DESIGN REPORT

Temporary Sedimentation Structure

J7-S

Black Mesa Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

DEC 1998
APPROVED

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

NOV 06 1997

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INTRODUCTION

Sedimentation Structure J7-S will be an earthen embankment, designed and constructed by Peabody Western Coal Company as a temporary sedimentation structure designed to control runoff and sediment from portions of J7 disturbed surface mining area at the Black Mesa Mine. The location of Structure J7-S and its watershed boundary are shown on Drawing No. 85400 (Sheet K-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 J7-S. 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 J7-S 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

Structure J7-S has a 13.1-acre drainage area and is located on a tributary upstream of Yucca Flat Wash at the Black Mesa Mine. The watershed is classified as 50% spoil and 50% disturbed.

DESIGN ANALYSES

GENERAL

Structure J7-S 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 J7-S is a Category A-3 embankment. 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 4:1 were assumed. Based on the total embankment height of approximately 6 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 10-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 J7-S 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 spillway for the J7-S pond was analyzed using the 25-year, 6-hour storm. Structure J7-S was conservatively assumed to be full to the emergency spillway prior to the time of the 25-year storm event. The storage capacity of structure J7-S was analyzed using the 10-year, 24-hour storm. The pond was verified to completely contain the 10-year, 24-hour storm event, and provide adequate sediment storage volume, without discharging into the Yucca Flat Wash.

The following parameters were used in the hydrologic analysis:

		10yr-24hr Storm	
1.	Water Course length, L	0.227	mi.
2.	Elevation Difference, H	130	ft
3.	Time of Concentration, T_c	0.072	hr
4.	SCS Curve Number	89	
5.	Rainfall Depth, 10-year, 24-hour storm	2.1	in
	25-year, 6-hour storm	1.9	in
6.	Drainage Area	13.1	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).

J7-S 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	15.0	19.0
Volume	ac-ft	1.2	1.0
Storage			
Peak Stage	msl	N/A	6323
Emerg. Spillway Elev.	msl	6322.5	6322.5
Peak Storage	ac-ft	N/A	3.9
Storage Capacity	ac-ft	2.7	2.7
Outflow			
Peak Flow	cfs	N/A	8.9
Spillway Elevation	msl	6322.5	6322.5
Embankment Crest Elev.	msl	6324	6324
Peak Stage	msl	--	6323
Freeboard	ft	--	1.0
Emergency Spillway Channel			
Flow Depth	ft	--	0.5
Critical Velocity	fps	--	2.9
Mannings "n"	--	--	.031
Width	ft	--	10
Outflow Channel			
Slope	%	--	25
Normal Velocity	fps	--	4.5
Normal Depth	ft	--	0.2
Mannings "n"	--	--	.052
Riprap D_{50}	in	--	3

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for J7-S will be a trapezoidal channel with dimensions listed below. The alignment and dimensions are shown on Exhibit 1.

Minimum Channel Depth	(Spillway)	1.5	ft
	(Outflow)	1.5	ft
Channel Width		10	ft
Channel Length	(Spillway)	20	ft
	(Outflow)	50	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25	%
Spillway Elevation		6322.5	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 J7-S is designed to contain approximately 2.7 acre-feet.

The calculations for the sediment load entering structure J7-S 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	0.17
3.	Slope Factor, LS	6.89
4.	Cover Factor, C	1.0
5.	Erosion Control Factor, P	0.9

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 J7-S is shown on Exhibit 1, J7-S Stage Capacity Table, and the results of the sediment inflow analysis are summarized in the following table.

J7-S STORAGE

Total Storage Capacity	2.7	acre-ft
10-year, 24-hour Storm Inflow	1.2	acre-ft
Available Sediment Storage Capacity	1.5	acre-ft
Sediment Inflow Rate	0.24	acre-ft/yr.
Sediment Storage Life	6.3	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 J7-S 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: J7-S

TIME OF CONCENTRATION (Haul Road):

Start Elevation (ft) =	6450
End Elevation (ft) =	6320
Elevation Difference, E (ft) =	130
Watercourse Length (ft) =	1200
Watercourse Length, L (mi) =	0.227
Tc = (11.9L^3/E)^0.385 =	0.072 hours

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Spoil	B	86	6.5	559
Disturbed	D	91	6.6	600.6
TOTAL:			13.1	1159.6

Weighted CN = Total CN*Area/ Total Area = 89

DRAINAGE BASIN AREA:

13.10 Acres

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CALCULATED SEDIMENTOLOGY DATA

PROJECT: J7-S

SOIL ERODIBILITY FACTOR:

Soil Type	Soil Group	Erodibility Factor, K	Area (acres)	K*Area
Spoil	B	0.12	6.5	0.78
Disturbed	D	0.22	6.6	1.452
TOTAL:			13.1	2.23

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

Weighted K = Total K*Area/ Total Area = 0.170

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
250	90	36.0%	0.6	19.8	10.90
200	60	30.0%	0.6	16.7	7.95
320	25	7.8%	0.5	4.5	1.83

Average LS = 6.89

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 > or = 9%*

Where:

Slope < or = 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
Spoil	0%	0%	6.5	1	6.5	0.80	5.2
Disturbed	0%	0%	6.6	1.00	6.6	1.00	6.6
TOTAL:			13.1		13.1		11.8

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

Weighted P = Total P*Area/ Total Area = 0.90

RAINFALL FACTOR:

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: J7-S

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	0.17	
Length Slope Factor	6.89	
Cover Factor	1.00	
Practice Factor	0.90	
Gross Annual Sediment Yield	42.31	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0207	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0186	acre-feet/acre/year
Watershed Area	13.1	acres
Watershed Annual Sediment Yield	0.2437	acre-feet/year
Number of years	1	years
Required Pond Sediment Storage	0.244	acre-feet

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SEDCAD+ RIPRAP CHANNEL DESIGN

J7-S

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	8.94 cfs	
Slope	25.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	10.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.19 ft
with Freeboard	0.49 ft
Top Width	11.12 ft
with Freeboard	12.92 ft
Velocity	4.52 fps
Cross Sectional Area	1.98 sq ft
Hydraulic Radius	0.18 ft
Manning's n	0.052
Froude Number	1.89
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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J7-S Spillway

Worksheet for Trapezoidal Channel

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

Input Data		
Mannings Coefficient	0.031	
Channel Slope	0.022112	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	10.00	ft
Discharge	8.90	cfs

Results		
Depth	0.28	ft
Flow Area	3.06	ft²
Wetted Perimeter	11.79	ft
Top Width	11.70	ft
Critical Depth	0.28	ft
Critical Slope	0.022111	ft/ft
Velocity	2.90	ft/s
Velocity Head	0.13	ft
Specific Energy	0.41	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

PEABODY COAL COMPANY: POND J7-S (10-YR,24-HR)

by

Name: TEL

Company Name: ACZ, INC.
File Name: J:\861\0350\SEDCAD\J7-S

Date: 10-28-1997

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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: J:\861\0350\SEDCAD\J7-S User: TEL
Date: 10-28-1997 Time: 15:58:06
PEABODY COAL COMPANY: POND J7-S (10-YR,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	13.10	89	F	0.072	0.000	0.000	0.0	1.21	14.99
		Type: Null			Label: J7-S POND					
111	Structure	13.10							1.21	
111	Total IN/OUT	13.10							1.21	14.99

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APPENDIX C

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

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

PEABODY COAL COMPANY: POND J7-S (25-YR,6-HR)

by

Name: TEL

Company Name: ACZ, INC.
File Name: J:\861\0350\SEDCAD\J7-S25

Date: 10-28-1997

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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: J:\861\0350\SEDCAD\J7-S25 User: TEL
Date: 10-28-1997 Time: 15:55:37
PEABODY COAL COMPANY: POND J7-S (25-YR,6-HR)
Storm: 1.90 inches, 25 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

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

J1, B1, S1
J7-S POND

Drainage Area from J1, B1, S1, SWS(s)1: 13.1 acres
Total Contributing Drainage Area: 13.1 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	6322.5
Crest Length (ft)	20.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	10.0

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POND RESULTS:

Permanent Pool (ac-ft)
2.7

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: ACZ, INC.
Filename: J:\861\0350\SEDCAD\J7-S25 User: TEL
Date: 10-28-1997 Time: 15:55:37
PEABODY COAL COMPANY: POND J7-S (25-YR,6-HR)
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	13.10	89	F	0.072	0.000	0.000	0.0	1.03	18.99
		Type: Pond			Label: J7-S POND					
111	Structure	13.10							1.03	
111	Total IN	13.10							1.03	18.99
111	Total OUT								1.03	8.94

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	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	1.03	18.99
OUT	1.03	8.94

Peak Elevation	Hydrograph Detention Time (hrs)
6323.0	0.00

****

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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\0350\SEDCAD\J7-S25 User: TEL
Date: 10-28-1997 Time: 15:55:37
PEABODY COAL COMPANY: POND J7-S (25-YR,6-HR)
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
J7-S POND

Drainage Area from J1, B1, S1, SWS(s)1: 13.1 acres
Total Contributing Drainage Area: 13.1 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6318.00	0.00	0.48	0.00	0.00	
6319.00	1.00	0.53	0.50	0.00	
6320.00	2.00	0.58	1.06	0.00	
6321.00	3.00	0.64	1.67	0.00	
6322.00	4.00	0.69	2.33	0.00	
6322.50	4.50	0.72	2.68	0.00	Stage of SW#1
6323.00	5.00	0.75	3.05	8.48	
6323.03	5.03	0.75	3.07	8.94	Peak Stage
6323.10	5.10	0.75	3.13	10.17	
6323.20	5.20	0.76	3.20	13.20	
6323.30	5.30	0.77	3.28	17.43	
6323.40	5.40	0.77	3.35	21.64	
6323.50	5.50	0.78	3.43	26.78	
6324.00	6.00	0.81	3.83	58.07	

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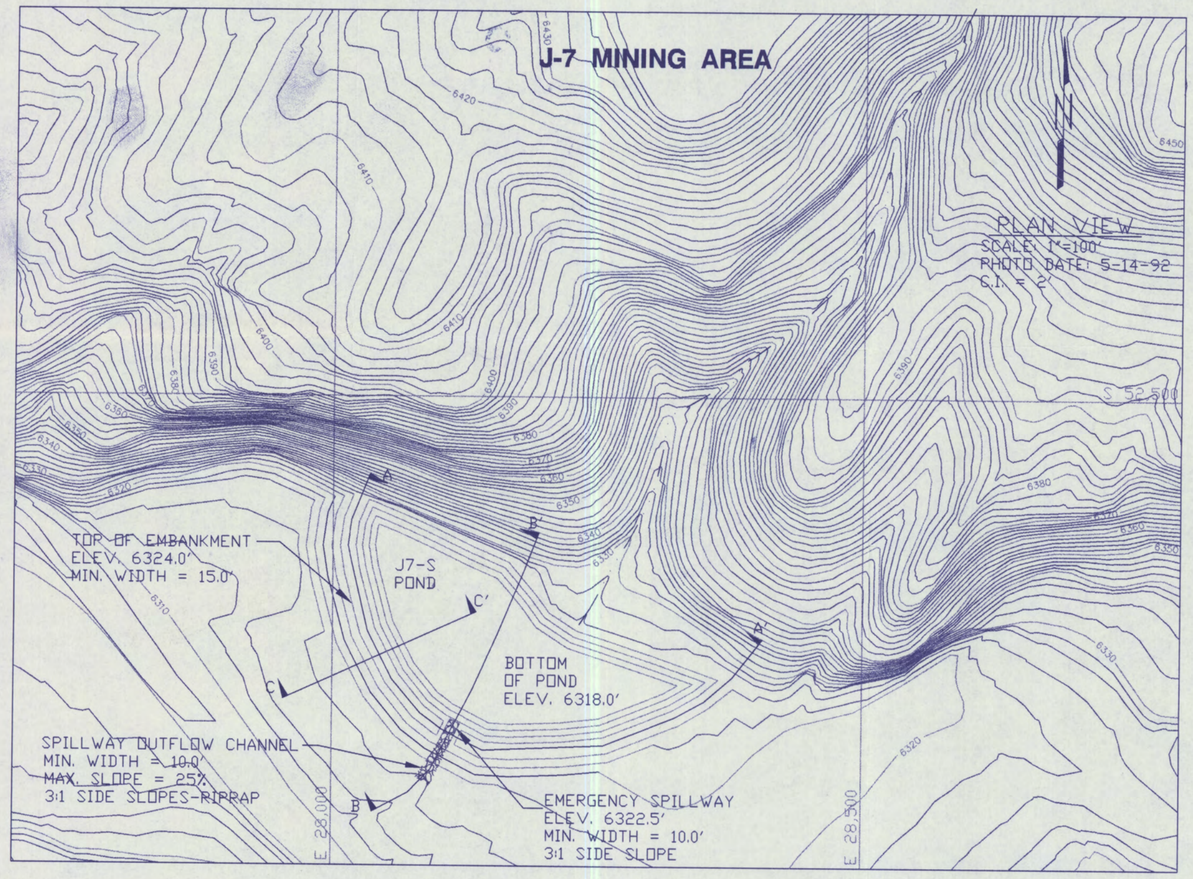
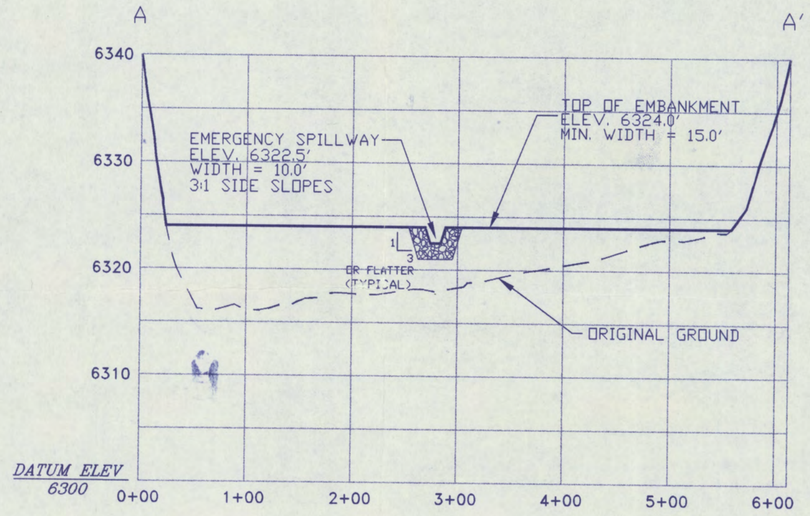
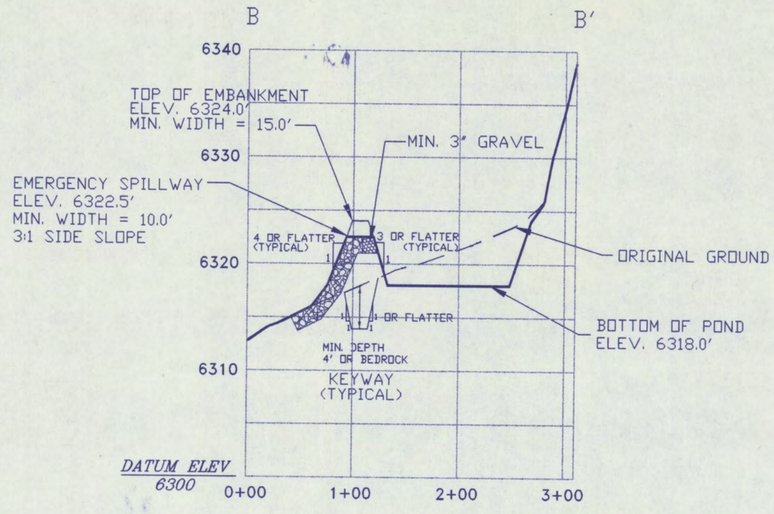




SECTION A - A'

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

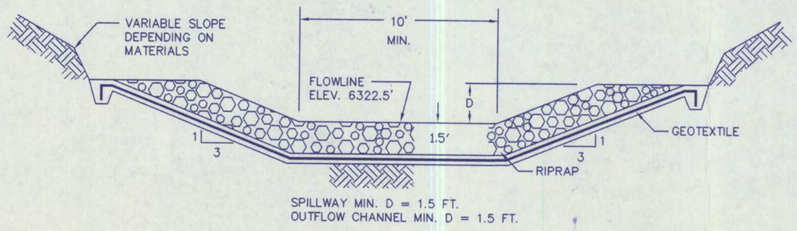


SECTION B - B'

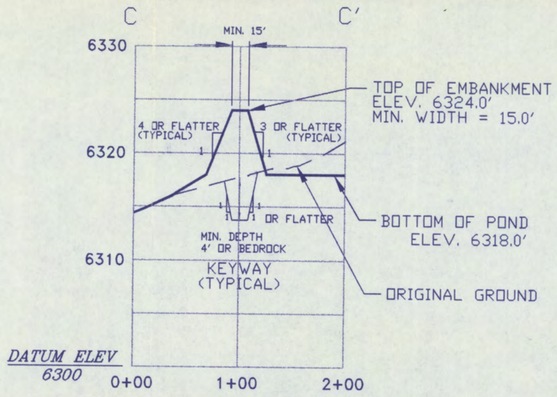
SCALE: HORIZ. 1"=100'
VERT. 1"=10'

J7-S POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6318.0	0.00	0.48	0.00	0.00	BOTTOM OF POND
6320.0	2.00	0.58	1.06	1.06	
6322.0	4.00	0.69	1.27	2.33	
6322.5	4.50	0.72	0.35	2.68	EMERGENCY SPILLWAY
6324.0	6.00	0.81	1.15	3.83	TOP OF EMBANKMENT



PROPOSED J7-S POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)



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 SCHIEFVOGT Arizona U.S.A.

JAMES G. SCHIEFVOGT
Comp. Work Mgr.
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: NOV 06 1997

NOTES:
1) General location, see Drawing No. 85400, Sheet K-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 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 # 1
PROPOSED J7-S SEDIMENTATION POND DESIGN

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

DESIGNED BY: TEL	SCALE: AS NOTED
DRAWN BY: JMB	DRAWING DATE: 10-29-97
CHECKED BY: JGS	PHOTO DATE: 05-14-92
CONTOUR INTERVAL: 2 FT.	DWG FILE: J7-S~1.DWG

DESIGN REPORT

Temporary Sedimentation Structure

J7-T

Black Mesa Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

DEC 1998 APPROVED

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

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INTRODUCTION

Sedimentation Structure J7-T will be an earthen embankment, designed and constructed by Peabody Western Coal Company as a temporary sedimentation structure designed to control runoff and sediment from portions of J7 disturbed surface mining area at the Black Mesa Mine. The location of Structure J7-T and its watershed boundary are shown on Drawing No. 85400 (Sheet K-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 J7-T. 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 J7-T 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

Structure J7-T has a 116.9-acre drainage area and is located on a tributary upstream of Yucca Flat Wash at the Black Mesa Mine. The watershed is classified as 37% spoil, 7% disturbed and 56% reclaimed.

DESIGN ANALYSES

GENERAL

Structure J7-T 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 J7-T is a Category A-3 embankment. 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 4:1 were assumed. Based on the total embankment height of approximately 17 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 10-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 J7-T 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 spillway for the J7-T pond was analyzed using the 25-year, 6-hour storm. Structure J7-T was conservatively assumed to be full to the emergency spillway prior to the time of the 25-year storm event. The storage capacity of structure J7-T was analyzed using the 10-year, 24-hour storm. The pond was verified to completely contain the 10-year, 24-hour storm event, and provide adequate sediment storage volume, without discharging into the Yucca Flat Wash.

The following parameters were used in the hydrologic analysis:

		10yr-24hr Storm	
1.	Water Course length, L	1.08	mi.
2.	Elevation Difference, H	170	ft
3.	Time of Concentration, T_c	0.392	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
6.	Drainage Area	116.9	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).

J7-T 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	71.0	81.4
Volume	ac-ft	7.9	6.6
Storage			
Peak Stage	msl	N/A	6342
Emerg. Spillway Elev.	msl	6341	6341
Peak Storage	ac-ft	N/A	12.3
Storage Capacity	ac-ft	10.7	10.7
Outflow			
Peak Flow	cfs	N/A	56.9
Spillway Elevation	msl	6341	6341
Embankment Crest Elev.	msl	6343	6343
Peak Stage	msl	--	6342
Freeboard	ft	--	1.0
Emergency Spillway Channel			
Flow Depth	ft	--	1.0
Critical Velocity	fps	--	4.0
Mannings "n"	--	--	.031
Width	ft	--	25
Outflow Channel			
Slope	%	--	25
Normal Velocity	fps	--	6.6
Normal Depth	ft	--	0.3
Mannings "n"	--	--	.053
Riprap D_{50}	in	--	6

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for J7-T will be a trapezoidal channel with dimensions listed below. The alignment and dimensions are shown on Exhibit 1.

Minimum Channel Depth	(Spillway)	2.0	ft
	(Outflow)	2.0	ft
Channel Width		25	ft
Channel Length	(Spillway)	25	ft
	(Outflow)	45	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25	%
Spillway Elevation		6341	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 J7-T is designed to contain approximately 10.7 acre-feet.

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The calculations for the sediment load entering structure J7-T 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	2.66
4.	Cover Factor, C	0.52
5.	Erosion Control Factor, P	0.59

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 J7-T is shown on Exhibit 1, J7-T Stage Capacity Table, and the results of the sediment inflow analysis are summarized in the following table.

J7-T STORAGE

Total Storage Capacity	10.7	acre-ft
10-year, 24-hour Storm Inflow	7.9	acre-ft
Available Sediment Storage Capacity	2.8	acre-ft
Sediment Inflow Rate	0.46	acre-ft/yr.
Sediment Storage Life	6.1	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) 25-Year, 6-Hour Storm Event

Exhibit # 1 - Proposed J7-T 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: J7-T

TIME OF CONCENTRATION (Haul Road):

Start Elevation (ft) =	6510
End Elevation (ft) =	6340
Elevation Difference, E (ft) =	170
Watercourse Length (ft) =	5700
Watercourse Length, L (mi) =	1.080
Tc = (11.9L^3/E)^0.385 =	0.392 hours

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Spoil	B	86	42.7	3672.2
Reclaimed	C	81	66.2	5362.2
Disturbed	D	91	8	728
TOTAL:			116.9	9762.4

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

DRAINAGE BASIN AREA:

116.90 Acres

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT: J7-T

SOIL ERODIBILITY FACTOR:

Soil Type	Soil Group	Erodibility Factor, K	Area (acres)	K*Area
Spoil	B	0.12	42.7	5.124
Reclaimed	C	0.38	66.2	25.156
Disturbed	D	0.22	8	1.76
TOTAL:			116.9	32.04

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

Weighted K = Total K*Area/ Total Area = 0.274

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
800	60	7.5%	0.5	4.3	2.78
800	30	3.8%	0.4	2.1	1.14
500	20	4.0%	0.4	2.3	1.00
900	30	3.3%	0.3	1.9	0.83
700	30	4.3%	0.4	2.5	1.22
300	80	26.7%	0.6	14.9	8.97

Average LS = 2.66

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 > or = 9%*

Where:

Slope < or = 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
Spoil	0%	0%	42.7	1	42.7	0.80	34.16
Reclaimed	40%	0%	66.2	0.15	9.93	0.40	26.48
Disturbed	0%	0%	8	1.00	8	1.00	8
TOTAL:			116.9		60.63		68.64

Weighted C = Total C*Area/ Total Area = 0.52

Weighted P = Total P*Area/ Total Area = 0.59

RAINFALL FACTOR:

R = 40

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: J7-T

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	2.66	
Cover Factor	0.52	
Practice Factor	0.59	
Gross Annual Sediment Yield	8.87	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0043	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0039	acre-feet/acre/year
Watershed Area	116.9	acres
Watershed Annual Sediment Yield	0.4557	acre-feet/year
Number of years	1	years
Required Pond Sediment Storage	0.456	acre-feet

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J7-T Spillway
Worksheet for Trapezoidal Channel

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

Input Data		
Mannings Coefficient	0.031	
Channel Slope	0.017763	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	25.00	ft
Discharge	56.90	cfs

Results		
Depth	0.53	ft
Flow Area	14.16	ft²
Wetted Perimeter	28.37	ft
Top Width	28.19	ft
Critical Depth	0.53	ft
Critical Slope	0.017762	ft/ft
Velocity	4.02	ft/s
Velocity Head	0.25	ft
Specific Energy	0.78	ft
Froude Number	1.00	
Flow is supercritical.		

