DESIGN REPORT

Temporary Sedimentation Structure

J21-G1

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

MAY 1998
APPROVED

Registered Professional Engineer (Civil)
CERTIFICATE NO.
18792
JAMES GARY
SCHLENVOGT
Date Signed
ARIZONA, U.S.A.

FEB 20 1998

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EXHIBIT #1 J21-G1 Temporary Proposed Sedimentation Pond

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INTRODUCTION

Sedimentation Structure J21-G1 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 J21 disturbed surface mining area at the Kayenta Mine. The location of Structure J21-G1 and its watershed boundary are shown on Drawing No. 85400 (Sheet N-11) 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 J21-G1, which is in series with sedimentation structure J21-G. 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 J21-G1 was inspected in August, 1997 by a Registered Professional Engineer from Peabody Western Coal Company, to assure that the site is suitable and no adverse conditions exist to prevent the successful construction of this 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

The J21-G1 and J21-G Structures have a combined watershed of 269.2 acres and are located on a tributary upstream of Dinnebito Wash at the Kayenta Mine. The 137.6 acres watershed, which contributes directly to structure J21-G1 is classified as 69% spoil, 14% undisturbed, and 17%, disturbed.

DESIGN ANALYSES

GENERAL

Structure J21-G1 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 1992 for Peabody Western Coal Company and was used in the analyses of the structure.

STABILITY

Structure J21-G1 is assumed to be a Category A-3 embankment. The embankment category will be reevaluated during construction under the supervision of a Register Professional Engineer and Table 3-6, Attachment D, Chapter 6 will be utilized as the guidance to construct stable embankment slopes. 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) or flatter slope and a downstream slope of 3.5:1 or flatter slope is assumed. Based on the total embankment height of approximately 15 feet, these slopes are equal to or 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 30-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 J21-G1 will be constructed in series with proposed downstream Structure J21-G. Structure J21-G1 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 floodplain. The structure will impound less than 20 acre-feet and be less than 20 vertical feet in height from the upstream toe of the embankment of the natural stream elevation to the emergency spillway invert elevation. The two 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 event. Structures J21-G1 and J21-G were conservatively assumed to be full to the emergency spillway at the time of 100-year storm event. The storage capacity of structure J21-G1 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 into the Dinnebito Wash.

The following parameters were used in the hydrologic analysis (see Appendix B and C):

		J21-G1
1.	Water Course length, L	0.432 mi.
2.	Elevation Difference, H	180 ft
3.	Time of Concentration, T_c	0.133 hr
4.	SCS Curve Number	86
5.	Rainfall Depth, 10-year, 24-hour storm	2.1 in
	100-year, 6-hour storm	2.4 in
6.	Drainage Area	137.6 acres

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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 Appendices A, B, and C).

J21-G1 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	123.2	221.3
Volume	ac-ft	10.6	13.3
Storage			
Peak Stage	msl	N/A	6948.6
Emerg. Spillway Elev.	msl	6947.0	6947.0
Peak Storage	ac-ft	N/A	23.9
Storage Capacity	ac-ft	19.62	19.62
Outflow			
Peak Flow	cfs	N/A	146.2
Spillway Elevation	msl	6947.0	6947.0
Embankment Crest Elev.	msl	6950	6950
Peak Stage	msl	--	6948.6
Freeboard	ft	--	1.4
Emergency Spillway Channel			
Flow Depth	ft	--	1.6
Critical Velocity	fps	--	5.1
Mannings "n"	--	--	.031
Width	ft	--	30
Outflow Channel			
Slope	%	--	25
Normal Velocity	fps	--	8.1
Normal Depth	ft	--	0.6
Mannings "n"	--	--	.061
Riprap D_{50}	in	--	6

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for J21-G1 will be a trapezoidal channel with dimensions listed below. The alignment and dimensions are shown on Exhibit 1.

Minimum Channel Depth	(Spillway)	3.0	ft
	(Outflow)	2.0	ft
Channel Width		30	ft
Channel Length	(Spillway)	40	ft
	(Outflow)	250	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25.0	%
Spillway Elevation		6947.0	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 J21-G1 is designed to contain approximately 19.62 acre-feet.

The calculations for the sediment load entering structure J21-G1 were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.15
3.	Slope Factor, LS	4.28
4.	Cover Factor, C	0.89
5.	Erosion Control Factor, P	0.86

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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 J21-G1 does not have sufficient storage to contain the 10-year, 24-hour storm by itself; however, in series with structure J21-G the cumulative storage capacity of the two ponds is adequate. The combined sediment storage capacity was determined for the two structures in series and the results of the analysis are presented in the following table.

Combined Storage for Structures J21-G1 and J21-G

	J21-G1	J21-G	Combined
Total Storage Capacity	19.62	19.30	38.92 acre-ft
10-Year, 24-Hour Storm Inflow	10.61	6.38	16.99 acre-ft
Available Sediment Storage Capacity	--	--	21.93 acre-ft
Sediment Inflow Rate/Year	1.23	1.45	2.68 acre-ft
Sediment Storage Life	--	--	8.2 years

* * *

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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	- J21-G1 Temporary Proposed Sedimentation Pond

APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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CALCULATED HYDROLOGIC DATA

PROJECT: J21 AREA

STRUCTURE: J21-G1

TIME OF CONCENTRATION:

Start Elevation (ft) =	7120
End Elevation (ft) =	6940
Elevation Difference, E (ft) =	180
Watercourse Length (ft) =	2280
Watercourse Length, L (mi) =	0.432
Tc = (11.9L^3/E)^0.385 =	0.133 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
Sagebrush-Grass	C	73	4.2	306.6
Pinyon Juniper	C	78	15	1170
Disturbed	C	91	22.7	2065.7
Spoil	B	86	95.7	8230.2
TOTAL:			137.6	11772.5

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

DRAINAGE BASIN AREA:

137.6 Acres

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CALCULATED SEDIMENTOLOGY DATA

PROJECT: J21-G1 Pond

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area (acres)	K*Area
Spoil	0.12	95.7	11.48
Disturbed	0.22	22.7	4.99
36	0.39	0	0.00
20	0.25	19.2	4.80
TOTAL:		137.6	21.28

Weighted K = Total K*Area/ Total Area = 0.15

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
500	60	12.0%	0.6	6.8	4.78
400	40	10.0%	0.5	5.7	2.75
600	50	8.3%	0.5	4.8	2.66
400	30	7.5%	0.5	4.3	1.97
300	30	10.0%	0.5	5.7	2.38
400	50	12.5%	0.6	7.1	4.41
400	110	27.5%	0.6	15.4	11.01

Average LS = 4.28

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*

COVER AND PRACTICE FACTORS:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C*Area	Practice Factor, P	P*Area
Sagebrush-Grass	20%	25%	4.2	0.20	0.84	1.00	4.20
Pinyon Juniper	20%	25%	15	0.22	3.30	1.00	15.00
Disturbed	0%	0%	22.7	1.00	22.70	1.00	22.70
Spoil	0%	0%	95.7	1.00	95.70	0.80	76.56
TOTAL:			137.6		122.54		118.46

Weighted C = Total C*Area/ Total Area = 0.891

Weighted P = Total P*Area/ Total Area = 0.861

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RAINFALL FACTOR:

R = 40

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CALCULATED SEDIMENT YIELD

PROJECT: J21-G1 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	0.15	
Length Slope Factor	4.28	
Cover Factor	0.89	
Practice Factor	0.86	
Gross Annual Sediment Yield	20.30	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0099	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0089	acre-feet/acre/year
Watershed Area	137.6	acres
Watershed Annual Sediment Yield	1.23	acre-feet/year
Number of years	1	years
Calculated Sediment Volume	1.23	acre-feet

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SEDCAD+ RIPRAP CHANNEL DESIGN

J21-G1 SPILLWAY

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	146.20 cfs	
Slope	25.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	30.00 feet	
Freeboard	None	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.57 ft
with Freeboard	0.00 ft
Top Width	33.42 ft
with Freeboard	30.00 ft
Velocity	8.08 fps
Cross Sectional Area	18.09 sq ft
Hydraulic Radius	0.54 ft
Manning's n	0.061
Froude Number	1.94
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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J21-G1 Spillway
Worksheet for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	J21-G1 Spillway
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.031	
Channel Slope	0.015175	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	30.00	ft
Discharge	146.20	cfs

Results		
Depth	0.88	ft
Flow Area	28.61	ft²
Wetted Perimeter	35.55	ft
Top Width	35.26	ft
Critical Depth	0.88	ft
Critical Slope	0.015176	ft/ft
Velocity	5.11	ft/s
Velocity Head	0.41	ft
Specific Energy	1.28	ft
Froude Number	1.00	
Flow is subcritical.		

