEY DATE: 4-2-97
C.A.S.#: 970214
C.I. = 2'



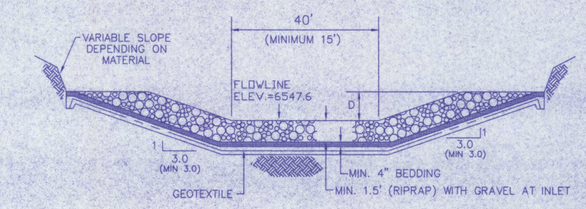
SECTION B – B'

VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 100'



SECTION C – C'

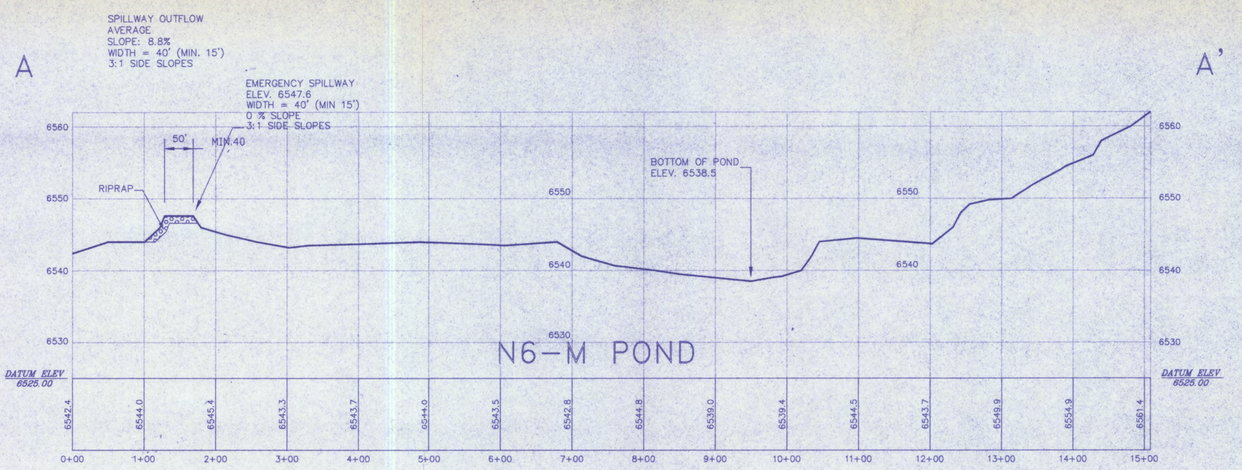
VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 100'



SPILLWAY D=1.9' (MINIMUM=1.7')
OUTFLOW CHANNEL D=2.5' (MINIMUM=1.2')

N6-M POND
TYPICAL CROSS-SECTION OF EMERGENCY SPILLWAY

NOT TO SCALE



SECTION A – A'

VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 100'

N6-M POND STAGE-CAPACITY TABLE

Elevation (ft-msl)	Stage (ft)	Area (Acres)	Capacity (ac-ft)	Total Capacity (ac-ft)	Description
6538.5	0.0	0.00	0.00	0.00	BOTTOM OF POND
6540.0	1.5	0.20	0.15	0.15	
6542.0	3.5	0.44	0.64	0.79	
6544.0	5.5	0.97	1.41	2.20	
6546.0	7.5	2.58	3.55	5.75	
6547.6	9.1	3.05	4.50	10.25	EMERGENCY SPILLWAY
6548.0	9.5	3.23	1.26	11.51	
6549.5	11.0	3.81	5.28	16.79	TOP OF EMBANKMENT

I CERTIFY THAT THIS SILTATION STRUCTURE WAS CONSTRUCTED IN ACCORDANCE WITH THE APPROVED MINING PERMIT AND THAT THE INFORMATION CONTAINED HEREIN ACCURATELY DESCRIBES THE CONSTRUCTED STRUCTURE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

ENGINEER'S CERTIFICATION

Registered Professional Engineer
CERTIFICATE NO. 18782
JAMES GARY SCHERNOCH
ARIZONA, U.S.A.

JAMES G. SCHERNOCH
COMPLIANCE ENGINEERING MANAGER
PEABODY WESTERN COAL COMPANY

ARIZONA P.E. 18782
DATE: APR 09 1997

REVISIONS		
DATE	CHK'D	DESCRIPTION

N6-M POND
AS-BUILT

BLACK MESA MINE
PEABODY WESTERN COAL COMPANY
1300 SOUTH YALE ST. FLAGSTAFF, ARIZONA 86001

DESIGNED BY: PWCC	SCALE: AS SHOWN
DRAWN BY: A. B.	DRAWING DATE: 4-9-97
CHECKED BY: JGS	PHOTO DATE: 3-26-95
CONTOUR INT.: 2'	DWG FILE: N6-MAS~1.DWG

INSPECTION REPORT

Sedimentation Structure

N7-A1

Kayenta Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Registered Professional Engineer
CERTIFICATE NO.
1337
LUTZ
KUNZE
Date Signed 11-22-85
ARIZONA, U.S.A.

deleted per arms # 01-08-17-03
letter dated 8/15/01

Dames & Moore
10139-011-22

INSPECTION REPORT

Sedimentation Structure

N7-B

Kayenta Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Dames & Moore
10139-011-22

TABLE OF CONTENTS

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HYDROLOGY	3
HYDRAULICS	4
Spillway Channel	6
Outflow Channel	6
STORAGE CAPACITY	6
REMEDIAL COMPLIANCE PLAN	7
GEOTECHNICS	7
HYDRAULICS	8

APPENDIX A - INSPECTION CHECK LIST

APPENDIX B - HYDROLOGY AND HYDRAULIC CALCULATIONS

INTRODUCTION

Sedimentation Structure N7-B is an earthen embankment, designed and constructed in 1981 by Peabody Coal Company as a temporary sedimentation structure to control runoff and sediment from the disturbed mining areas of the Kayenta Mine. The location of Structure N7-B is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure N7-B. Regional site information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody Coal Company," along with the methods and results of analyses used for slope stability, hydrology and hydraulics.

INSPECTION

Structure N7-B was inspected on September 6, 1985 by an interdisciplinary team of engineers from Dames & Moore. The purpose of the inspection was to assess the safety and general condition of the structure with respect to United States Department of Interior, Office of Surface Mining (OSM) regulations.

Dames & Moore's inspection was performed in accordance with applicable 30 CFR 780 and 816 regulations and included a review of the N7-B project files and a field inspection of the structure. The most current information contained in the Peabody Coal Company files includes the 1984 and current survey data and inspections performed in 1984 and 1985 by

Peabody Coal Company. The survey data developed in August 1984 was used in the analyses of the structure. Results of the field inspection are included in this report as Appendix A.

SITE DESCRIPTION

LAND USE

Structure N7-B has a 46.1-acre tributary drainage area and is located near Yellow Water Canyon at the Kayenta Mine. The watershed is classified as 75% Pinion/Juniper and 25% reclaimed.

EMBANKMENT

Structure N7-B is a homogeneous earthen embankment classified as a cross-valley embankment. Physical characteristics of the embankment are listed in the following table:

Structure N7-B

Embankment	Residual Sandstone Soils
Foundation	Residual Sandstone Soils
Right Abutment	Residual Sandstone Soils
Left Abutment	Residual Sandstone Soils
Height	12.3 ft
Crest Width	14 ft
Upstream Slope	2.5 H : 1 V
Downstream Slope . . .	4 H : 1 V

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section N7-B, A-A'. Grass provides erosion protection on the upstream and downstream slopes of the embankment.

ANALYSES

STABILITY

Structure N7-B is a category A-1 embankment. A standard category A-1 embankment has static and seismic factors of safety equal to or greater than 1.5 and 1.2, respectively, under the following conditions:

1. Maximum height = 15 ft
2. Maximum upstream slope = 1.75 H : 1 V
3. Maximum downstream slope = 3.25 H : 1 V
4. Normal pool with steady seepage saturation conditions

The N7-B embankment is lower in height and has flatter slopes than the category standard; therefore, the embankment has factors of safety greater than the design minimum.

HYDROLOGY

The hydrologic analysis was completed using the U.S. Army Corps of Engineers generalized computer program HEC-1, Flood Hydrograph Package. Structure N7-B is located upstream from Structures N7-C and N7-A1. The three structures have a combined storage capacity that is less than 20 acre-feet. Therefore, the spillway for N7-B was analyzed using the 25-year, 6-hour storm. The storage capacity of Structure N7-B was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.235	mi
2.	Elevation Difference, H	160	ft
3.	Time of Concentration, T_c	0.069	h
4.	Lag time, $0.6T_c$	0.041	h
5.	SCS Curve Number	79	
6.	Rainfall Depth, 10-year, 24-hour storm .	2.1	in.
	25-year, 6-hour storm. .	1.9	in.
7.	Drainage Area	46.1	acres

HYDRAULICS

The HEC-1 program was used to evaluate inflow to the sedimentation structure, outflow from the structure and the resulting water surface elevations. The initial conditions and results of the analysis are summarized in the following table.

N7-B HYDRAULICS

	Units	10-year 24-hour Storm	25-year 6-hour Storm
Initial Reservoir Volume Condition		Empty	Full to the spillway elevation
Inflow			
Peak Flow	cfs	51	58
Volume	acre-ft	2.19	1.69
Storage			
Peak Stage	ft	6650.57	6653.40
Spillway Elevation . .	ft	6652.16	--
Peak Storage	acre-ft	2.19	--
Storage Capacity . . .	acre-ft	2.82	--
Outflow			
Peak Flow	cfs	0	29
Embankment Crest Elevation	ft	--	6654.20
Peak Stage	ft	--	6653.40
Freeboard	ft	--	0.80

Spillway Channel

The existing spillway for N7-B has a trapezoidal channel with the following dimensions:

Channel depth	1.8	ft
Channel width	25	ft
Channel length	30	ft
Side slopes (horizontal to vertical). .	2:1	
Average exit slope	3	percent

There is presently no erosion protection within the channel.

Outflow Channel

The existing outflow channel for N7-B has a trapezoidal channel with the following dimensions:

Channel width	25	ft
Channel length	30	ft
Side slopes (horizontal to vertical). .	2:1	
Average exit slope	5	percent

There is presently no erosion protection within the channel.

STORAGE CAPACITY

The impoundment volume-elevation curve is based on site specific surveys conducted for Peabody Coal Company's August 1984 inspection, and 1985 resurveys, where available. Additionally, the most current topographic maps available were used in developing Plate 3, Volume-Elevation Curve, N7-B.

The calculations for the sediment load entering Structure N7-B were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.21
3. Slope Factor, LS 19.20
4. Cover Factor, C 0.143
5. Erosion Control Factor, P 1.0

The hydrologic analysis gives the storage volume required to contain the 10-year, 24-hour storm, and the remaining storage volume available for storing sediment. The existing storage capacity of N7-B and the results of the sediment inflow analysis are summarized in the following table.

N7-B STORAGE

Total Storage Capacity	2.82	acre-ft
10-year, 24-hour Storm Inflow	2.19	acre-ft
Available Sediment Storage Capacity . .	0.63	acre-ft
Sediment Inflow Rate	0.493	acre-ft/yr
Sediment Storage Life	1	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure N7-B indicated that the only geotechnical problem is rill and gully on the upstream and downstream slopes, the side slopes of the spillway and outlet channel, the bottom of the outlet channel and the right and left abutments. Correction of erosion is considered a periodic maintenance task and does not require remedial action.

HYDRAULICS

The storage capacity of Structure N7-B is adequate but the spillway capacity is inadequate. The structure does not have an adequate outflow channel. The bottom elevation of the existing spillway channel should be lowered to elevation 6651.50 feet while maintaining the bottom width of 20 feet as shown on Plate 5. A trapezoidal outflow channel with the same bottom width as the spillway should be constructed along the alignment shown in Plate 1. The channel profile is shown in Plate 4 and required dimensions are shown in Plate 5. Both the spillway and outflow channel should be protected against erosion using geotextile and riprap as shown in Plate 5.

Lowering the spillway elevation to 6651.50 feet decreases the storage capacity and increases the freeboard. The analysis of these conditions is summarized in the following table.