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SEDCAD+ RIPRAP CHANNEL DESIGN

J7-T

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	56.90 cfs	
Slope	25.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	25.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.33 ft
with Freeboard	0.63 ft
Top Width	27.00 ft
with Freeboard	28.80 ft
Velocity	6.57 fps
Cross Sectional Area	8.66 sq ft
Hydraulic Radius	0.32 ft
Manning's n	0.053
Froude Number	2.04
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

PEABODY COAL COMPANY: POND J7-T (10-YR,24-HR)

by

Name: TEL

Company Name: ACZ, INC.
File Name: J:\861\0350\SEDCAD\J7-T

Date: 10-28-1997

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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: J:\861\0350\SEDCAD\J7-T User: TEL
Date: 10-28-1997 Time: 16:00:22
PEABODY COAL COMPANY: POND J7-T (10-YR,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	116.90	84	F	0.392	0.000	0.000	0.0	7.94	70.99
		Type: Null			Label: J7-T POND					
111	Structure	116.90							7.94	
111	Total IN/OUT	116.90							7.94	70.99

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APPENDIX C

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

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

PEABODY COAL COMPANY: POND J7-T (25-YR,6-HR)

by

Name: TEL

Company Name: ACZ, INC.
File Name: J:\861\0350\SEDCAD\J7-T25

Date: 10-29-1997

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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: J:\861\0350\SEDCAD\J7-T25 User: TEL
Date: 10-29-1997 Time: 10:42:03
PEABODY COAL COMPANY: POND J7-T (25-YR,6-HR)
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	116.90	84	F	0.392	0.000	0.000	0.0	6.57	81.42
		Type: Pond			Label: J7-T POND					
111	Structure	116.90							6.57	
111	Total IN	116.90							6.57	81.42
111	Total OUT								6.57	56.91

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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\0350\SEDCAD\J7-T25 User: TEL
Date: 10-29-1997 Time: 10:42:03
PEABODY COAL COMPANY: POND J7-T (25-YR,6-HR)
Storm: 1.90 inches, 25 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

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

J1, B1, S1
J7-T POND

Drainage Area from J1, B1, S1, SWS(s)1: 116.9 acres
Total Contributing Drainage Area: 116.9 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	6341.0
Crest Length (ft)	25.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	25.0

POND RESULTS:

Permanent Pool (ac-ft)
10.7

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	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	6.57	81.42
OUT	6.57	56.91

Peak Elevation	Hydrograph Detention Time (hrs)
6342.0	0.00

****

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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\0350\SEDCAD\J7-T25 User: TEL
Date: 10-29-1997 Time: 10:42:03
PEABODY COAL COMPANY: POND J7-T (25-YR,6-HR)
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
J7-T POND

Drainage Area from J1, B1, S1, SWS(s)1: 116.9 acres
Total Contributing Drainage Area: 116.9 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6332.00	0.00	0.86	0.00	0.00	
6333.00	1.00	0.92	0.89	0.00	
6334.00	2.00	0.99	1.85	0.00	
6335.00	3.00	1.07	2.88	0.00	
6336.00	4.00	1.14	3.98	0.00	
6337.00	5.00	1.22	5.16	0.00	
6338.00	6.00	1.30	6.42	0.00	
6339.00	7.00	1.38	7.75	0.00	
6340.00	8.00	1.46	9.17	0.00	
6341.00	9.00	1.55	10.68	0.00	Stage of SW#1
6341.70	9.70	1.62	11.79	29.72	
6341.80	9.80	1.62	11.95	38.60	
6341.90	9.90	1.63	12.12	47.78	
6341.99	9.99	1.64	12.26	56.91	Peak Stage
6342.00	10.00	1.64	12.28	58.25	
6342.50	10.50	1.69	13.11	124.22	
6343.00	11.00	1.74	13.97	206.19	

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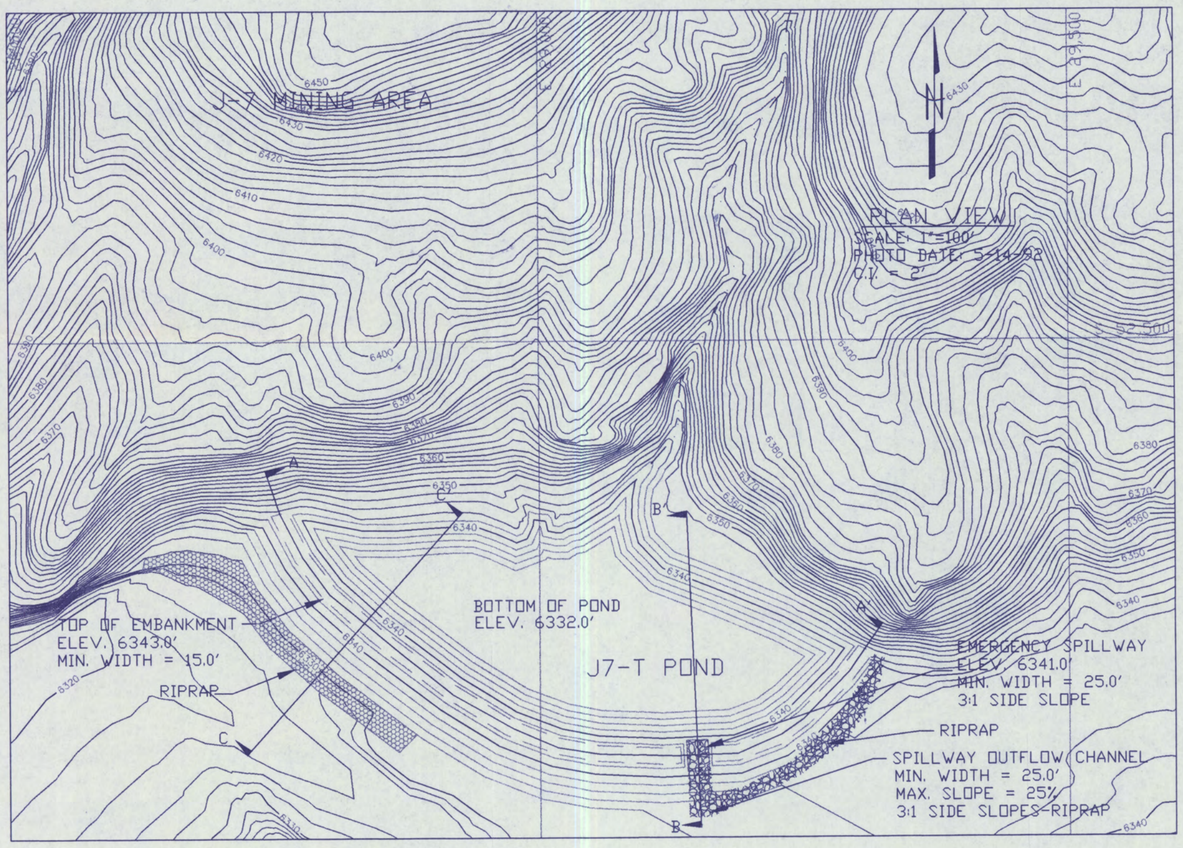
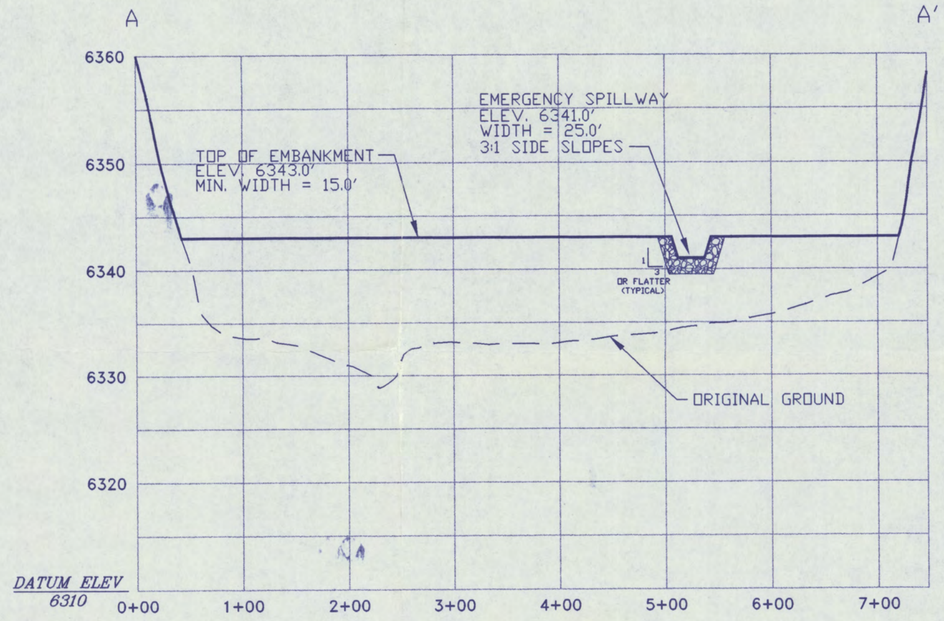
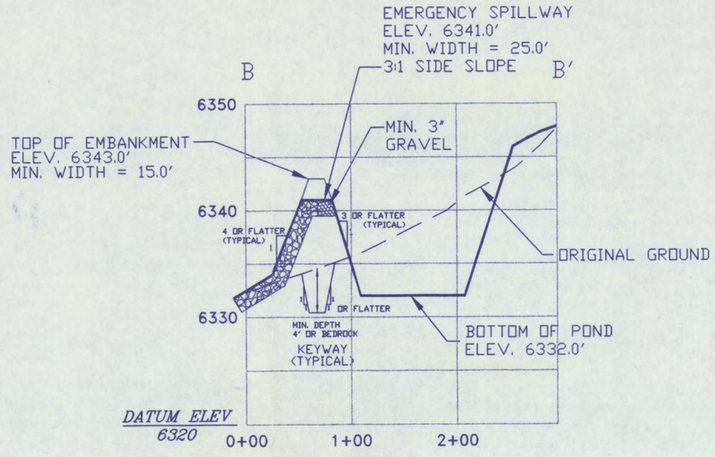




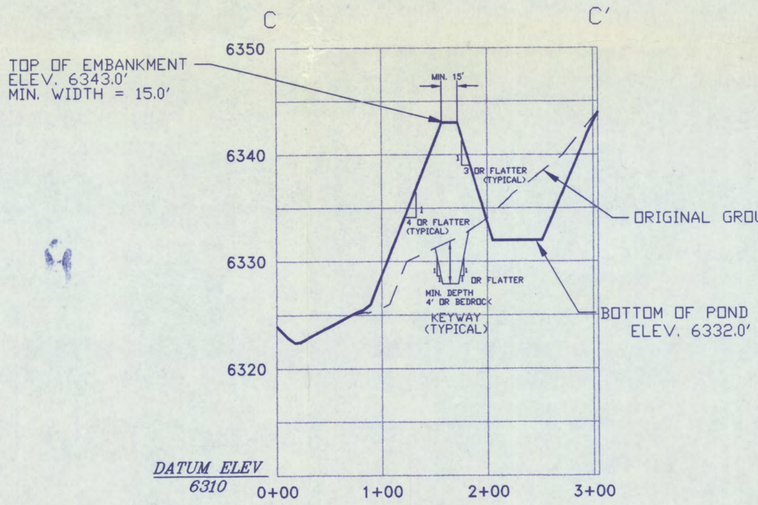
SECTION A - A'

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



SECTION B - B'

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

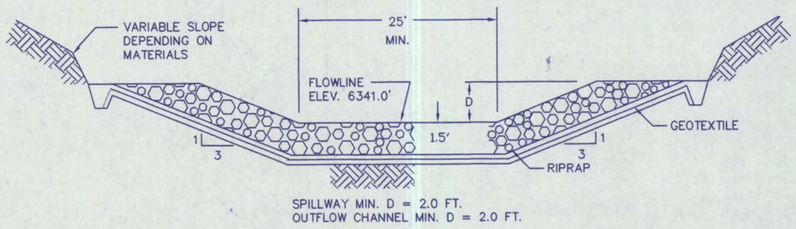


SECTION C - C'

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

J7-T POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6332.0	0.00	0.86	0.00	0.00	BOTTOM OF POND
6334.0	2.00	0.99	1.85	1.85	
6336.0	4.00	1.14	2.13	3.98	
6338.0	6.00	1.30	2.44	6.42	
6340.0	8.00	1.46	2.75	9.17	
6341.0	9.00	1.55	1.51	10.68	EMERGENCY SPILLWAY
6342.0	10.0	1.64	1.60	12.28	
6343.0	11.0	1.74	1.69	13.97	TOP OF EMBANKMENT



PROPOSED J7-T POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)

ENGINEER'S CERTIFICATION

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

JAMES G. SCHLENVOGT
COMPLIANCE ENG. MGR.
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: NOV 06 1997

NOTES:
1) General location, see Drawing No. 85400, Sheet K-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 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 #1
PROPOSED J7-T
SEDIMENTATION POND DESIGN

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

DESIGNED BY: TEL	SCALE: AS NOTED
DRAWN BY: JMB	DRAWING DATE: 10-29-97
CHECKED BY: JGS	PHOTO DATE: 05-14-92
CONTOUR INTERVAL: 2 FT.	DWG FILE: PONDJ7T.DWG

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DESIGN REPORT

Temporary Sedimentation Structure

J7-U

Black Mesa Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

DEC 1998
APPROVED

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

NOV 06 1997

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STORAGE CAPACITY 5

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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 J7-U Sedimentation Pond Design

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INTRODUCTION

Sedimentation Structure J7-U will be an earthen embankment, designed and constructed by Peabody Western Coal Company as a temporary sedimentation structure designed to control runoff and sediment from portions of J7 disturbed surface mining area at the Black Mesa Mine. The location of Structure J7-U and its watershed boundary are shown on Drawing No. 85400 (Sheet K-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 J7-U. 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 J7-U 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

Structure J7-U has an 18.2-acre drainage area and is located on a tributary upstream of Yucca Flat Wash at the Black Mesa Mine. The watershed is classified as 50% spoil and 50% disturbed.

DESIGN ANALYSES

GENERAL

Structure J7-U 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 J7-U is a Category A-3 embankment. A homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 15 feet wide on top will be constructed. An upstream slope of 2:1 (horizontal to vertical) and a downstream slope of 3.25:1 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 10-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 J7-U 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 spillway for the J7-U pond was analyzed using the 25-year, 6-hour storm. Structure J7-U was conservatively assumed to be full to the emergency spillway prior to the time of the 25-year storm event. The storage capacity of structure J7-U was analyzed using the 10-year, 24-hour storm. The pond was verified to completely contain the 10-year, 24-hour storm event, and provide adequate sediment storage volume, without discharging into the Yucca Flat Wash.

The following parameters were used in the hydrologic analysis:

		10yr-24hr Storm	
1.	Water Course length, L	0.284	mi.
2.	Elevation Difference, H	140	ft
3.	Time of Concentration, T_c	0.090	hr
4.	SCS Curve Number	89	
5.	Rainfall Depth, 10-year, 24-hour storm	2.1	in
	25-year, 6-hour storm	1.9	in
6.	Drainage Area	18.2	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).

J7-U 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	20.8	26.4
Volume	ac-ft	1.7	1.4
Storage			
Peak Stage	msl	N/A	6350.8
Emerg. Spillway Elev.	msl	6350	6350
Peak Storage	ac-ft	N/A	3.9
Storage Capacity	ac-ft	3.4	3.4
Outflow			
Peak Flow	cfs	N/A	17.7
Spillway Elevation	msl	6364	6350
Embankment Crest Elev.	msl	6367	6352
Peak Stage	msl	--	6350.8
Freeboard	ft	--	1.2
Emergency Spillway Channel			
Flow Depth	ft	--	0.8
Critical Velocity	fps	--	3.6
Mannings "n"	--	--	.031
Width	ft	--	10
Outflow Channel			
Slope	%	--	31
Normal Velocity	fps	--	6.0
Normal Depth	ft	--	0.3
Mannings "n"	--	--	.055
Riprap D_{50}	in	--	3

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for J7-U will be a trapezoidal channel with dimensions listed below. The alignment and dimensions are shown on Exhibit 1.

Minimum Channel Depth	(Spillway)	2.0	ft
	(Outflow)	2.0	ft
Channel Width		10	ft
Channel Length	(Spillway)	20	ft
	(Outflow)	20	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	31	%
Spillway Elevation		6350.0	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 J7-U is designed to contain approximately 3.4 acre-feet.

The calculations for the sediment load entering structure J7-U 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 — 0.17
3. Slope Factor, LS — 4.39
4. Cover Factor, C — 1.0
5. Erosion Control Factor, P — 0.9

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 J7-U is shown on Exhibit 1, J7-U Stage Capacity Table, and the results of the sediment inflow analysis are summarized in the following table.

J7-U STORAGE

Total Storage Capacity	3.4	acre-ft
10-year, 24-hour Storm Inflow	1.7	acre-ft
Available Sediment Storage Capacity	1.7	acre-ft
Sediment Inflow Rate	0.22	acre-ft/yr.
Sediment Storage Life	7.7	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 J7-U 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: J7-U

TIME OF CONCENTRATION (Haul Road):

Start Elevation (ft) =	6480
End Elevation (ft) =	6340
Elevation Difference, E (ft) =	140
Watercourse Length (ft) =	1500
Watercourse Length, L (mi) =	0.284
Tc = (11.9L^3/E)^0.385 =	0.090 hours

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Spoil	B	86	9.1	782.6
Disturbed	D	91	9.1	828.1
TOTAL:			18.2	1610.7

Weighted CN = Total CN*Area/ Total Area = 89

DRAINAGE BASIN AREA:

18.20 Acres

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT: J7-U

SOIL ERODIBILITY FACTOR:

Soil Type	Soil Group	Erodibility Factor, K	Area (acres)	K*Area
Spoil	B	0.12	9.1	1.092
Disturbed	D	0.22	9.1	2.002
TOTAL:			18.2	3.09

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

Weighted K = Total K*Area/ Total Area = 0.170

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
500	30	6.0%	0.5	3.4	1.78
250	15	6.0%	0.5	3.4	1.26
200	50	25.0%	0.6	14.0	6.57
200	60	30.0%	0.6	16.7	7.95

Average LS = 4.39

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 > or = 9%*

Where:

Slope < or = 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
Spoil	0%	0%	9.1	1	9.1	0.80	7.28
Disturbed	0%	0%	9.1	1.00	9.1	1.00	9.1
TOTAL:			18.2		18.2		16.38

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

Weighted P = Total P*Area/ Total Area = 0.90

RAINFALL FACTOR:

R = 40

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: J7-U

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	0.17	
Length Slope Factor	4.39	
Cover Factor	1.00	
Practice Factor	0.90	
Gross Annual Sediment Yield	26.85	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0131	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0118	acre-feet/acre/year
Watershed Area	18.2	acres
Watershed Annual Sediment Yield	0.2148	acre-feet/year
Number of years	1	years
Required Pond Sediment Storage	0.215	acre-feet

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SEDCAD+ RIPRAP CHANNEL DESIGN

J7-U

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	17.70 cfs	
Slope	31.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	10.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.27 ft
with Freeboard	0.57 ft
Top Width	11.63 ft
with Freeboard	13.43 ft
Velocity	6.01 fps
Cross Sectional Area	2.95 sq ft
Hydraulic Radius	0.25 ft
Manning's n	0.055
Froude Number	2.10
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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J7-U Spillway
Worksheet for Trapezoidal Channel

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

Input Data		
Mannings Coefficient	0.031	
Channel Slope	0.019396	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	10.00	ft
Discharge	17.70	cfs

Results		
Depth	0.44	ft
Flow Area	4.97	ft^2
Wetted Perimeter	12.78	ft
Top Width	12.64	ft
Critical Depth	0.44	ft
Critical Slope	0.019397	ft/ft
Velocity	3.56	ft/s
Velocity Head	0.20	ft
Specific Energy	0.64	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 COAL COMPANY: POND J7-U (10-YR,24-HR)

by

Name: TEL

Company Name: ACZ, INC.
File Name: J:\861\0350\SEDCAD\J7-U

Date: 10-28-1997

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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: J:\861\0350\SEDCAD\J7-U User: TEL
Date: 10-28-1997 Time: 16:12:50
PEABODY COAL COMPANY: POND J7-U (10-YR,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	18.20	89	F	0.090	0.000	0.000	0.0	1.69	20.83
		Type: Null			Label: J7-U POND					
111	Structure	18.20							1.69	
111	Total IN/OUT	18.20							1.69	20.83

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APPENDIX C

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

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

PEABODY COAL COMPANY: POND J7-U (25-YR,6-HR)

by

Name: TEL

Company Name: ACZ, INC.
File Name: J:\861\0350\SEDCAD\J7-U25

Date: 10-28-1997

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DEC 1998

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

Company Name: ACZ, INC.
Filename: J:\861\0350\SEDCAD\J7-U25 User: TEL
Date: 10-28-1997 Time: 16:48:17
PEABODY COAL COMPANY: POND J7-U (25-YR,6-HR)
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	18.20	89	F	0.090	0.000	0.000	0.0	1.43	26.38
		Type: Pond			Label: J7-U POND					
111	Structure	18.20							1.43	
111	Total IN	18.20							1.43	26.38
111	Total OUT								1.43	17.73

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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\0350\SEDCAD\J7-U25 User: TEL
Date: 10-28-1997 Time: 16:48:17
PEABODY COAL COMPANY: POND J7-U (25-YR,6-HR)
Storm: 1.90 inches, 25 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

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

J1, B1, S1
J7-U POND

Drainage Area from J1, B1, S1, SWS(s)1: 18.2 acres
Total Contributing Drainage Area: 18.2 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	6350.0
Crest Length (ft)	20.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	10.0

POND RESULTS:

	Permanent Pool (ac-ft)
	3.4

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	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	1.43	26.38
OUT	1.43	17.73

Peak Elevation	Hydrograph Detention Time (hrs)
6350.8	0.00

****

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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\0350\SEDCAD\J7-U25 User: TEL
Date: 10-28-1997 Time: 16:48:17
PEABODY COAL COMPANY: POND J7-U (25-YR,6-HR)
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
J7-U POND

Drainage Area from J1, B1, S1, SWS(s)1: 18.2 acres
Total Contributing Drainage Area: 18.2 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6340.00	0.00	0.18	0.00	0.00	
6341.00	1.00	0.21	0.20	0.00	
6342.00	2.00	0.24	0.42	0.00	
6343.00	3.00	0.27	0.68	0.00	
6344.00	4.00	0.30	0.96	0.00	
6345.00	5.00	0.34	1.28	0.00	
6346.00	6.00	0.37	1.64	0.00	
6347.00	7.00	0.41	2.03	0.00	
6348.00	8.00	0.44	2.45	0.00	
6349.00	9.00	0.48	2.92	0.00	
6350.00	10.00	0.52	3.42	0.00	Stage of SW#1
6350.60	10.60	0.55	3.74	10.17	
6350.70	10.70	0.55	3.79	13.20	
6350.80	10.80	0.55	3.85	17.43	
6350.81	10.81	0.55	3.85	17.73	Peak Stage
6350.90	10.90	0.56	3.91	21.64	
6351.00	11.00	0.56	3.96	26.78	
6351.50	11.50	0.58	4.25	58.07	
6352.00	12.00	0.60	4.54	102.53	

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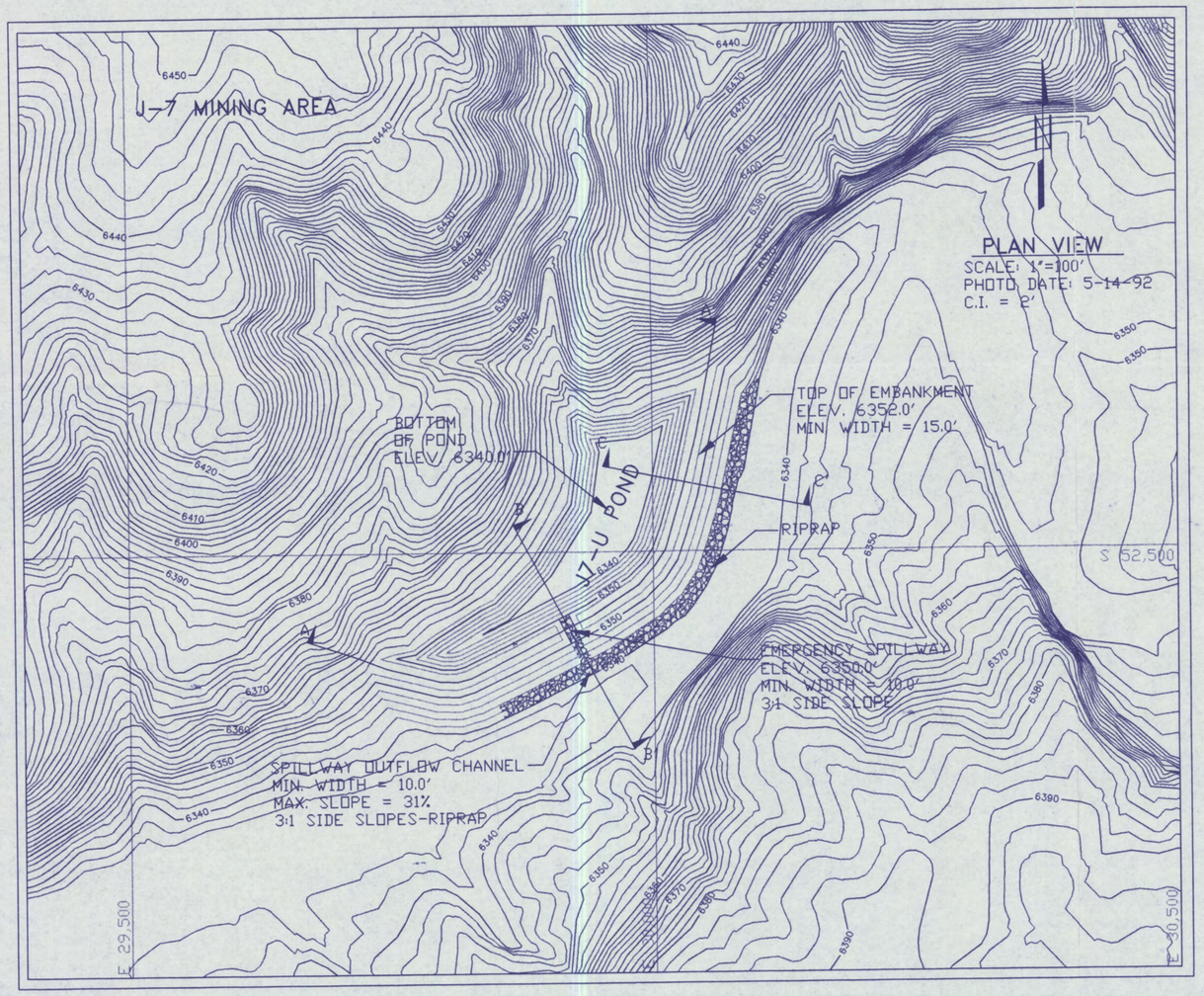
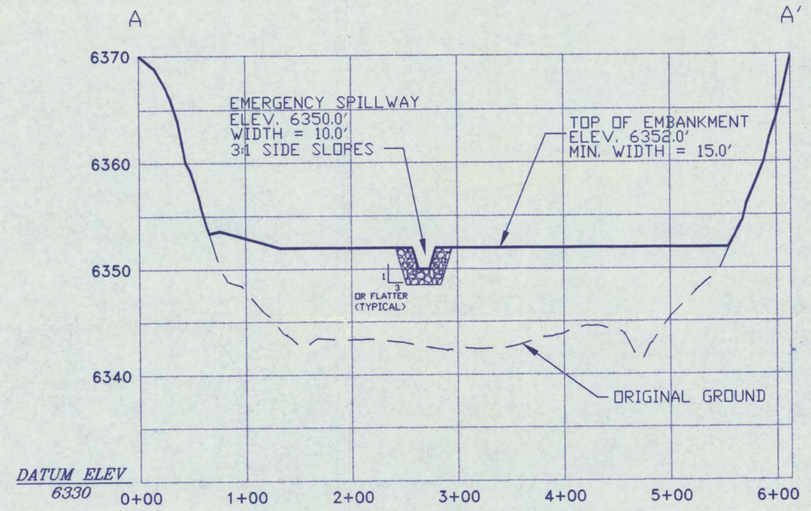
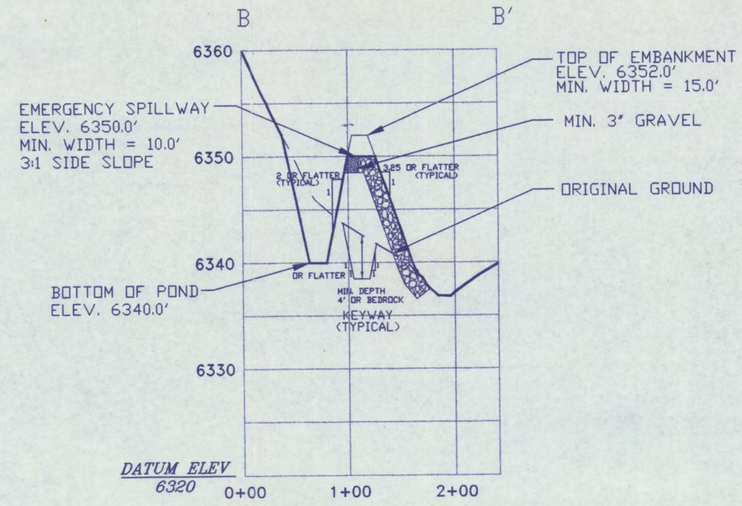