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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

PEABODY WESTERN COAL COMPANY : POND G1 & G (10 YEAR, 24-HR)

by

Name: D. GLEASON

Company Name: ACZ, INC.
File Name: J:\861\0400\SEDCAD\J21G

Date: 02-04-1998

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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: J:\861\0400\SEDCAD\J21G User: D. GLEASON
Date: 02-04-1998 Time: 10:05:47
PEABODY WESTERN COAL COMPANY : POND G1 & G (10 YEAR, 24-HR)
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	137.60	86	F	0.133	0.000	0.000	0.0	10.61	123.21
		Type: Pond			Label: J21-G1 POND					
111	Structure	137.60							10.61	
111	Total IN	137.60							10.61	123.21
111	Total OUT								10.61	72.76
112	1	131.60	79	F	0.200	0.000	0.000	0.0	6.38	68.70
		Type: Pond			Label: J21-G POND					
112	Structure	131.60							16.99	
112	Total IN	269.20							16.99	136.34
112	Total OUT								16.99	71.88
111 to 112 Routing						0.005	0.424			

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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

PEABODY WESTERN COAL COMPANY : POND G1 & G (100 YEAR, 6-HR)

by

Name: D. GLEASON

Company Name: ACZ, INC.
File Name: J:\861\0400\SEDCAD\J21G10

Date: 02-03-1998

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Company Name: ACZ, INC.
Filename: J:\861\0400\SEDCAD\J21G10 User: D. GLEASON
Date: 02-03-1998 Time: 09:47:21
PEABODY WESTERN COAL COMPANY : POND G1 & G (100 YEAR, 6-HR)
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	201.00	10.00	9.49	0.01	0.005	0.424

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Company Name: ACZ, INC.
Filename: J:\861\0400\SEDCAD\J21G10 User: D. GLEASON
Date: 02-03-1998 Time: 09:47:21
PEABODY WESTERN COAL COMPANY : POND G1 & G (100 YEAR, 6-HR)
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	137.60	86	F	0.133	0.000	0.000	0.0	13.33	221.31
		Type: Pond			Label: J21-G1 POND					
111	Structure	137.60							13.33	
111	Total IN	137.60							13.33	221.31
111	Total OUT								13.33	146.20
112	1	131.60	79	F	0.200	0.000	0.000	0.0	8.46	134.70
		Type: Pond			Label: J21-G POND					
112	Structure	131.60							21.78	
112	Total IN	269.20							21.78	259.79
112	Total OUT								21.79	160.76
111 to 112 Routing						0.005	0.424			

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Company Name: ACZ, INC.
Filename: J:\861\0400\SEDCAD\J21G10 User: D. GLEASON
Date: 02-03-1998 Time: 09:47:21
PEABODY WESTERN COAL COMPANY : POND G1 & G (100 YEAR, 6-HR)
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

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

J1, B1, S1
J21-G1 POND

Drainage Area from J1, B1, S1, SWS(s)1: 137.6 acres
Total Contributing Drainage Area: 137.6 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	6947.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	30.0

POND RESULTS:

Permanent Pool (ac-ft)
19.6

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	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	13.33	221.31
OUT	13.33	146.20

Peak Elevation	Hydrograph Detention Time (hrs)
6948.6	0.00

****

J1, B1, S2
J21-G POND

Drainage Area from J1, B1, S2, SWS(s)1: 131.6 acres
Total Contributing Drainage Area: 269.2 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	6864.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	30.0

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POND RESULTS:

Permanent Pool (ac-ft)

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=========
    19.3

              Runoff     Peak
              Volume   Discharge
              (ac-ft)    (cfs)
          ========================
           IN      21.78    259.79
           OUT     21.79    160.76