N7-B HYDRAULICS FOR REDESIGNED SPILLWAY

	Units	10-year 24-hour Storm	25-year 6-hour Storm	
Initial Reservoir Volume Condition		Empty	Full to the spillway elevation	
Inflow				
Peak Flow	cfs		58	
Volume	acre-ft		1.69	
Storage				
Peak Stage	ft	6650.57	6652.76	
Spillway Elevation . .	ft	6651.50	--	
Peak Storage	acre-ft	2.19	--	
Storage Capacity . . .	acre-ft	2.56	--	
Available Sediment Storage Capacity . .	acre-ft	0.37	--	
Sediment Inflow Rate .	acre-ft/yr	0.493	--	
Sediment Storage Life.	yrs	1*	--	
Outflow				
Peak Flow	cfs	0	31	
Embankment Crest Elevation	ft	--	6654.20	
Peak Stage	ft	--	6652.76	
Freeboard	ft	--	1.44	
Spillway Channel				
Flow Depth	ft	--	1.26	
Critical Velocity. . .	fps	--	3.6	
Manning's "n"		--	0.040	
Outflow Channel			Section I	Section II
Slope	%	--	5	40
Normal Velocity. . . .	fps	--	4.1	7.6
Normal Depth	ft	--	0.36	0.19
Manning's "n"		--	0.040	0.040

*One year of sediment is adequate because excess sediment storage is available in Structures N7-C and N7-A1 located downstream.

* * *

The following plates and appendix are attached and complete this inspection report.

Plate 1 - Site Plan N7-B

Plate 2 - Existing Maximum Cross Section N7-B, A-A'

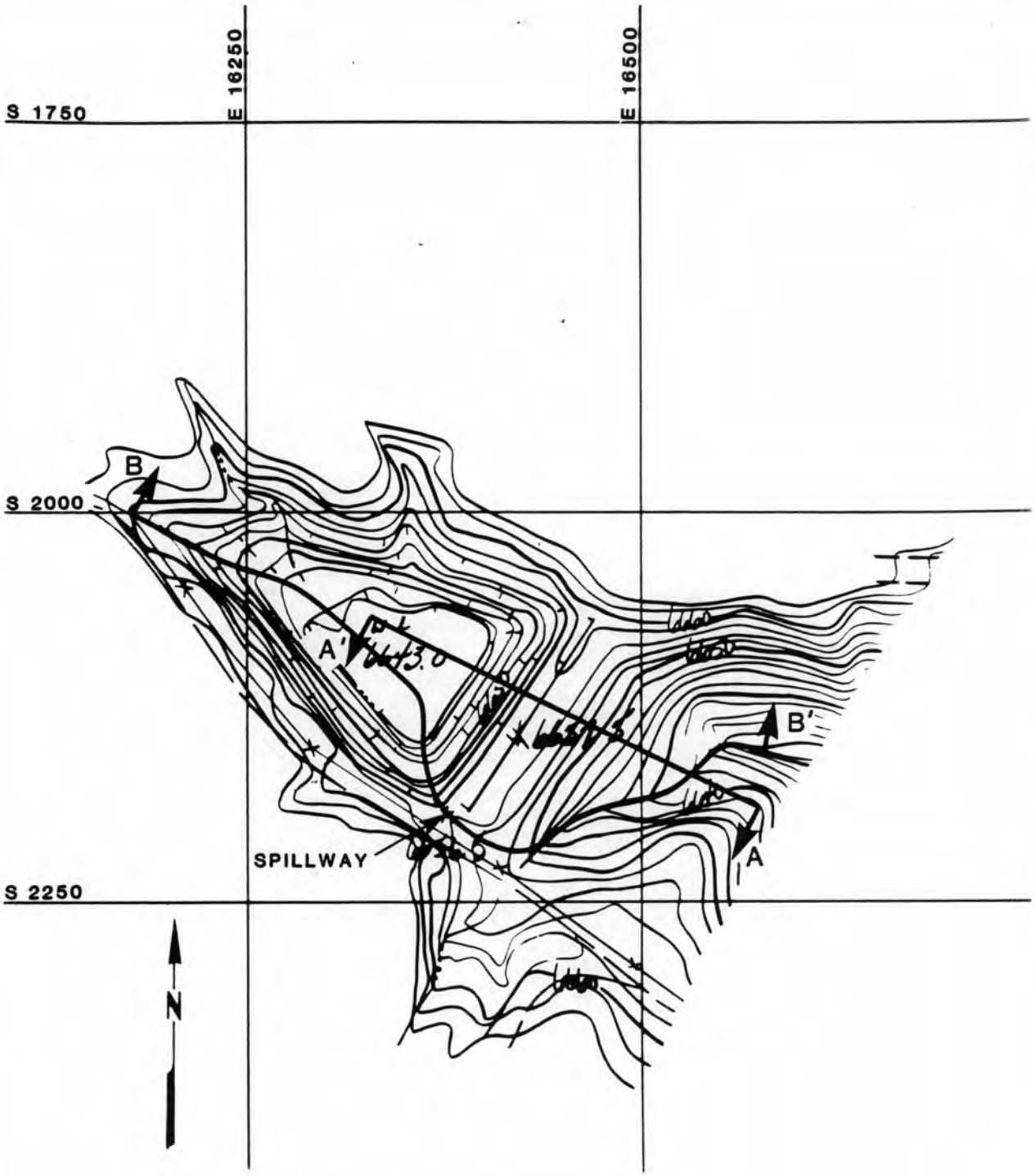
Plate 3 - Volume-Elevation Curve N7-B

Plate 4 - Channel Profile N7-B, B-B'

Plate 5 - Spillway and Outflow Channel Cross Section N7-B

Appendix A - Inspection Check List

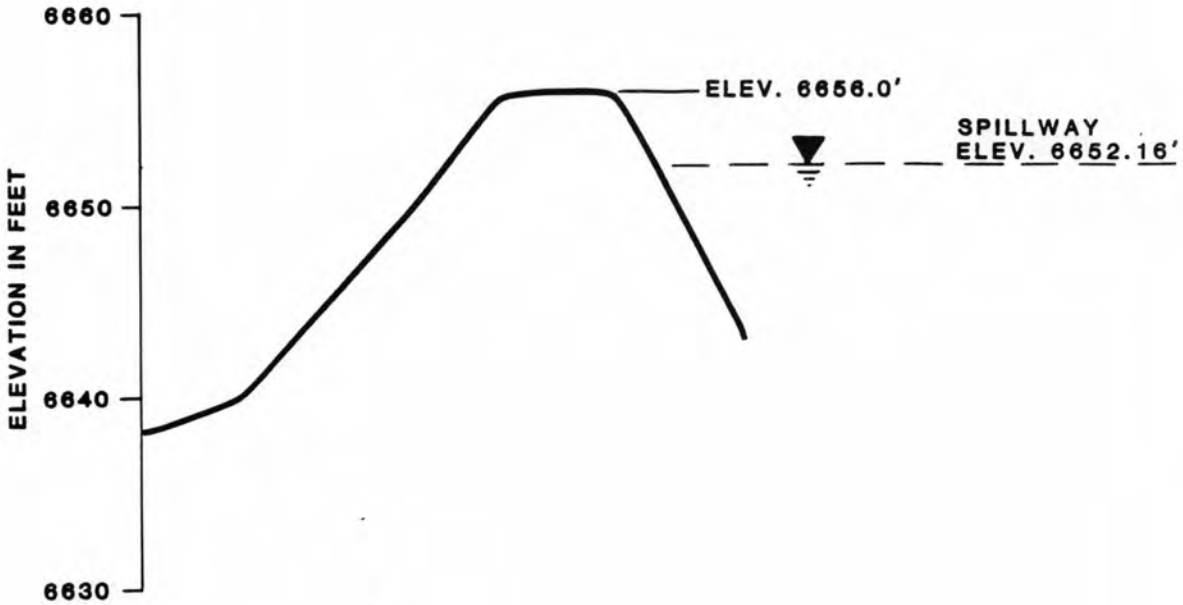
Appendix B - Hydrology and Hydraulic Calculations