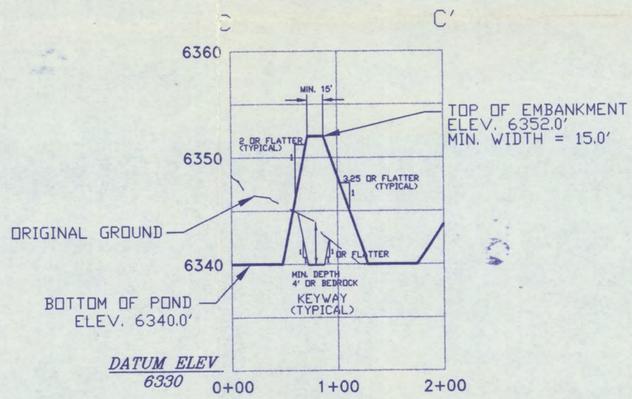
SECTION A - A'

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



SECTION B - B'

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



SECTION C - C'

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

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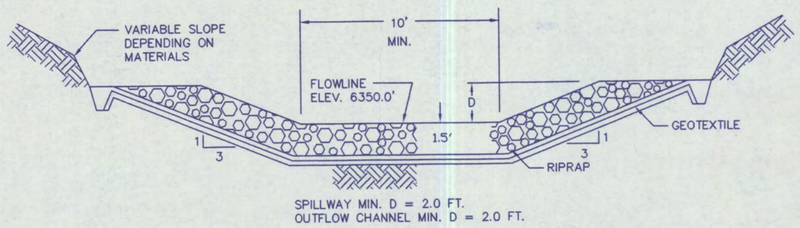
J7-U POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6340.0	0.00	0.18	0.00	0.00	BOTTOM OF POND
6342.0	2.00	0.24	0.42	0.42	
6344.0	4.00	0.30	0.54	0.96	
6346.0	6.00	0.37	0.68	1.64	
6348.0	8.00	0.44	0.81	2.45	
6350.0	10.00	0.52	0.97	3.42	EMERGENCY SPILLWAY
6352.0	12.00	0.60	1.12	4.54	TOP OF EMBANKMENT



PROPOSED J7-U POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)

ENGINEER'S CERTIFICATION

Registered Professional Engineer (Civil) CERTIFICATE NO. 18782 JAMES GARY SCHLENVOGT STATE OF ARIZONA U.S.A.

JAMES G. SCHLENVOGT
COMPLIANCE ENG. MGR.
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: NOV 06 1997

NOTES:
1) General location, see Drawing No. 85400, Sheet K-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 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 #1
PROPOSED J7-U
SEDIMENTATION POND DESIGN

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

DESIGNED BY: TEL	SCALE: AS NOTED
DRAWN BY: JMB	DRAWING DATE: 10-29-97
CHECKED BY: JGS	PHOTO DATE: 05-14-92
CONTOUR INTERVAL: 2 FT.	DWG FILE: PONDJ7U.DWG

INSPECTION REPORT

Sedimentation Structure

J7-G

Black Mesa Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Dames & Moore
10139-011-22

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APPENDIX A - INSPECTION CHECK LIST

APPENDIX B - HYDROLOGY AND HYDRAULIC CALCULATIONS

INTRODUCTION

Sedimentation Structure J7-G 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 Black Mesa Mine. The location of Structure J7-G is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure J7-G. 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 J7-G was inspected on September 4, 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 J7-G 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 J7-G has a 26.7-acre tributary drainage area and is located near the Red Peak Valley at the Black Mesa Mine. The watershed is classified as 100% reclaimed land.

EMBANKMENT

Structure J7-G is a homogeneous earthen embankment classified as a sidehill embankment. Physical characteristics of the embankment are listed in the following table:

Structure J7-G

Embankment	Residual Sandstone Soils
Foundation	Residual Sandstone Soils
Right Abutment	Sandstone/Residual Sandstone Soils
Left Abutment	Residual Sandstone Soils
Height	10.1 ft
Crest Width	14.0 ft
Upstream Slope	2.5 H : 1 V
Downstream Slope . . .	4.25 H : 1 V

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section J7-G, A-A'. Grass provides erosion protection on the upstream and downstream slopes of the embankment.

ANALYSES

STABILITY

Structure J7-G is a category A-1 embankment. A standard category A-1 embankment has static and seismic factors of safety of 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 J7-G 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 J7-G is not in series with any other structure and therefore the spillway was analyzed using the 25-year, 6-hour storm. The storage capacity of Structure J7-G was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1. Water Course length, L . . . . . 0.152 mi
2. Elevation Difference, H . . . . . 28 ft
3. Time of Concentration in hours, T_c . . . 0.081 h
4. Lag time, $0.6T_c$ . . . . . 0.049 h
5. SCS Curve Number 81
6. Rainfall Depth, 10-year, 24-hour storm . 2.1 in.
   25-year, 6-hour storm. . 1.9 in.
7. Drainage Area . . . . . 26.7 acres

HYDRAULICS

The HEC-1 program was utilized to evaluate inflow, reservoir response and outflow from the sedimentation structure. The initial conditions and results of the analysis are summarized in the following table.

J7-G 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	37	41
Volume	acre-ft	1.65	1.27
Storage			
Peak Stage	ft	6366.4	6369.0
Spillway Elevation . .	ft	6368.3	--
Peak Storage	acre-ft	1.65	--
Storage Capacity . . .	acre-ft	3.20	--
Outflow			
Peak Flow	cfs	0	3
Embankment Crest Elevation	ft	--	6370.30
Peak Storage	ft	--	6368.98
Freeboard	ft	--	1.32
Spillway Channel			
Flow Depth	ft	--	0.68
Critical Velocity. . .	fps	--	1.8
Manning's "n"		--	0.035
Outflow Channel			
Slope	%	--	9
Normal Velocity. . . .	fps	--	2.4
Normal Depth	ft	--	0.08
Manning's "n"		--	0.035

Spillway Channel

The existing spillway for J7-G has a trapezoidal channel with the following dimensions:

Channel depth	2 ft
Channel width	14 ft
Channel length	85 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 structure presently has no outflow 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, J7-G.

The calculations for the sediment load entering Structure J7-G were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.42
3. Slope Factor, LS 4.6
4. Cover Factor, C 0.042
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 J7-G is shown on Plate 3, Volume-Elevation Curve, J7-G, and the results of the analysis are summarized in the following table.

J7-G STORAGE

Total Storage Capacity	3.20	acre-ft
10-year, 24-hour Storm Inflow	1.65	acre-ft
Available Sediment Storage Capacity . .	1.55	acre-ft
Sediment Inflow Rate	0.144	acre-ft/yr
Sediment Storage Life	11	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure J7-G indicated that the only geotechnical problem is minor rill erosion on the downstream face of the structure and on the sideslopes of the spillway channel. Correction of erosion is considered a periodic maintenance task and does not require remedial action.

HYDRAULICS

Dames & Moore's evaluation indicates that the storage and spillway capacity of Structure J7-G are adequate; however, the spillway does not have an outflow channel nor adequate erosion protection. A trapezoidal outflow channel should be constructed along the alignment B-B' shown on Plate 1. The channel profile is shown on Plate 4 and the required dimensions are shown on Plate 5. Both the spillway and outflow channel should be protected against erosion using geotextile and gravel as shown on Plate 5.

* * *

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

Plate 1 - Site Plan J7-G

Plate 2 - Existing Maximum Cross Section J7-G, A-A'

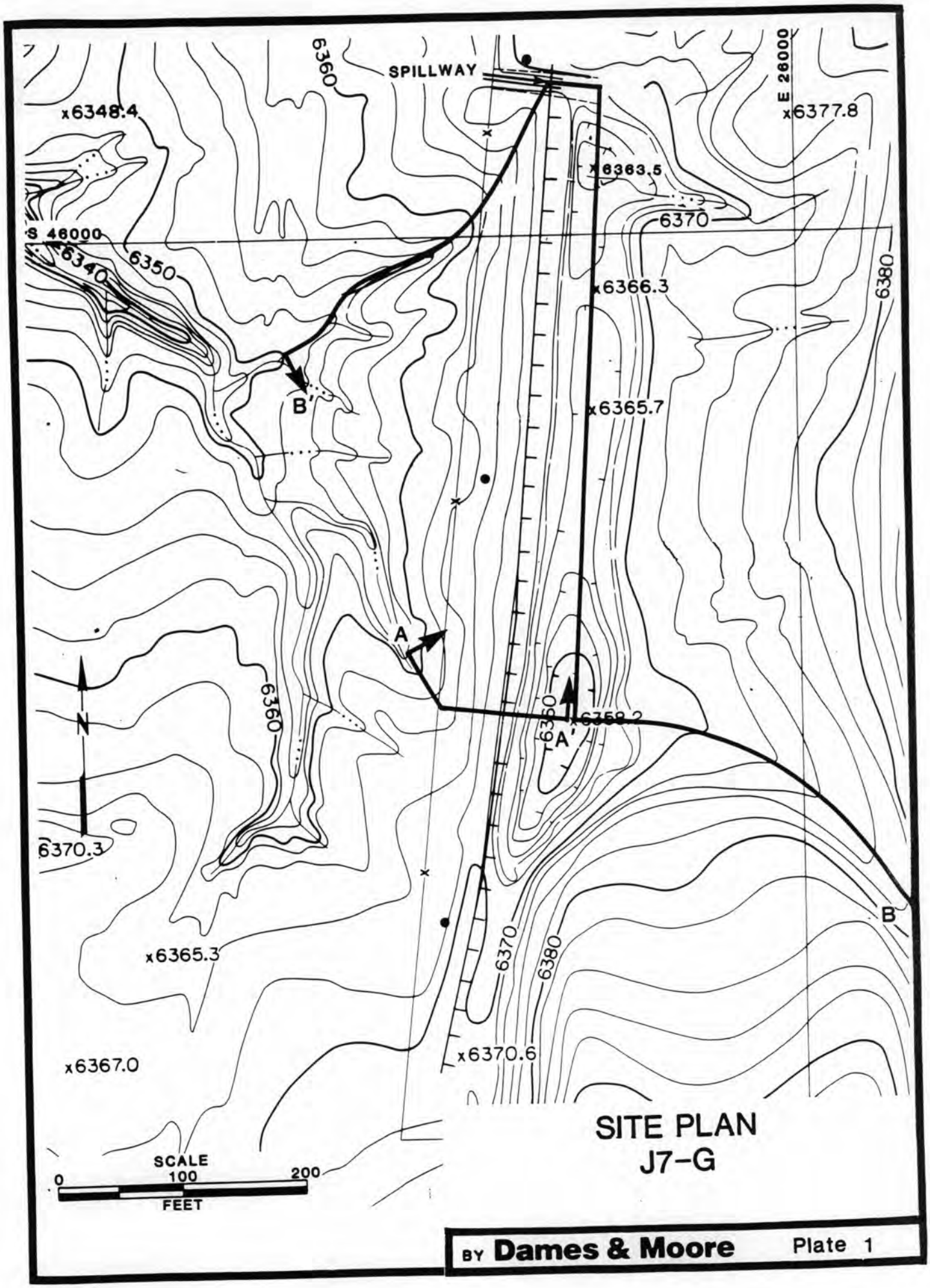
Plate 3 - Volume-Elevation Curve J7-G

Plate 4 - Channel Profile J7-G, B-B'

Plate 5 - Spillway and Outflow Channel Cross Section J7-G

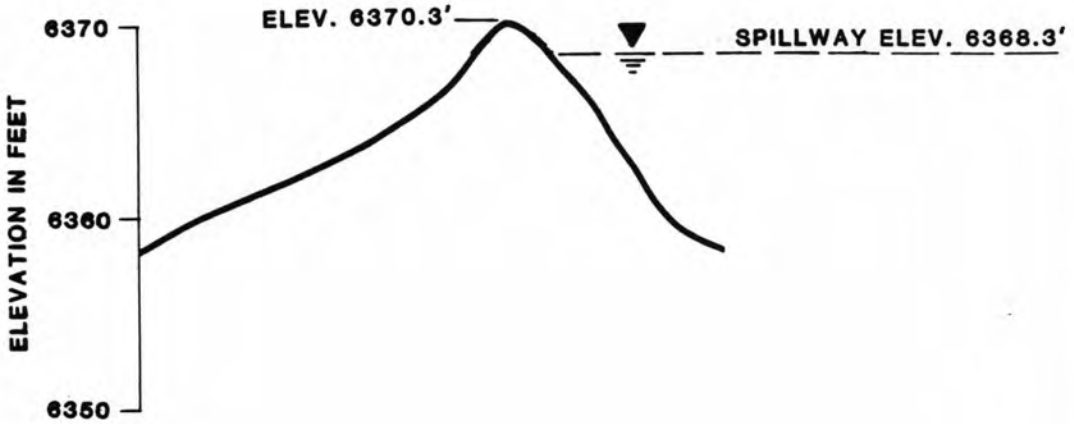
Appendix A - Inspection Check List

Appendix B - Hydrology and Hydraulic Calculations



SITE PLAN
J7-G

BY **Dames & Moore** Plate 1



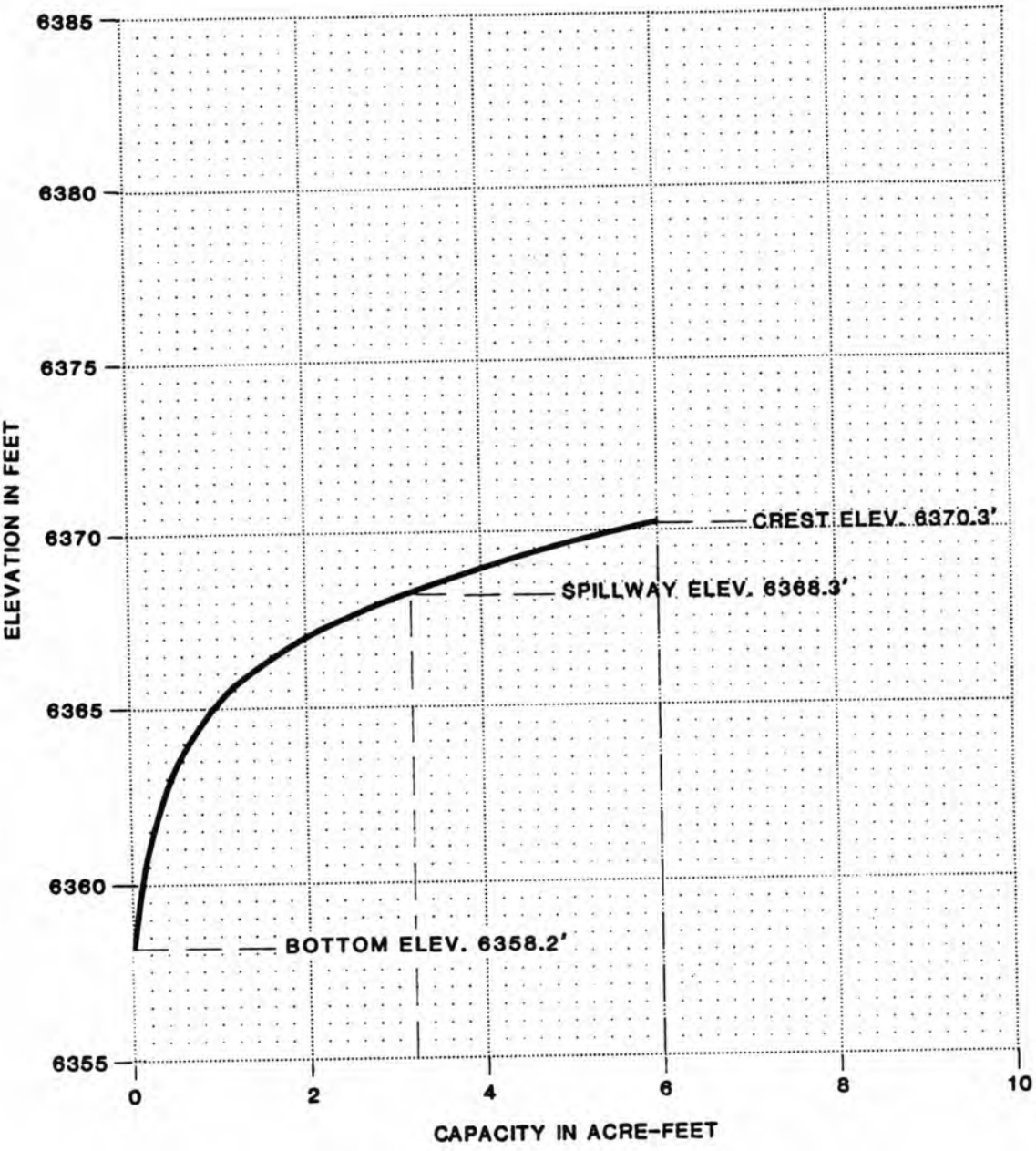
SCALE
0 50 100
FEET

EXISTING MAXIMUM CROSS-SECTION J7-G A-A'

FOR LOCATION SEE PLATE 1

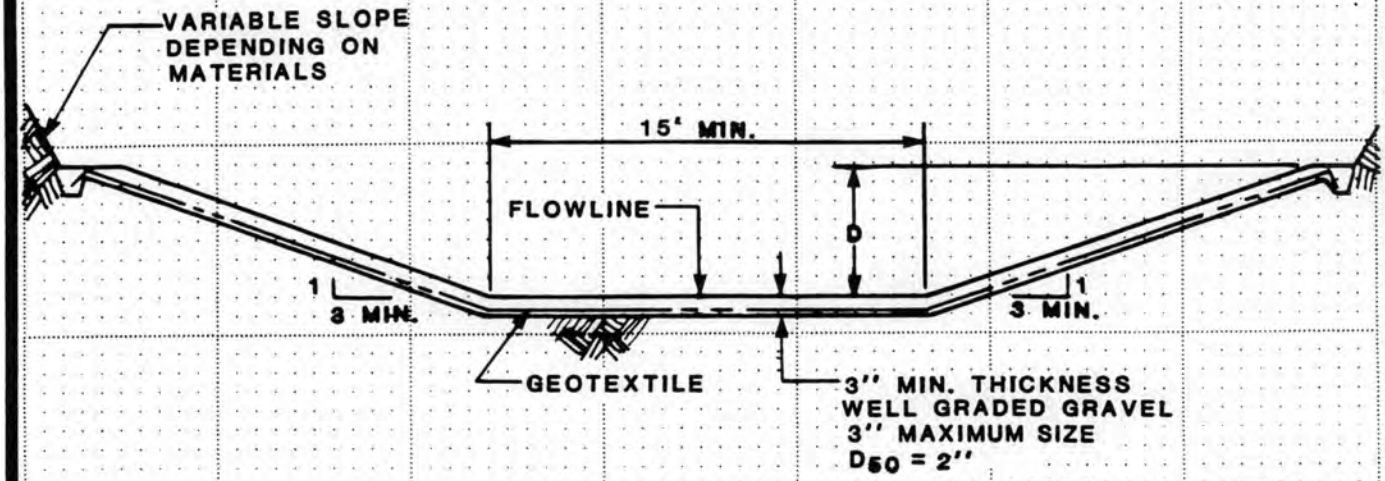
BY **Dames & Moore**

Plate 2



VOLUME-ELEVATION CURVE
J7-G

BY **Dames & Moore** Plate 3



SPILLWAY CHANNEL

D = 1.7'

LENGTH = 50'

FLOWLINE ELEV.= 6368.3'

OUTFLOW CHANNEL

D = 1'

SPILLWAY AND OUTFLOW CHANNEL CROSS SECTION J7-G

BY **Dames & Moore** Plate 5

APPENDIX A

INSPECTION CHECK LIST

Sediment Impoundment Name: J7-G
Page: 4

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST			
a. Any visual settlements?		X	Overgrown with grass
b. Misalignment?		X	
c. Cracking?		X	
2. UPSTREAM SLOPE			
a. Adequate grass cover?	X		
b. Any erosion?			
c. Are trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Adequate riprap protection?	X		grass
g. Any stone deterioration?			NA
h. Visual depressions or bulges?		X	
i. Visual settlements?		X	
j. Animal burrows?		X	
3. DOWNSTREAM SLOPE			13°
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			22°
a. Any erosion?		X	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			brown silt
5. ABUTMENT CONTACT. LEFT			
a. Any erosion?		X	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			silt brown

Sediment Impoundment Name: J7-G
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?			NA
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
c. Spillway Channel:	X		
Are side slopes eroding?	X		Sm Rills
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?		X	
d. Outflow Channel:		X	
Are side slopes eroding?			NA
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
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: J7-G
Page: 6

ITEM	YES	NO	REMARKS
8. IMPOUNDMENT			
a. Sinkholes?		X	(Elev.) feet
b. Water present?		X	(Elev.) feet
c. Siltation?	X		some
d. Watershed matches soil map?		X	Reclaimed 90% bare 10%

9. GENERAL COMMENTS

FENCED POND

Canopy Cover 10%

Ground Cover 75%

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

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

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6396 − 6368 = 28 ft.

WATER COURSE LENGTH = 800 ft. = 0.152 mi.

$$T_c = \left(\frac{11.9(0.152)^3}{28}\right)^{0.385} = 0.081 \text{ hr.}$$

LAG TIME = $0.6 T_c$ = 0.049 hr.

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
26.7 (100%)	pasture - lawns Rell.	fair	—	Use 81

DRAINAGE BASIN AREA

26.7 AC. 0.042 SQ. MI.

BY ___ DATE ___
CHECKED BY ___
COPY TO EO ___

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

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

R = 40

SOIL ERODIBILITY FACTOR

SOIL TYPE = 100% RECLAIMED

K = 0.42

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
1000	55	6	2.13
500	65	13	4.6

USE 4.6

COVER FACTOR

AREA (ac)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
100%	RECL.	75	—	.15

BY ___ DATE ___
CHECKED BY ___
COPY TO EO ___

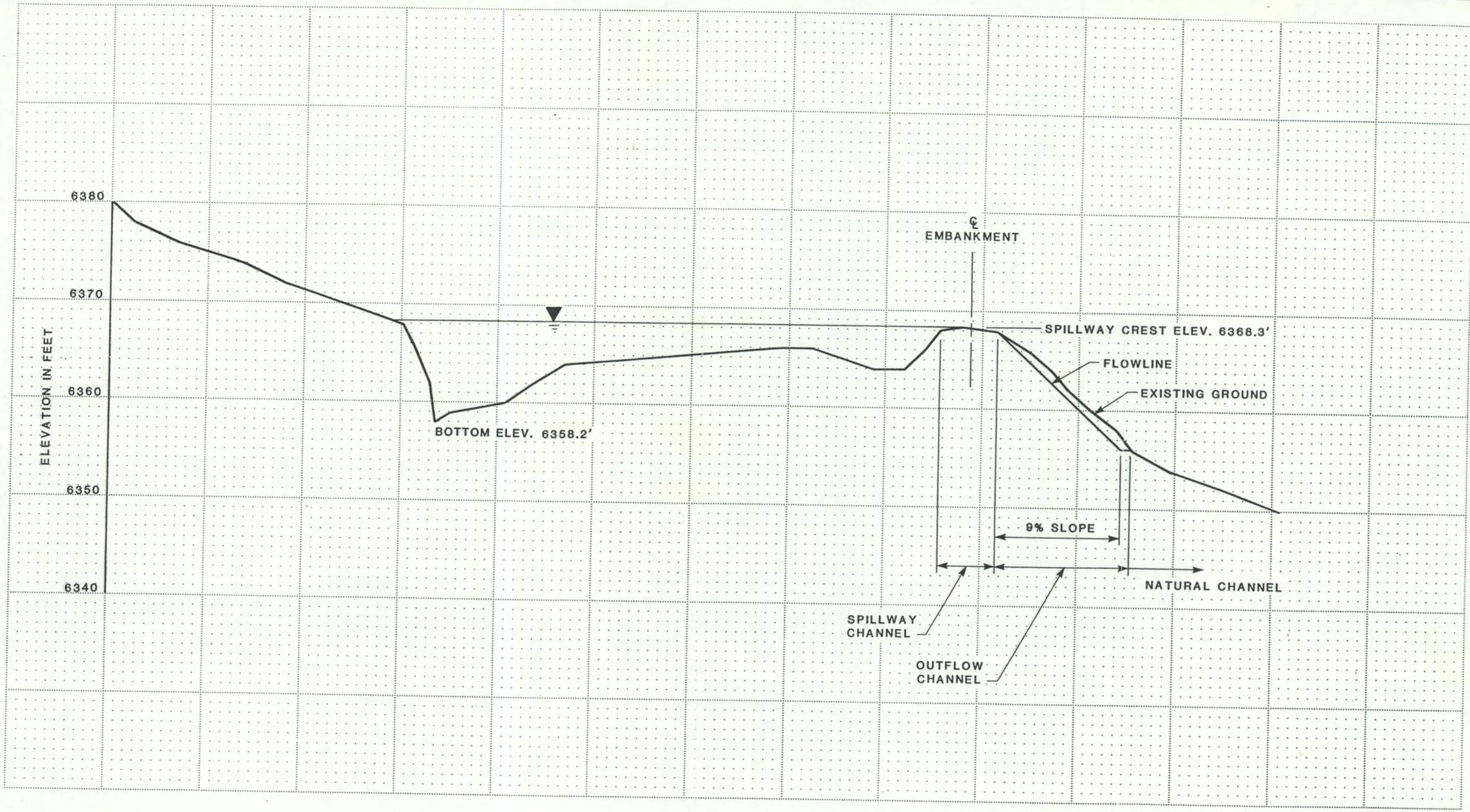
EROSION CONTROL FACTOR

P = 1.0

SEDIMENT INFLOW

$A = 40(0.42)(4.6)(0.15)(1.0) = 11.59$ ton/acre/year

$A = 11.59\left(\frac{1}{2047}\right)(26.7\text{ ac.})(0.75) = .144$ acre-feet/year



SCALE
0 100 200
FEET

CHANNEL PROFILE B-B'
J7-G

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 4

INSPECTION REPORT

Sedimentation Structure

J7-H

Black Mesa Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Registered Professional Engineer (Civil)
CERTIFICATE NO.
13376
LUTZ
KUNZE
Date Signed 11-22-85
ARIZONA, U.S.A.