     Peak          Hydrograph
  Elevation     Detention Time
                     (hrs)
          ==========================
           6865.6          0.20
```

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Company Name: ACZ, INC.
Filename: J:\861\0400\SEDCAD\J21G10 User: D. GLEASON
Date: 02-03-1998 Time: 09:47:21
PEABODY WESTERN COAL COMPANY : POND G1 & G (100 YEAR, 6-HR)
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
J21-G1 POND

Drainage Area from J1, B1, S1, SWS(s)1: 137.6 acres
Total Contributing Drainage Area: 137.6 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6935.00	0.00	0.88	0.00	0.00	
6936.00	1.00	0.99	0.93	0.00	
6937.00	2.00	1.10	1.97	0.00	
6938.00	3.00	1.22	3.13	0.00	
6939.00	4.00	1.34	4.41	0.00	
6940.00	5.00	1.47	5.81	0.00	
6941.00	6.00	1.60	7.35	0.00	
6942.00	7.00	1.74	9.02	0.00	
6943.00	8.00	1.88	10.83	0.00	
6944.00	9.00	2.03	12.78	0.00	
6945.00	10.00	2.18	14.88	0.00	
6946.00	11.00	2.37	17.16	0.00	
6947.00	12.00	2.57	19.62	0.00	Stage of SW#1
6947.70	12.70	2.71	21.47	30.80	
6947.80	12.80	2.73	21.74	40.29	
6947.90	12.90	2.75	22.02	50.68	
6948.00	13.00	2.77	22.30	61.92	
6948.50	13.50	2.88	23.71	136.90	
6948.55	13.55	2.89	23.86	146.20	Peak Stage
6949.00	14.00	2.99	25.18	229.05	
6949.50	14.50	3.10	26.70	334.84	
6950.00	15.00	3.21	28.28	472.05	

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J1, B1, S2
J21-G POND

Drainage Area from J1, B1, S2, SWS(s)1: 131.6 acres
Total Contributing Drainage Area: 269.2 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)

6857.00	0.00	2.19	0.00	0.00	
6858.00	1.00	2.35	2.27	0.00	
6859.00	2.00	2.51	4.70	0.00	
6860.00	3.00	2.68	7.29	0.00	
6861.00	4.00	2.84	10.05	0.00	
6862.00	5.00	3.00	12.97	0.00	
6863.00	6.00	3.16	16.05	0.00	
6864.00	7.00	3.33	19.30	0.00	Stage of SW#1
6864.70	7.70	3.41	21.66	30.80	
6864.80	7.80	3.43	22.00	40.29	
6864.90	7.90	3.44	22.34	50.68	
6865.00	8.00	3.45	22.69	61.92	
6865.50	8.50	3.54	24.43	136.90	
6865.63	8.63	3.56	24.90	160.76	Peak Stage
6866.00	9.00	3.62	26.22	229.05	
6866.50	9.50	3.70	28.05	334.84	
6867.00	10.00	3.79	29.93	472.05	
6867.50	10.50	3.88	31.84	629.82	
6868.00	11.00	3.97	33.81	819.57	

****

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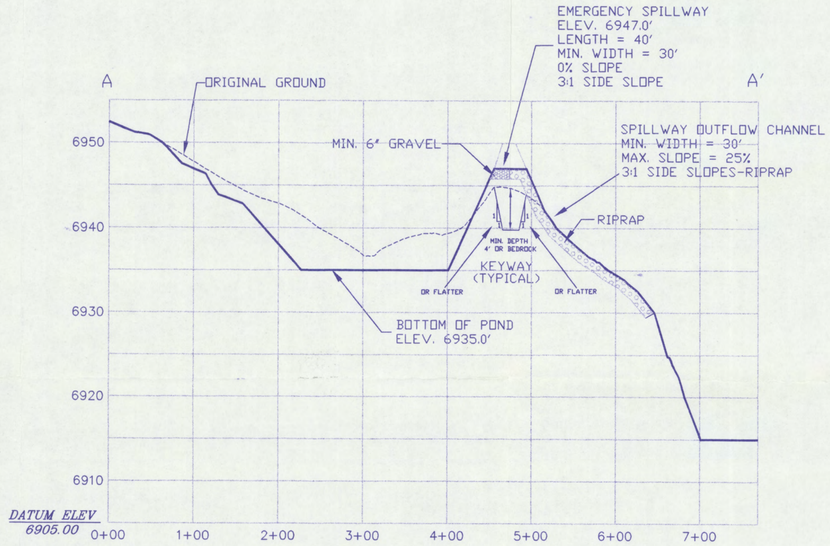
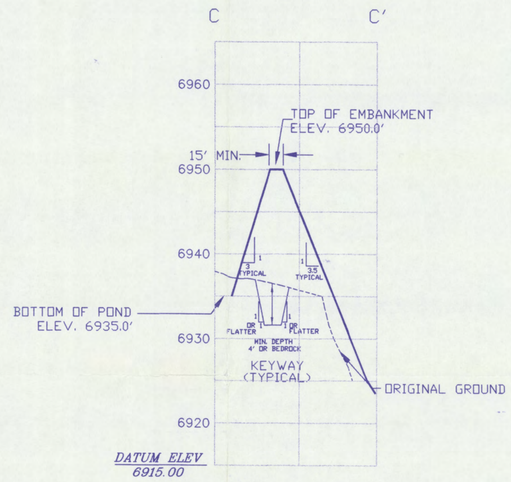
J21-G1 POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6935	0.00	0.88	0.00	0.00	BOTTOM OF POND
6936	1.00	0.99	0.93	0.93	
6937	2.00	1.10	1.04	1.97	
6938	3.00	1.22	1.16	3.13	
6939	4.00	1.34	1.28	4.41	
6940	5.00	1.47	1.40	5.81	
6941	6.00	1.60	1.53	7.35	
6942	7.00	1.74	1.67	9.02	
6943	8.00	1.88	1.81	10.83	
6944	9.00	2.03	1.95	12.78	
6945	10.00	2.18	2.10	14.88	
6946	11.00	2.37	2.27	17.16	
6947	12.00	2.57	2.47	19.62	EMERGENCY SPILLWAY
6948	13.00	2.77	2.67	22.30	
6949	14.00	2.99	2.88	25.18	
6950	15.00	3.21	3.11	28.28	TOP OF EMBANKMENT



SECTION A - A'

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



SECTION C - C'

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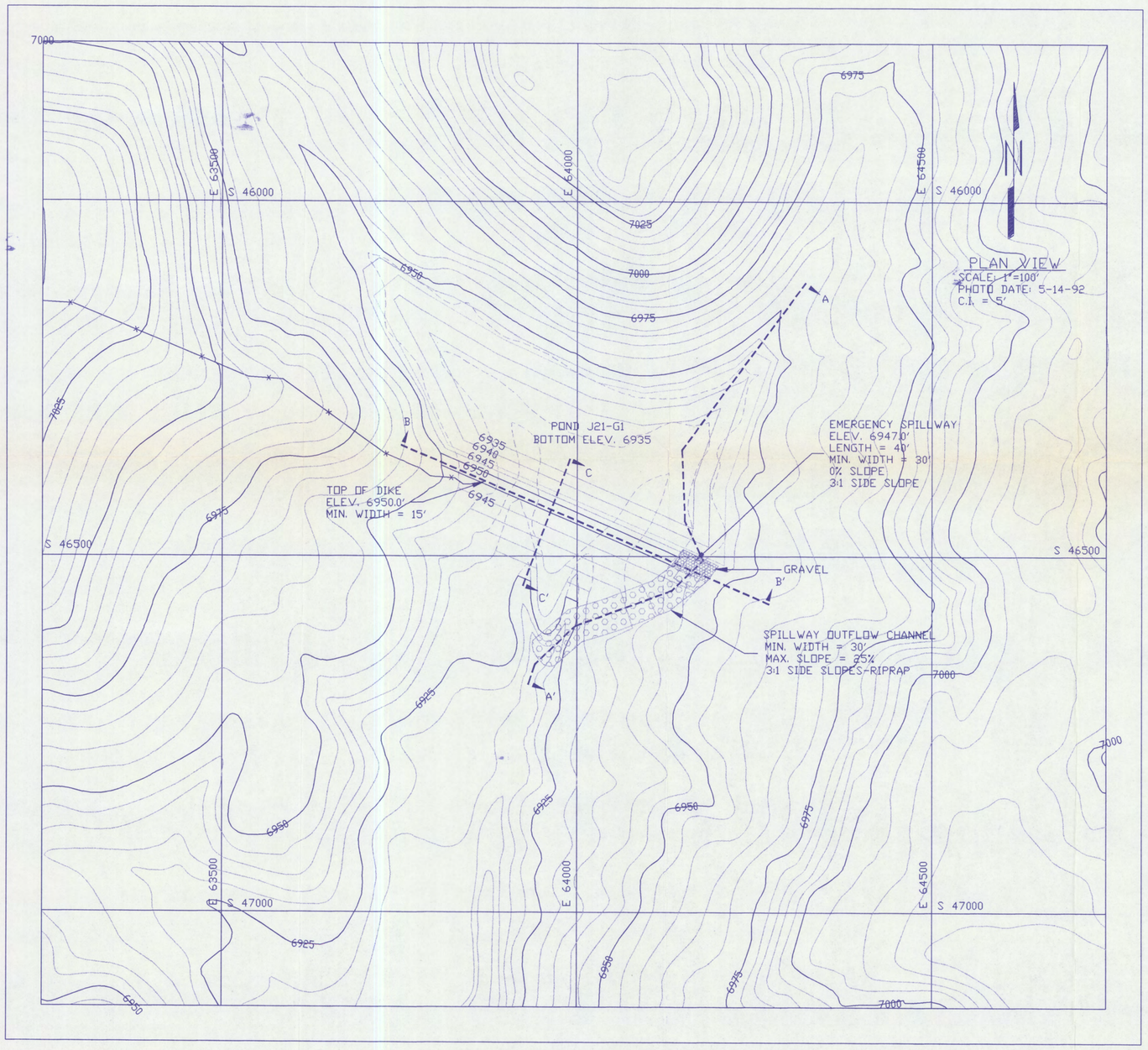
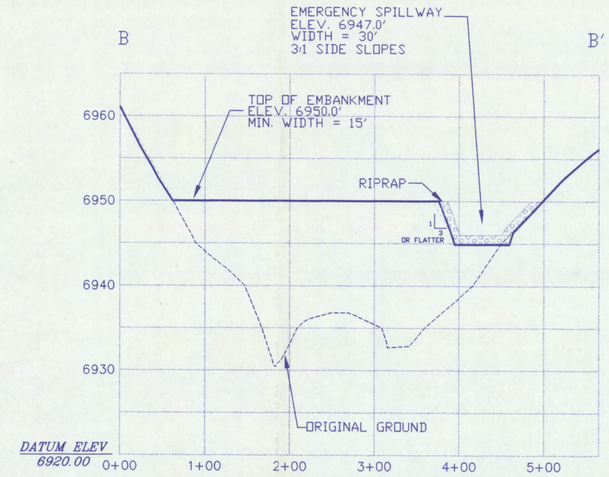
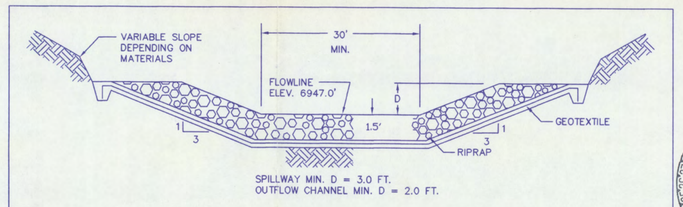
VERT. 1"=10'





SECTION B - B"

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



PROPOSED J21-G1 POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)

MAY 1998
APPROVED

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

ENGINEER'S CERTIFICATION

JAMES G. SCHENDEL
Engineer
Peabody Western Coal Company

ARIZONA P.E. 18782

Date FEB 20 1998

NOTES:
1) General location, see Drawing No. 85400, Sheet N-11 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 disturbed 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 # 1
J21-G1 TEMPORARY
PROPOSED SEDIMENTATION POND

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

DESIGNED BY: PWCC	SCALE: 1"=100'
DRAWN BY: PWCC	DRAWING DATE: 9-15-95
CHECKED BY: JGS	PHOTO DATE: 5-14-92
CONTOUR INTERVAL: 5 FT.	DWG FILE: J21-G.DWG

DESIGN REPORT

Temporary Sedimentation Structure

J21-H

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

OCT 2000 APPROVED

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

James G. Schlenvogt

AUG 18 2000

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APPENDIX B -SEDCAD4 (Input and Output) 10-Year, 24-Hour Storm Event
APPENDIX C -SEDCAD4 (Input and Output) 100-Year, 6-Hour Storm Event
EXHIBIT #1 -J21-H1 and J21-H Proposed Sedimentation Ponds

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INTRODUCTION

Sedimentation Structure J21-H 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 J21 disturbed surface mining area at the Kayenta Mine. The location of Structure J21-H and its watershed boundary are shown on Drawing No. 85400 (Sheet M-11) 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 J21-H that is in series with sedimentation structure J21-H1. J21-H is the downstream pond in the series. 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 J21-H was inspected in January 2000 by a Registered Professional Engineer from Peabody Western Coal Company, to assure that the site is suitable and no adverse conditions exist to prevent the successful construction of this 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

The J21-H and J21-H1 Structures have a combined watershed of 235.5 acres and are located on a tributary upstream of Dinnebito Wash at the Kayenta Mine. The 104-acre watershed, which contributes directly to structure J21-H is classified as 50% undisturbed, 28% spoil and 22% disturbed.

DESIGN ANALYSES

GENERAL

Structure J21-H 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 1999 for Peabody Western Coal Company and was used in the analyses of the structure.

STABILITY

Structure J21-H is assumed to be a Category A-3 embankment. The structure will be a homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 15 feet wide on top. An upstream minimum slope of 2H:1V or flatter slope and downstream minimum slope of 3.25H:1V or flatter slope were assumed. Based on the total embankment height of approximately 12 feet, these slopes are equal to or 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 15-foot wide, riprap-lined, trapezoidal channel.

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HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD4 (see Appendices A, B, and C). Structure J21-H will be constructed in series with proposed Structure J21-H1. J21-H is located down-gradient of J21-H1. Structure J21-H 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 floodplain. The structure will impound less than 20 acre-feet and be less than 20 vertical feet in height from the upstream toe of the embankment of the natural stream elevation to the emergency spillway invert elevation. The two structures have a combined capacity greater than 20 acre-feet; therefore, the spillway for J21-H was analyzed using the 100-year, 6-hour storm event in lieu of the 25-year, 6-hour storm event. Structures J21-H and J21-H1 were conservatively assumed to be full to the emergency spillway at the time of 100-year storm event. The storage capacity of structure J21-H 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 into the Dinnebito Wash.