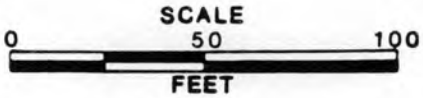


SCALE
0 100 200
FEET

SITE PLAN
N7-B

BY **Dames & Moore** Plate 1



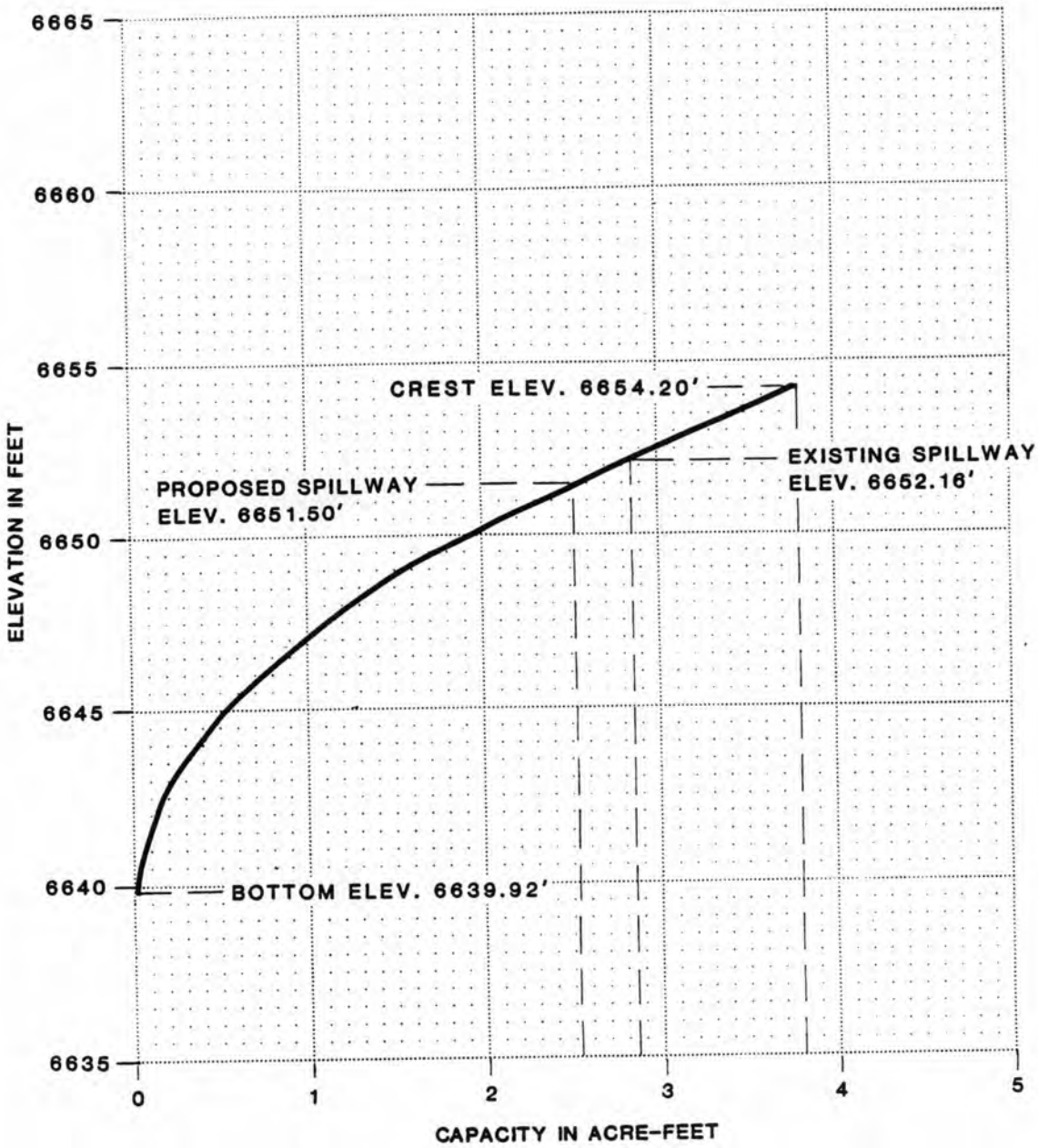


EXISTING MAXIMUM CROSS-SECTION A-A' N7-B

FOR LOCATION SEE PLATE 1

BY **Dames & Moore**

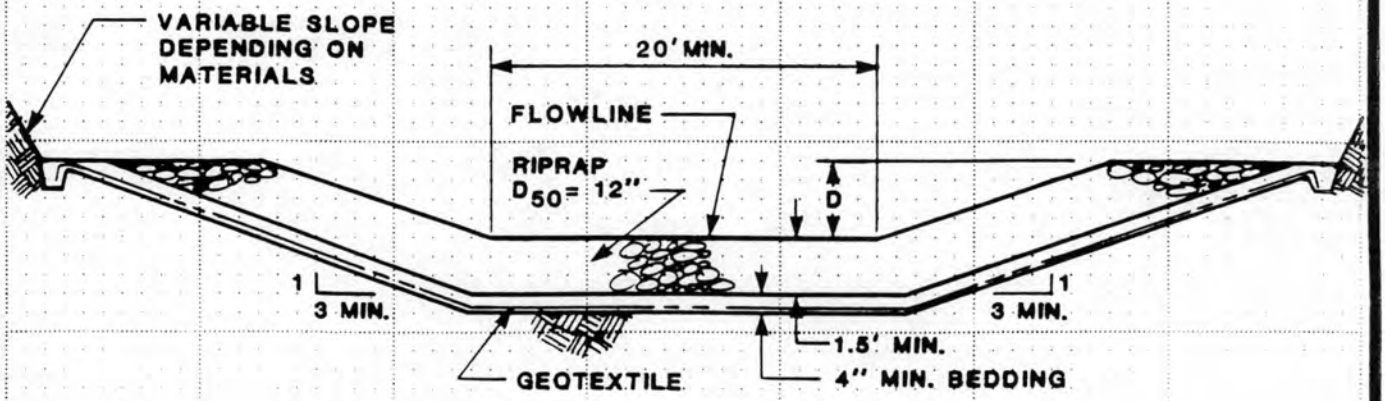
Plate 2



VOLUME-ELEVATION CURVE

N7-B

BY **Dames & Moore** Plate 3



SPILLWAY CHANNEL

D = 2.3'

LENGTH = 30'

FLOWLINE ELEV. = 6651.50'

OUTFLOW CHANNEL

D = 1.5'

SPILLWAY AND OUTFLOW CHANNEL CROSS SECTION N7-B

BY **Dames & Moore** Plate 5

APPENDIX A

INSPECTION CHECK LIST

Sediment Impoundment Name: N 7-B
Page: 4

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST			14' w
a. Any visual settlements?		X	
b. Misalignment?		X	
c. Cracking?		X	
2. UPSTREAM SLOPE			22°
a. Adequate grass cover?		X	
b. Any erosion?	X		Rills
c. Are trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Adequate riprap protection?		X	
g. Any stone deterioration?			NA
h. Visual depressions or bulges?		X	
i. Visual settlements?		X	
j. Animal burrows?		X	
3. DOWNSTREAM SLOPE			14°
a. Adequate grass cover?		X	
b. Any erosion?	X		Rills
c. Are trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Visual depressions or bulges?		X	
g. Visual settlements?		X	
h. Is the toe drain dry?			NA
i. Are the relief wells flowing?			NA
j. Are boils present at the toe?		X	
k. Is seepage present?		X	
l. Animal burrows?		X	
4. ABUTMENT CONTACT. RIGHT			
a. Any erosion?	X		Rills
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			Reddish brown SM
5. ABUTMENT CONTACT. LEFT			
a. Any erosion?	X		Rills
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			gray SM w/ rock

Sediment Impoundment Name: N7-B
Page: 5

ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			
a. Location:			
Left abutment?			
Right abutment?	X		
Crest of Embankments?			
b. Approach Channel:		X	
Are side slopes eroding?			
Are side slopes sloughing?			NA
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
c. Spillway Channel:	X		3° Slope 25' W 30' L
Are side slopes eroding?	X		From RA Rills From Dam Rills
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?		X	
d. Outflow Channel:	X		25' 5 5° 30' L
Are side slopes eroding?		X	
Are side slopes sloughing?		X	
Bottom of channel eroding?	X		At end where it turns
Obstructed?		X	
Erosion protection?		X	
e. Weir:		X	
Condition?			
7. SPILLWAY/EMERGENCY			NA
a. Location:			
Left abutment?			
Right abutment?			
Crest of Embankments?			
b. Approach Channel:			
Are side slopes eroding?			
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
c. Spillway Channel:			
Are side slopes eroding?			
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
d. Outflow Channel:			
Are side slopes eroding?			
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
e. Weir:			
Condition?			

Sediment Impoundment Name: N7 - B
Page: 6

ITEM	YES	NO	REMARKS
8. IMPOUNDMENT			
a. Sinkholes?		X	(Elev.) feet
b. Water present?		X	(Elev.) feet
c. Siltation?	X		
d. Watershed matches soil map?		X	

9. GENERAL COMMENTS

Canopy Cover 60 %
Ground Cover 85 %

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

FILE PEABODY COAL CO. 10139-011-22
SUBJECT SEDIMENT POND HYDROLOGY
N7-B SHEET ___ OF ___

REVISIONS BY ___ DATE ___ TO EO ___
BY ___ DATE ___ TO EO ___

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6812 − 6652 = 160 ft. ✓

WATER COURSE LENGTH = 3.1(400) = 1240 ft. = 0.235 mi. ✓

$$T_c = \left(\frac{11.9\,(0.235)^3}{160}\right)^{0.385} = 0.069 \text{ hr.}$$ ✓

LAG TIME = $0.6T_c$ = 0.041 hr. ✓

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
11.3 (25%)	Reclaim (Post law)		C	0.25(81) = 20.3
34.8 (75%)	P-J	ave.	D	0.75(78) = 58.5
			EH #30	78.8

USE 79 ✓

DRAINAGE BASIN AREA

46.1 ACRE 0.072 SQ MILE ✓

BY S. DOLAN DATE 9-10-85
CHECKED BY RHM 10/28/85
COPY TO EO ___

SUBJECT SEDIMENT INFLOW
N7B SHEET ___ OF ___

REVISIONS BY ___ DATE ___ TO EO ___ BY ___ DATE ___ TO EO ___

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

R = 40

SOIL ERODIBILITY FACTOR

SOIL TYPE = 25% reclaimed .25 (.42)
75% EH #30 .75 (.14)
.21 ✓

K = .21

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
600'	120'	20	10.0 (.3)
800'	250'	31.3	24.0 (.6)
1050'	250'	23.8	17.6 (.10)

use 19.2 ✓

COVER FACTOR

AREA (ac)	MATERIAL TYPE	% COVER	CANOPY (%)	WEIGHTED C
25%	reclaimed	—	—	.25 (.15)
75%	P-J	40	25	.75 (.14)

C = .143 ✓

EROSION CONTROL FACTOR

P = 1.0

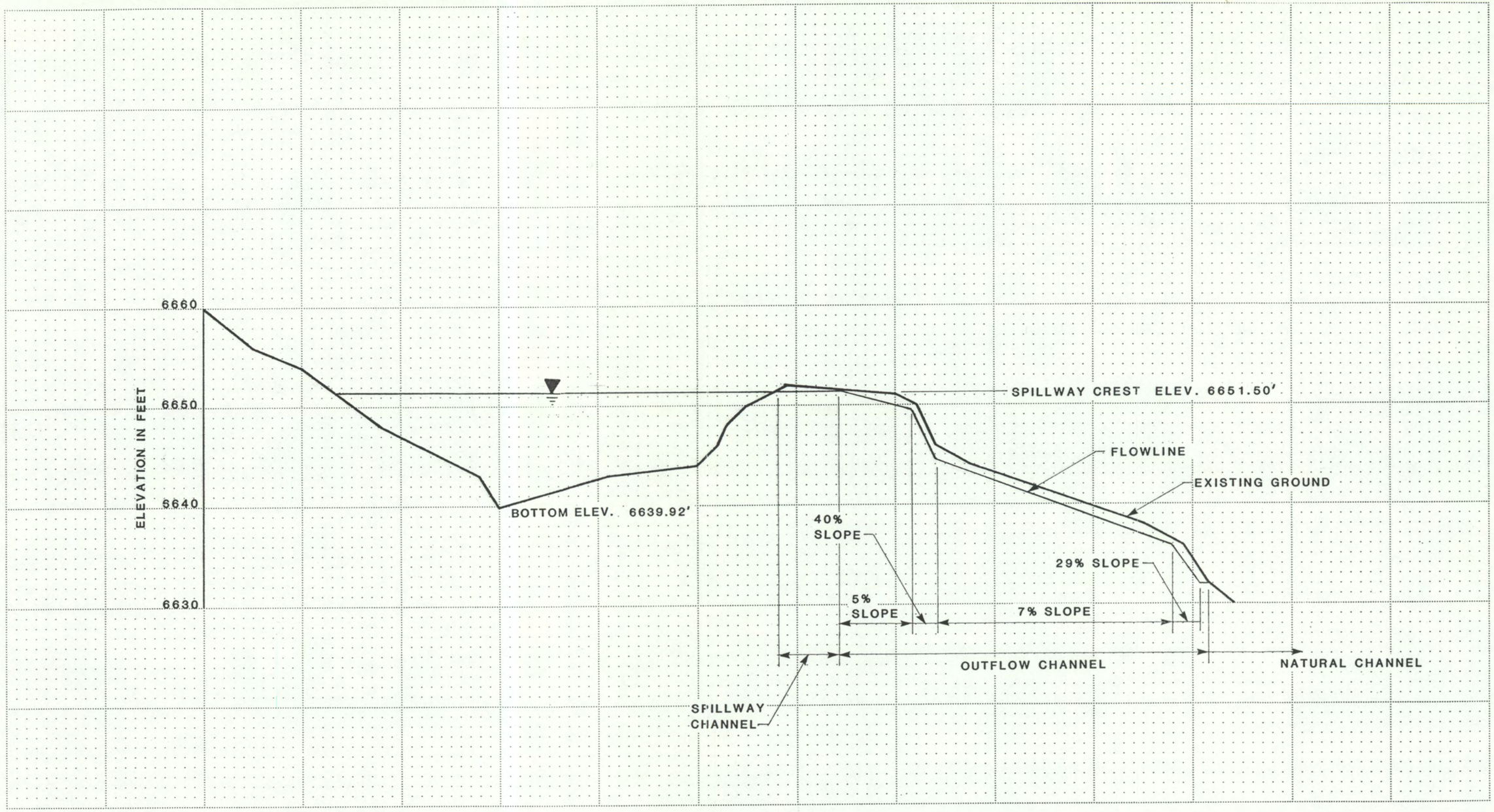
SEDIMENT INFLOW

$A = 40(.21)(19.2)(.143)(1.0) = 23.0\cancel{7}^{6}$ ton/acre/year

$A = 23.0\cancel{7}^{6}\left(\frac{1}{2047}\right)(40)(.95) = 0.49\cancel{4}^{3}$ acre-foot/year

BY ___ DATE ___ CHECKED BY ___ COPY TO EO ___

Dames & Moore



SCALE
0 50 100
FEET

CHANNEL PROFILE B-B'
N7-B

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 4

DESIGN REPORT

Permanent Impoundment

N7-D

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

OCT 2001
APPROVED

Registered Professional Engineer (Civil)
CERTIFICATE NO.
18782
JAMES DAVID
SCHLENVOGT
Date Signed
ARIZONA, U.S.A.

AUG 10 2001

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APPENDIX C - Water Persistence Calculation
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INTRODUCTION

Pond N7-D is an existing incised internal impoundment structure constructed by Peabody Western Coal Company (PWCC) in 1990 in the N-7/N-8 reclamation area and is proposed as a permanent impoundment structure. PWCC plans to utilize structure N7-D as one of the original AZ-0001-D Permit impoundments to mitigate post-mining livestock and wildlife watering sources, see Chapter 6, Permanent Impoundment section. The location of structure N7-D and its watershed boundary are shown on Drawing No. 85400 (sheet K-7) and Drawing No. 85405. The site-specific general construction plans are shown on the attached Exhibit #1.