Dames & Moore
10139-011-22

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APPENDIX A - INSPECTION CHECK LIST

APPENDIX B - HYDROLOGY AND HYDRAULIC CALCULATIONS

INTRODUCTION

Sedimentation Structure J7-H is an earthen embankment, designed and constructed in 1980 by Peabody Coal Company as a temporary sedimentation structure to control runoff and sediment from the disturbed mining areas of the Black Mesa Mine. The location of Structure J7-H is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure J7-H. 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 J7-H was inspected on September 2, 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 J7-H 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 J7-H has a 33.0-acre tributary drainage area and is located near he Yucca Flats Wash at the Black Mesa Mine. The watershed is classified as 34% reclaimed, 33% Sagebrush/grass, and 33% disturbed.

EMBANKMENT

Structure J7-H is a homogeneous earthen embankment classified as a sidehill embankment. Physical characteristics of the embankment are listed in the following table:

Structure J7-H

Embankment	Residual Shale/Sandstone Soils
Foundation	Residual Shale Soils
Right Abutment	Residual Shale Soils
Left Abutment	Residual Shale Soils
Height	7.3 ft
Crest Width	22 ft
Upstream Slope	2.5 H : 1 V
Downstream Slope . . .	7.5 H : 1 V

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section J7-H, A-A'.

ANALYSES

STABILITY

Structure J7-H is a category B-1 embankment. A standard category B-1 embankment has static and seismic factors of safety of 1.5 and 1.2, respectively, under the following conditions:

1. Maximum height = 10 ft
2. Maximum upstream slope = 1.5 H : 1 V
3. Maximum downstream slope = 2.5 H : 1 V
4. Normal pool with steady seepage saturation conditions

The J7-H 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 J7-H is located upstream from Structure J7-I. The two structures have a combined storage capacity that is greater than 20 acre-feet. However, the spillway for J7-H was analyzed using the 25-year, 6-hour storm because J7-H is the upstream structure. The storage capacity of Structure J7-H was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.294	mi
2.	Elevation Difference, H	23	ft
3.	Time of Concentration, T_c	0.188	h
4.	Lag time, $0.6T_c$	0.113	h
5.	SCS Curve Number	85	
6.	Rainfall Depth, 10-year, 24-hour storm .	2.1	in.
	25-year, 6-hour storm. .	1.9	in.
7.	Drainage Area	33.0	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.

J7-H 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	45	53
Volume	acre-ft	2.45	2.09
Storage			
Peak Stage	ft	6371.25	6375.12
Spillway Elevation . .	ft	6373.80	—
Peak Storage	acre-ft	2.47	--
Storage Capacity . . .	acre-ft	4.82	--
Outflow			
Peak Flow	cfs	0	9
Embankment Crest Elevation	ft	--	6376.30
Peak Stage	ft	—	6375.05
Freeboard	ft	--	1.25
Spillway Channel			
Flow Depth	ft	--	1.25
Critical Velocity. . .	fps	--	2.6
Manning's "n"		--	0.035
Outflow Channel			
Slope	%	--	5
Normal Velocity. . . .	fps	--	3.1
Normal Depth	ft	—	0.19
Manning's "n"		--	0.035

Spillway Channel

The existing spillway for J7-H has a trapezoidal channel with the following dimensions:

Channel depth	2.5	ft
Channel width	16	ft
Channel length	80	ft
Side slopes (horizontal to vertical). .	2:1	
Average exit slope	2	percent

There is presently only grass for erosion protection within the channel.

Outflow Channel

The structure presently has no outflow 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, J7-H.

The calculations for the sediment load entering Structure J7-H were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.22
3. Slope Factor, LS 1.65
4. Cover Factor, C 0.394
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 storage capacity of J7-H is shown on Plate 3, Volume-Elevation Curve, J7-H, and the results of the analysis are summarized in the following table.

J7-H STORAGE

Total Storage Capacity	4.82	acre-ft
10-year, 24-hour Storm Inflow	2.45	acre-ft
Available Sediment Storage Capacity . .	2.35	acre-ft
Sediment Inflow Rate	0.095	acre-ft/yr
Sediment Storage Life	25	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure J7-H indicated that the only geotechnical problem is rill erosion on the upstream slope and the side slopes and bottom of the spillway channel. Correction of erosion is considered a periodic maintenance task and does not require remedial action.

HYDRAULICS

The storage capacity and spillway capacity of Structure J7-H are adequate; however, the spillway does not have an outflow channel or adequate erosion protection. A trapezoidal outflow channel should be constructed along the alignment B-B' shown in Plate 1. The channel profile is shown in Plate 4 and the required dimensions are shown in Plate 5. Both the spillway and outflow channel should be protected against erosion using geotextile and gravel as shown in Plate 5.

* * *

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

Plate 1 - Site Plan J7-H

Plate 2 - Existing Maximum Cross Section J7-H, A-A'

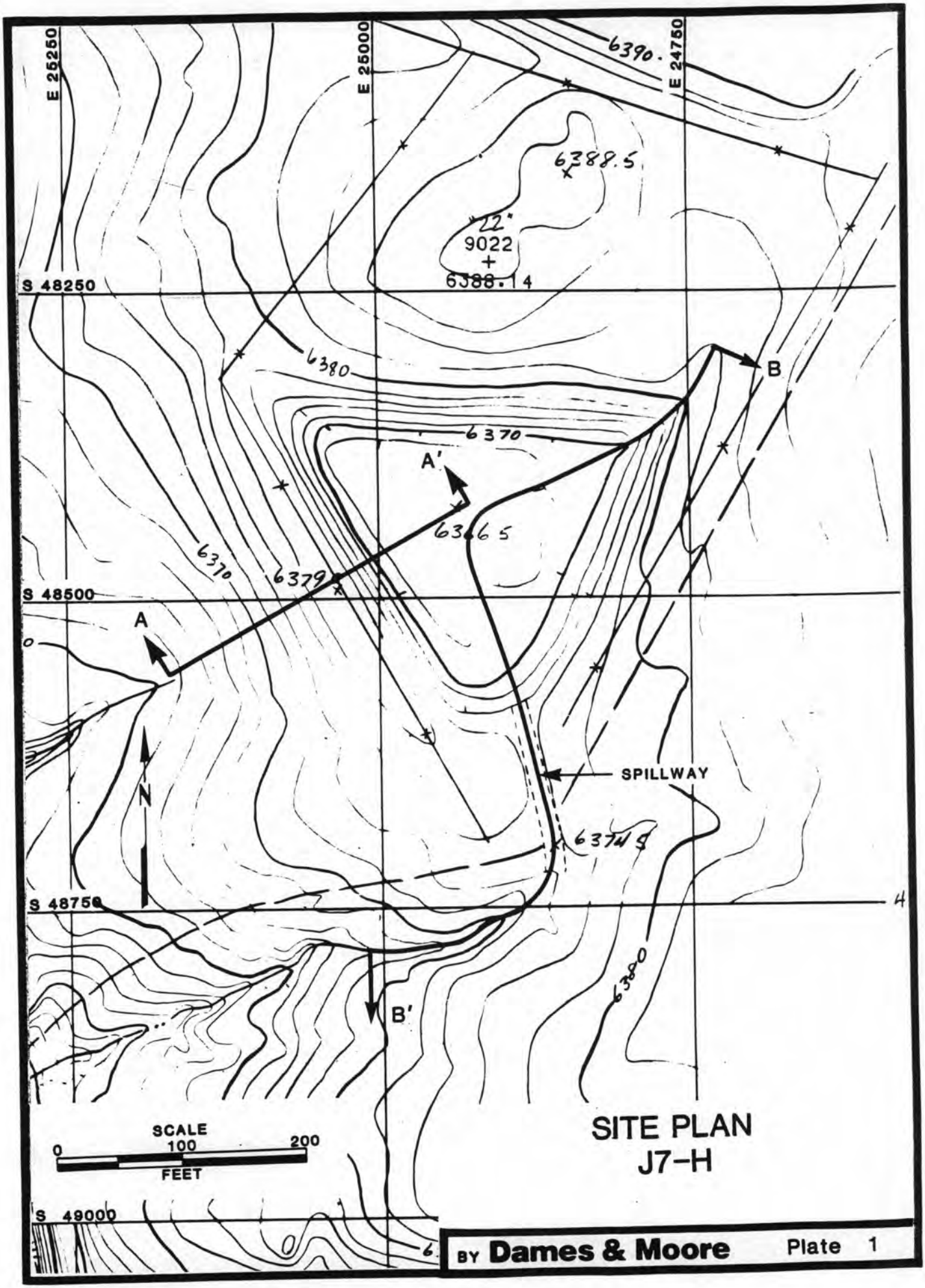
Plate 3 - Volume-Elevation Curve J7-H

Plate 4 - Channel Profile J7-H, B-B'

Plate 5 - Spillway and Outflow Channel Cross Section J7-H

Appendix A - Inspection Check List

Appendix B - Hydrology and Hydraulic Calculations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E 25000
E 24750
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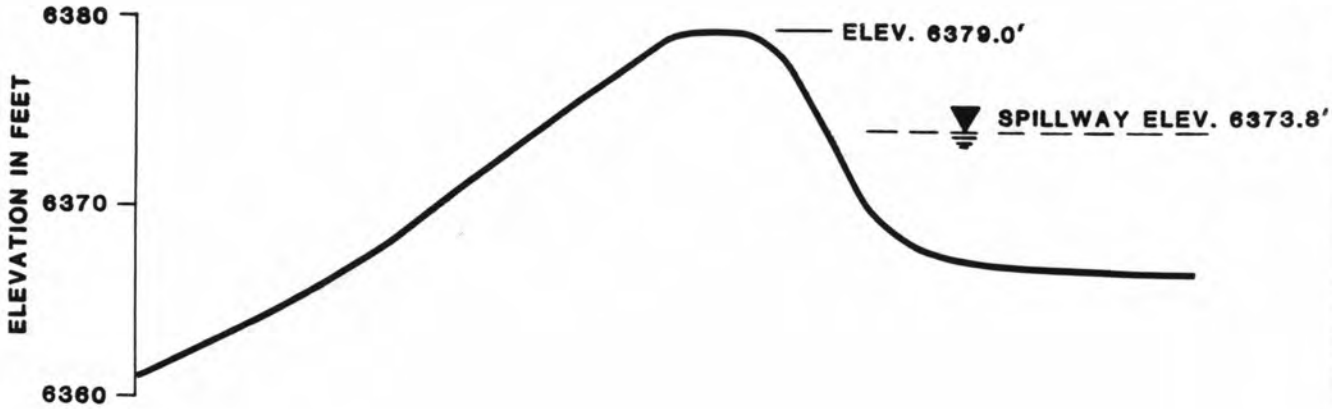
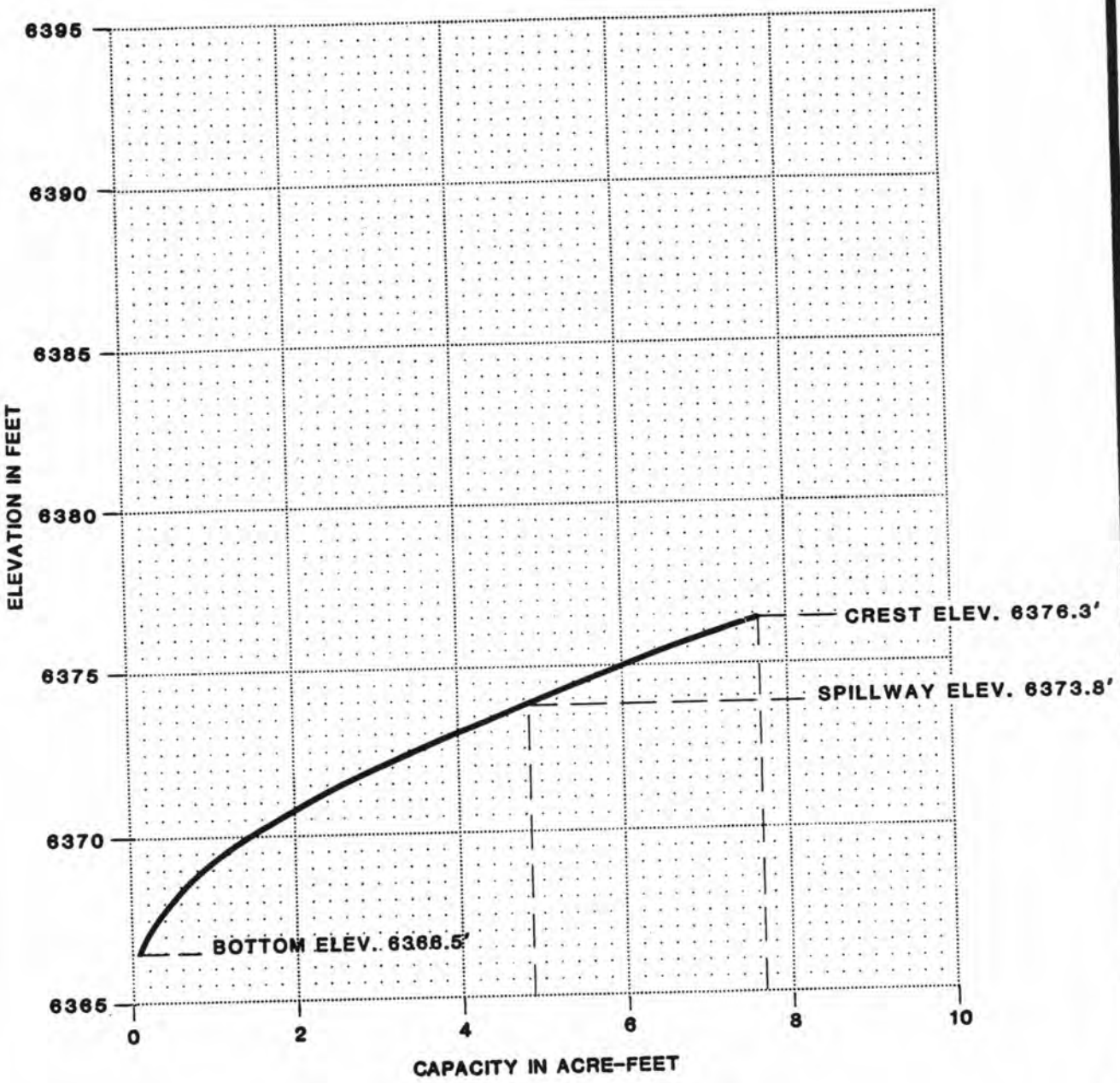
S 48500
S 48750
S 49000
6390
6388.5
22
9022
6388.14
6380
6370
6370
6379
6366.5
A
A'
B
B'
SPILLWAY
6374.5
6380
N
SCALE
0
100
200
FEET
SITE PLAN
J7-H
BY Dames & Moore
Plate 1



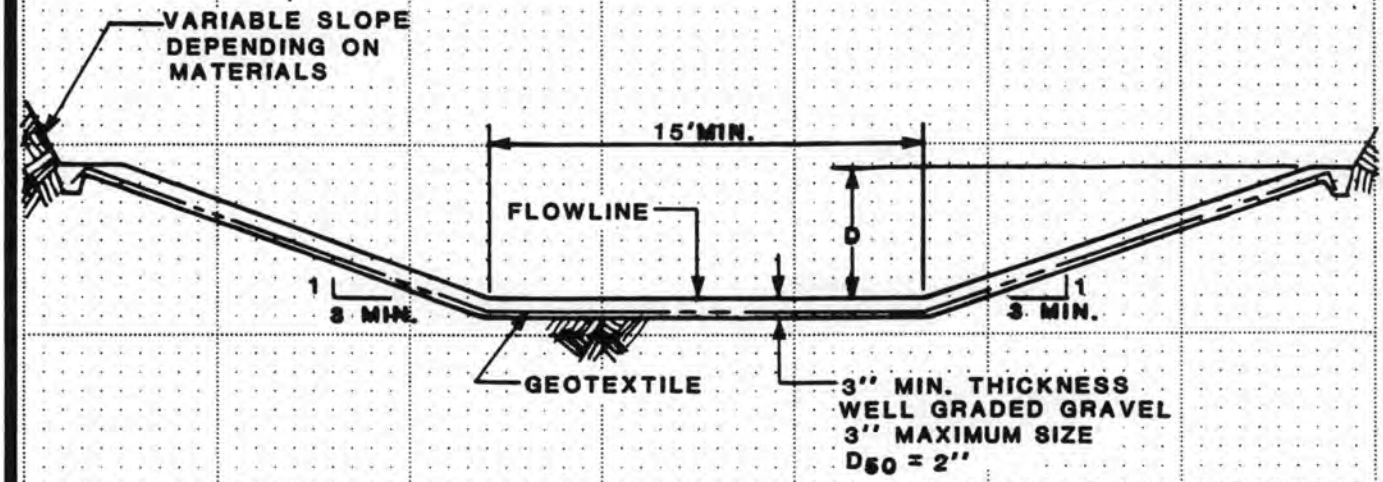
EXISTING
MAXIMUM CROSS-SECTION
A-A'
J7-H

BY **Dames & Moore** Plate 2



VOLUME-ELEVATION CURVE J7-H

BY **Dames & Moore** Plate 3



SPILLWAY CHANNEL

D = 2.3'

LENGTH = 50'

FLOWLINE ELEV.=6373.80'

OUTFLOW CHANNEL

D = 1'

SPILLWAY AND OUTFLOW CHANNEL CROSS SECTION J7-H

BY **Dames & Moore** Plate 5

APPENDIX A

INSPECTION CHECK LIST

Sediment Impoundment Name: J7-H
Page: 4

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST			
a. Any visual settlements?		X	
b. Misalignment?		X	
c. Cracking?		X	
2. UPSTREAM SLOPE			
a. Adequate grass cover?		X	20% grass
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			
a. Adequate grass cover?		X	Rocky slope
b. Any erosion?		X	
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	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			brown SM
5. ABUTMENT CONTACT. LEFT			
a. Any erosion?		X	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			brown SM

Sediment Impoundment Name: J7-H
Page: 5

ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			
a. Location:			
Left abutment?	X		
Right abutment?			
Crest of Embankments?			
b. Approach Channel:		X	
Are side slopes eroding?			NA
Are side slopes sloughing?			↓
Bottom of channel eroding?			↓
Obstructed?			↓
Erosion protection?			↓
c. Spillway Channel:	X		
Are side slopes eroding?	X		Rills
Are side slopes sloughing?		X	
Bottom of channel eroding?	X		Rills
Obstructed?		X	
Erosion protection?	X	X	Partial Grass 60%
d. Outflow Channel:		X	
Are side slopes eroding?			NA
Are side slopes sloughing?			↓
Bottom of channel eroding?			↓
Obstructed?			↓
Erosion protection?			↓
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: J7-H
Page: 6

ITEM	YES	NO	REMARKS
8. IMPOUNDMENT			
a. Sinkholes?		X	(Elev.) feet
b. Water present?		X	(Elev.) feet
c. Siltation?	X		A Little / 10%
d. Watershed matches soil map?		X	Reclaimed 50% HAUL ROADS & UNRECLAIMED LAND

9. GENERAL COMMENTS

FENCED POND

Canopy 10%
ground 50%
Bare 40%

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

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

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6397 − 6374 = 23 ft.

WATER COURSE LENGTH = 1550 ft. = 0.294 mi.

$$T_c = \left(\frac{11.9\,(0.294)^3}{23}\right)^{0.385} = 0.188 \text{ hr.}$$

LAG TIME = $0.6 T_c$ = 0.113 hr.

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
11.0 (33%)	S-G	ave.	D	0.33(79) = 26.1
11.0 (33%)	DIST	—	D	0.33(94) = 31.0
11.0 (34%)	RECL. (post law)	—	—	0.34(81) = 27.5
				84.6
			EH#SA Assume worst case.	USE 85

REVISIONS BY ___ DATE ___ CHECKED BY ___ COPY TO EO ___

DRAINAGE BASIN AREA

33.0 AC. 0.052 SQ. MI.

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

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

R = 40

SOIL ERODIBILITY FACTOR

SOIL TYPE = EH #34

K = 0.22

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
600	35	6	1.65

COVER FACTOR

AREA (ac)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
33%	RECLAIMED	50	—	0.33 (.15)
33%	DISTURBED	—	—	0.33 (1.0)
34%	S-G	40	25	0.34 (.13)

C = .424

BY ___ DATE ___
CHECKED BY ___
COPY TO EO ___

EROSION CONTROL FACTOR

P = 1.0

SEDIMENT INFLOW

$A = 40(0.22)(1.65)(.424)(1.0) = 6.16$ ton/acre/year

$A = 6.16\left(\frac{1}{2047}\right)(33.0)(0.95) = .095$ acre-feet/year

FILE PEABODY COAL
SUBJECT 10139-011-22
J7-H & J7-I SHEET ___ OF ___

POND J7-H SPILLS INTO POND J7-I

WATER COURSE LENGTH = 400 FT. = 0.076 mi
ELEV. DIFFERENCE = 6374 - 6340 = 34'

$$T_L = \left(\frac{11.9\,(0.76)^3}{34}\right)^{0.385} = 0.034 \text{ hr} = 2.0 \text{ min}$$

VELOCITY = 400/2 x 60 = 3.3 ft/sec.

SLOPE = 34/400 = 8.5%

VELOCITY IS REASONABLE FOR THE SLOPE.