The following parameters were used in the hydrologic analysis (see Appendix B & C):

		J21-H
1.	Water Course length, L	0.632 mi.
2.	Elevation Difference, H	211 ft
3.	Time of Concentration, T_c	0.195 hr
4.	SCS Curve Number	82
5.	Rainfall Depth, 10-year, 24-hour storm	2.1 in
	100-year, 6-hour storm	2.4 in
6.	Drainage Area	104.0 acres

Values reported represent the watershed, which drains directly to Pond J21-H. Hydrologic input parameters for upstream structure J21-H1 is presented in the Design Report for J21-H1.

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Muskingum routing parameters were utilized to route the 100-year hydrographs between the J21-H and J21-H1 structures. The routing parameters are presented in Appendices B and C, and are shown on a sub-watershed basis.

HYDRAULICS

The SEDCAD4 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 Appendices A, B, and C).

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J21-H 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	65.6	176.6
Volume	ac-ft	6.2	8.0
Storage			
Peak Stage	msl	N/A	6878.8
Emerg. Spillway Elev.	msl	6877.0	6877.0
Peak Storage	ac-ft	N/A	23.1
Storage Capacity	ac-ft	18.0	18.0
Outflow			
Peak Flow	cfs	N/A	100.3
Spillway Elevation	msl	6877.0	6877.0
Embankment Crest Elev.	msl	6880	6880
Peak Stage	msl	--	6878.7
Freeboard	ft	--	1.3
Emergency Spillway Channel			
Flow Depth	ft	--	1.7
Critical Velocity	fps	--	5.3
Mannings "n"	--	--	.03
Width	ft	--	15
Outflow Channel			
Slope	%	--	4 24 33
Normal Velocity	fps	--	6.4 9.0 9.0
Normal Depth	ft	--	1.9 1.7 1.7
Mannings "n"	--	--	0.039 0.057 0.066
Riprap D_{50}	in	--	3 6 9

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for J21-H will be a trapezoidal channel with dimensions listed below. The alignment and dimensions are shown on Exhibit 1.

Minimum Channel Depth	(Spillway)	2.8	ft
	(Outflow)	2.7	ft
Channel Width		15	ft
Channel Length	(Spillway)	28	ft
	(Outflow)	170	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	33	%
Spillway Elevation		6877.0	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 1999 aerial topographic mapping conducted for Peabody Western Coal Company. Structure J21-H is designed to contain approximately 18.0 acre-feet.

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The calculations for the sediment load entering structure J21-H were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.20
3.	Slope Factor, LS	6.53
4.	Cover Factor, C	0.61
5.	Erosion Control Factor, P	0.95

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 J21-H has sufficient storage to contain the 10-year, 24-hour storm. The combined sediment storage capacity was determined for the two structures in series and the results of the analysis are presented in the following table.

Combined Storage for Structures J21-H1 and J21-H

	J21-H1	J21-H	Combined
Total Storage Capacity	17.9	18.0	35.9 acre-ft
10-Year, 24-Hour Storm Inflow	8.9	6.2	15.1 acre-ft
Available Sediment Storage Capacity	-	-	20.8 acre-ft
Sediment Inflow Rate/Year	2.42	1.39	3.81 acre-ft
Sediment Storage Life	-	-	5.5 years

* * *

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

Appendix A- Hydrology, Hydraulic, and Sedimentation Calculations

Appendix B- SEDCAD4 (Input and Output) 10-Year, 24-Hour Storm Event

Appendix C- SEDCAD4 (Input and Output) 100-Year, 6-Hour Storm Event

Exhibit #1- J21-H Proposed Sedimentation Pond

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: J21 AREA

STRUCTURE: J21-H Pond (Lower Pond)

TIME OF CONCENTRATION:

Start Elevation (ft) =	7081
End Elevation (ft) =	6870
Elevation Difference, E (ft) =	211
Watercourse Length (ft) =	3336
Watercourse Length, L (mi) =	0.632
Tc = (11.9L^3/E)^0.385 =	0.195 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
Pinyon Juniper	C	78	37.7	2940.6
Sagebrush	C	73	14.6	1065.8
Disturbed - Topsoil Stripped		90	23.1	2079
Disturbed - Spoil		86	28.6	2459.6
TOTAL:			104	8545

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

DRAINAGE BASIN AREA:

104.0 Acres

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT: J21-H Pond

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area (acres)	K*Area
3DE	0.15	6	0.90
15	0.37	1	0.37
20	0.25	45.3	11.33
34-spoil	0.12	28.6	3.43
Mine Pits	0.22	23.1	5.08
TOTAL:		104	21.11

Weighted K = Total K*Area/ Total Area = 0.20

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
195	40	20.5%	0.6	11.6	5.20
185	60	32.4%	0.6	18.0	8.21
400	70	17.5%	0.6	9.9	6.67
320	60	18.8%	0.6	10.6	6.32
285	70	24.6%	0.6	13.8	7.97
425	60	14.1%	0.6	8.0	5.34
145	40	27.6%	0.6	15.4	6.01

Average LS = 6.53

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
Pinyon Juniper	20%	25%	37.7	0.22	8.29	1.00	37.70
Sagebrush/Grass	20%	25%	14.6	0.20	2.92	1.00	14.60
Disturbed	0%	0%	23.1	1.00	23.10	1.00	23.10
Spoil	0%	0%	28.6	1.00	28.60	0.80	22.88
TOTAL:			104		62.91		98.28

Weighted C = Total C*Area/ Total Area = 0.605

Weighted P = Total P*Area/ Total Area = 0.945

RAINFALL FACTOR:

R = 40

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: J21-H 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	0.20	
Length Slope Factor	6.53	
Cover Factor	0.60	
Practice Factor	0.95	
Gross Annual Sediment Yield	30.31	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0148	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0133	acre-feet/acre/year
Watershed Area	104	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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J21-H SPILLWAY CRITICAL VELOCITY
Worksheet for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	Y
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.013947	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	15.00	ft
Discharge	100.30	cfs

Results		
Depth	1.04	ft
Flow Area	18.79	ft²
Wetted Perimeter	21.56	ft
Top Width	21.23	ft
Critical Depth	1.04	ft
Critical Slope	0.013948	ft/ft
Velocity	5.34	ft/s
Velocity Head	0.44	ft
Specific Energy	1.48	ft
Froude Number	1.00	
Flow is subcritical.		

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J21-H SPILLWAY OUTFLOW CHANNEL @ 4% SLOPE

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
15.00	3.0:1	3.0:1	4.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	100.30 cfs	
Depth:	0.89 ft	1.89 ft
Top Width:	20.34 ft	26.34 ft
Velocity:	6.38 fps	
X-Section Area:	15.73 sq ft	
Hydraulic Radius:	0.762	
Froude Number:	1.28	
Manning's n:	0.0390	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

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J21-H SPILLWAY OUTFLOW CHANNEL @ 24% SLOPE

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
15.00	3.0:1	3.0:1	24.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	100.30 cfs	
Depth:	0.66 ft	1.66 ft
Top Width:	18.96 ft	24.96 ft
Velocity:	8.95 fps	
X-Section Area:	11.20 sq ft	
Hydraulic Radius:	0.584	