This design report contains information specific to structure N7-D. Mine-wide design, construction, and reclamation information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona, for Peabody Western Coal Company", December, 1985 (PAP), Chapter 6, Attachment D, Volume 2, along with the methods and results of analyses used for slope stability, hydrology, and hydraulics, and in Chapter 6, Pages 11 to 42, "Sediment and Water Control Facility Plan".

INSPECTION

The site of the existing structure N7-D was inspected in July, 2001 by a Registered Professional Engineer from PWCC, to assure that the site is suitable and no adverse conditions exist to prevent the successful operation of this structure. A detailed geotechnical investigation was not performed since the impoundment will be incised, with no embankments or emergency spillway required. Information in Chapter 6, Attachment D was utilized to confirm the stability of the re-graded incised slopes.

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SITE DESCRIPTION

LAND USE

Structure N7-D has a 756-acre tributary drainage area of the Yellow Water Canyon Wash and is located in the N-7/N-8 reclamation area at the Kayenta Mine. The watershed is classified as 55% post-law reclaimed and 45% undisturbed.

DESIGN ANALYSES

GENERAL

Structure N7-D was designed under the supervision of a Registered Professional Engineer from Peabody Western Coal Company. The design was performed in accordance with applicable 30 CFR 780 and 816 regulations of the United States Department of Interior, Office of Surface Mining (OSM) and included a review of available project files. The most current information contained in the Peabody Western Coal Company files includes topographic maps developed from aerial photography flown in 1989 for Peabody Western Coal Company and was used in the analyses of the structure.

STABILITY

Structure N7-D is completely incised and does not incorporate an embankment. All re-graded (incised) slopes are equal to or flatter than 4.0:1(horizontal to vertical). Given that the graded side slopes are equal to or flatter than the recommended final reclamation slopes, the slopes will be stable.

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WATER PERSISTENCE

Pond N7-D is an existing impoundment located in the N-7/8 reclamation area of the Kayenta mine. The watershed draining to the impoundment is completely reclaimed or undisturbed. The area draining to the impoundment is 756 acres and, therefore, has resulted in standing water occurring in the pond during all years of average precipitation. PWCC and/or OSM personnel have documented

water persistence and/or water levels for the last 11 years. The presences of water, water depths or levels are presented in the quarterly reports and annual hydrology reports, (AHR's) to OSM.

To determine water persistence for Structure N7-D, run-off volume calculated from average annual precipitation was compared to annual evaporation and infiltration. This comparison was performed on a monthly basis. The analysis was performed beginning on the first month of the year (January) with the pond assumed to be empty. Runoff for each month was determined using the NRCS Curve Number Method and the mean monthly precipitation. To simulate conservative runoff and water persistence conditions, a curve number of 77 was used in the analysis. The curve number was determined in the following manner. Precipitation occurs at the site under antecedent I and antecedent II conditions. Antecedent I represents a condition when the soils and subsoils are dry, and antecedent II represents average conditions. It was assumed that antecedent I conditions occur 1/4 of the time, and antecedent II conditions occurs 3/4 of the time. Using a curve number of 82 for antecedent II (see Appendix A) and a curve number 64 for antecedent I, a weighted average results in a curve number of 77. The run-off volume was calculated for each month and added to the pond. A water elevation and resulting surface area for each month was determined from the pond Stage Storage curve (see Appendix C). Total evaporation and infiltration rates were calculated based on the monthly pond surface areas. The calculated evaporation and infiltration values were subtracted from the total runoff to determined the water volume increase or decrease to the pond. The pond volume calculated for the first month (January) was used as the starting volume for the next month (February). The same steps were repeated for each month. This analysis was conducted for 8 years. The inputs and results are shown in Appendix B in graphical and tabular format. As shown in Appendix C, the final surface water elevation of the pond should stabilize between an elevation of 6566.5 (low seasonal mark) and 6568 (high seasonal mark). The final pond surface water elevation corresponds to a volume of between 32 ac-ft and 41 ac-ft. The spreadsheet model indicates that on a typical year that the pond water level will be at its lowest in June of each year and then begin to collect water until reaching its maximum volume in December-January (refer to Appendix C).

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WATER QUALITY

Water contained in the proposed N7-D impoundment will originate from surface water run-off from reclaimed spoil areas. Given that neither the spoils or replaced topsoil in the reclaimed area contain material which could adversely impact surface water run-off, Peabody Western Coal Company does not anticipate any problems with water quality in the N7-D impoundment. Ten full suite water quality analyses have been performed on water samples collected from the N7-D to substantiate the aforementioned statement. A statistical analysis of the water quality parameters analyzed is presented in Table 1. In addition, a comparison of the chemical concentrations versus livestock drinking water standards is presented in Table 2. None of the livestock standards for any toxic chemical constituent were exceeded. One pH measurement (6.4) at impoundment N7-D was slightly less than the standard of 6.5 and one SO4 measurement (3482 mg/l) was over the recommended standard of 3000 mg/l. Some total recoverable aluminum measurements exceeded the standard of 5 mg/l. Because none of the dissolved aluminum measurements were over 5 mg/l, it is clear the total recoverable exceedences were caused by sediment entrained with the water samples. Aluminum is soluble in an acid pH and is pulled off the sediment and dissolved during the total recoverable acid digestion. Based on the above-referenced chemical analyses, the water in the impoundment is quite well suited for its intended use as livestock and wildlife drinking water.

DIMINUTION OF ADJACENT WATER QUANTITY AND QUALITY

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Peabody believes sufficient information has been submitted and evaluated by OSM in Hydrology Reports, Permits and other documents to demonstrate that this impoundment will not result in the diminution of the quantity and quality of water utilized by adjacent or surrounding landowners. Chapter 17 (Protection of the Hydrologic Balance) of the AZ-0001D Permit presents detailed descriptions of pre-existing water sources within the leasehold, including those proximate to the N-7/N-8 reclamation area. No pre-existing ponds or wells have been documented adjacent or immediately downstream of the N7-D impoundment. Plans for mitigation or replacement of pre-existing water sources that have been or may be affected by mining are presented in Chapter 17.

There is no potential for Permanent Impoundment N7-D to directly impact the adjacent downgradient water quality because it is a permanent internal impoundment and is designed to contain the 6-hour PMP with adequate freeboard. The pond has never discharged and based on the PMP analysis is never expected to discharge.

The Pond N7-D watershed of 756 acres represents approximately 2.7% of the drainage area of the encompassing watershed which drains this portion of Yellow Water Canyon Wash. If the watershed areas of N7-D and N7-E are combined, they only represent 3.6% of the Yellow Water Canyon watershed to this portion of the drainage. Based on this, any water quantity diminution due to Permanent Impoundments N7-D and E is negligible. Water levels in alluvial wells (see Appendix D, Figures 1-3) adjacent and immediately downgradient in the alluvium from the pond show normal fluctuations in response to low and high stream flow years. There is no evidence of persistent diminished recharge to the alluvium from runoff, which could be potentially attributed to the loss of watershed area associated with Pond N7-D. In addition, Peabody has no evidence that flood irrigation has been practiced along this reach of Yellow Water Canyon Wash below the N7-D impoundment. Monitoring of stream flows in the main channels on Black Mesa since 1980 has shown extremely high sediment concentrations, which would preclude flood irrigation practices due to high maintenance costs.

Chapter 18 (Probable Hydrologic Consequences) of the AZ-0001D Permit presents analyses of the potential impacts of the mining operation, including a section that discusses the effects of dams, sediment ponds and permanent impoundments on downstream users. Although some localized decreases in receiving stream runoff may result after mining areas are reclaimed, these localized decreases will become less pronounced and unmeasurable further downstream, as lateral inflows from undisturbed basins will provide additional contributions to downstream runoff volumes. Channel transmission losses, evapotranspiration and other losses in the main channels to the Little Colorado River would completely mask any runoff reductions from the smaller reclaimed areas on the leasehold.

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OSM's Cumulative Hydrologic Impact Assessment (CHIA) and Environmental Impact Statement (EIS) which was written for the Black Mesa PAP in 1990, concluded that short- and long-term impacts from proposed permanent impoundments would be minor. Short- and long-term impacts of mining proposed in the PAP on the surface water quantity at Moenkopi Wash will be negligible. Based on the above summaries, Peabody maintains this impoundment will not result in the diminution of the quantity or quality of water utilized by adjacent or surrounding landowners.

HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD4 (see Appendix B). Structure N7-D is classified as a low hazard structure (see Drawing No. 85408). In addition, the Kayenta mine area is sparsely populated with no people living in the downstream flood plain. The Pond contains no embankment. Since the structure is completely incised and is designed without an emergency spillway, it has been conservatively designed to contain the runoff volume from the General 6 Hour PMP (See calculation for 6-hour PMP, Appendix B) plus several years of sediment yield.

The following parameters were used in the hydrologic analysis, (see Appendix A):

		General 6-Hour PMP	
1.	Water Course length, L	1.962	mi.
2.	Elevation Difference, H	760	ft.
3.	Time of Concentration, T_c	0.440	hr.
4.	NRCS Curve Number	82	
5.	General 6-Hour PMP Storm Rainfall Depth	5.96	in.
6.	Pond Watershed Area	756	ac.

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HYDRAULICS

The SEDCAD4 computer program was used to evaluate inflow to Structure N7-D and the resulting water surface elevations. The initial conditions and results of the analysis are summarized in the following table (supporting calculations are presented in Appendix B).

Initial Reservoir Volume Condition	Units	General 6 Hr. PMP
Inflow		
Peak Flow	cfs	2,945
Volume	ac-ft	249
Starting Volume (estimated high water mark)	ac-ft	41
Starting Elevation	msl	6567'
Peak Volume (high water mark + PMP)	ac-ft	290
Peak Elevation	msl	6590.5'
Pond Crest Elevation	msl	6604'
Freeboard	ft	13.5

INLET CHANNEL

There is one inlet channel to Pond N7-D. The channel is designated as N7D-1c and is shown on the N7/N8 Drainages and Permanent Facilities map. This channel is designed for the 100-year, 6-hour storm event and all input parameters, design, and hydrology printouts are shown in the N-7 and N-8 Reclamation Areas, Reclaimed Channels, Downdrains, and Terraces, Design Report.

EMERGENCY SPILLWAY and OUTFLOW CHANNEL

Pond N7-D is designed to contain the entire runoff from the General 6-hour PMP, therefore, no emergency spillway or outflow channel is required.

STORAGE CAPACITY

The impoundment stage-capacity table (see Appendix B) is based on the existing topography for N7-D and lowering the crest of the embankment from approximately 6611 elevation to the 6604 elevation. This will reduce the existing capacity by approximately 186 ac.-ft, but still maintain adequate storage capacity. The calculations for the sediment load entering structure N7-D were made utilizing the Revised Universal Soil Loss Equation (RUSLE) using the following parameters, (see Appendix A):

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.29
3.	Slope Factor, LS	8.44
4.	Cover Factor, C	0.21
5.	Erosion Control Factor, P	0.89

The storage capacity for structure N7-D is shown in Appendix B and the results of the runoff and sediment inflow analysis are summarized in the following table.

N7-D STORAGE

Total Storage Volume	559	ac-ft
High Water Mark Volume	41	ac-ft
Volume of General 6-hour PMP	249	ac-ft
Available Sediment Capacity	269	ac-ft
Sediment Inflow Rate	6.14	ac-ft/yr.
Sediment Storage Life	43.8	years

See Appendix A for sediment inflow calculations.

* * *

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The following appendices and drawing are attached and complete this design report.