USE 2 min. LAG TIME FOR TRAVEL BETWEEN J7-H AND J7-I

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

BY [illegible] DATE 5/21/85
CHECKED BY ___
COPY TO EO ___

Dames & Moore

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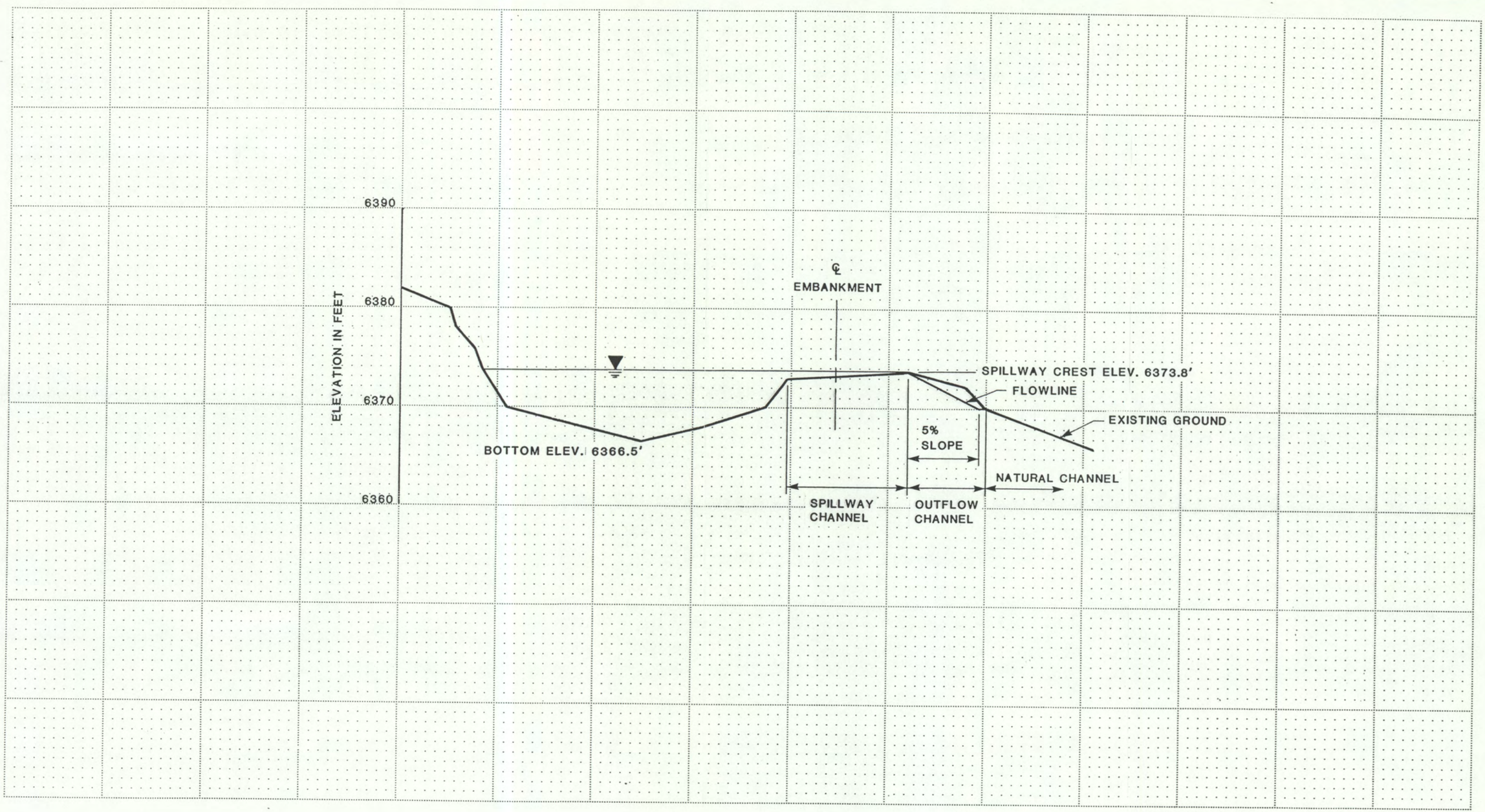

SCALE
0 100 200
FEET

CHANNEL PROFILE B–B'
J7–H

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 4

INSPECTION REPORT

Sedimentation Structure

J7-I

Black Mesa Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Dames & Moore
10139-011-22

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APPENDIX A - INSPECTION CHECK LIST

APPENDIX B - HYDROLOGY AND HYDRAULIC CALCULATIONS

INTRODUCTION

Sedimentation Structure J7-I is an earthen embankment, designed and constructed in 1983 by Peabody Coal Company as a temporary sedimentation structure to control runoff and sediment from the disturbed mining areas of the Black Mesa Mine. The location of Structure J7-I is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure J7-I. 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 J7-I was inspected on September 2, 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 J7-I 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 J7-I has a 117.1-acre tributary drainage area and is located near Yucca Flats Wash at the Black Mesa Mine. The watershed is classified as 66% disturbed, 31% Sagebrush, and 3% reclaimed.

EMBANKMENT

Structure J7-I is a homogeneous earthen embankment classified as a roadway embankment. Physical characteristics of the embankment are listed in the following table:

Structure J7-I

Embankment	Residual Sandstone/Shale Soils
Foundation	Sandstone
Right Abutment	Residual Shale Soils
Left Abutment	Residual Shale Soils
Height	13.7 ft
Crest Width	30 ft
Upstream Slope	3.75 H : 1 V
Downstream Slope . . .	3.75 H : 1 V

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section J7-I, A-A'. Grass provides erosion protection on the upstream and downstream slopes of the embankment.

ANALYSES

STABILITY

Structure J7-I is a category A-5 embankment. A standard category A-5 embankment has static and seismic factors of safety of 1.5 and 1.2, respectively, under the following conditions:

1. Maximum height = 30 ft
2. Maximum upstream slope = 2.0 H : 1 V
3. Maximum downstream slope = 4.25 H : 1 V
4. Normal pool with steady seepage saturation conditions

The upstream slope is lower in height and has a flatter slope than the category standard. The downstream slope is steeper than the category standard; therefore, the embankment has factors of safety less 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 J7-I is located downstream from Structure J7-H. The two structures have a combined storage capacity that is greater than 20 acre-feet. Therefore, the spillway for J7-I was analyzed using the 100-year, 6-hour storm. The storage capacity of Structure J7-I was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.473	mi
2.	Elevation Difference, H	135	ft
3.	Time of Concentration in hours, T_c . . .	0.166	h
4.	Lag time, $0.6T_c$	0.099	h
5.	SCS Curve Number	85	
6.	Rainfall Depth, 10-year, 24-hour storm .	2.1	in.
	100-year, 6-hour storm .	2.4	in.
7.	Drainage Area, 10-year, 24-hour storm .	117.1	acres
	100-year, 6-hour storm . .	150.1	acres

HYDRAULICS

The HEC-1 program was utilized to evaluate inflow, reservoir response and outflow from the sedimentation structure. The initial conditions and results of the analysis are summarized in the following table.

J7-I HYDRAULICS

	Units	10-year 24-hour Storm	100-year 6-hour Storm	
Initial Reservoir Volume Condition		Empty	Full to the spillway elevation	
Inflow				
Peak Flow	cfs	162	362	
Volume	acre-ft	8.59	10.54	
Storage				
Peak Stage	ft	6335.76	6343.19	
Spillway Elevation . .	ft	6340.00	--	
Peak Storage	acre-ft	8.57	--	
Storage Capacity . . .	acre-ft	16.8	--	
Outflow				
Peak Flow	cfs	0	80	
Embankment Crest Elevation	ft	--	6347.60	
Peak Storage	ft	--	6343.19	
Freeboard	ft	--	3.19	
Spillway				
Pipe Exit Velocity . .	fps	--	10.3	✓
Mannings "n"		--	0.024	
Outflow Channel			Section I	Section II
Slope	%	--	14	5
Normal Velocity. . . .	fps	--	8.7	6.2
Normal Depth	ft	--	0.74	0.55
Manning's "n"		--	0.040	0.040 ✓

Spillway

The existing spillway for J7-I consists of two corrugated metal pipes (CMP) with the following dimensions:

Pipe Diameter	36	in.
Pipe length	89	ft
Upstream invert elevation	6340.0	ft
Approximate slope	3.9	percent

Outflow Channel

The existing outflow channel for J7-I has a trapezoidal channel with the following dimensions:

Channel depth	2	ft
Channel width	15	ft
Channel length	100	ft
Side slopes (horizontal to vertical). .	2:1	
Average exit slope	10	percent

The first 50 feet of the channel is riprapped with rock.

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, J7-I.

The calculations for the sediment load entering Structure J7-I were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.192
3. Slope Factor, LS 1.0
4. Cover Factor, C 0.673
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 J7-I is shown on Plate 3, Volume-Elevation Curve, J7-I, and the results of the analysis are summarized in the following table.

J7-I STORAGE

Total Storage Capacity	16.8	acre-ft
10-year, 24-hour Storm Inflow	8.59	acre-ft
Available Sediment Storage Capacity . .	8.23	acre-ft
Sediment Inflow Rate	0.27	acre-ft/yr
Sediment Storage Life	30	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure J7-I indicated that the geotechnical problems consist of rill erosion on the upstream slopes; a large gully on downstream slope; heavy erosion at the downstream toe of the embankment and gullys on the right abutment; and a steep downstream slope. Correction of erosion is considered a periodic maintenance task and does not require

remedial action. The downstream slope should be flattened to 4.25 horizontal to 1 vertical to meet stability requirements. Evidence of seepage was noted below the downstream toe of embankment through the sandstone bedrock. Remedial action for this condition is not required at the present time, however, future inspections should check for changes.

HYDRAULICS

The storage capacity and spillway capacity of Structure J7-I are adequate; however, the spillway does not have an adequate outflow channel or adequate erosion protection. A trapezoidal outflow channel and a stilling basin should be constructed along the alignment B-B' shown in Plate 1. The channel and stilling basin profile is shown in Plate 4 and the required dimensions are shown in Plate 5 and Plate 6. The outflow channel, and stilling basin should be protected against erosion using geotextile and riprap as shown in Plate 5. A trashrack should be installed on the inlet of the CMP to prevent clogging of the spillway.

* * *

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

Plate 1 - Site Plan J7-I

Plate 2 - Existing Maximum Cross Section J7-I, A-A'

Plate 3 - Volume-Elevation Curve J7-I

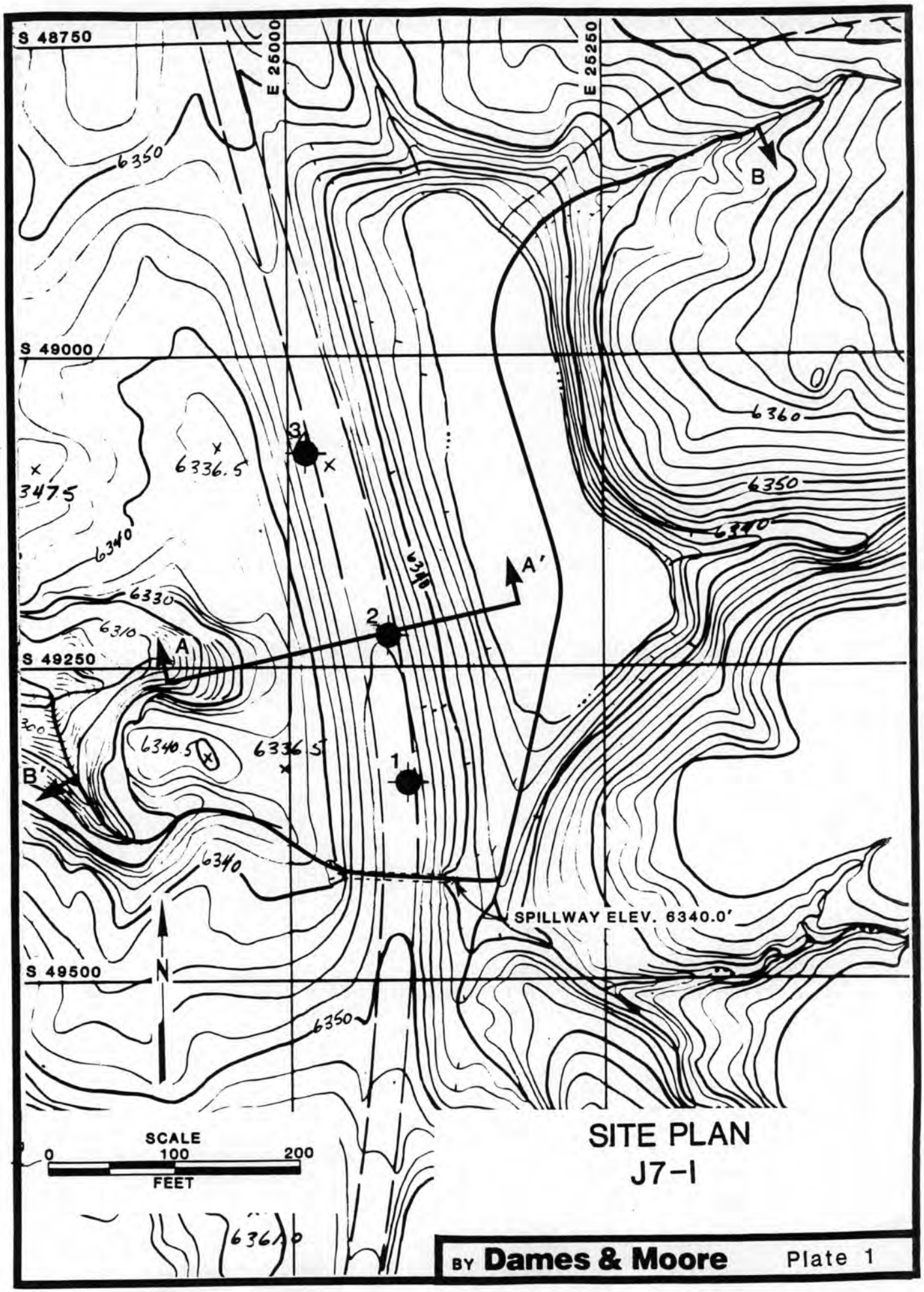
Plate 4 - Channel Profile J7-I, B-B'

Plate 5 - Spillway and Outflow Channel Cross Section J7-I

Plate 6 - Spillway Stilling Basin Plan J7-I

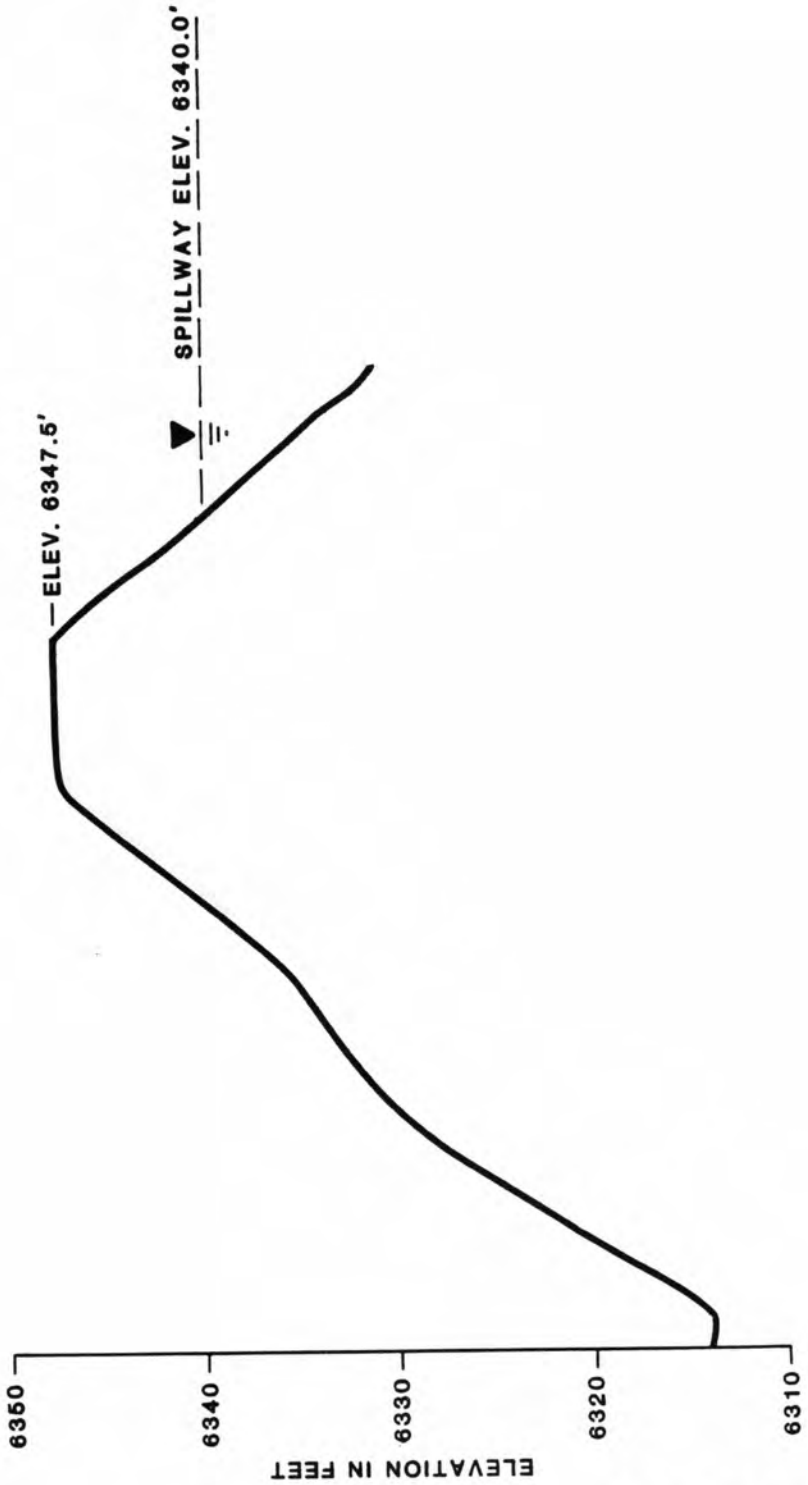
Appendix A - Inspection Check List

Appendix B - Hydrology and Hydraulic Calculations



SITE PLAN
J7-I

BY **Dames & Moore** Plate 1

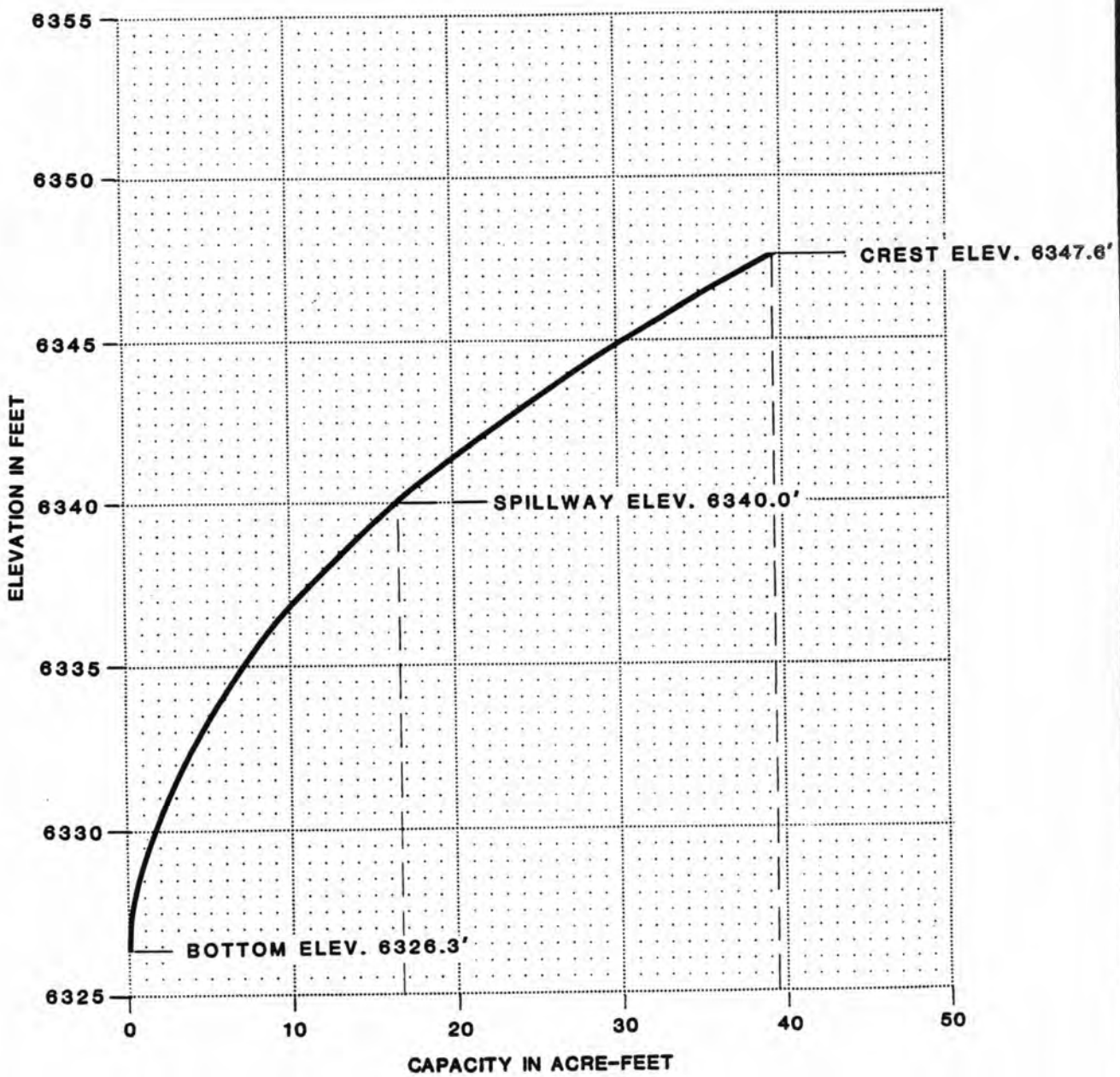


EXISTING MAXIMUM CROSS-SECTION A-A' J7-I

FOR LOCATION SEE PLATE 1

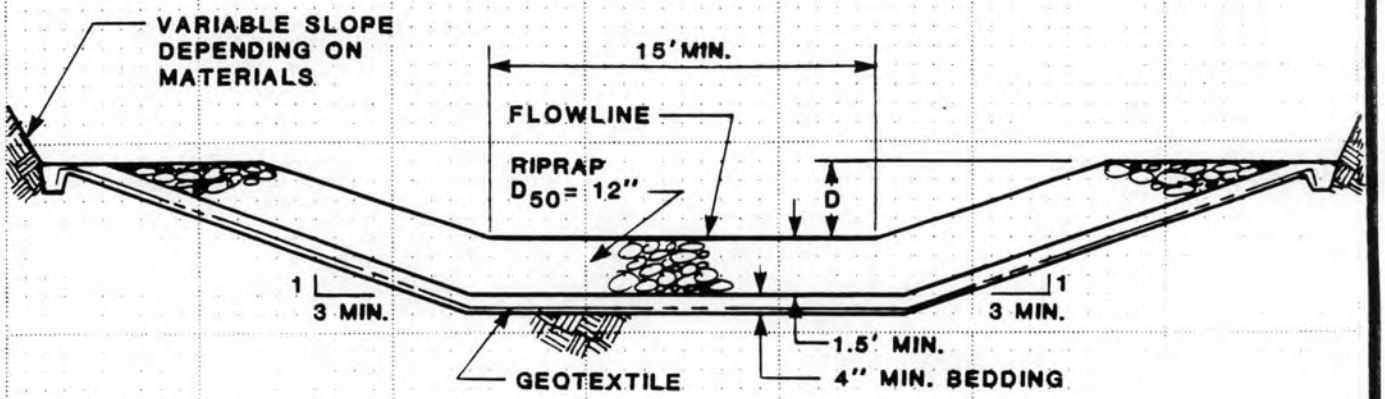
BY **Dames & Moore**

Plate 2



VOLUME-ELEVATION CURVE
J7-I

BY **Dames & Moore** Plate 3

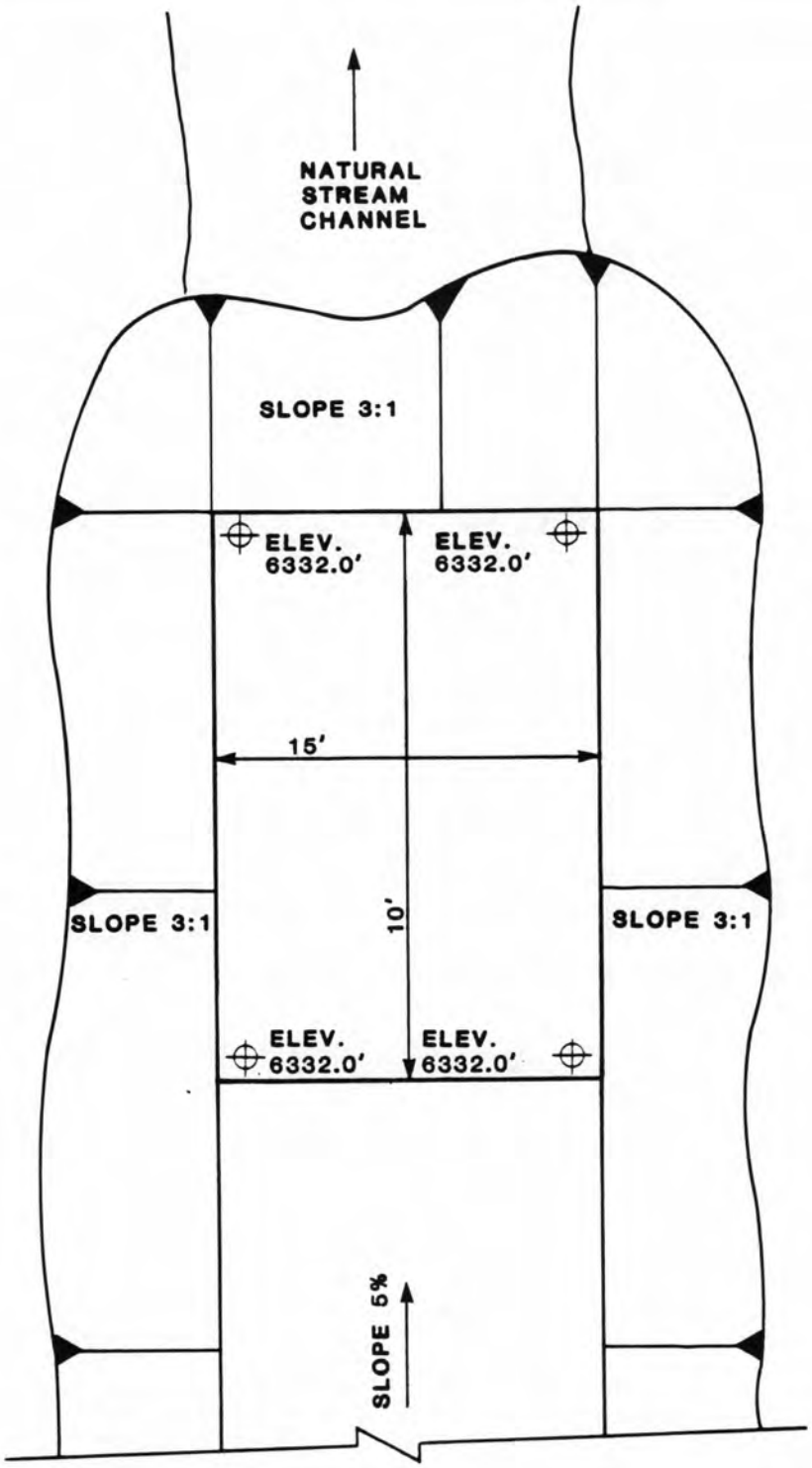


OUTFLOW CHANNEL

D = 1.5'

OUTFLOW CHANNEL CROSS SECTION J7-I

BY **Dames & Moore** Plate 5



MINIMUM HEIGHT OF RIPRAP
ALONG SIDEWALLS ABOVE
THE BASIN FLOOR = 3.0'

MINIMUM DEPTH OF BASIN FLOOR
BELOW NATURAL STREAMBED = 1.3'

SPILLWAY STILLING BASIN PLAN
J7-I

BY **Dames & Moore** Plate 6

APPENDIX A

INSPECTION CHECK LIST

Sediment Impoundment Name: J7-I
Page: 4

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST			
a. Any visual settlements?		X	
b. Misalignment?		X	
c. Cracking?		X	
2. UPSTREAM SLOPE			
a. Adequate grass cover?	X		towards R. Abut. 70% grass 5% towards L. Abut.
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	Partial Grass
g. Any stone deterioration?			NA
h. Visual depressions or bulges?		X	
i. Visual settlements?		X	
j. Animal burrows?		X	
3. DOWNSTREAM SLOPE			
a. Adequate grass cover?			
b. Any erosion?	X		5' deep 6' wide gulley X Heavy erosion at toe
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		thru Sandstone / water standing
l. Animal burrows?		X	
4. ABUTMENT CONTACT. RIGHT			
a. Any erosion?	X		2' wide gulley into Pond
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			brown SM /
5. ABUTMENT CONTACT. LEFT			
a. Any erosion?		X	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			brown SM

Sediment Impoundment Name: J7-I
Page: 5

ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			
a. Location:			
Left abutment?			
Right abutment?			
Crest of Embankments?	X		Near left abutment
b. Approach Channel:		X	
Are side slopes eroding?			NA
Are side slopes sloughing?			↓
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			2-36" CMP
c. Spillway Channel:			NA
Are side slopes eroding?			NA
Are side slopes sloughing?			NA
Bottom of channel eroding?			tumbleweeds at both ends
Obstructed?	X		NA
Erosion protection?			
d. Outflow Channel:	X		
Are side slopes eroding?		X	
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?	X		Partial Rock DSU 24" 1st 50'
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: J7-I
Page: 6

ITEM	YES	NO	REMARKS
8. IMPOUNDMENT			
a. Sinkholes?		X	(Elev.) feet
b. Water present?	X		(Elev.) feet
c. Siltation?			Could not tell.
d. Watershed matches soil map?	X		

9. GENERAL COMMENTS

Minor change in Water shed / Public watering area (2%)

Canopy cover 10%
ground cover 80%

water at toe of d.s. slope thru sandstone, water loving plants growing.