Froude Number:	2.05	
Manning's n:	0.0570	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

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J21-H SPILLWAY OUTFLOW CHANNEL @ 33% SLOPE

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
15.00	3.0:1	3.0:1	33.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	100.30 cfs	
Depth:	0.66 ft	1.66 ft
Top Width:	18.93 ft	24.93 ft
Velocity:	9.03 fps	
X-Section Area:	11.11 sq ft	
Hydraulic Radius:	0.581	
Froude Number:	2.08	
Manning's n:	0.0660	
Dmin:	5.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

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APPENDIX B

SEDCAD4 (Input and Output) 10-Year, 24-Hour Storm Event

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PEABODY WESTERN KAYENTA MINE POND J21H1 & J21H

10 Year, 24 Hour storm

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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:	10 yr - 24 hr
Rainfall Depth:	2.100 inches

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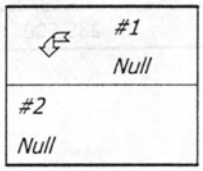
Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.008	0.344	Pond J21H1
Null	#2	==>	End	0.000	0.000	Pond J21H



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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	131.500	131.500	92.26	8.94
#2	104.000	235.500	157.42	15.14

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Structure Detail:

Structure #1 (Null)

Pond J21H1

Structure #2 (Null)

Pond J21H

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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	131.500	0.230	0.000	0.000	84.000	F	92.26	8.936
	$\sum$	**131.500**						**92.26**	**8.936**
#2	1	104.000	0.195	0.000	0.000	82.000	F	65.65	6.201
	$\sum$	**235.500**						**157.42**	**15.137**

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APPENDIX C

SEDCAD4 (Input and Output) 100-Year, 6-Hour Storm Event

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PEABODY WESTERN
KAYENTA MINE
POND J21-H

100 Year, 6 Hour storm

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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:	100 yr - 6 hr
Rainfall Depth:	2.400 inches

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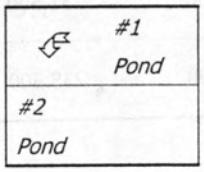
Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#2	0.008	0.344	Pond J21H1
Pond	#2	==>	End	0.000	0.000	Pond J21H



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Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	131.500	131.500	168.15	11.38
	Out			88.11	11.38
#2	In	104.000	235.500	176.61	19.40
	Out			100.29	18.35

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Structure Detail:

Structure #1 (Pond)

Pond J21H1

Pond Inputs:

Initial Pool Elev:	6,896.00
Initial Pool:	17.92 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,896.00	17.00	3.00:1	3.00:1	15.00

Pond Results:

Peak Elevation:	6,897.53
Dewater Time:	1.53 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,886.00	1.300	0.000	0.000	
6,886.50	1.340	0.660	0.000	
6,887.00	1.380	1.340	0.000	
6,887.50	1.425	2.041	0.000	
6,888.00	1.470	2.765	0.000	
6,888.50	1.517	3.511	0.000	
6,889.00	1.564	4.281	0.000	
6,889.50	1.612	5.075	0.000	
6,890.00	1.660	5.893	0.000	
6,890.50	1.709	6.735	0.000	
6,891.00	1.759	7.602	0.000	
6,891.50	1.809	8.494	0.000	
6,892.00	1.860	9.412	0.000	
6,892.50	1.921	10.357	0.000	
6,893.00	1.983	11.333	0.000	
6,893.50	2.046	12.340	0.000	
6,894.00	2.110	13.379	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,894.50	2.188	14.453	0.000		
6,895.00	2.267	15.567	0.000		
6,895.50	2.348	16.721	0.000		
6,896.00	2.430	17.915	0.000		Spillway #1
6,896.50	2.518	19.152	2.858	33.25	
6,897.00	2.607	20.433	39.578	2.80	
6,897.50	2.698	21.759	83.969	0.70	
6,897.53	2.705	21.855	88.112	0.05	Peak Stage
6,898.00	2.790	23.131	143.540		
6,898.50	2.901	24.554	217.837		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,886.00	0.000	0.000
6,886.50	0.000	0.000
6,887.00	0.000	0.000
6,887.50	0.000	0.000
6,888.00	0.000	0.000
6,888.50	0.000	0.000
6,889.00	0.000	0.000
6,889.50	0.000	0.000
6,890.00	0.000	0.000
6,890.50	0.000	0.000
6,891.00	0.000	0.000
6,891.50	0.000	0.000
6,892.00	0.000	0.000
6,892.50	0.000	0.000
6,893.00	0.000	0.000
6,893.50	0.000	0.000
6,894.00	0.000	0.000
6,894.50	0.000	0.000
6,895.00	0.000	0.000
6,895.50	0.000	0.000
6,896.00	0.000	0.000
6,896.50	2.858	2.858
6,897.00	39.578	39.578
6,897.50	83.969	83.969

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,898.00	143.540	143.540
6,898.50	0.000	217.837

Structure #2 (Pond)

Pond J21H

Pond Inputs:

Initial Pool Elev:	6,877.00
Initial Pool:	18.04 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,877.00	28.00	3.00:1	3.00:1	15.00

Pond Results:

Peak Elevation:	6,878.71
Dewater Time:	3.66 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,868.00	1.420	0.000	0.000	
6,868.50	1.462	0.720	0.000	
6,869.00	1.504	1.462	0.000	
6,869.50	1.547	2.224	0.000	
6,870.00	1.590	3.009	0.000	
6,870.50	1.658	3.820	0.000	
6,871.00	1.727	4.667	0.000	
6,871.50	1.798	5.548	0.000	
6,872.00	1.870	6.465	0.000	
6,872.50	1.955	7.421	0.000	
6,873.00	2.041	8.420	0.000	
6,873.50	2.130	9.462	0.000	
6,874.00	2.220	10.549	0.000	
6,874.50	2.309	11.682	0.000	
6,875.00	2.400	12.859	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,875.50	2.494	14.082	0.000		
6,876.00	2.590	15.353	0.000		
6,876.50	2.690	16.673	0.000		
6,877.00	2.791	18.043	0.000		Spillway #1
6,877.50	2.895	19.464	0.242	71.15*	
6,878.00	3.000	20.938	35.287	15.15	
6,878.50	3.119	22.468	78.406	1.10	
6,878.71	3.170	23.126	100.291	0.45	Peak Stage
6,879.00	3.240	24.057	131.226		
6,879.50	3.364	25.708	200.210		
6,880.00	3.490	27.421	286.263		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,868.00	0.000	0.000
6,868.50	0.000	0.000
6,869.00	0.000	0.000
6,869.50	0.000	0.000
6,870.00	0.000	0.000
6,870.50	0.000	0.000
6,871.00	0.000	0.000
6,871.50	0.000	0.000
6,872.00	0.000	0.000
6,872.50	0.000	0.000
6,873.00	0.000	0.000
6,873.50	0.000	0.000
6,874.00	0.000	0.000
6,874.50	0.000	0.000
6,875.00	0.000	0.000
6,875.50	0.000	0.000
6,876.00	0.000	0.000
6,876.50	0.000	0.000
6,877.00	0.000	0.000
6,877.50	0.242	0.242
6,878.00	35.287	35.287
6,878.50	78.406	78.406

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,879.00	131.226	131.226
6,879.50	200.210	200.210
6,880.00	286.263	286.263

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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	131.500	0.230	0.000	0.000	84.000	F	168.15	11.385
	Σ	**131.500**						**168.15**	**11.385**
#2	1	104.000	0.195	0.000	0.000	82.000	F	122.82	8.019
	Σ	**235.500**						**176.61**	**19.404**

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DESIGN REPORT

Temporary Sedimentation Structure

J21-H1

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

OCT 2000
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Registered Professional Engineer (Civil)
CERTIFICATE NO.
18782
JAMES GARY
SCHLENNERT
Date Signed
ARIZONA, U.S.A.
AUG 18 2000