Appendix A - Hydrology and Sedimentology Calculations

Appendix B - SEDCAD4 (Input and Output), 6-Hour PMP Calculation

Appendix C - Water Persistence Calculation

Exhibit #1 - N7-D Permanent Impoundment Design

Table 1

Peabody Western - Black Mesa Complex
Paradox Hydrology System
Water Quality Statistics

Sample Point : N7-D-P PERM IMPOUND N7-D
Location:
Elevation:

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	Uncensored Data					Censored Data				
	No of Obs	Mean	StDv	Min	Max	No of Obs		Min		Max
Field Parameters										
Field Ph S.U.	9	8.07		7.34	8.84	1	<	7.96	<	7.96
Temperature C	8	14.91	9.61	1.00	28.50					
Conductivity UMHOS/CM	8	1124.00	1544.81	211.00	4870.00					
Field Salinity 0/00	6	.70	1.00	.10	2.70	1	<	.10	<	.10
Laboratory Parameters										
Acidity MG/L	5	0.00		0.00	0.00					
Alk As CaCO3, Ph 4.5 MG/L	10	74.00	24.96	51.00	128.00					
Alk, Bicarb As CaCO3 MG/L	5	66.20	13.74	51.00	81.00					
Alk, Carb As CaCO3 MG/L						5	<	2.00	<	2.00
Alk, Hydrox As CaCO3 MG/L						5	<	2.00	<	2.00
Aluminum, Dissolved MG/L						5	<	.05	<	.05
Antimony, Dissolved UG/L	1	1.00		1.00	1.00	4	<	1.00	<	5.00
Arsenic, Dissolved UG/L						5	<	1.00	<	1.00
Barium, Dissolved UG/L	5	42.00	16.43	20.00	60.00					
Boron, Dissolved UG/L	9	56.67	26.69	20.00	140.00	1	<	20.00	<	20.00
Cadmium, Dissolved UG/L						5	<	5.00	<	10.00
Calcium, Dissolved MG/L	10	154.79	214.10	30.20	749.00					
C.O.D. MG/L	5	30.00	11.73	20.00	45.00					
Chloride MG/L	9	20.00	33.51	3.00	109.00	1	<	1.00	<	1.00
Chromium, Dissolved UG/L						5	<	10.00	<	10.00
Conductivity UMS/CM2	10	1036.20	1232.34	237.00	4420.00					
Copper, Dissolved UG/L						5	<	10.00	<	10.00
Fluoride MG/L	10	.62	.20	.30	1.10					
Hardness As CaCO3 MG/L	10	617.30	932.40	108.00	3221.00					
Iron, Total MG/L	10	1.71	2.60	.17	8.79					
Iron, Dissolved MG/L	4	.08	.03	.05	.12	6	<	.01	<	.02
Lead, Dissolved UG/L						5	<	20.00	<	20.00
Magnesium, Dissolved MG/L	10	56.16	97.13	6.30	329.00					
Manganese, Total MG/L	10	.07	.04	.01	.19					
Manganese, Dissolved MG/L	7	.05	.05	.01	.16	3	<	.01	<	.01
Mercury, Dissolved UG/L						5	<	.10	<	.20

Conditions: From: 01/01/1986...To: 12/20/2000...Sites: N7-D-P OR N7-E-P...

Tab[illegible]. (cont.)

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Peabody Western Black Mesa Complex
Paradox Hydrology System
Water Quality Statistics

Sample Point : N7-D-P PERM IMPOUND N7-D
Location:
Elevation:

	Uncensored Data					Censored Data				
	No of Obs	Mean	StDv	Min	Max	No of Obs		Min		Max
Laboratory Parameters										
Molybdenum, Dissolved UG/L	2	3.00	1.41	2.00	4.00	3	<	1.00	<	1.00
Nickel, Dissolved UG/L						5	<	20.00	<	20.00
Ammonia Nitrogen_N MG/L	3	.33	.25	.10	.59	2	<	.05	<	.05
Nitrate Nitrogen_N MG/L	9	1.09	1.45	.05	4.73	1	<	.02	<	.02
Nitrite Nitrogen_N MG/L	7	.08	.12	.01	.35	3	<	.01	<	.01
NO3_NO2 Nitrogen_N MG/L	9	1.11	1.44	.06	4.73	1	<	.02	<	.02
Ph At 25 Deg. Cent. S.U.	10	7.57		6.40	8.40					
Phosphorus, Orthophos MG/L	1	.01		.01	.01	4	<	.01	<	.01
Potassium, Dissolved MG/L	10	14.54	12.14	5.90	47.00					
Selenium, Dissolved UG/L	1	3.00		3.00	3.00	4	<	1.00	<	5.00
Silica, Dissolved MG/L	10	4.76	4.46	.10	14.60					
Silver, Dissolved UG/L						5	<	10.00	<	10.00
Sodium, Dissolved MG/L	10	40.83	77.30	4.80	259.00					
Solids, Dissolved MG/L	10	939.00	1422.57	140.00	4904.00					
Solids, Suspended MG/L	10	56.80	76.77	2.00	228.00					
Sulfate MG/L	10	595.10	1030.43	60.00	3482.00					
Vanadium, Dissolved UG/L						5	<	10.00	<	10.00
Zinc, Dissolved MG/L	2	.02	.01	.01	.02	3	<	.01	<	.01
Bicarbonate As HCO3 MG/L	10	90.10	30.41	62.00	156.00					
Carbonate As CO3 MG/L	5	0.00		0.00	0.00	5	<	2.00	<	2.00
Hydroxide As OH MG/L						5	<	2.00	<	2.00
Phosphate As PO4 MG/L						5	<	.10	<	.10
Cation_Anion Balance PERCENT	10	.73	1.86	-2.00	3.60					
SAR RATIO	10	.55	.54	.18	2.01					
Solids, Diss. (Calc) MG/L	10	921.42	1457.66	158.15	5005.00					
Sum Of Anions MEQ/L	5	5.22	3.97	2.50	12.10					
Sum Of Cations MEQ/L	5	5.44	4.30	2.50	12.90					
Total Recoverable Al MG/L	10	2.55	5.17	.08	17.00					
Total Recoverable As UG/L	5	1.80		1.00	4.00	5	<	1.00	<	1.00
Total Recoverable Ba UG/L	5	54.00	25.10	20.00	90.00					
Total Recoverable Cd UG/L						10	<	3.00	<	5.00
Total Recoverable Cr UG/L	1	10.00		10.00	10.00	9	<	10.00	<	10.00

Conditions: From: 01/01/1986...To: 12/20/2000...Sites: N7-D-P OR N7-E-P...

Table 1. (cont.)

Peabody Western - Black Mesa Complex
Paradox Hydrology System
Water Quality Statistics

Sample Point : N7-D-P PERM IMPOUND N7-D

Location:

Elevation:

Laboratory Parameters	Uncensored Data					Censored Data				
	No of Obs	Mean	StDv	Min	Max	No of Obs		Min		Max
Total Recoverable Cu UG/L	1	10.00		10.00	10.00	9	<	10.00	<	20.00
Total Recoverable Fe MG/L	5	.49	.53	.06	1.38					
Total Recoverable Pb UG/L						10	<	20.00	<	40.00
Total Recoverable Mn MG/L	5	.07	.06	.02	.18					
Total Recoverable Hg UG/L						10	<	.10	<	.20
Total Recoverable Mo UG/L	3	2.67	1.15	2.00	4.00	2	<	1.00	<	1.00
Total Recoverable Ni UG/L						5	<	20.00	<	20.00
Total Recoverable Se UG/L	4	4.00	4.04	1.00	10.00	6	<	1.00	<	1.00
Total Recoverable Ag UG/L						5	<	10.00	<	10.00
Total Recoverable Zn MG/L	7	.02		.01	.04	3	<	.01	<	.01
TDS Ratio ANAL/CALC	10	1.05	.09	.89	1.20					
Total Recoverable Sb UG/L	1	3.00		3.00	3.00	4	<	1.00	<	10.00
Total Recoverable V UG/L	2	21.00	22.07	5.00	37.00	8	<	5.00	<	10.00

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Conditions: From: 01/01/1986...To: 12/20/2000...Sites: N7-D-P OR N7-E-P...

Table

---- Excursion Summary Report --

Analyte	Standard	No. Sites	Sites	Frequency	Exceedence Date Range	Exceedence Value Range	Exceedence Median
Aluminum, Dissolved	0.0000 - 5.0000	0	none				
Arsenic, Dissolved	0.0000 - 200.0000	0	none				
Boron, Dissolved	0.0000 - 5000.0000	0	none				
Cadmium, Dissolved	0.0000 - 50.0000	0	none				
Chloride	0.0000 - 2000.0000	0	none				
Chromium, Dissolved	0.0000 - 1000.0000	0	none				
Copper, Dissolved	0.0000 - 500.0000	0	none				
Fluoride	0.0000 - 2.0000	0	none				
Lead, Dissolved	0.0000 - 100.0000	0	none				
Mercury, Dissolved	0.0000 - 10.0000	0	none				
Nickel, Dissolved	0.0000 - 1000.0000	0	none				
Nitrate Nitrogen_N	0.0000 - 100.0000	0	none				
Nitrite Nitrogen_N	0.0000 - 10.0000	0	none				
Ph At 25 Deg. Cent.	6.5000 - 8.5000	1	N7-D-P	1/8	03/04/98-03/04/98	6.4000 - 6.4000	6.4000
Selenium, Dissolved	0.0000 - 50.0000	0	none				
Solids, Dissolved	0.0000 - 5000.0000	0	none				
Sulfate	0.0000 - 3000.0000	1	N7-D-P	1/8	12/09/92-12/09/92	3482.0000 - 3482.0000	3482.0000
Total Recoverable Al	0.0000 - 5.0000	2	N7-D-P	1/8	09/01/99-09/01/99	17.0000 - 17.0000	17.0000
			N7-E-P	6/11	09/02/93-07/10/99	5.8500 - 49.9000	11.1800
Total Recoverable As	0.0000 - 200.0000	0	none				
Total Recoverable Cd	0.0000 - 50.0000	0	none				
Total Recoverable Cr	0.0000 - 1000.0000	0	none				
Total Recoverable Cu	0.0000 - 500.0000	0	none				
Total Recoverable Hg	0.0000 - 10.0000	0	none				
Total Recoverable Ni	0.0000 - 1000.0000	0	none				
Total Recoverable Pb	0.0000 - 100.0000	1	N7-E-P*	2/11	08/05/97-07/10/99	200.0000 - 400.0000	300.0000
Total Recoverable Se	0.0000 - 50.0000	0	none				
Total Recoverable V	0.0000 - 100.0000	0	none				

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Table 2. (cont.)

Total Recoverable Zn	0.0000 -	25.0000	0	none
Vanadium, Dissolved	0.0000 -	100.0000	0	none
Zinc, Dissolved	0.0000 -	25.0000	0	none

* = Sample below detection limit and detection limit greater than standard.