"Does not appear to affect stability of structure"

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

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

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6475 − 6340 = 135 ft.

WATER COURSE LENGTH = 2500 ft. = 0.473 mi.

$$T_c = \left(\frac{11.9\,(0.473)^3}{135}\right)^{0.385} = 0.166 \text{ hr.}$$

LAG TIME = $0.6T_c$ = 0.099 hr.

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
77.1 (66%)	DIST	—	C-D	0.66(93) = 61.4
36.7 (31%)	S-G	fair	C-D	0.31 (68) = 21.0
3.2 (3%)	REL.	fair	C-D	0.03(81) = 2.4
			60% EH#23 - D 40% EH#32 - C	84.8

USE 85

BY ___ DATE ___ CHECKED BY ___ COPY TO EO ___

DRAINAGE BASIN AREA

117.1 AC. 0.183 SQ. MI.

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

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

R = 40

SOIL ERODIBILITY FACTOR

SOIL TYPE = 60% EH # 23 0.6(0.18) = 0.108
40% EH # 32 0.4(0.21) = 0.084
0.192

K = 0.192

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
1600	70	4	0.46
900	50	6	2.02
1500	35	2	0.45

Use 1.0

COVER FACTOR

AREA (ac.)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
66%	DIST	—	—	0.66 (1.0)
31%	S-G	60	25	0.31 (.082)
3%	RECLAIMED		—	0.03 (.15)

C = .690

EROSION CONTROL FACTOR

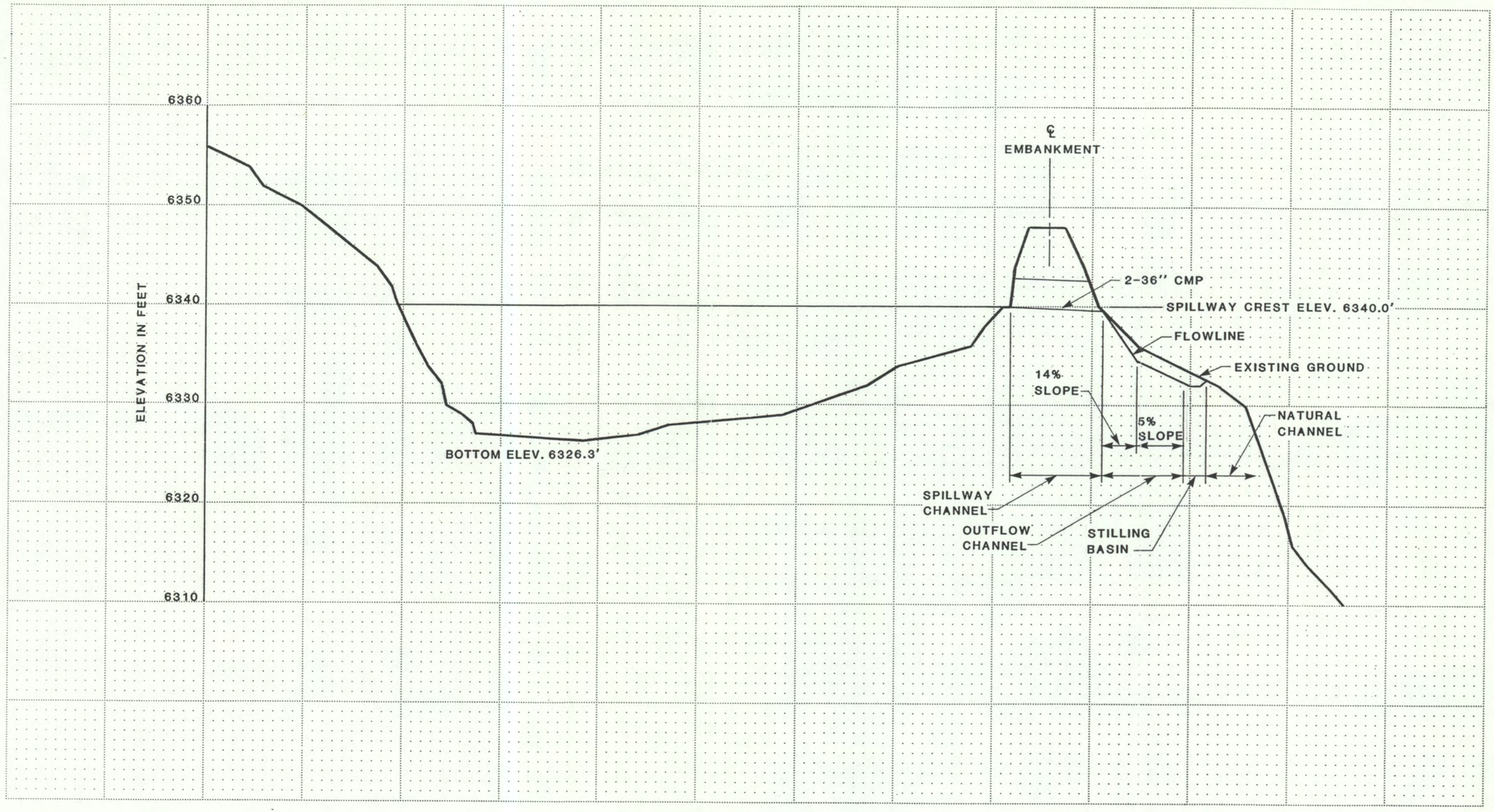
P = 1.0

SEDIMENT INFLOW

$A = 40(0.192)(1)(0.690)(1.0) = 5.30$ ton/acre/year

$A = 5.30\left(\frac{1}{2047}\right)(117.1)(0.90) = 0.273$ acre-feet/year

BY ___ DATE ___ CHECKED BY ___ COPY TO EO ___



SCALE
0 100 200
FEET

CHANNEL PROFILE B-B'
J7-I

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 4

INSPECTION REPORT

Sedimentation Structure

J7-J

Black Mesa Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Dames & Moore
10139-011-22

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APPENDIX A - INSPECTION CHECK LIST

APPENDIX B - HYDROLOGY AND HYDRAULIC CALCULATIONS

INTRODUCTION

Sedimentation Structure J7-J is an earthen embankment, designed and constructed in 1983 by Peabody Coal Company as a temporary sedimentation structure to control runoff and sediment from the disturbed mining areas of the Black Mesa Mine. The location of Structure J7-J is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure J7-J. 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 J7-J was inspected on August 31, 1985 by an inter-disciplinary 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 J7-J 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 J7-J has a 9.14-acre tributary drainage area and is located near Yucca Flats Wash at the Black Mesa Mine. The watershed is classified as 100% disturbed.

EMBANKMENT

Structure J7-J is a homogeneous earthen embankment classified as a roadway embankment. Physical characteristics of the embankment are listed in the following table:

Structure J7-J

Embankment	Residual Shale Soils
Foundation	Sandstone
Right Abutment	Residual Shale Soils
Left Abutment	Residual Shale Soils
Height	10.8 ft
Crest Width	30 ft
Upstream Slope	3.3 H : 1 V
Downstream Slope . . .	2.9 H : 1 V

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section J7-J, A-A'. Grass provides erosion protection on the upstream and downstream slopes of the embankment.

ANALYSES

STABILITY

Structure J7-J is a category B-5 embankment. A standard category B-5 embankment has static and seismic factors of safety of 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 = 2.5 H : 1 V
4. Normal pool with steady seepage saturation conditions

The J7-J 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 J7-J is not in series with any other structure and therefore the spillway was analyzed using the 25-year, 6-hour storm. The storage capacity of Structure J7-J was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.142	mi
2.	Elevation Difference, H	62	ft
3.	Time of Concentration in hours, T_c . . .	0.0556	h
4.	Lag time, $0.6T_c$	0.0333	h
5.	SCS Curve Number	91	
6.	Rainfall Depth, 10-year, 24-hour storm .	2.1	in.
	25-year, 6-hour storm. .	1.9	in.
7.	Drainage Area	9.14	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.

J7-J 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	24	30	
Volume	acre-ft	0.96	0.81	
Storage				
Peak Stage	ft	6357.16	6361.73	
Spillway Elevation . .	ft	6360.31	--	
Peak Storage	acre-ft	0.94	--	
Storage Capacity . . .	acre-ft	1.72	--	
Outflow				
Peak Flow	cfs	0	8	
Embankment Crest Elevation	ft	--	6363.20	
Peak Stage	ft	--	6361.73	
Freeboard	ft	--	1.47	
Spillway				
Pipe Exit Velocity . .	fps	--	7.7	
Mannings "n"		--	0.024	
Outflow Channel			Section I	Section II
Slope	%	--	8	35
Normal Velocity. . . .	fps	--	3.2	5.0
Normal Depth	ft	--	0.17	0.11
Manning's "n"		--	0.040	0.040

Spillway

The existing spillway for J7-J is a corrugated metal pipe (CMP) with the following dimensions:

Pipe diameter	24	in.
Pipe length	108	ft
Upstream invert elevation	6360.31	ft
Downstream invert elevation	6356.11	ft
Slope	5.2	percent

Outflow Channel

The structure presently has no outflow 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, J7-J.

The calculations for the sediment load entering Structure J7-J 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 2.77
4. Cover Factor, C 1.0
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 J7-J is shown on Plate 3, Volume-Elevation Curve, J7-J, and the results of the analysis are summarized in the following table.

J7-J STORAGE

Total Storage Capacity	1.72	acre-ft
10-year, 24-hour Storm Inflow	0.96	acre-ft
Available Sediment Storage Capacity . .	0.78	acre-ft
Sediment Inflow Rate	0.099	acre-ft/yr
Sediment Storage Life	8	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure J7-J indicated that the only geotechnical problem is rill erosion on the upstream and downstream slopes; and a steep downstream slope. Correction of erosion is considered a periodic maintenance task and does not require remedial action.

HYDRAULICS

The storage capacity and spillway capacity of Structure J7-J are adequate; however, the spillway does not have an outflow channel. A trapezoidal outflow channel should be constructed along the alignment B-B' shown in Plate 1. The channel profile is shown in Plate 4 and the required dimensions are shown in Plate 5. The outflow channel should be protected against erosion using geotextile and riprap as shown in Plate 5. A trash-rack should be installed on the inlet of the CMP to prevent clogging of the spillway.

* * *

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

Plate 1 - Site Plan J7-J

Plate 2 - Existing Maximum Cross Section J7-J, A-A'

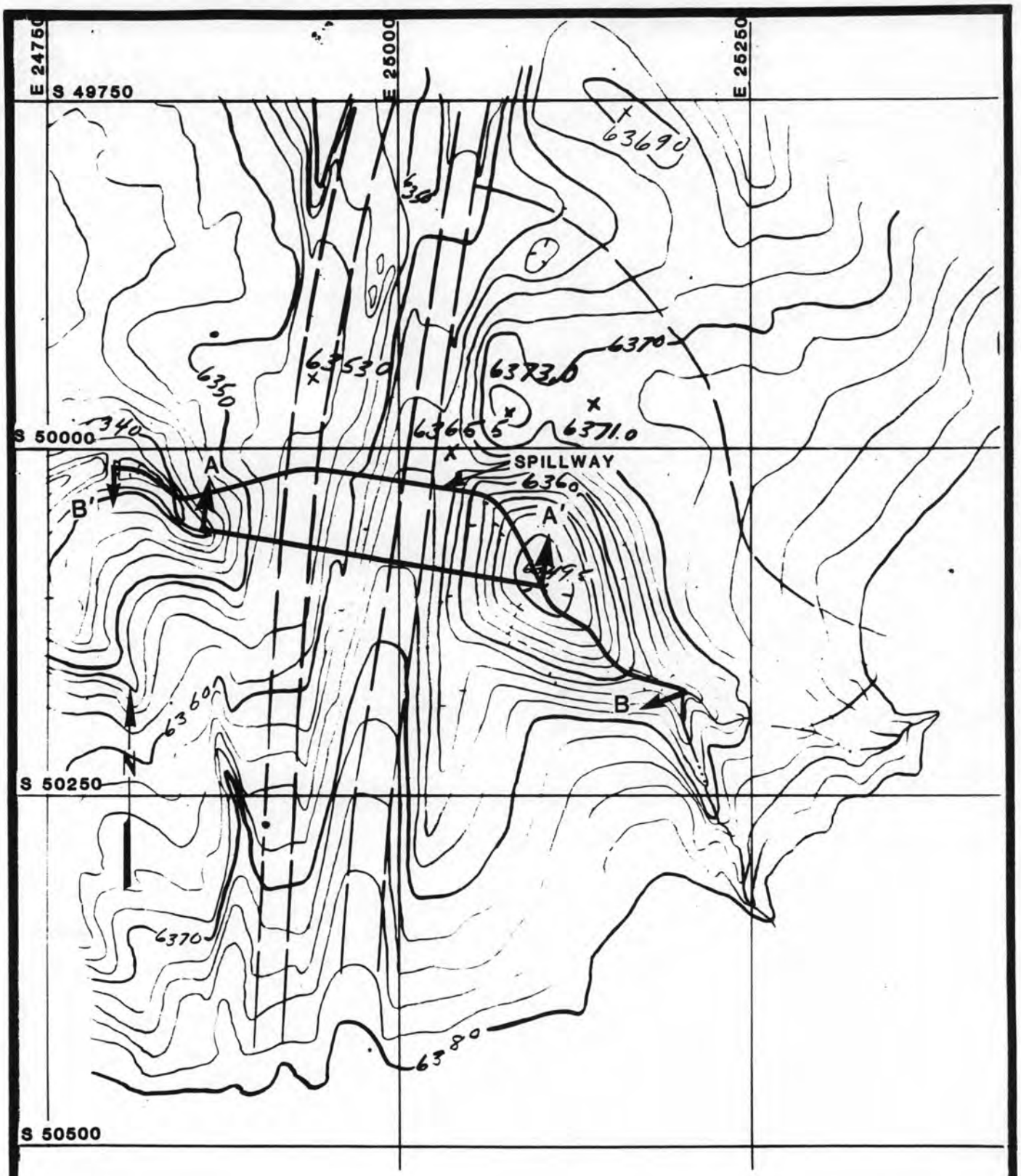
Plate 3 - Volume-Elevation Curve J7-J

Plate 4 - Channel Profile J7-J, B-B'

Plate 5 - Outflow Channel Cross Section J7-J

Appendix A - Inspection Check List

Appendix B - Hydrology and Hydraulic Calculations



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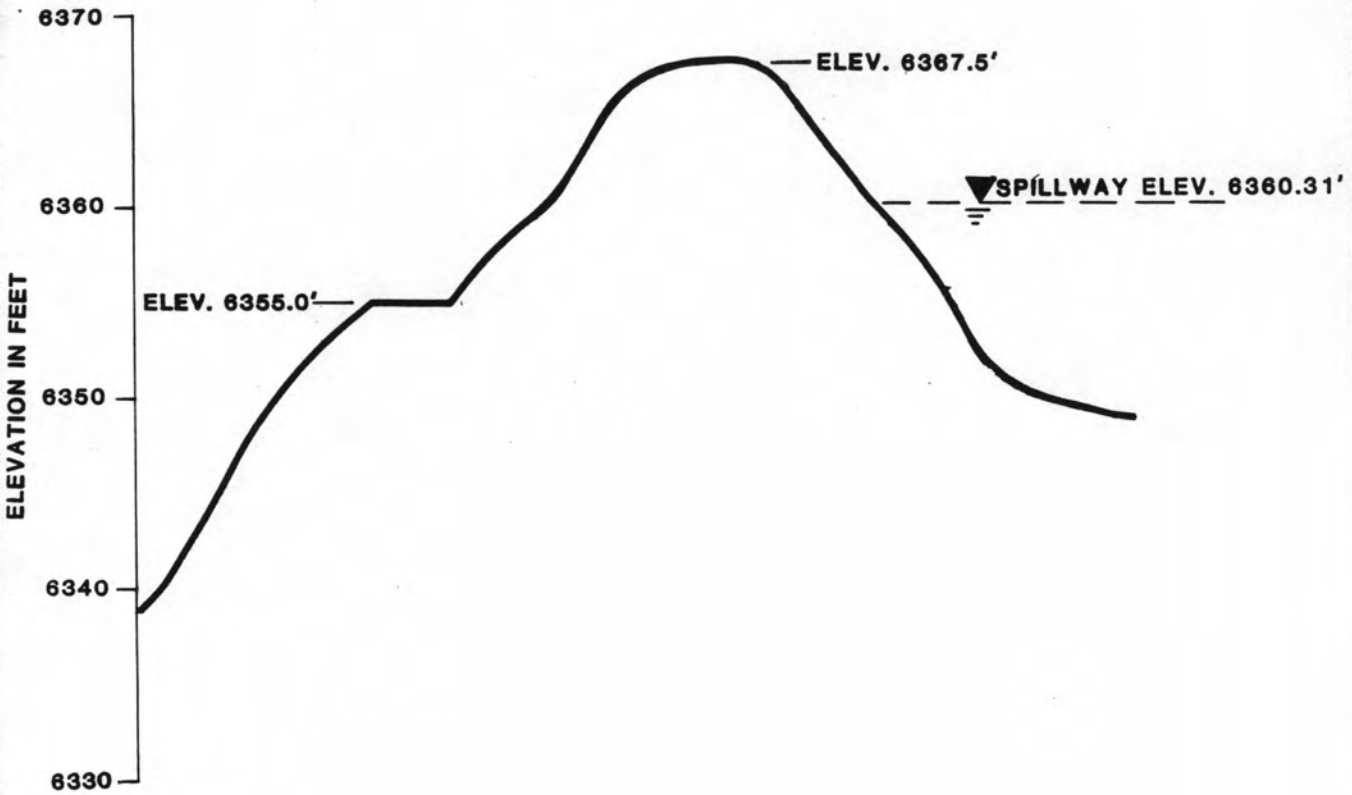
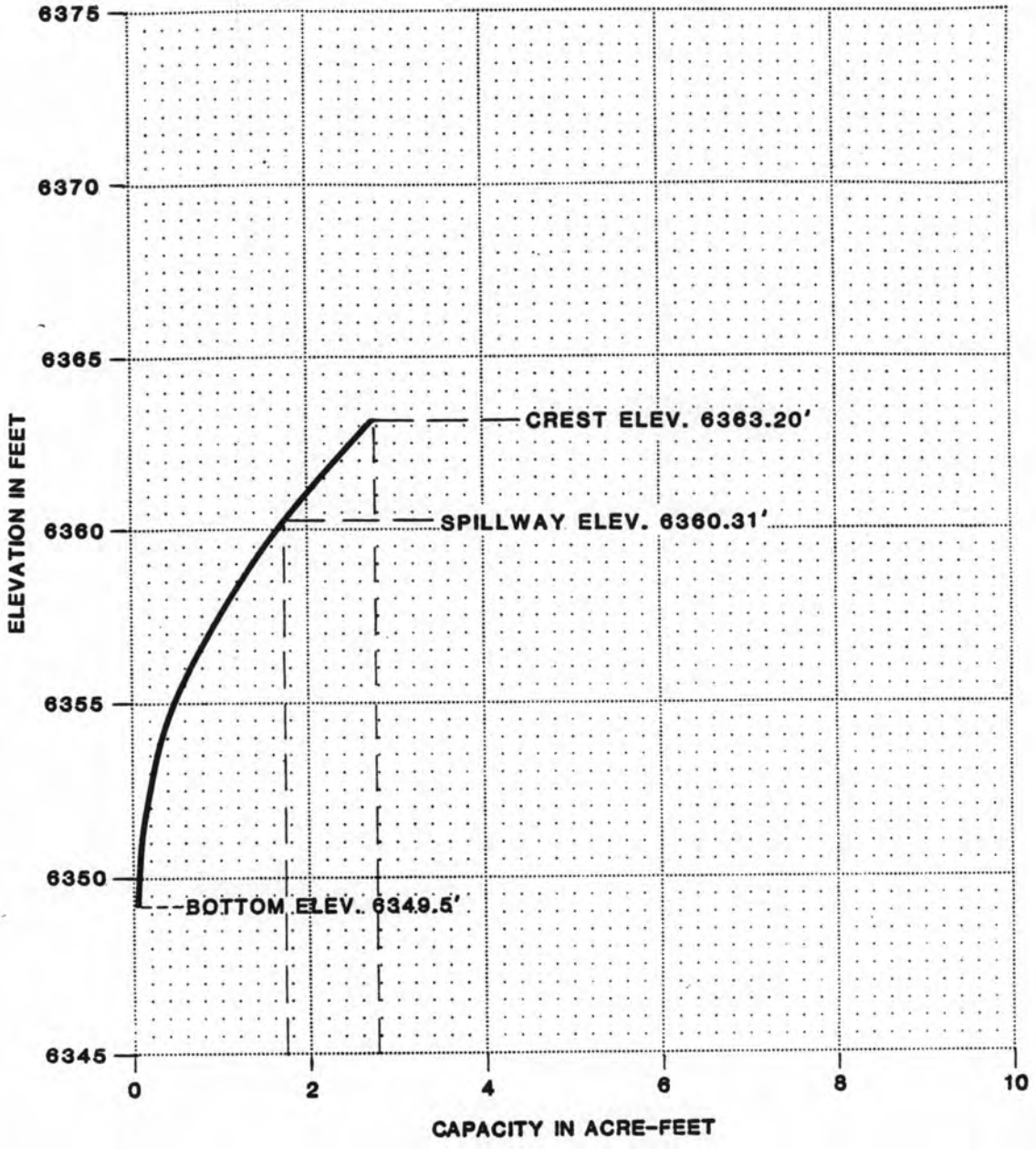
SITE PLAN
J7-J

BY **Dames & Moore** Plate 1



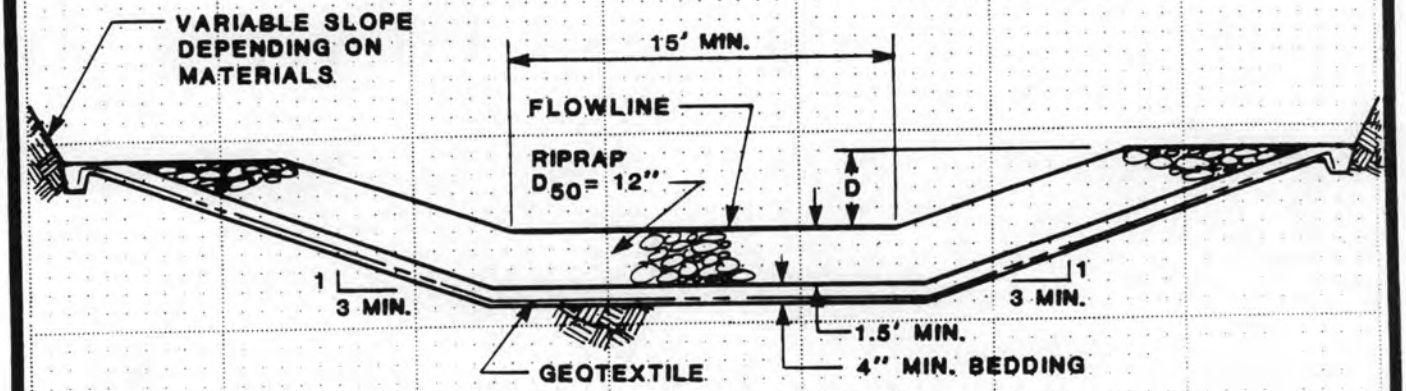
EXISTING
MAXIMUM CROSS-SECTION
A-A'
J7-J

BY **Dames & Moore** Plate 2



VOLUME-ELEVATION CURVE J7-J

BY **Dames & Moore** Plate 3



OUTFLOW CHANNEL

D = 1'

OUTFLOW CHANNEL CROSS SECTION J7-J

BY **Dames & Moore** Plate 5

APPENDIX A

INSPECTION CHECK LIST

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST			
a. Any visual settlements?		X	
b. Misalignment?		X	
c. Cracking?		X	
2. UPSTREAM SLOPE			
a. Adequate grass cover?	X		80%
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		Grass
g. Any stone deterioration?			NA
h. Visual depressions or bulges?		X	
i. Visual settlements?		X	
j. Animal burrows?		X	
3. DOWNSTREAM SLOPE			
a. Adequate grass cover?	X		70
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	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			brown SM
5. ABUTMENT CONTACT. LEFT			
a. Any erosion?		X	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			brown SM

ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			
a. Location:			
Left abutment?			
Right abutment?			
Crest of Embankments?	X		Near Right Abutment
b. Approach Channel:		X	
Are side slopes eroding?			NA
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
c. Spillway Channel:	X		24" CMP
Are side slopes eroding?			NA
Are side slopes sloughing?			NA
Bottom of channel eroding?			NA
Obstructed?	X		tumbleweeds at both ends
Erosion protection?			NA
d. Outflow Channel:		X	
Are side slopes eroding?			
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			Some Rock at exit D50 18"
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: J7-J
Page: 6

8. GENERAL COMMENTS

No problems / clean out tumbleweeds

Watershed - same as design

Canopy cover - sagebrush / grass 25%

No water in pond

ground cover average

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

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

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6420 - 6358 = 62'

WATER COURSE LENGTH = 750' = 0.142 mi

$$T_c = \left(\frac{11.9\,(0.142)^3}{62}\right)^{0.385} = 0.0556\,hr = 3.3\ min$$

LAG TIME = $0.6\,T_c$ = 0.0333 hr

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
9.14 (100%)	DIST	—	C	91

EH#32

BY ___ DATE ___ CHECKED BY ___ COPY TO EO ___

DRAINAGE BASIN AREA

9.14 AC. 0.014 SQ. MI.

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

Universal Soil Loss Equation

Rainfall Factor

R = 40

Soil Erodibility Factor

Soil Type = EH #32

K = 0.21

Slope Factor

Length (ft.)	ΔElev (ft.)	Slope (%)	LS
650	60	9	2.77

Cover Factor

Area (ac.)	Cover Type	% Cover	Canopy (%)	Weighted C
100%	Disturbed	—	—	1.0

BY ___ DATE ___
CHECKED BY WDS 10/2/85
COPY TO EO ___

Erosion Control Factor

P = 1.0

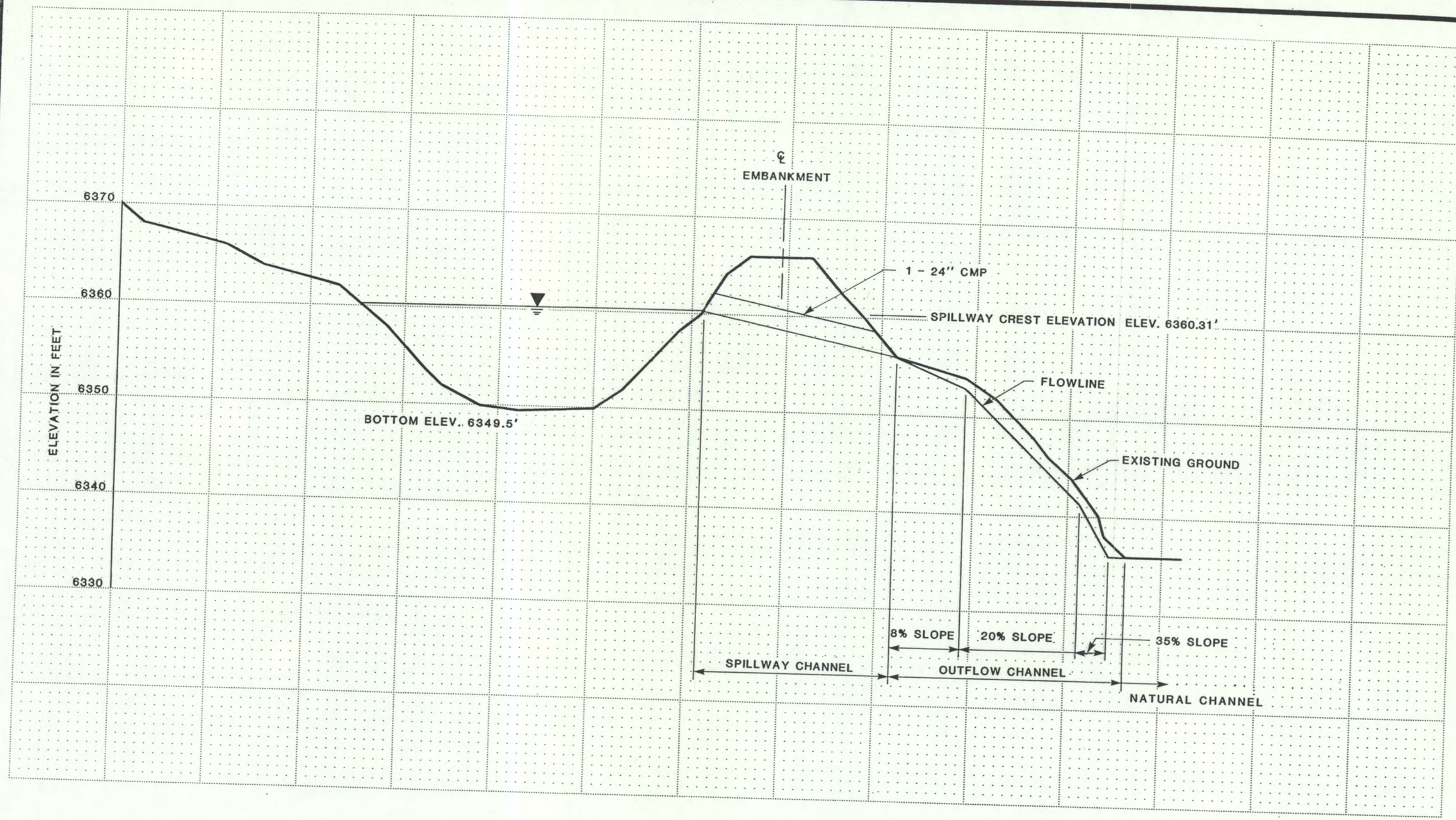
Sediment Inflow

A = 40 (0.21)(2.77)(1.0)(1.0) = 23.3 ✓ ton/acre/year

A = 23.3 ($\frac{1}{\cancel{2047}}$) (9.14) (0.95) = ~~0.097~~ ✓ acre-feet/year

2047? → 0.099

Dames & Moore



SCALE
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CHANNEL PROFILE B-B'
J7-J

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 4

INSPECTION REPORT

Sedimentation Structure

J7-K

Black Mesa Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Dames & Moore
10139-011-22

TABLE OF CONTENTS

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INTRODUCTION	1
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APPENDIX A - INSPECTION CHECK LIST

APPENDIX B - HYDROLOGY AND HYDRAULIC CALCULATIONS

INTRODUCTION

Sedimentation Structure J7-K 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 Black Mesa Mine. The location of Structure J7-K is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure J7-K. 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 J7-K was inspected on August 31, 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 J7-K 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 J7-K has a 40.9-acre tributary drainage area and is located near Sagebrush Wash at the Black Mesa Mine. The watershed is classified as 51% disturbed and 49% Sagebrush/grass.

EMBANKMENT

Structure J7-K is a homogeneous earthen embankment classified as a sidehill embankment. Physical characteristics of the embankment are listed in the following table:

Structure J7-K

Embankment	Residual Shale Soils
Foundation	Residual Shale Soils
Right Abutment	Residual Shale Soils
Left Abutment	Residual Shale Soils/ Residual Sandstone Soils
Height	10.0 ft
Crest Width	15 ft
Upstream Slope	2.0 H : 1 V
Downstream Slope . . .	2.6 H : 1 V

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section J7-K, A-A'.

ANALYSES

STABILITY

Structure J7-K is a category B-1 embankment. A standard category B-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 = 2.5 H : 1 V
4. Normal pool with steady seepage saturation conditions

The J7-K 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 J7-K is not in series with any other structure and therefore the spillway was analyzed using the 25-year, 6-hour storm. The storage capacity of Structure J7-K was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.326	mi
2.	Elevation Difference, H	72	ft
3.	Time of Concentration, T_c	0.137	h
4.	Lag time, $0.6T_c$	0.082	h
5.	SCS Curve Number	87	
6.	Rainfall Depth, 10-year, 24-hour storm .	2.1	in.
	25-year, 6-hour storm. .	1.9	in.
7.	Drainage Area	40.9	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.

J7-K 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	65	83	
Volume	acre-ft	3.38	2.90	
Storage				
Peak Stage	ft	6445.16	6449.35	
Spillway Elevation . .	ft	6447.80	--	
Peak Storage	acre-ft	3.38	--	
Storage Capacity . . .	acre-ft	5.53	--	
Outflow				
Peak Flow	cfs	0	28	
Embankment Crest Elevation	ft	--	6452.10	
Peak Stage	ft	--	6449.35	
Freeboard	ft	--	2.75	
Spillway Channel				
Flow Depth	ft	--	1.20	
Critical Velocity. . .	fps	--	3.4	
Manning's "n"		--	0.040	
Outflow Channel			Section I	Section II
Slope	%	--	3	12
Normal Velocity. . . .	fps	--	3.4	5.1
Normal Depth	ft	--	0.40	0.26
Manning's "n"		--	0.040	0.040

Spillway Channel

The existing spillway for J7-K has a trapezoidal channel with the following dimensions:

Channel depth	4 ft
Channel width	20 ft
Channel length	75 ft
Side slopes (horizontal to vertical). .	2:1
Average exit slope	2 percent

There is presently no erosion protection within the channel.

Outflow Channel

The existing outflow channel for J7-K has a U-shaped channel with the following dimensions:

Channel width	20 ft
Channel length	30 ft
Average exit slope	15 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, J7-K.

The calculations for the sediment load entering Structure J7-K were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.18
3. Slope Factor, LS 3.30
4. Cover Factor, C 0.574
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 J7-K and the results of the sediment inflow analysis are summarized in the following table.

J7-K STORAGE

Total Storage Capacity	5.53	acre-ft
10-year, 24-hour Storm Inflow	3.38	acre-ft
Available Sediment Storage Capacity . .	2.15	acre-ft
Sediment Inflow Rate	0.259	acre-ft/yr
Sediment Storage Life	8	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure J7-K indicated that the geotechnical problems consist of rills on the upstream and downstream slopes, the side slopes of the spillway and outlet channel and the right and left abutments; and a steep downstream slope. Correction of erosion is considered a periodic maintenance task and does not require remedial action.

HYDRAULICS

The storage capacity and spillway capacity of Structure J7-K are adequate; however, the spillway does not have an adequate outflow channel or adequate erosion protection. A trapezoidal outflow channel should be constructed along the alignment B-B' shown in Plate 1. The channel profile is shown in Plate 4 and the 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.

* * *

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

Plate 1 - Site Plan J7-K

Plate 2 - Existing Maximum Cross Section J7-K, A-A'

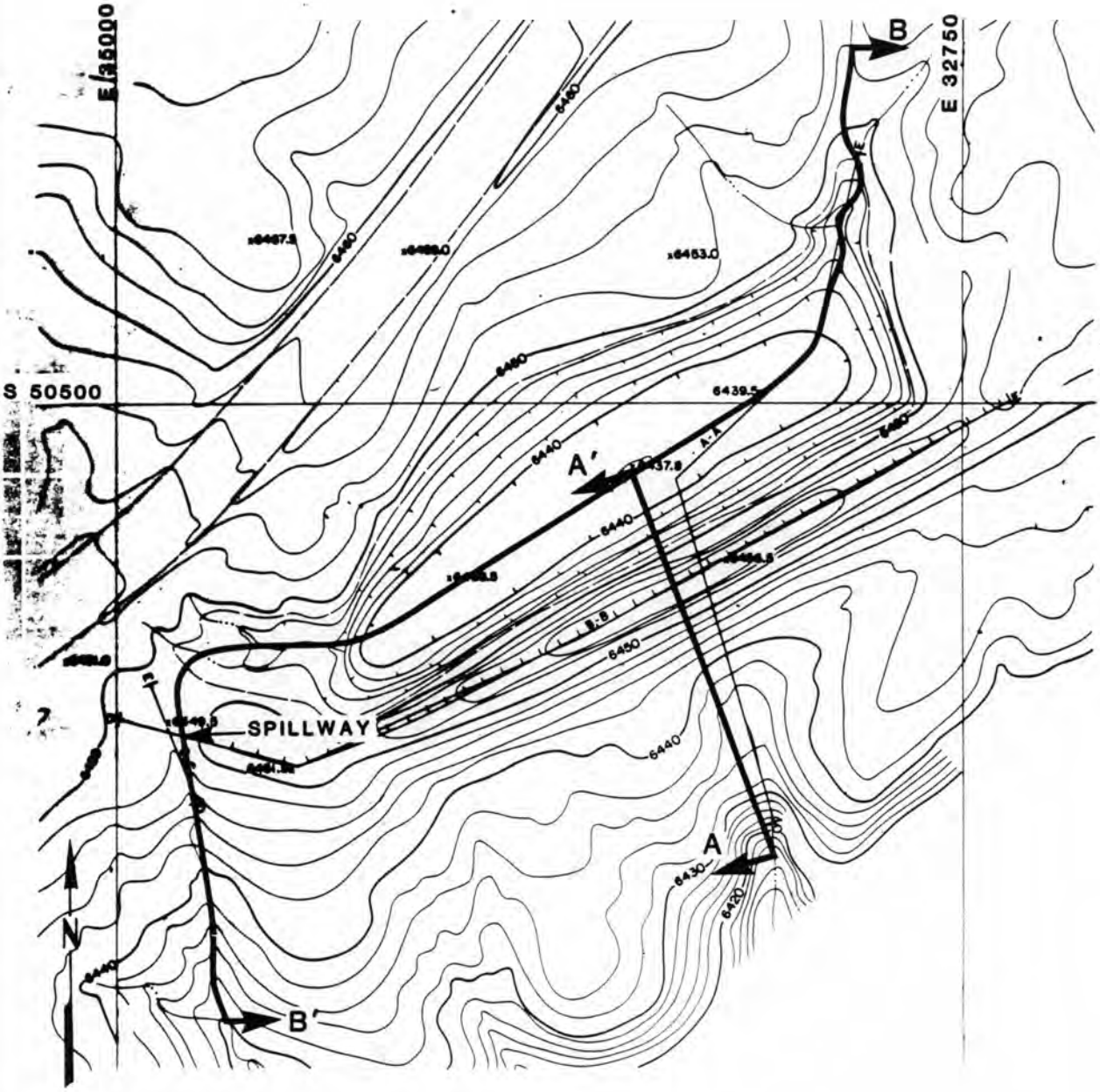
Plate 3 - Volume-Elevation Curve J7-K

Plate 4 - Channel Profile J7-K, B-B'

Plate 5 - Spillway and Outflow Channel Cross Section J7-K

Appendix A - Inspection Check List

Appendix B - Hydrology and Hydraulic Calculations



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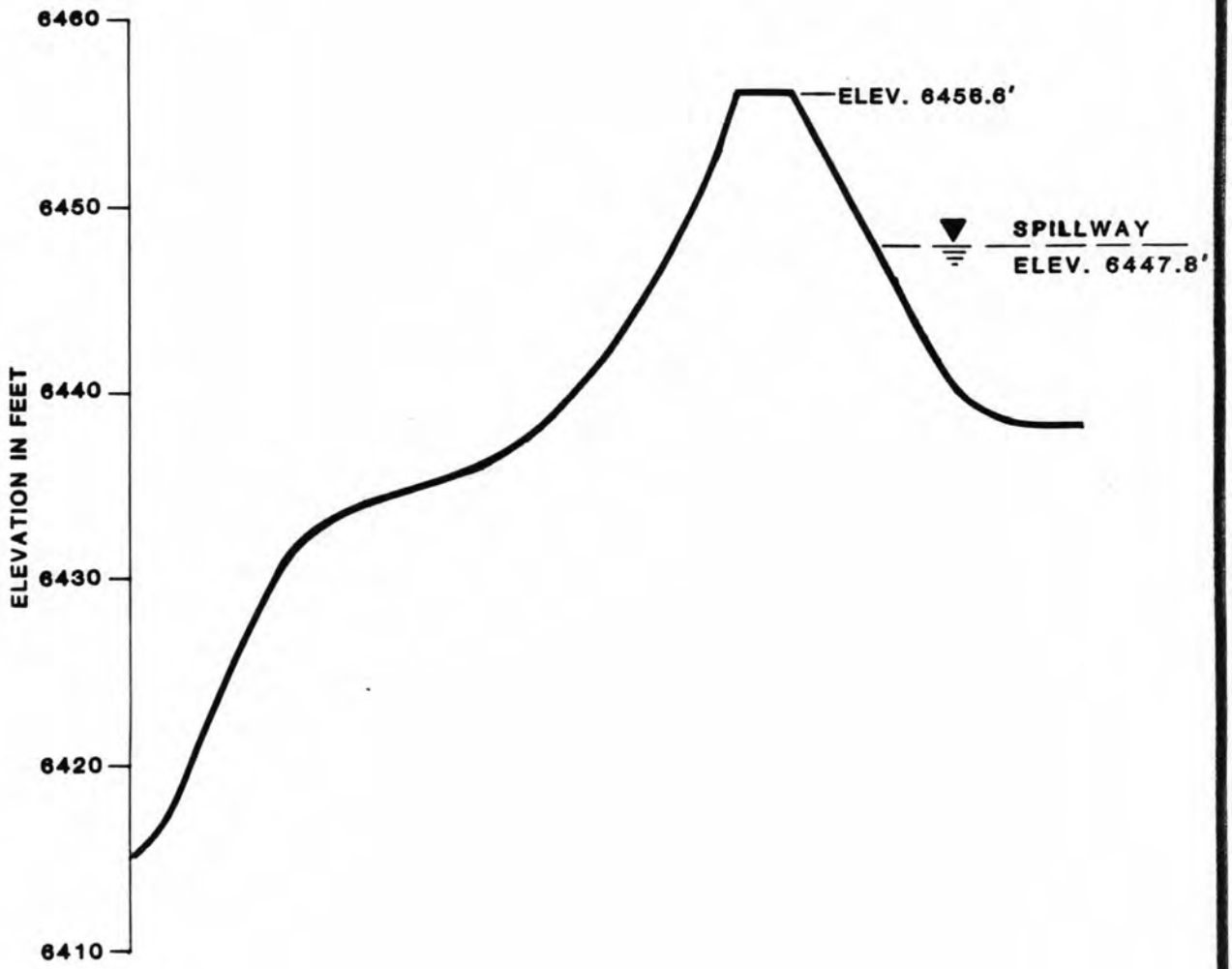
SITE PLAN
J7-K

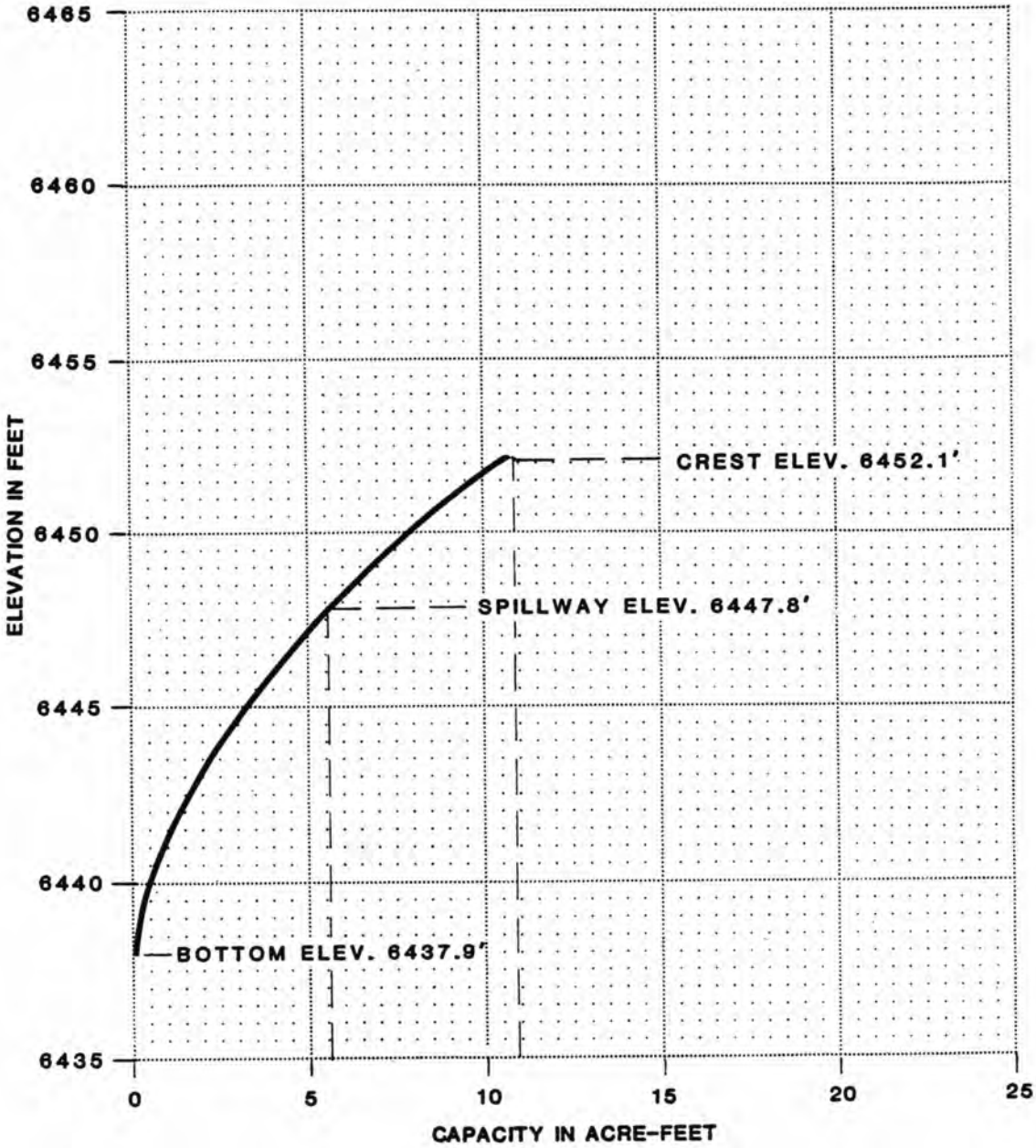
BY **Dames & Moore** Plate 1



EXISTING MAXIMUM CROSS-SECTION A-A' J7-K

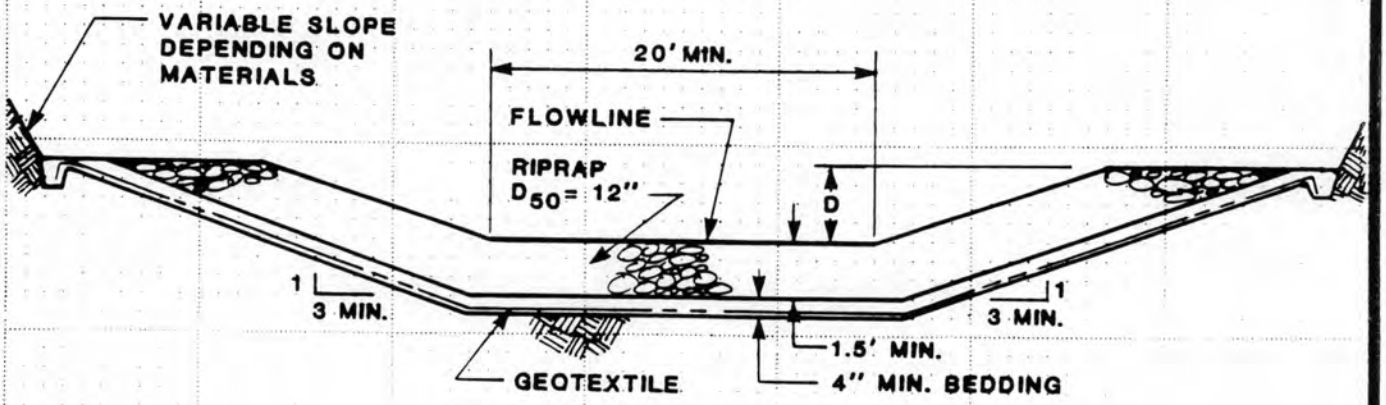
FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 2



VOLUME-ELEVATION CURVE J7-K

BY **Dames & Moore** Plate 3



SPILLWAY CHANNEL

D = 2.3'

LENGTH = 50'

FLOWLINE ELEV. = 6447.80'

OUTFLOW CHANNEL

D = 1.5'

SPILLWAY AND OUTFLOW CHANNEL CROSS SECTION J7-K

BY **Dames & Moore** Plate 5

APPENDIX A

INSPECTION CHECK LIST

Sediment Impoundment Name: J7-K
Page: 4

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST			
a. Any visual settlements?		X	
b. Misalignment?		X	
c. Cracking?		X	
2. UPSTREAM SLOPE			
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			
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?			gray 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

Sediment Impoundment Name: J7-K
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?			NA
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
c. Spillway Channel:	X		
Are side slopes eroding?	X		Rills
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?	X		Partial 25% grass
d. Outflow Channel:		X	
Are side slopes eroding?			NA
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
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?			

8. GENERAL COMMENTS

Impoundment

Water shed 20% Reclaim
20% disturbed bare
60% sage brush / grass

Ground cover
canapy " ≤ 25

No water
Some sediment in pond

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

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

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6520 - 6448 = 72 ft.

WATER COURSE LENGTH = 4.3 in (400 ft/in) = 1720 ft. = 0.326 mi.

$$T_c = \left(\frac{11.9\,(0.326)^3}{72}\right)^{0.385} = 0.137 \text{ hr.}$$

LAG TIME = $0.6\,T_c$ = 0.082 hr.