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EXHIBIT #1 -J21-H1 and J21-H Proposed Sedimentation Ponds

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INTRODUCTION

Sedimentation Structure J21-H1 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 J21 disturbed surface mining area at the Kayenta Mine. The location of Structure J21-H1 and its watershed boundary are shown on Drawing No. 85400, (Sheet M-11), 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 J21-H1 that is in series with sedimentation structure J21-H. J21-H1 is the upstream pond in the series. 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 J21-H1 was inspected in January 2000 by a Registered Professional Engineer from Peabody Western Coal Company, to assure that the site is suitable and no adverse conditions exist to prevent the successful construction of this 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

The J21-H and J21-H1 Structures have a combined watershed of 235.5 acres and are located on a tributary upstream of Dinnebito Wash at the Kayenta Mine. The 131.5-acre watershed, which contributes directly to structure J21-H1 is classified as 43% undisturbed, 23% spoil and 34% disturbed.

DESIGN ANALYSES

GENERAL

Structure J21-H1 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 1999 for Peabody Western Coal Company and was used in the analyses of the structure.

STABILITY

Structure J21-H1 is assumed to be a Category A-3 embankment. The structure will be a homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 15 feet wide on top. A minimum upstream slope of 2H:1V or flatter slope and minimum downstream slope of 3.25H:1V or flatter slope were assumed. Based on the total embankment height of approximately 12.5 feet, these slopes are equal to or 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 15-foot wide, riprap-lined, trapezoidal channel.

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HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD4 (see Appendices A, B, and C). Structure J21-H1 will be constructed in series with proposed Structure J21-H. Structure J21-H1 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 floodplain. The structure will impound less than 20 acre-feet and be less than 20 vertical feet in height from the upstream toe of the embankment of the natural stream elevation to the emergency spillway invert elevation. The two structures have a combined capacity greater than 20 acre-feet; however, since J21-H1 is the upstream pond and has a capacity of less than 20 acre-feet, the spillway was analyzed using the 25-year, 6-hour storm. In addition, the spillway was verified to pass the peak flow from the 100-year, 6-hour storm. Structures J21-H and J21-H1 were conservatively assumed to be full to the emergency spillway at the time of the design storm event. The storage capacity of structure J21-H1 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 into the Dinnebito Wash.

The following parameters were used in the hydrologic analysis (see Appendix B & C):

		J21-H1
1.	Water Course length, L	0.770 mi.
2.	Elevation Difference, H	247 ft
3.	Time of Concentration, T_c	0.230 hr
4.	SCS Curve Number	84
5.	Rainfall Depth, 10-year, 24-hour storm	2.1 in
	25-year, 6-hour storm	1.9 in
	100-year, 6-hour storm	2.4 in
6.	Drainage Area	131.5 ac

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Values reported represent the watershed, which drains directly to Pond J21-H1. Hydrologic input parameters for downstream structure, J21-H, is presented in the Design Report for J21-H.

Muskingum routing parameters were utilized to route the 100-year hydrographs between the J21-H and J21-H1 structures. The routing parameters are presented in Appendices B and C, and are shown on a sub-watershed basis.

HYDRAULICS

The SEDCAD4 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 Appendices A, B, and C).

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J21-H1 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	92.3	108.5
Volume	ac-ft	8.9	7.4
Storage			
Peak Stage	msl	N/A	6897.2
Emergency Spillway Elev.	msl	6896.0	6896.0
Peak Storage	ac-ft	N/A	20.6
Storage Capacity	ac-ft	17.9	17.9
Outflow			
Peak Flow	cfs	N/A	46.6
Spillway Elevation	msl	6896.0	6896.0
Embankment Crest Elev.	msl	6898.5	6898.5
Peak Stage	msl	--	6897.1
Freeboard	ft	--	1.4
Emergency Spillway Channel			
Flow Depth	ft	--	1.1
Critical Velocity	fps	--	4.3
Mannings "n"	--	--	0.03
Width	ft	--	15
Outflow Channel			
Slope	%	13	33
Normal Velocity	fps	-- 6.4	6.6
Normal Depth	ft	-- 1.4	1.4
Mannings "n"	--	-- 0.046	0.070
Riprap D_{50}	in	-- 3	6

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for J21-H1 will be a trapezoidal channel with dimensions listed below. The alignment and dimensions are shown on Exhibit 1.

Minimum Channel Depth	(Spillway)	2.2	ft
	(Outflow)	2.4	ft
Channel Width		15	ft
Channel Length	(Spillway)	17	ft
	(Outflow)	300	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	33	%
Spillway Elevation		6896.0	ft

The riprap-lined channel will extend a minimum 15-feet beyond the toe of the embankment as shown on Exhibit 1.

STORAGE CAPACITY

The impoundment stage-capacity table (see Exhibit 1) is based on the 1999 aerial topographic mapping conducted for Peabody Western Coal Company. Structure J21-H1 is designed to contain approximately 17.9 acre-feet.

The calculations for the sediment load entering structure J21-H1 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	0.21
3.	Slope Factor, LS	7.87
4.	Cover Factor, C	0.66
5.	Erosion Control Factor, P	0.95

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 J21-H1 has sufficient storage to contain the 10-year, 24-hour storm. The combined sediment storage capacity was determined for the two structures in series and the results of the analysis are presented in the following table.

Combined Storage for Structures J21-H1 and J21-H

	J21-H1	J21-H	Combined
Total Storage Capacity	17.9	18.0	35.9 acre-ft
10-Year, 24-Hour Storm Inflow	8.9	6.2	15.1 acre-ft
Available Sediment Storage Capacity	-	-	20.8 acre-ft
Sediment Inflow Rate/Year	2.42	1.39	3.81 acre-ft
Sediment Storage Life	-	-	5.5 years

* * *

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

Appendix A- Hydrology, Hydraulic, and Sedimentation Calculations

Appendix B- SEDCAD4 (Input and Output) 10-Year, 24-Hour Storm Event

Appendix C- SEDCAD4 (Input and Output) 25-Year, 6-Hour Storm Event

Exhibit #1- J21-H and J21-H1 Proposed Sedimentation Ponds

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: J21 AREA

STRUCTURE: J21-H1 Pond (Upper Pond)

TIME OF CONCENTRATION:

Start Elevation (ft) =	7112
End Elevation (ft) =	6865
Elevation Difference, E (ft) =	247
Watercourse Length (ft) =	4068
Watercourse Length, L (mi) =	0.770
Tc = (11.9L^3/E)^0.385 =	0.230 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
Pinyon Juniper	C	78	46.5	3627
Sagebrush	C	73	10	730
Disturbed - Topsoil Stripped		90	44.7	4023