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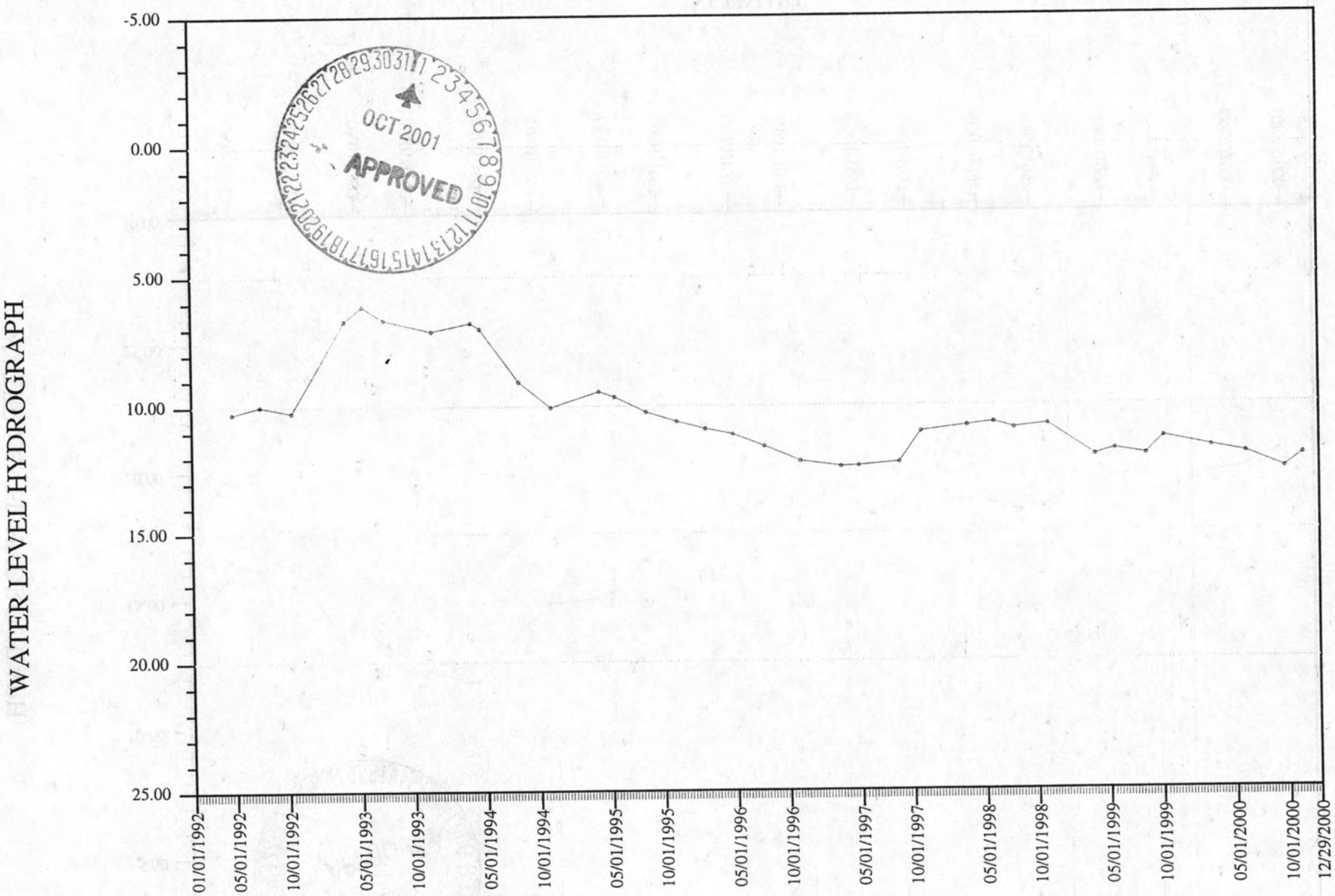

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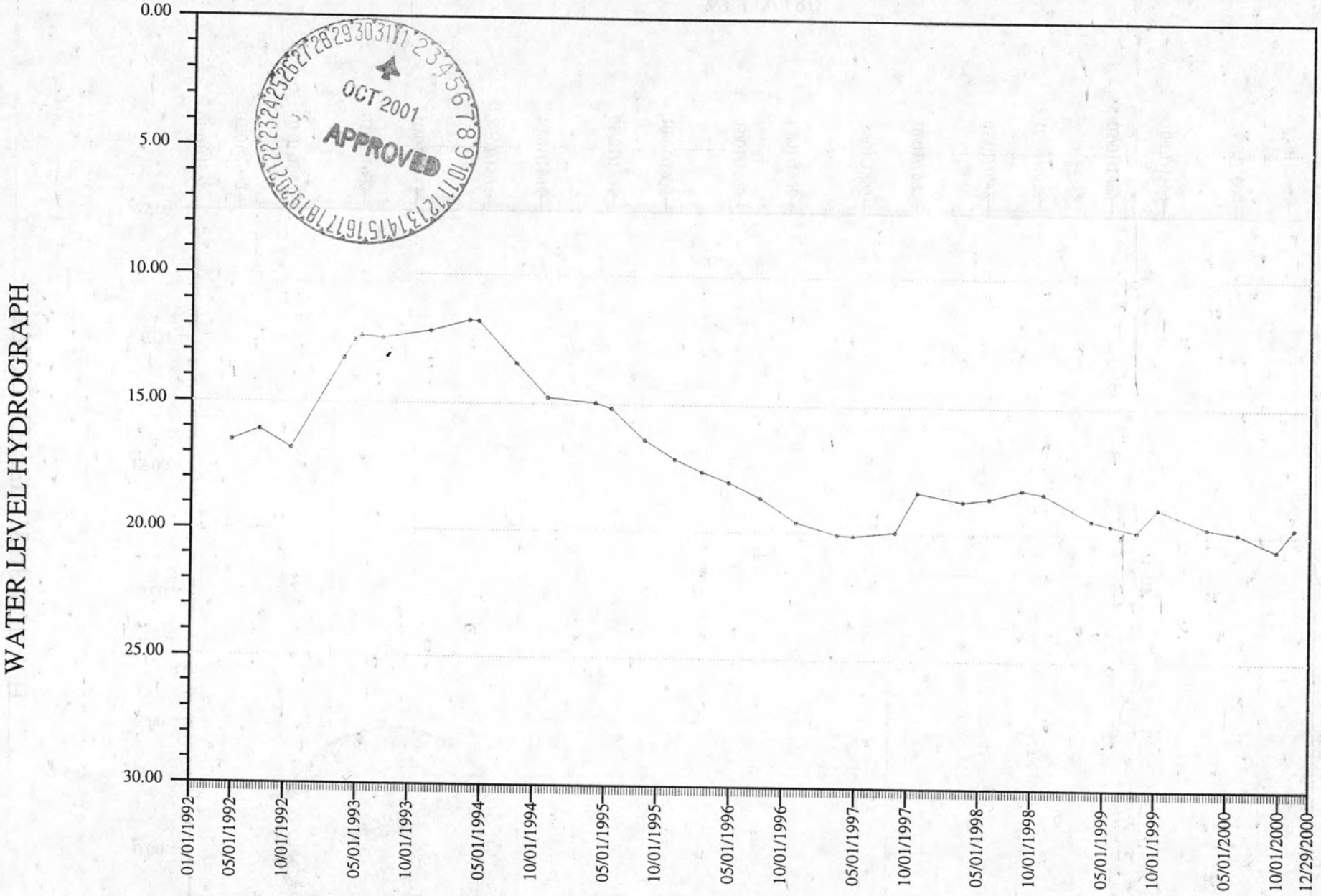
Figure 2



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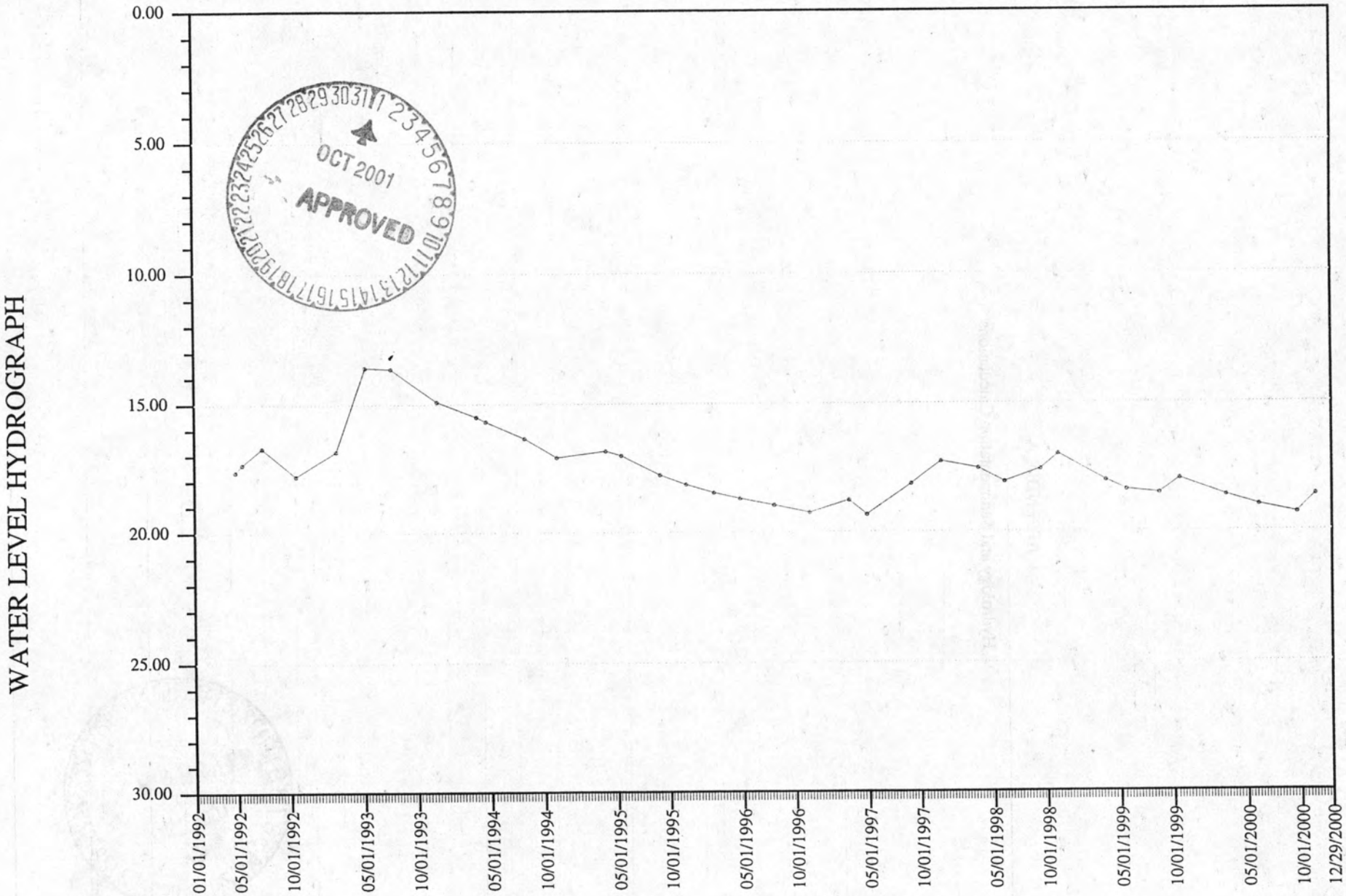
Figu



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APPENDIX A

Hydrology and Sedimentation Calculations

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PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: N7/N8 AREA

STRUCTURE: N7-D Pond

TIME OF CONCENTRATION:

Start Elevation (ft) =	7320
End Elevation (ft) =	6560
Elevation Difference, E (ft) =	760
Watercourse Length (ft) =	10360
Watercourse Length, L (mi) =	1.962

Tc = (11.9L^3/E)^0.385 = 0.440 hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland Method in SEDCAD4. Input and output parameters are shown on the SEDCAD4 printouts in Appendices C.

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Reclaimed	C	81	418.4	33890.4
Undisturbed-Pinon Juniper	D	83	337.6	28020.8
TOTAL:			756	61911.2

Weighted CN = Total CN*Area/ Total Area = 82

DRAINAGE BASIN AREA:

756.0 Acres

RAINFALL FACTOR:

R = 40

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Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage Red Peak Valley Wash 110° 19' 52" Area 6.2 (mi²) (km²)

Latitude 36°26'13", Longitude / of basin center

Month August

Step	Duration (hrs) (6) 12	18	24	48	72
A. Convergence PMP					
1. Drainage average value from one of figures 2.5 to 2.16	12.5 in. (mm)				
2. Reduction for barrier-elevation [fig. 2.18]	45%				
3. Barrier-elevation reduced PMP [step 1 X step 2]	5.625 in. (mm)				
4. Durational variation [figs. 2.25 to 2.27 and table 2.7].	72				%
5. Convergence PMP for indicated durations [steps 3 X 4]	4.05				in. (mm)
6. Incremental 10 mi² (26 km²) PMP [successive subtraction in step 5] Fig. 4.9	4.05				in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29]	100				%
8. Areally reduced PMP [step 6 X step 7]	4.05				in. (mm)
9. Drainage average PMP [accumulated values of step 8]	4.05				in. (mm)
B. Orographic PMP					
1. Drainage average orographic index from figure 3.11a to d. (revised)	5.8 in. (mm)				
2. Areal reduction [figure 3.20]	100%				
3. Adjustment for month [one of figs. 3.12 to 3.17]	100%				
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3]	5.8 in. (mm)				
5. Durational variation [table ~~3.8~~] 3.9	33				%
6. Orographic PMP for given durations [steps 4 X 5]	1.91				in. (mm)
C. Total PMP					
1. Add steps A9 and B6	5.96				in. (mm)

2. PMP for other durations from ~~smooth curve~~ fitted to plot of computed data.

3. Comparison with local-storm PMP (see sec. 6.3).

General PMP = 5.96 in

½ General PMP = 2.98 in

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT: N7-D Pond

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area (acres)	K*Area
35	0.38	473.6	179.97
30	0.18	255.3	45.95
42	0.16	82.3	13.17
TOTAL:		811.2	239.09