Disturbed - Spoil		86	30.3	2605.8
TOTAL:			131.5	10985.8

Weighted CN = Total CN*Area/ Total Area = 84

DRAINAGE BASIN AREA:

131.5 Acres

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT: J21-H1 Pond

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area (acres)	K*Area
20	0.25	56.5	14.13
34-spoil	0.12	30.3	3.64
Mine Pits	0.22	44.7	9.83
TOTAL:		131.5	27.60

Weighted K = Total K*Area/ Total Area = 0.21

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
270	70	25.9%	0.6	14.5	8.17
230	90	39.1%	0.6	21.4	11.23
190	70	36.8%	0.6	20.2	9.45
200	50	25.0%	0.6	14.0	6.57
345	60	17.4%	0.6	9.9	6.06
240	50	20.8%	0.6	11.8	6.00
420	90	21.4%	0.6	12.1	8.66
360	80	22.2%	0.6	12.5	8.22
250	60	24.0%	0.6	13.5	7.18
375	100	26.7%	0.6	14.9	10.25
130	40	30.8%	0.6	17.1	6.30
100	30	30.0%	0.6	16.7	5.24
190	40	21.1%	0.6	11.9	5.27
210	60	28.6%	0.6	15.9	7.78
520	130	25.0%	0.6	14.0	11.65

Average LS = 7.87

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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J21-H1 POND (cont)

COVER AND PRACTICE FACTORS:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C*Area	Practice Factor, P	P*Area
Pinyon Juniper	40%	25%	46.5	0.22	10.23	1.00	46.50
Sagebrush/Grass	40%	25%	10	0.20	2.00	1.00	10.00
Disturbed	0%	0%	44.7	1.00	44.70	1.00	44.70
Spoil	0%	0%	30.3	1.00	30.30	0.80	24.24
TOTAL:			131.5		87.23		125.44

Weighted C = Total C*Area/ Total Area = 0.663

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: J21-H1 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	0.21	
Length Slope Factor	7.87	
Cover Factor	0.66	
Practice Factor	0.95	
Gross Annual Sediment Yield	41.80	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0204	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0184	acre-feet/acre/year
Watershed Area	131.5	acres
Watershed Annual Sediment Yield	2.42	acre-feet/year
Number of years	1	years
Calculated Sediment Volume	2.42	acre-feet

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J21-H1 SPILLWAY CRITICAL VELOCITY

Worksheet for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	T
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.016003	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	15.00	ft
Discharge	46.60	cfs

Results		
Depth	0.64	ft
Flow Area	10.83	ft²
Wetted Perimeter	19.05	ft
Top Width	18.84	ft
Critical Depth	0.64	ft
Critical Slope	0.016004	ft/ft
Velocity	4.30	ft/s
Velocity Head	0.29	ft
Specific Energy	0.93	ft
Froude Number	1.00	
Flow is subcritical.		

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J21-H1 SPILLWAY OUTFLOW CHANNEL @ 13% SLOPE

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
15.00	3.0:1	3.0:1	13.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	46.60 cfs	
Depth:	0.44 ft	1.44 ft
Top Width:	17.67 ft	23.67 ft
Velocity:	6.42 fps	
X-Section Area:	7.26 sq ft	
Hydraulic Radius:	0.408	
Froude Number:	1.76	
Manning's n:	0.0460	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

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J21-H1 SPILLWAY OUTFLOW CHANNEL @ 33% SLOPE

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
15.00	3.0:1	3.0:1	33.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	46.60 cfs	
Depth:	0.43 ft	1.43 ft
Top Width:	17.60 ft	23.60 ft
Velocity:	6.61 fps	
X-Section Area:	7.05 sq ft	
Hydraulic Radius:	0.397	
Froude Number:	1.84	
Manning's n:	0.0700	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

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APPENDIX B

SEDCAD4 (Input and Output) 10-Year, 24-Hour Storm Event

OCT 2000
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PEABODY WESTERN KAYENTA MINE POND J21H1 & J21H

10 Year, 24 Hour storm

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OCT 2000

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:	10 yr - 24 hr
Rainfall Depth:	2.100 inches

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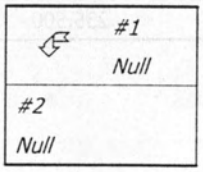
OCT 2000

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.008	0.344	Pond J21H1
Null	#2	==>	End	0.000	0.000	Pond J21H



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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	131.500	131.500	92.26	8.94
#2	104.000	235.500	157.42	15.14

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Structure Detail:

Structure #1 (Null)

Pond J21H1

Structure #2 (Null)

Pond J21H

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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	131.500	0.230	0.000	0.000	84.000	F	92.26	8.936
	$\sum$	**131.500**						**92.26**	**8.936**
#2	1	104.000	0.195	0.000	0.000	82.000	F	65.65	6.201
	$\sum$	**235.500**						**157.42**	**15.137**

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APPENDIX C

SEDCAD4 (Input and Output) 25-Year, 6-Hour Storm Event

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PEABODY WESTERN KAYENTA MINE POND J21-H1

25-Year, 6-Hour storm

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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:	25 yr - 6 hr
Rainfall Depth:	1.900 inches

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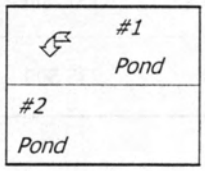
Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#2	0.008	0.344	Pond J21H1
Pond	#2	==>	End	0.000	0.000	Pond J21H



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OCT 2000

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	131.500	131.500	108.47	7.39
	Out			46.59	7.39
#2	In	104.000	235.500	98.89	12.45
	Out			45.65	11.24

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Structure Detail:

Structure #1 (Pond)

Pond J21H1

Pond Inputs:

Initial Pool Elev:	6,896.00
Initial Pool:	17.92 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,896.00	17.00	3.00:1	3.00:1	15.00

Pond Results:

Peak Elevation:	6,897.08
Dewater Time:	1.52 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,886.00	1.300	0.000	0.000	
6,886.50	1.340	0.660	0.000	
6,887.00	1.380	1.340	0.000	
6,887.50	1.425	2.041	0.000	
6,888.00	1.470	2.765	0.000	
6,888.50	1.517	3.511	0.000	
6,889.00	1.564	4.281	0.000	
6,889.50	1.612	5.075	0.000	
6,890.00	1.660	5.893	0.000	
6,890.50	1.709	6.735	0.000	
6,891.00	1.759	7.602	0.000	
6,891.50	1.809	8.494	0.000	
6,892.00	1.860	9.412	0.000	
6,892.50	1.921	10.357	0.000	
6,893.00	1.983	11.333	0.000	
6,893.50	2.046	12.340	0.000	
6,894.00	2.110	13.379	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,894.50	2.188	14.453	0.000		
6,895.00	2.267	15.567	0.000		
6,895.50	2.348	16.721	0.000		
6,896.00	2.430	17.915	0.000		Spillway #1
6,896.50	2.518	19.152	2.858	33.25	
6,897.00	2.607	20.433	39.578	3.05	
6,897.08	2.622	20.642	46.587	0.30	Peak Stage
6,897.50	2.698	21.759	83.969		
6,898.00	2.790	23.131	143.540		
6,898.50	2.901	24.554	217.837		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,886.00	0.000	0.000
6,886.50	0.000	0.000
6,887.00	0.000	0.000
6,887.50	0.000	0.000
6,888.00	0.000	0.000
6,888.50	0.000	0.000
6,889.00	0.000	0.000
6,889.50	0.000	0.000
6,890.00	0.000	0.000
6,890.50	0.000	0.000