Weighted K = Total K*Area/ Total Area = 0.29

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
490	60	12.2%	0.6	7.0	4.85
510	90	17.6%	0.6	10.0	7.79
240	30	12.5%	0.6	7.1	3.25
570	80	14.0%	0.6	8.0	6.32
680	130	19.1%	0.6	10.8	10.16
770	120	15.6%	0.6	8.9	8.61
300	90	30.0%	0.6	16.7	10.14
520	140	26.9%	0.6	15.1	12.60
620	170	27.4%	0.6	15.3	14.28
360	110	30.6%	0.6	17.0	11.52
330	50	15.2%	0.6	8.6	5.00
470	50	10.6%	0.6	6.1	3.92
540	140	25.9%	0.6	14.5	12.39
700	100	14.3%	0.6	8.1	7.31

Average LS = 8.44

The LS Factor was calculated by:

LS = (Slope Length/72.6)^m(10.8*sin(slope angle) + 0.03) for Slopes < 9%*

LS = (Slope Length/72.6)^m(16.8*sin(slope angle) - 0.5) for Slopes > 9%*

Where:

Slope < 3%	*m = 0.3*
Slope = 4%	*m = 0.4*
5% > Slope < 10%	*m = 0.5*
Slope > 10%	*m = 0.6*

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COVER AND PRACTICE FACTORS:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C*Area	Practice Factor, P	P*Area
Reclaimed (Post-Law)	40%	0%	418.4	0.20	83.68	0.80	334.72
Undist. Pinon Juniper	35%	25%	337.6	0.22	74.27	1.00	337.60
TOTAL:			756		157.95		672.32

Weighted C = Total C*Area/ Total Area = 0.209

Weighted P = Total P*Area/ Total Area = 0.889

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: N7-D POND

The following spreadsheet calculates the predicted sediment yield for the project area. The gross sediment yie is determined according to the Revised Universal Soil Loss Equation.

PARAMETER DESCRIPTION	VALUE	
Annual Rainfall Factor	40.00	
Soil Erodibility Factor	0.29	
Length Slope Factor	8.44	
Cover Factor	0.21	
Practice Factor	0.89	
Gross Annual Sediment Yield	18.48	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0090	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0081	acre-feet/acre/year
Watershed Area	756	acres
Watershed Annual Sediment Yield	6.14	acre-feet/year
Number of years	1	years
Calculated Sediment Volume	6.14	acre-feet

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APPENDIX B

SEDCAD4 (Input and Output)

General 6-Hour PMP Calculation

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PEABODY WESTERN
KAYENTA MINE
POND N7-D

General 6 Hour PMP

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DJK

Montgomery Watson
165 S. Union Blvd.
Suite 410
Lakewood, Co. 80228

Phone: 303 763-5140

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100000 yr - 6 hr
Rainfall Depth:	5.960 inches

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	756.000	756.000	2,945.21	248.87

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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	756.000	0.440	0.000	0.000	82.000	F	2,945.21	248.871
	$\sum$	**756.000**						**2,945.21**	**248.871**

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APPENDIX C

Water Persistence

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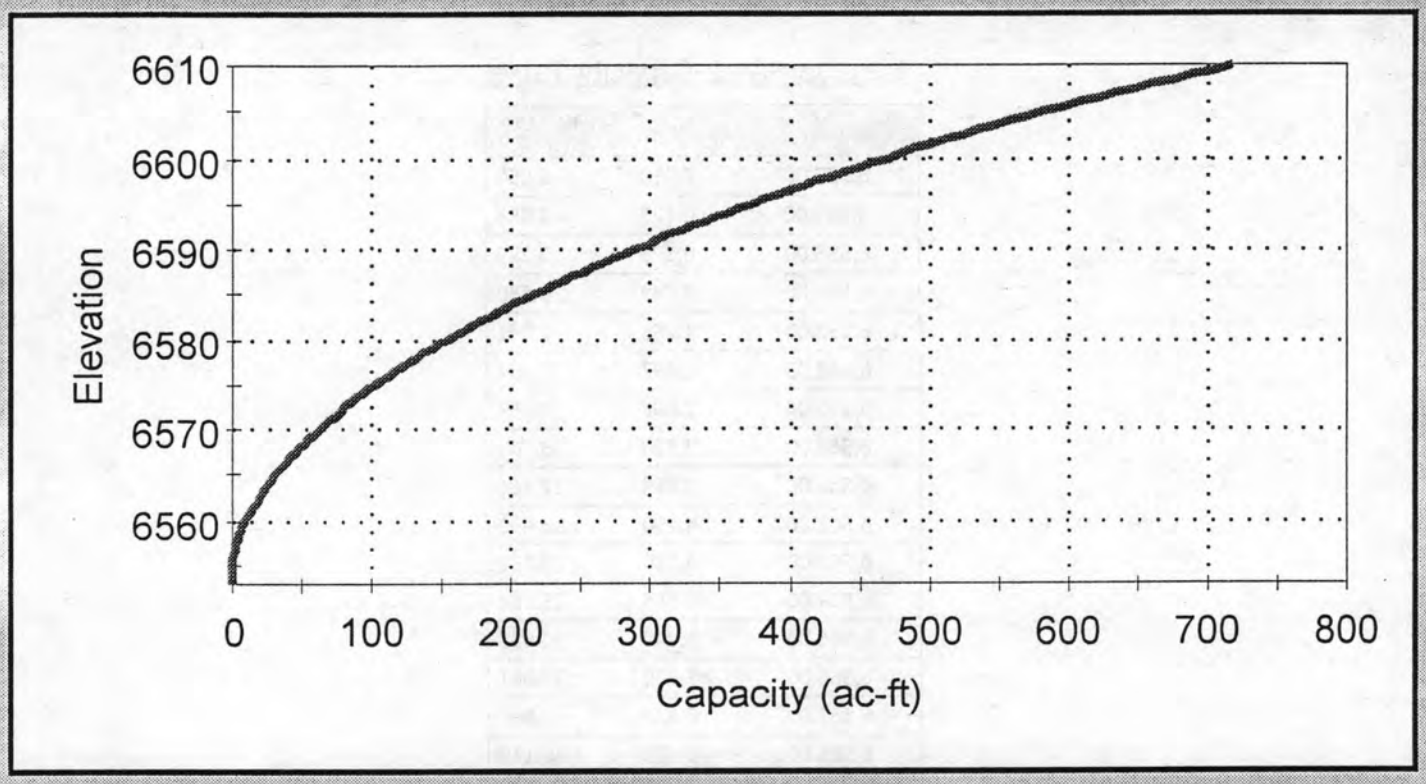
PERMANENT IMPOUNDMENT N7-D



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Elevation-Area-Capacity Table

Elevation	Area (ac)	Capacity (ac-ft)
6,553.00	0.010	0.000
6,554.00	0.128	0.058
6,555.00	0.375	0.299
6,556.00	0.749	0.850
6,557.00	1.255	1.841
6,558.00	1.892	3.404
6,559.00	2.657	5.668
6,560.00	3.550	8.761
6,561.00	3.864	12.466
6,562.00	4.190	16.492
6,563.00	4.530	20.852
6,564.00	4.884	25.558
6,565.00	5.249	30.623
6,566.00	5.630	36.061
6,567.00	6.022	41.886
6,568.00	6.428	48.110
6,569.00	6.848	54.747
6,570.00	7.280	61.810
6,571.00	7.644	69.272
6,572.00	8.017	77.102
6,573.00	8.399	85.309
6,574.00	8.790	93.903
6,575.00	9.189	102.892
6,576.00	9.598	112.284
6,577.00	10.015	122.090
6,578.00	10.441	132.317
6,579.00	10.876	142.976
6,580.00	11.320	154.073
6,581.00	11.719	165.592
6,582.00	12.125	177.514
6,583.00	12.538	189.844
6,584.00	12.957	202.591
6,585.00	13.384	215.761
6,586.00	13.817	229.361
6,587.00	14.258	243.398
6,588.00	14.705	257.879
6,589.00	15.159	272.810
6,590.00	15.620	288.200
6,591.00	16.106	304.062
6,592.00	16.599	320.414

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Elevation	Area (ac)	Capacity (ac-ft)
6,593.00	17.099	337.262
6,594.00	17.607	354.615
6,595.00	18.122	372.479
6,596.00	18.645	390.862
6,597.00	19.175	409.771
6,598.00	19.713	429.214
6,599.00	20.258	449.199
6,600.00	20.810	469.733
6,601.00	21.576	490.924
6,602.00	22.354	512.888
6,603.00	23.146	535.637
6,604.00	23.953	559.185
6,605.00	24.772	583.547
6,606.00	25.607	608.736
6,607.00	26.454	634.765
6,608.00	27.316	661.649
6,609.00	28.192	689.402
6,610.00	29.080	718.037

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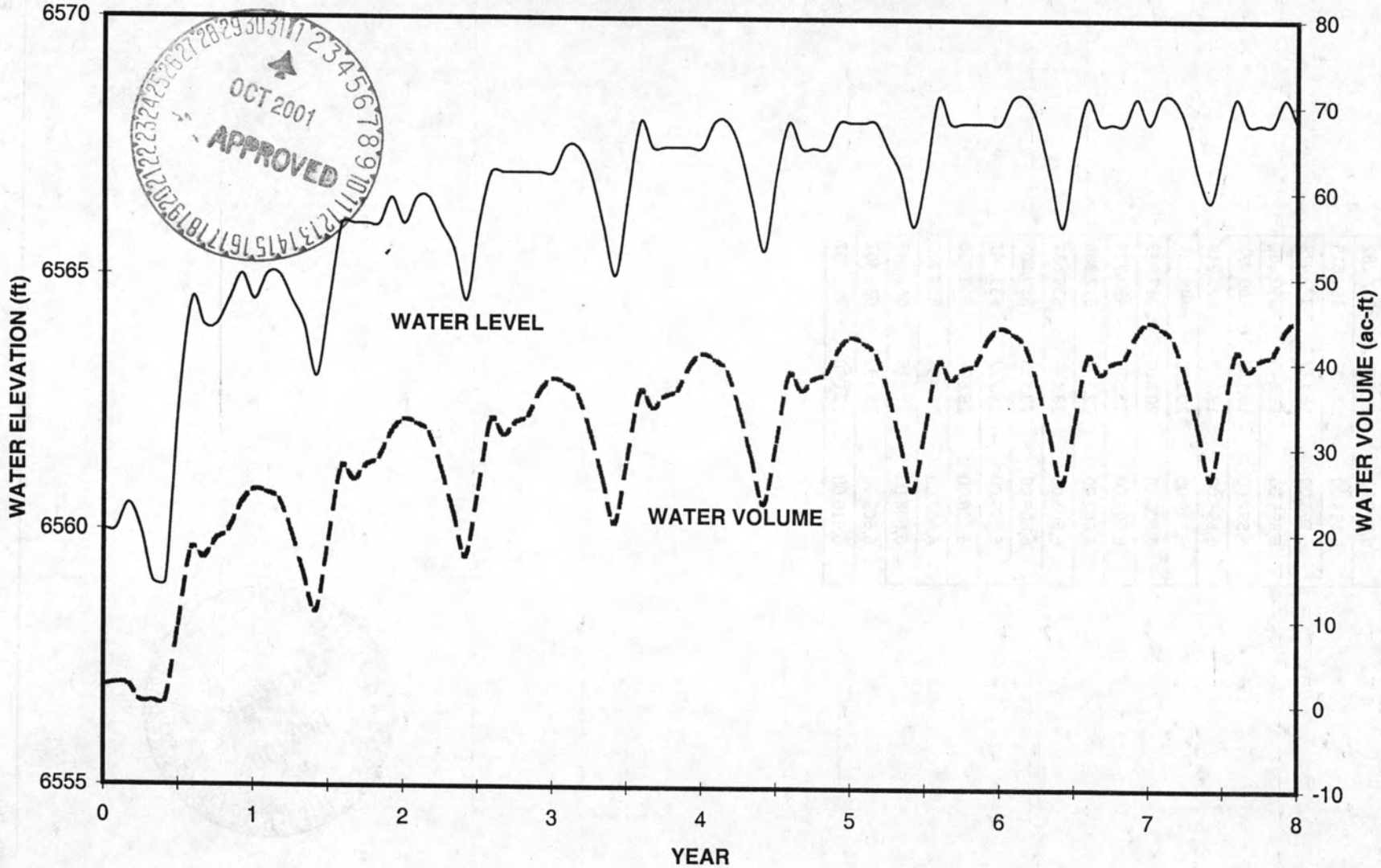
N7D PERMANENT IMPOUNDMENT
WATER PERSISTENCE EVALUATION



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PEABODY WESTERN COAL COMPANY
N7D PERMANENT IMPOUNDMENT POND WATER PERSISTEN

0

0

	January	February	March	April	May	June	July	August	September	October
Average Precipitation (inch)	0.95	0.86	0.89	0.58	0.45	0.46	1.49	1.49	0.95	1.09
Area (acres)	756.0	756.0	756.0	756.0	756.0	756.0	756.0	756.0	756.0	756.0
Curve Number	77	77	77	77	77	77	77	77	77	77
S	2.99	2.99	2.99	2.99	2.99	2.99	2.99	2.99	2.99	2.99
Run-Off (inches)	0.04	0.02	0.03	0.00	0.00	0.00	0.21	0.21	0.04	0.07
Run-Off (ac-ft)	2.35	1.34	1.64	0.00	0.00	0.00	12.94	12.94	2.35	4.39
Starting Pond Volume (ac-ft)	0	1.78	2.05	1.92	0.00	0.00	0.00	8.89	17.78	16.80
Pond Volume + Runoff (ac-ft)	2.35	3.11	3.70	1.92	0.00	0.00	12.94	21.83	20.12	21.19
Water Elevation (ft)	6560	6560	6560.5	6560	6559	6559	6562.5	6564.5	6564	6564
Water Surface Area (acres)	3.55	3.55	3.72	3.55	0.00	0.00	4.41	5.10	4.93	4.93
Evaporation Rate (inches/month)	0.87	2.63	4.68	7.38	10.54	10.77	9.95	8.49	7.08	4.68
Evaporation (ac-ft)	0.26	0.78	1.45	2.18	0.00	0.00	3.66	3.61	2.91	1.92
Infiltration Rate (inches/month)	1.054	0.952	1.054	1.02	1.054	1.02	1.054	1.054	1.02	1.054
Infiltration (ac-ft)	0.31	0.28	0.33	0.30	0.00	0.00	0.39	0.45	0.42	0.43
Total Water Loss (ac-ft)	0.57	1.06	1.78	2.49	0.00	0.00	4.04	4.05	3.33	2.35
Total Water Change (ac-ft)	1.78	0.28	-0.13	-2.49	0.00	0.00	8.89	8.88	-0.98	2.04
Ending Pond Volume	1.78	2.05	1.92	0.00	0.00	0.00	8.89	17.78	16.80	18.84

Notes:

1) Run-off volumes based on SCS Runoff Curve Number method: Q = (P-0.2S)^2/(P+0.8S)

P= Accumulative Precipitation
S= (1000/CN)-10

2) Evaporation and infiltration rates based on data presented in the report entitled " Hydrologic and Engineering Studies at the Peabody

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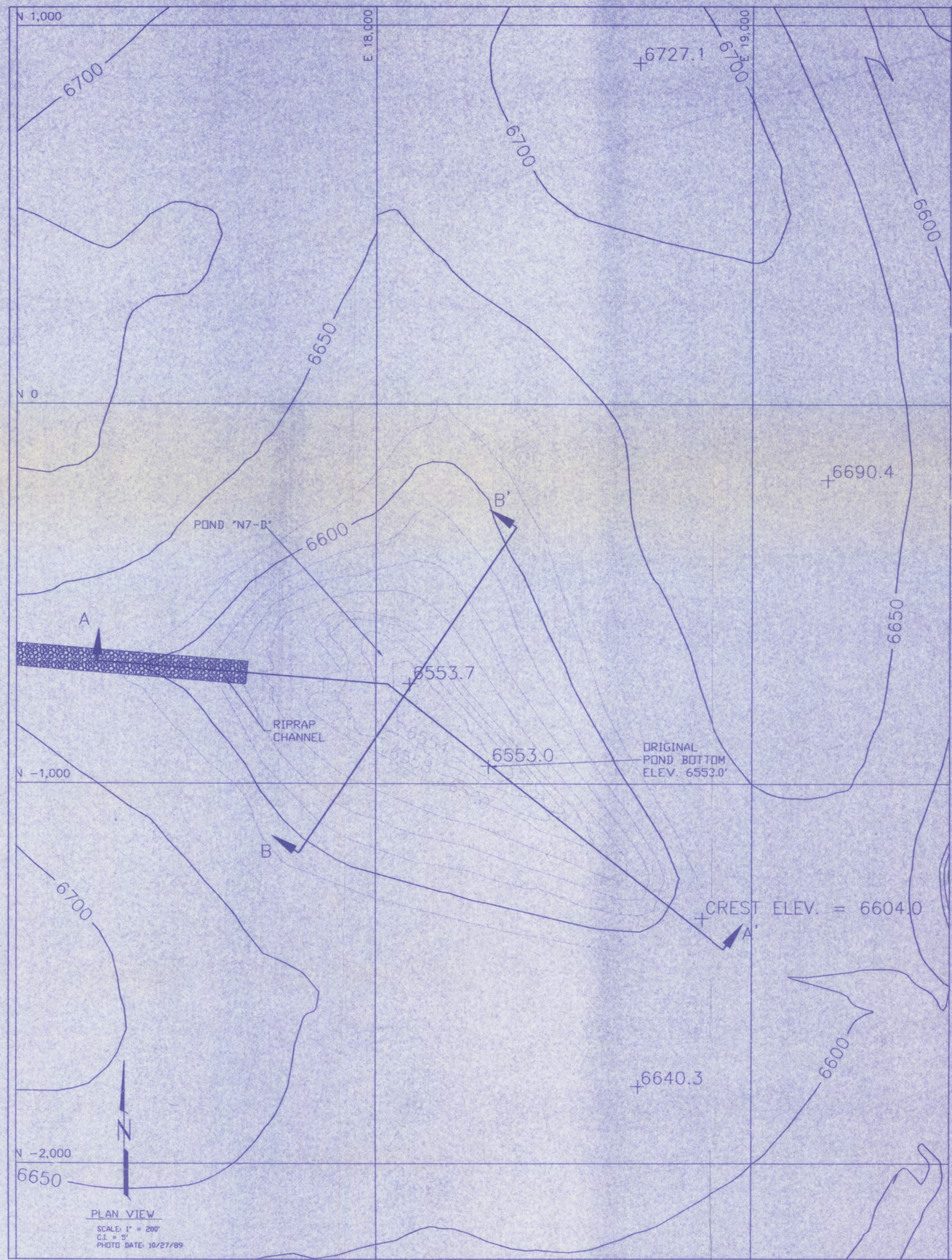
12/21/00

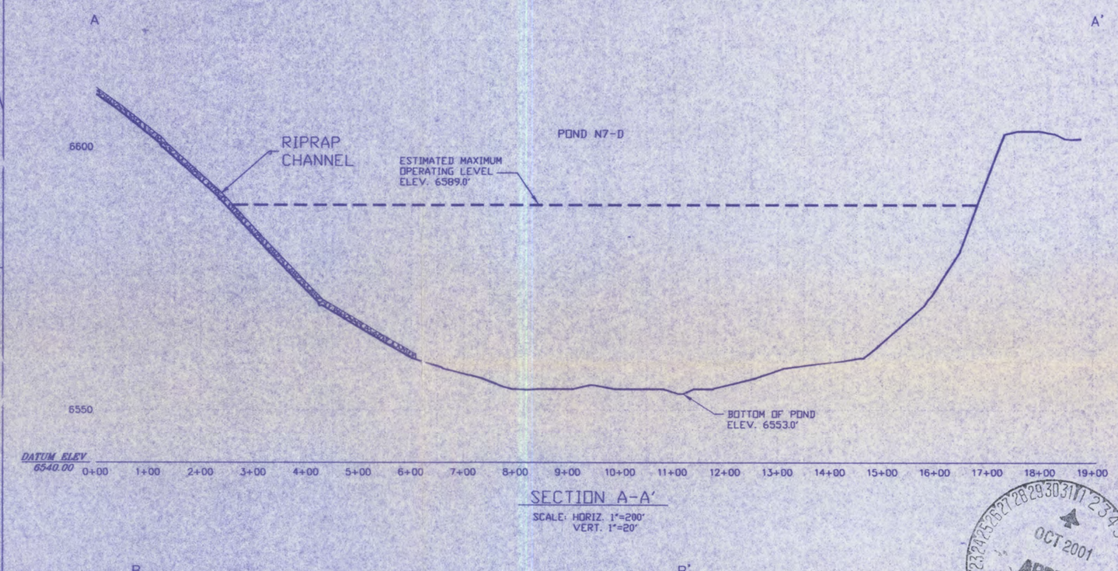


PLAN VIEW

SCALE: 1" = 200'
C.I. = 5'
PHOTO DATE: 10/27/89

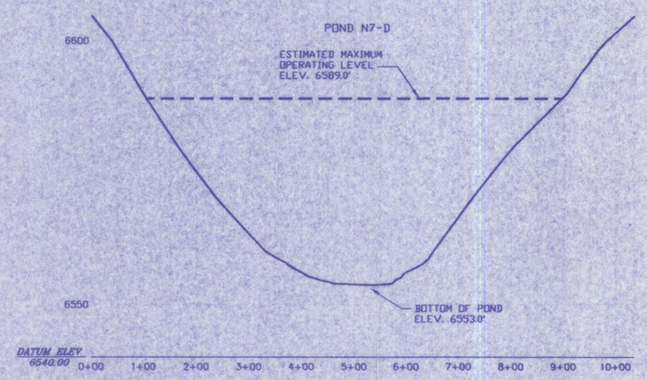
N7-D POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6553.0	0.0	0.01	0.00	BOTTOM OF POND
6560.0	7.0	3.55	8.76	
6570.0	17.0	7.28	61.81	
6580.0	27.0	11.32	154.07	
6590.0	37.0	15.62	288.20	
6600.0	47.0	20.81	469.73	
6604.0	51.0	23.95	559.19	CREST OF INCISED POND



SECTION A-A'

SCALE: HORIZ. 1"=200'
VERT. 1"=20'



SECTION B-B'

SCALE: HORIZ. 1"=200'
VERT. 1"=20'

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Registered Professional Engineer (Civil) CERTIFICATE NO. 18782 ARIZONA, U.S.A.

ENGINEER'S CERTIFICATION

I HEREBY CERTIFY THAT THE ENGINEERING & RECLAMATION MANAGER PEABODY WESTERN COAL COMPANY

ARIZONA P.E. 18782

DATE AUG 10 2001

NOTES:
1) General location, see Drawing No. 85400, Sheet K-7 and Drawing No. 85405.
2) See Chapter 6, Kayenta PAP for Construction Specifications.
3) See Vol. 2, Chapter 6, Attachment B, Sections 1-3 for description of Geotechnical Evaluation.
4) Salvage topsoil in accordance with approved topsoil salvage plan.
5) Reclamation of the disturbed area above the high waterline shall be in accordance with the approved reclamation plan.
6) Ponding area side slopes, typical 4:1 slope or flatter and blend into natural topography.
7) Detailed pond topo taken from pond N7-D as-built 08/30/98.

REVISIONS

DATE	CHK'D	DESCRIPTION

EXHIBIT #1
N7-D
PERMANENT IMPOUNDMENT DESIGN

KAYENTA MINE
PEABODY WESTERN COAL COMPANY
P. O. BOX 650 KAYENTA, ARIZONA 86033

DESIGNED BY: DK	SCALE: 1"=200'
DRAWN BY: TH	DRAWING DATE: 08-05-01
CHECKED BY: DK	PHOTO DATE: 04-21-99
CONTOUR INT.: 5'	DWG FILE: N7-D.DWG