6,891.00	0.000	0.000
6,891.50	0.000	0.000
6,892.00	0.000	0.000
6,892.50	0.000	0.000
6,893.00	0.000	0.000
6,893.50	0.000	0.000
6,894.00	0.000	0.000
6,894.50	0.000	0.000
6,895.00	0.000	0.000
6,895.50	0.000	0.000
6,896.00	0.000	0.000
6,896.50	2.858	2.858
6,897.00	39.578	39.578
6,897.50	83.969	83.969

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,898.00	143.540	143.540
6,898.50	217.837	217.837

Structure #2 (Pond)

Pond J21H

Pond Inputs:

Initial Pool Elev:	6,877.00
Initial Pool:	18.04 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,877.00	28.00	3.00:1	3.00:1	10.00

Pond Results:

Peak Elevation:	6,878.33
Dewater Time:	5.22 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,868.00	1.420	0.000	0.000	
6,868.50	1.462	0.720	0.000	
6,869.00	1.504	1.462	0.000	
6,869.50	1.547	2.224	0.000	
6,870.00	1.590	3.009	0.000	
6,870.50	1.658	3.820	0.000	
6,871.00	1.727	4.667	0.000	
6,871.50	1.798	5.548	0.000	
6,872.00	1.870	6.465	0.000	
6,872.50	1.955	7.421	0.000	
6,873.00	2.041	8.420	0.000	
6,873.50	2.130	9.462	0.000	
6,874.00	2.220	10.549	0.000	
6,874.50	2.309	11.682	0.000	
6,875.00	2.400	12.859	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,875.50	2.494	14.082	0.000		
6,876.00	2.590	15.353	0.000		
6,876.50	2.690	16.673	0.000		
6,877.00	2.791	18.043	0.000		Spillway #1
6,877.50	2.895	19.464	0.161	106.51*	
6,878.00	3.000	20.938	24.669	17.25	
6,878.33	3.081	21.955	45.654	1.45	Peak Stage
6,878.50	3.119	22.468	56.242		
6,879.00	3.240	24.057	96.142		
6,879.50	3.364	25.708	149.618		
6,880.00	3.490	27.421	217.853		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,868.00	0.000	0.000
6,868.50	0.000	0.000
6,869.00	0.000	0.000
6,869.50	0.000	0.000
6,870.00	0.000	0.000
6,870.50	0.000	0.000
6,871.00	0.000	0.000
6,871.50	0.000	0.000
6,872.00	0.000	0.000
6,872.50	0.000	0.000
6,873.00	0.000	0.000
6,873.50	0.000	0.000
6,874.00	0.000	0.000
6,874.50	0.000	0.000
6,875.00	0.000	0.000
6,875.50	0.000	0.000
6,876.00	0.000	0.000
6,876.50	0.000	0.000
6,877.00	0.000	0.000
6,877.50	0.161	0.161
6,878.00	24.669	24.669
6,878.50	56.242	56.242

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,879.00	96.142	96.142
6,879.50	149.618	149.618
6,880.00	217.853	217.853

OCT 2000
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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	131.500	0.230	0.000	0.000	84.000	F	108.47	7.385
	Σ	**131.500**						**108.47**	**7.385**
#2	1	104.000	0.195	0.000	0.000	82.000	F	78.00	5.060
	Σ	**235.500**						**98.89**	**12.445**

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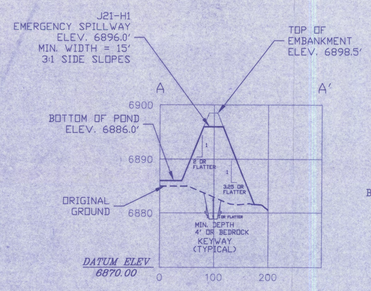

SECTION A - A'

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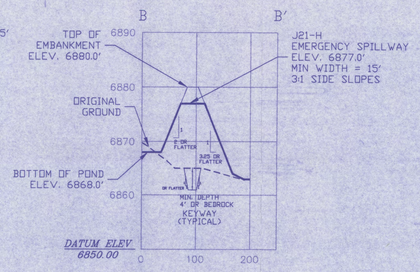
VERT. 1"=10'



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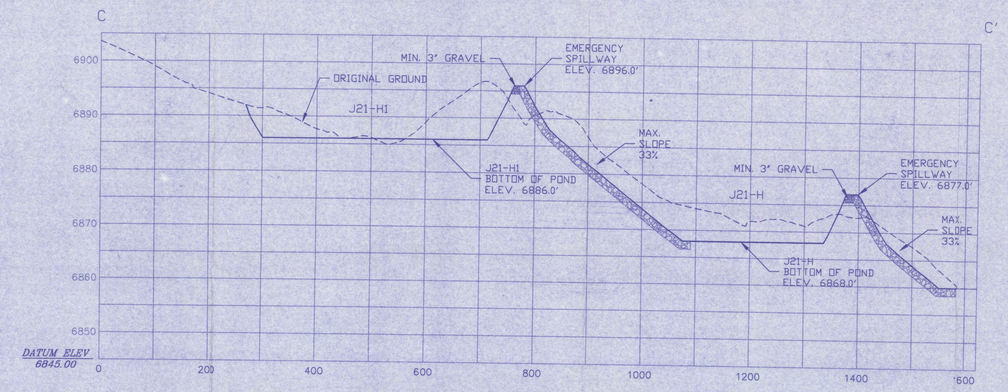


SECTION C - C'

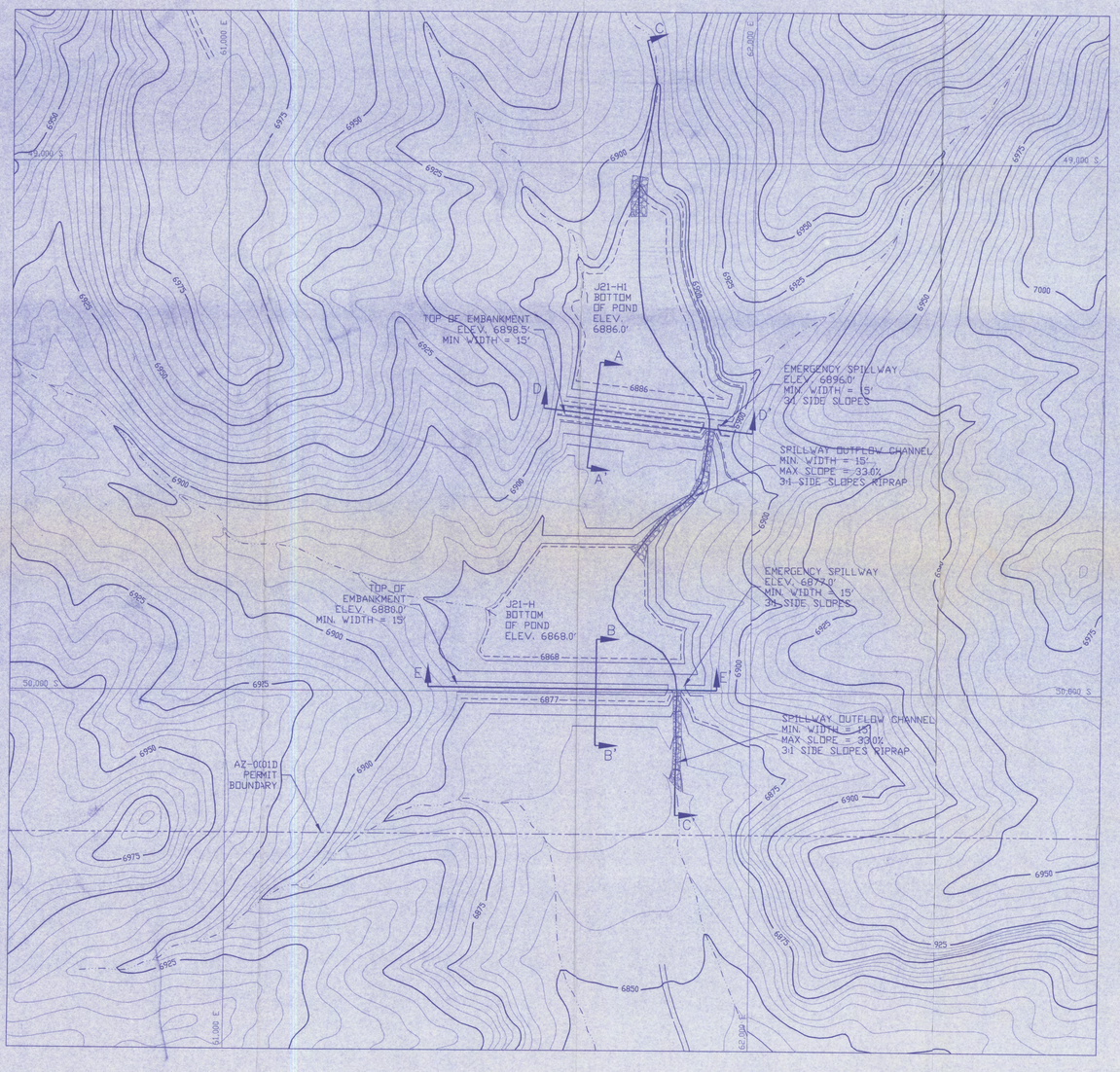
SCALE: HORIZ. 1"=100'
VERT. 1"=10'

J21-H1 POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6886	0.0	1.30	0.00	BOTTOM OF POND
6888	2.0	1.47	2.77	
6890	4.0	1.66	5.89	
6892	6.0	1.86	9.41	
6894	8.0	2.11	13.38	
6896	10.0	2.43	17.92	EMERGENCY SPILLWAY
6898	12.0	2.79	23.13	
6898.5	12.5	2.90	24.55	TOP OF EMBANKMENT

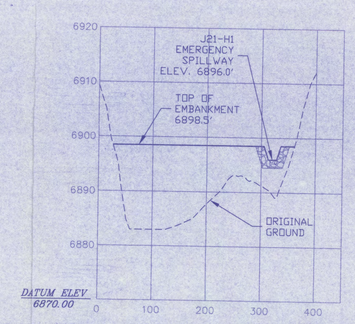
J21-H POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6868	0.0	1.42	0.00	BOTTOM OF POND
6870	2.0	1.59	3.01	
6872	4.0	1.87	6.47	
6874	6.0	2.22	10.55	
6876	8.0	2.59	15.35	
6877	9.0	2.79	18.04	EMERGENCY SPILLWAY
6878	10.0	3.00	20.94	
6880	12.0	3.49	27.42	TOP OF EMBANKMENT



PLAN VIEW

SCALE: 1" = 100'
PHOTO DATE: 4/21/99
C.I. = 5'



SECTION D - D'

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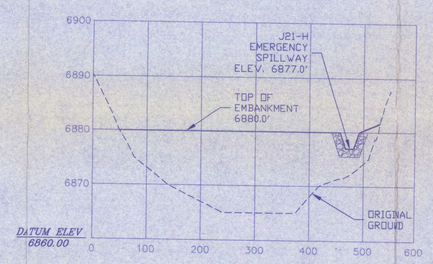

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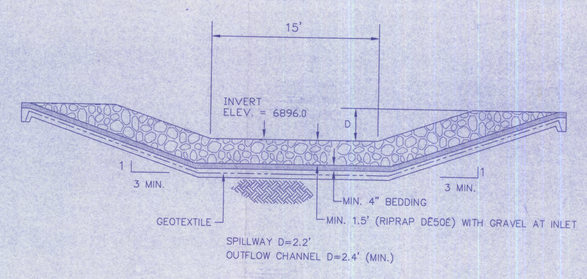
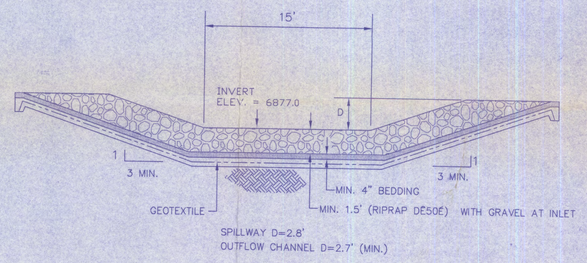


J21-H1 POND
TYPICAL CROSS-SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE



J21-H POND
TYPICAL CROSS-SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE

OCT 2000
APPROVED

ENGINEER'S CERTIFICATION

JACK G. SCHLENVOGT
ENGINEERING & RECLAMATION MANAGER
PEABODY WESTERN COAL COMPANY

ARIZONA P.E. 18782
DATE: AUG 18 2000

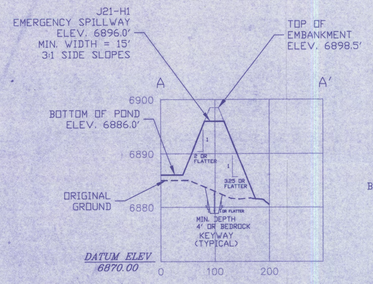
NOTES:
1) General location, see Drawing No. 85400, Sheets M-11 and Drawing No. 85405.
2) See Chapter 6, Kayenta PAP for Construction Specifications.
3) See Vol. 2, Chapter 6, Attachment D, Sections 1-3 for description of Geotechnical Evaluation.
4) Salvage topsoil in accordance with approved topsoil salvage plan.
5) Reclamation of the disturbed 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.

REVISIONS		
DATE	CHK'D	DESCRIPTION

EXHIBIT 1
J21-H1 & J21-H
PROPOSED SEDIMENTATION POND

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

DESIGNED BY: MW	SCALE: 1"=100'
DRAWN BY: JMB	DRAWING DATE: 02-10-00
CHECKED BY: JGS	PHOTO DATE: 04-21-99
CONTOUR INT.: 5'	DWG FILE: J21-HPONDS.DWG



SECTION A - A'

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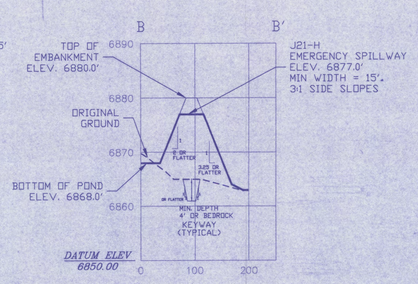
VERT. 1"=10'



SECTION B - B'

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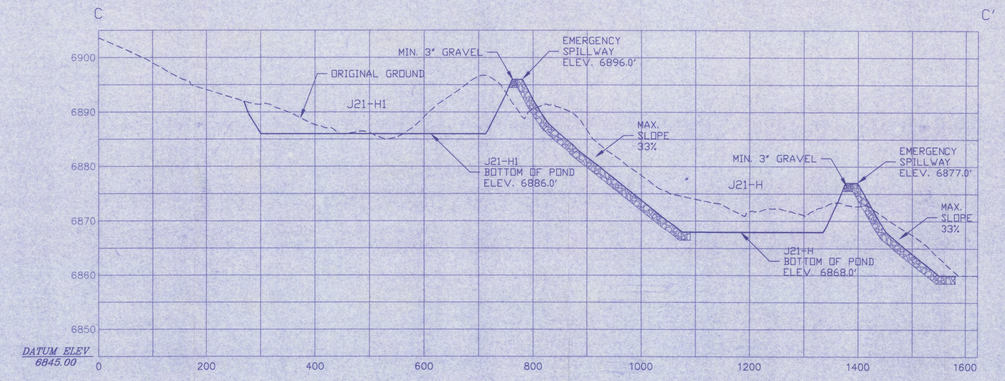
VERT. 1"=10'



SECTION C - C'

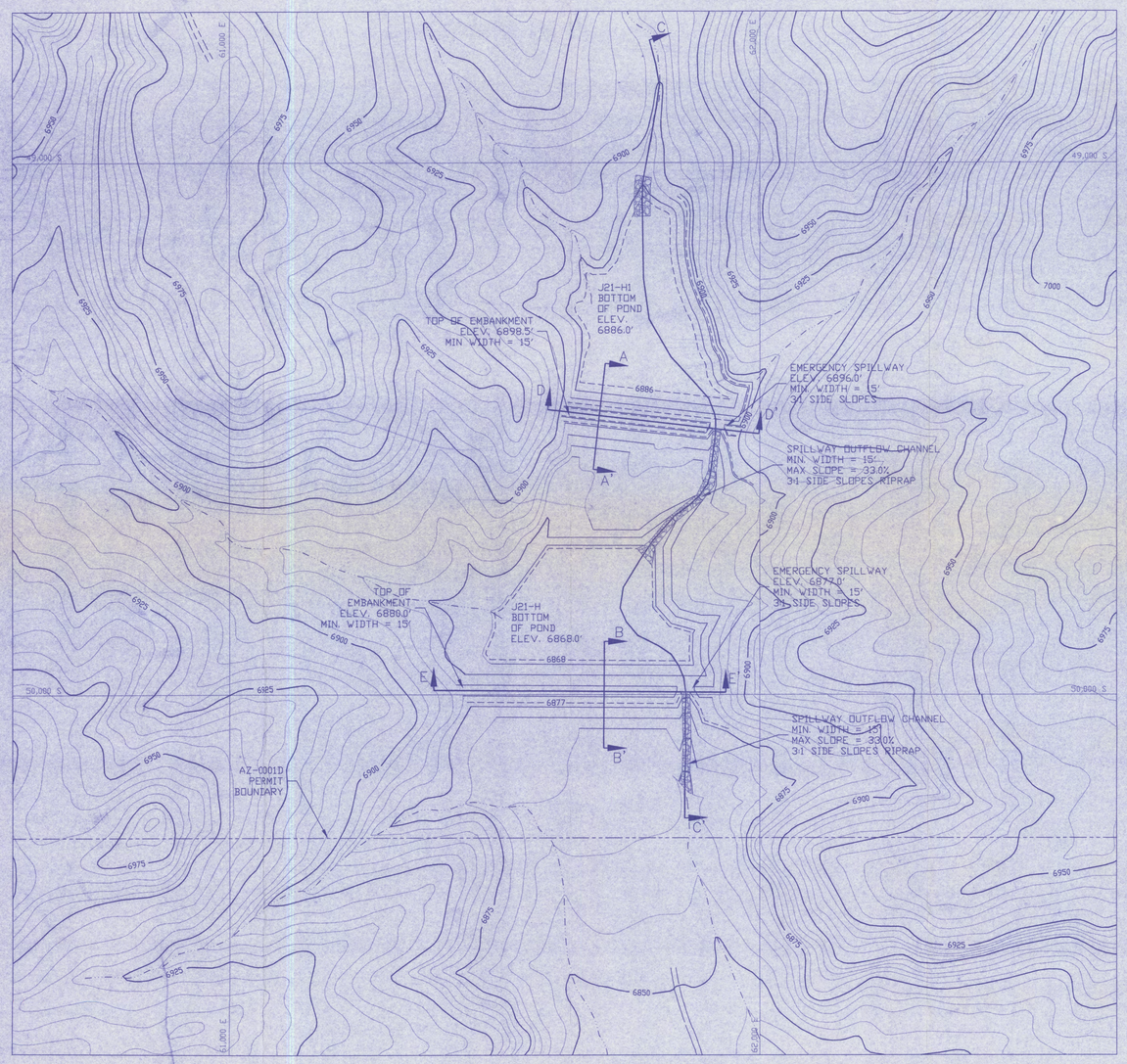
SCALE: HORIZ. 1"=100'
VERT. 1"=10'

J21-H1 POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6886	0.0	1.30	0.00	BOTTOM OF POND
6888	2.0	1.47	2.77	
6890	4.0	1.66	5.89	
6892	6.0	1.86	9.41	
6894	8.0	2.11	13.38	
6896	10.0	2.43	17.92	EMERGENCY SPILLWAY
6898	12.0	2.79	23.13	
6898.5	12.5	2.90	24.55	TOP OF EMBANKMENT

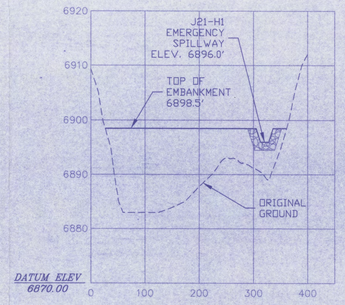
J21-H POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6868	0.0	1.42	0.00	BOTTOM OF POND
6870	2.0	1.59	3.01	
6872	4.0	1.87	6.47	
6874	6.0	2.22	10.55	
6876	8.0	2.59	15.35	
6877	9.0	2.79	18.04	EMERGENCY SPILLWAY
6878	10.0	3.00	20.94	
6880	12.0	3.49	27.42	TOP OF EMBANKMENT



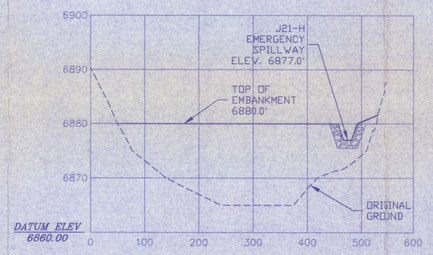
PLAN VIEW

SCALE: 1" = 100'
PHOTO DATE: 4/21/99
C.I. = 5'



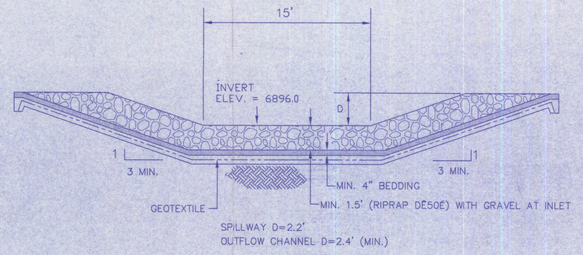
SECTION D - D'

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

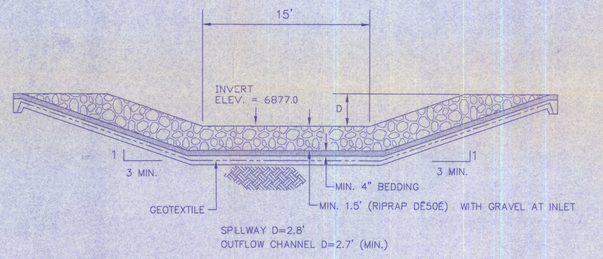


SECTION E - E'

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



J21-H1 POND
TYPICAL CROSS-SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE



J21-H POND
TYPICAL CROSS-SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE

NOTES:
1) General location, see Drawing No. 85400, Sheets M-11 and Drawing No. 85405.
2) See Chapter 6, Kayenta 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.

ENGINEER'S CERTIFICATION

JAMES S. SCHLENDORF
ENGINEERING & RECLAMATION MANAGER
PEABODY WESTERN COAL COMPANY

ARIZONA P.E. 18782
DATE: AUG 18 2000

APPROVED

REVISIONS		
DATE	CHK'D	DESCRIPTION

EXHIBIT 1
J21-H1 & J21-H
PROPOSED SEDIMENTATION POND

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

DESIGNED BY: MW	SCALE: 1"=100'
DRAWN BY: JMB	DRAWING DATE: 02-10-00
CHECKED BY: JGS	PHOTO DATE: 04-21-99
CONTOUR INT.: 5'	DWG FILE: J21-HPONDS.DWG