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
20.0 (49%)	S-G	ave	D	0.49 (79) = 33.7
20.9 (51%)	DISTURBED	—	D	0.51 (94) = 47.9
				86.6
			EH #23	USE 87

BY ___ DATE ___ CHECKED BY ___ COPY TO EO ___

DRAINAGE BASIN AREA

40.9 AC. 0.064 SQ. MI.

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

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

R = 40

SOIL ERODIBILITY FACTOR

SOIL TYPE = EH #23

K = 0.18

SLOPE FACTOR

LENGTH (ft.)	ΔELEV (ft.)	SLOPE (%)	LS
600	55	9	2.9
800	70	9	3.3

USE 3.3

COVER FACTOR

AREA (ac.)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
49%	S-G	40	25	0.49 (0.13)
51%	DISTURBED			0.51 (1)

C = .574

BY ___ DATE ___
CHECKED BY ___
COPY TO EO ___

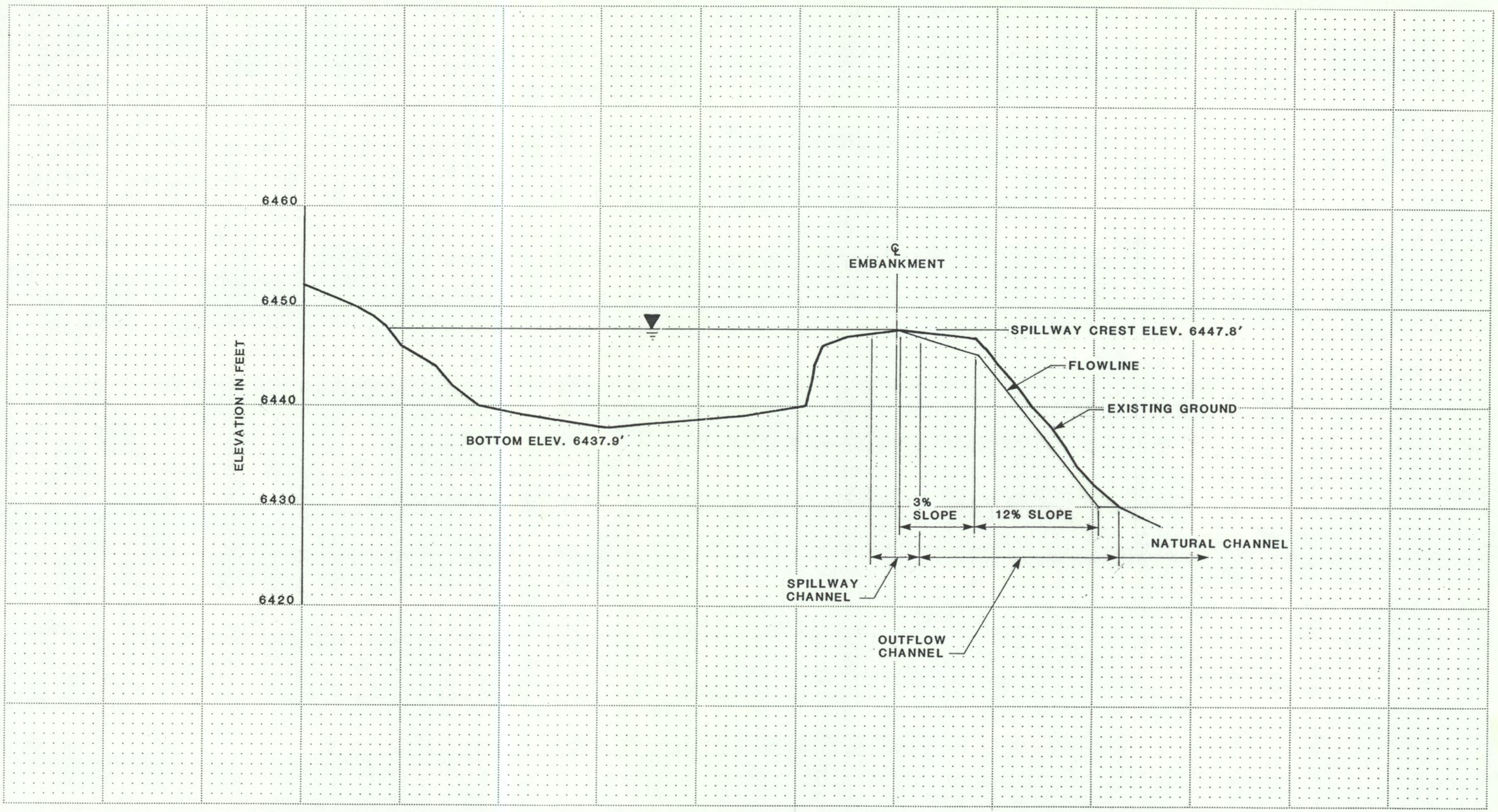
EROSION CONTROL FACTOR

P = 1.0

SEDIMENT INFLOW

$A = 40(0.18)(3.3)(0.574)(1.0) = 13.64$ ton/acre/year

$A = 13.64\left(\frac{1}{2047}\right)(40.9)(0.95) = 0.259$ acre-feet/year



SCALE
0 100 200
FEET

CHANNEL PROFILE B-B'
J7-K

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 4

INSPECTION REPORT

Sedimentation Structure

J7-M

Black Mesa Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Dames & Moore
10139-011-22

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APPENDIX A - INSPECTION CHECK LIST

APPENDIX B - HYDROLOGY AND HYDRAULIC CALCULATIONS

INTRODUCTION

Sedimentation Structure J7-M is an earthen embankment, designed and constructed in 1983 by Peabody Coal Company as a temporary sedimentation structure to control runoff and sediment from the disturbed mining areas of the Black Mesa Mine. The location of Structure J7-M is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure J7-M. 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 J7-M was inspected on August 31, 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 J7-M 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 J7-M has a 52.0-acre tributary drainage area and is located near Sagebrush Wash at the Black Mesa Mine. The watershed is classified as 100% disturbed.

EMBANKMENT

Structure J7-M is a homogeneous earthen embankment classified as a roadway embankment. Physical characteristics of the embankment are listed in the following table:

Structure J7-M

Embankment	Residual Sandstone Soils
Foundation	Residual Sandstone Soils
Right Abutment	Residual Sandstone Soils/Sandstone
Left Abutment	Residual Sandstone Soils/Sandstone
Height	13.9 ft
Crest Width	30 ft
Upstream Slope	3.3 H : 1 V
Downstream Slope . . .	2.6 H : 1 V

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section J7-M, A-A'. Grass provides erosion protection on the upstream and downstream slopes of the embankment.

ANALYSES

STABILITY

Structure J7-M is a category A-1 embankment. A standard category A-1 embankment has static and seismic factors of safety of 1.5 and 1.2, respectively, under the following conditions:

1. Maximum height = 20 ft
2. Maximum upstream slope = 2.0 H : 1 V
3. Maximum downstream slope = 4.0 H : 1 V
4. Normal pool with steady seepage saturation conditions

The J7-M embankment is lower in height; however, the downstream slope is steeper than the category standard; therefore, the embankment has factors of safety less 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 J7-M is located downstream from Structure J7-N. The two structures have a combined storage capacity that is less than 20 acre-feet. Therefore, the spillway for J7-M was analyzed using the 25-year, 6-hour storm. The storage capacity of Structure J7-M was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.540	mi
2.	Elevation Difference, H	98	ft
3.	Time of Concentration, T_c	0.218	h
4.	Lag time, $0.6T_c$	0.131	h
5.	SCS Curve Number	92	
6.	Rainfall Depth, 10-year, 24-hour storm .	2.1	in.
	25-year, 6-hour storm. .	1.9	in.
7.	Drainage Area	52.0	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. Both the 10-year and 25-year storms were routed through Structure J7-N located upstream and into Structure J7-M. The initial conditions and results of the analysis are summarized in the following table.

J7-M 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	100	127
Volume	acre-ft	5.91	5.07
Storage			
Peak Stage	ft	6373.69	--
Spillway Elevation . .	ft	6377.40	--
Peak Storage	acre-ft	5.91	--
Storage Capacity . . .	acre-ft	10.4	--
Outflow			
Peak Flow	cfs	0	49
Embankment Crest Elevation	ft	--	6382.40
Peak Stage	ft	--	6379.61
Freeboard	ft	--	2.79
Spillway			
Pipe Exit Velocity (36" CMP)	fps	--	11.8
Pipe Exit Velocity (48" CMP)	fps	--	7.2
Mannings "n"		--	0.024
Outflow Channel			
Slope	%	--	9
Normal Velocity. . . .	fps	--	6.4
Normal Depth	ft	--	0.47
Manning's "n"		--	0.040

Spillway Channel

The existing spillway for J7-M consists of two corrugated metal pipes (CMP) with the following dimensions:

Pipe diameters	36, 48 in.
Pipe lengths	60 ft
Approximate slope	1-2 percent
Upstream invert elevation	6377.40 ft

Outflow Channel

The existing outflow channel for J7-M is a U-shaped channel with the following dimensions:

Channel width	8 ft
Channel length	30 ft
Average exit slope	3 percent

Rock provides 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, J7-M.

The calculations for the sediment load entering Structure J7-M were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.203
3. Slope Factor, LS 2.6
4. Cover Factor, C 1.0
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 J7-M and the results of the sediment inflow analysis are summarized in the following table.

J7-M STORAGE

Total Storage Capacity	10.4	acre-ft
10-year, 24-hour Storm Inflow	5.91	acre-ft
Available Sediment Storage Capacity . .	4.49	acre-ft
Sediment Inflow Rate	0.509	acre-ft/yr
Sediment Storage Life	9	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure J7-M indicated that the geotechnical problems consist of rills on the upstream and downstream slopes and gullys in the right and left abutments; and a steep downstream slope. Correction of erosion is considered a periodic maintenance task and does not require

remedial action. The downstream slope should be flattened to 4.0 horizontal to 1 vertical to meet stability requirements.

HYDRAULICS

The storage capacity and spillway capacity of Structure J7-M are adequate; however, the spillway does not have an adequate outflow channel. A trapezoidal outflow channel should be constructed along the alignment B-B' shown in Plate 1. The channel profile is shown in Plate 4 and the required dimensions are shown in Plate 5. The outflow channel should be protected against erosion using geotextile and riprap as shown in Plate 5. A trash-rack should be installed on the inlet of the CMP to prevent clogging of the spillway.

* * *

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

Plate 1 - Site Plan J7-M

Plate 2 - Existing Maximum Cross Section J7-M, A-A'

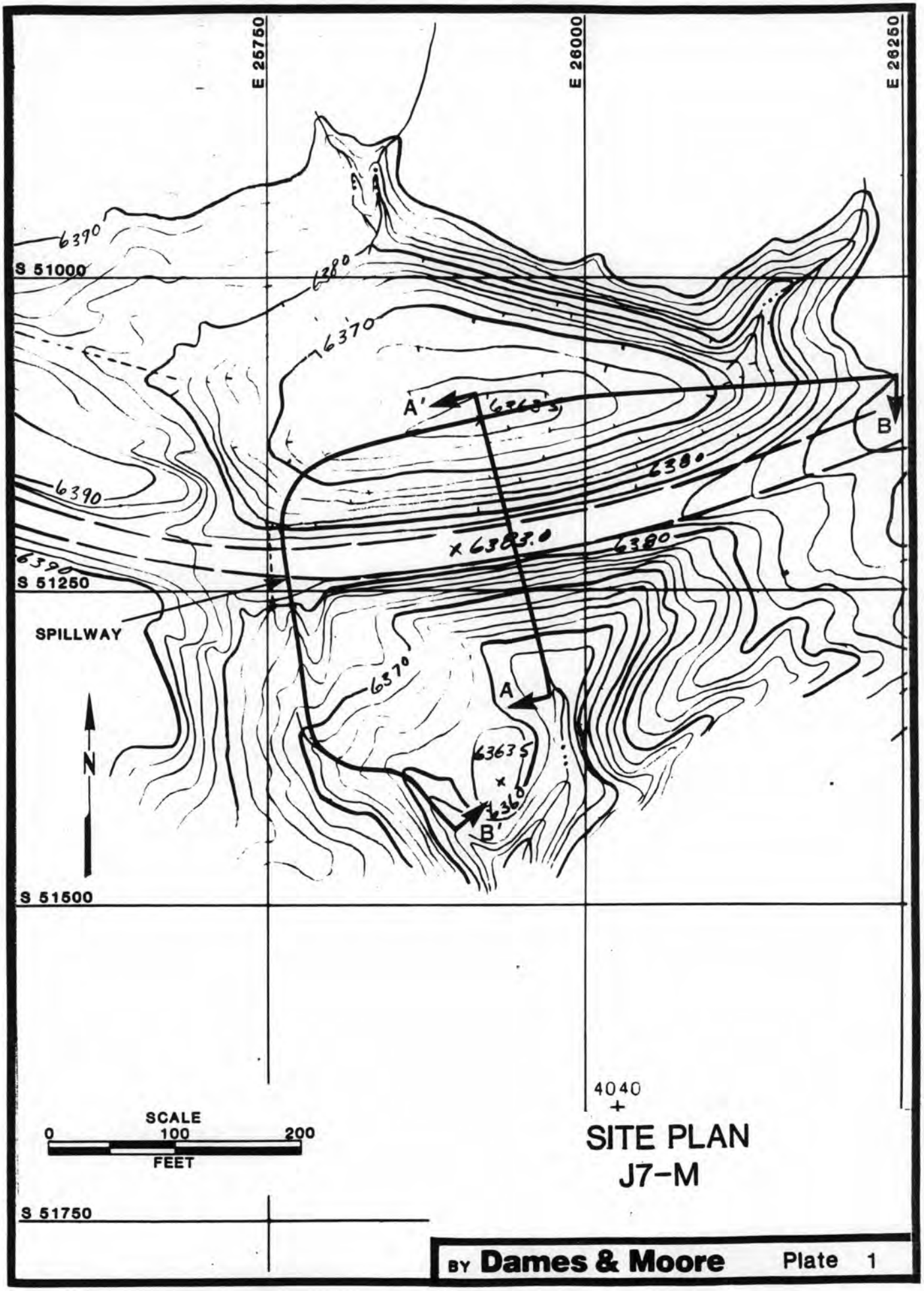
Plate 3 - Volume-Elevation Curve J7-M

Plate 4 - Channel Profile J7-M, B-B'

Plate 5 - Outflow Channel Cross Section J7-M

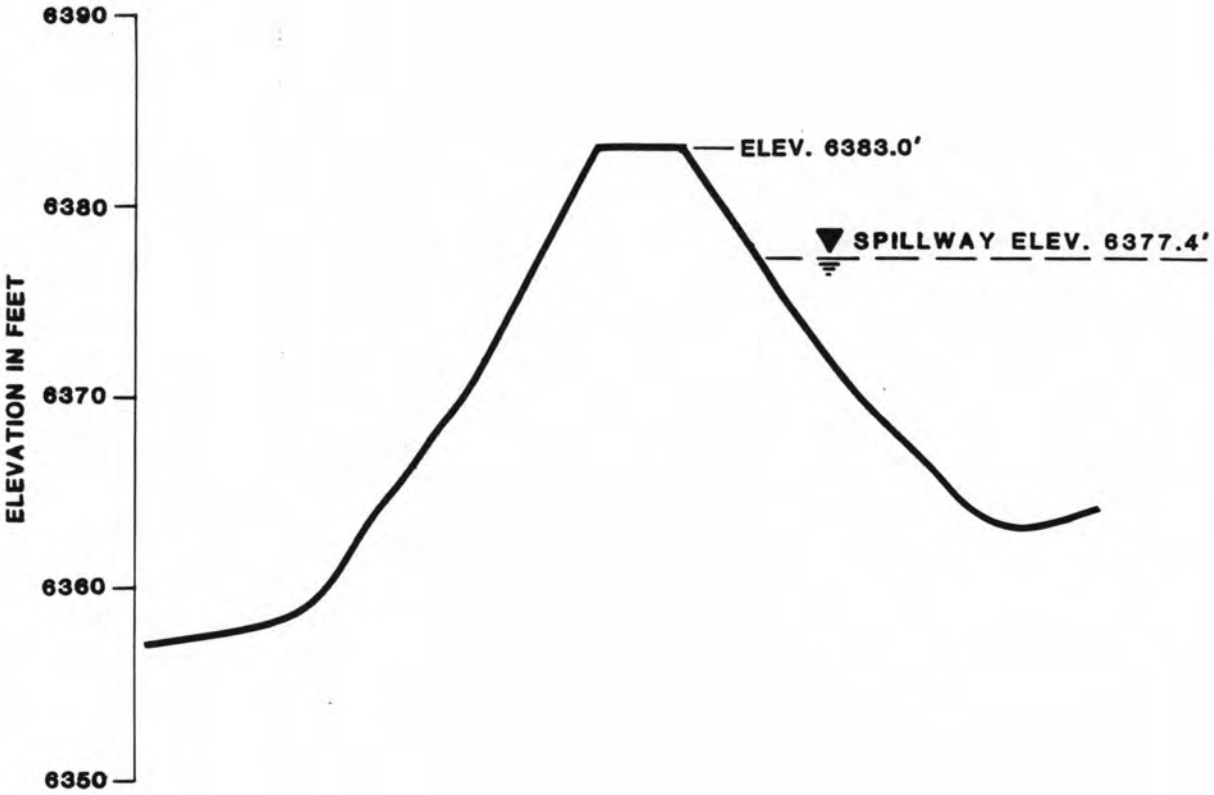
Appendix A - Inspection Check List

Appendix B - Hydrology and Hydraulic Calculations



SITE PLAN
J7-M

BY **Dames & Moore** Plate 1

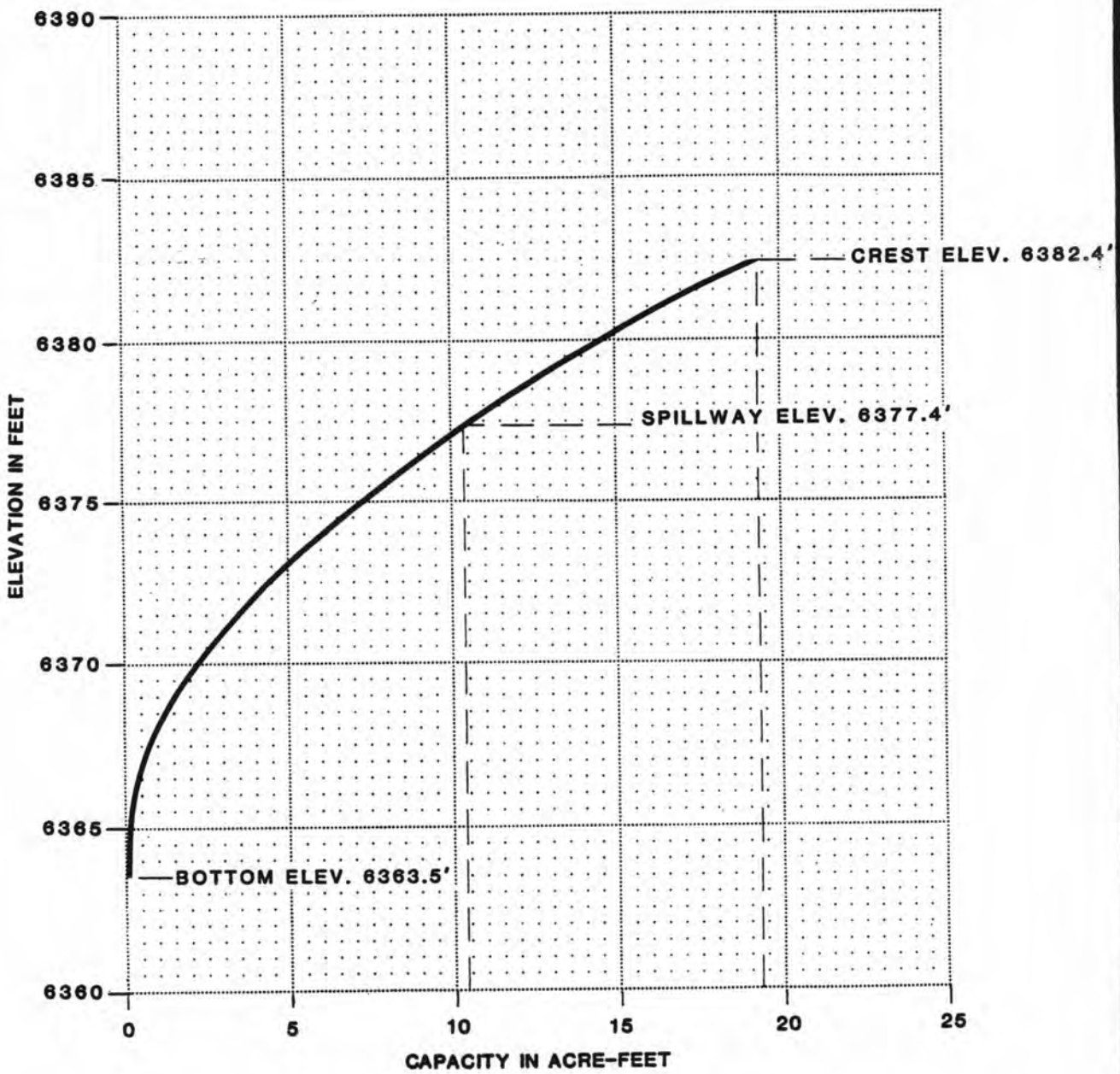


EXISTING MAXIMUM CROSS-SECTION A-A' J7-M

FOR LOCATION SEE PLATE 1

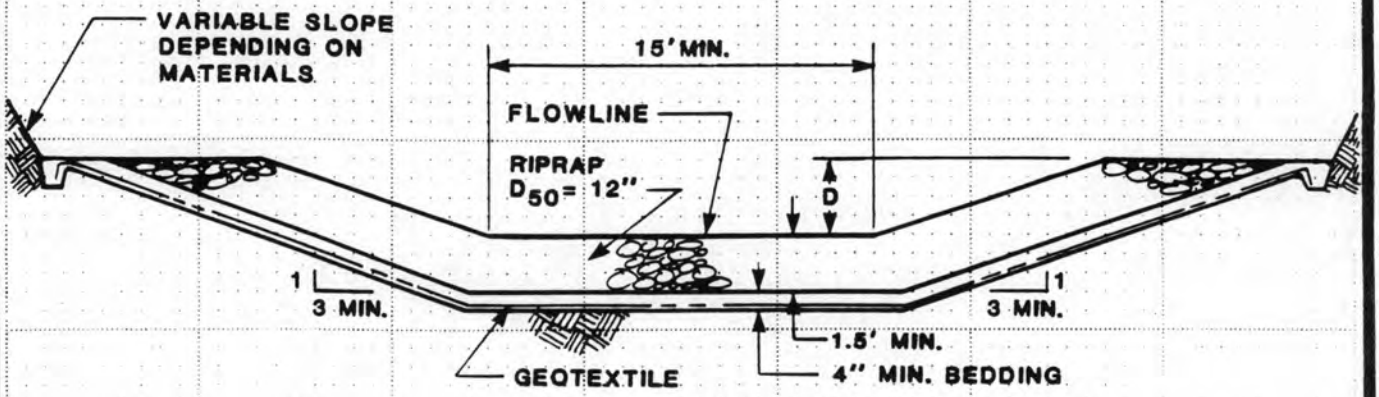
BY **Dames & Moore**

Plate 2



VOLUME-ELEVATION CURVE
J7-M

BY **Dames & Moore** Plate 3



OUTFLOW CHANNEL

D = 1.5'

OUTFLOW CHANNEL CROSS SECTION J7-M

BY **Dames & Moore** Plate 5

APPENDIX A

INSPECTION CHECK LIST

Sediment Impoundment Name: J7 - M
Page: 4

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST ROADWAY/GRAVEL			
a. Any visual settlements?		X	
b. Misalignment?		X	
c. Cracking?		X	
2. UPSTREAM SLOPE			
a. Adequate grass cover?	X		85%
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		Grass
g. Any stone deterioration?			NA
h. Visual depressions or bulges?		X	
i. Visual settlements?		X	
j. Animal burrows?		X	
3. DOWNSTREAM SLOPE			
a. Adequate grass cover?	X		85%
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		SM. gulley ll to contact
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			SM brown rock near surface
5. ABUTMENT CONTACT. LEFT			
a. Any erosion?	X		Gulley adjacent to Road
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			SM rock near surface

Sediment Impoundment Name: J7-M
Page: 5

ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			
a. Location:			
Left abutment?			
Right abutment?			
Crest of Embankments?	X		towards right abutment
b. Approach Channel:		X	
Are side slopes eroding?			NA
Are side slopes sloughing?			↓
Bottom of channel eroding?			↓
Obstructed?			↓
Erosion protection?			↓
c. Spillway Channel:			CMP
Are side slopes eroding?			NA
Are side slopes sloughing?			↓
Bottom of channel eroding?			↓
Obstructed?	X		tumbleweeds in entrance
Erosion protection?			NA
d. Outflow Channel:	X		2 distinct 30'
Are side slopes eroding?		X	
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?	X		Rock D50/10"
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?			

8. GENERAL COMMENTS

No problems

IMPOUNDMENT

Watershed - same as design

Sage brush / grass 10% disturbed

Canopy Cover ≤25

Ground Cover average

sediment in pond - very little

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

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

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6475 − 6377 = 98 ft.

WATER COURSE LENGTH = 2850′ = 0.540 mi.

$$T_c = \left(\frac{11.9\,(0.540)^3}{98}\right)^{0.385} = 0.218 \text{ hr.}$$

LAG TIME = $0.6 T_c$ = 0.131 hr.

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
52.0 (100%)	DIST.	—	C-D 75% EH#32 25% EH #23	92

BY ___ DATE ___
CHECKED BY ___
COPY TO EO ___

DRAINAGE BASIN AREA

52.0 AC. 0.081 SQ. mi.

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

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

R = 40

SOIL ERODIBILITY FACTOR

SOIL TYPE = 75% EH # 32 0.75(0.21) = 0.158
25% EH # 23 0.25(0.18) = 0.045
0.203

K = 0.203

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
500	47	9	2.64
900	85	9	3.55
1400	45	3	0.64

USE 2.6

COVER FACTOR

AREA (ac.)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
100%	DISTURBED	--	—	1.0

BY ___ DATE ___ CHECKED BY ___ COPY TO EO ___

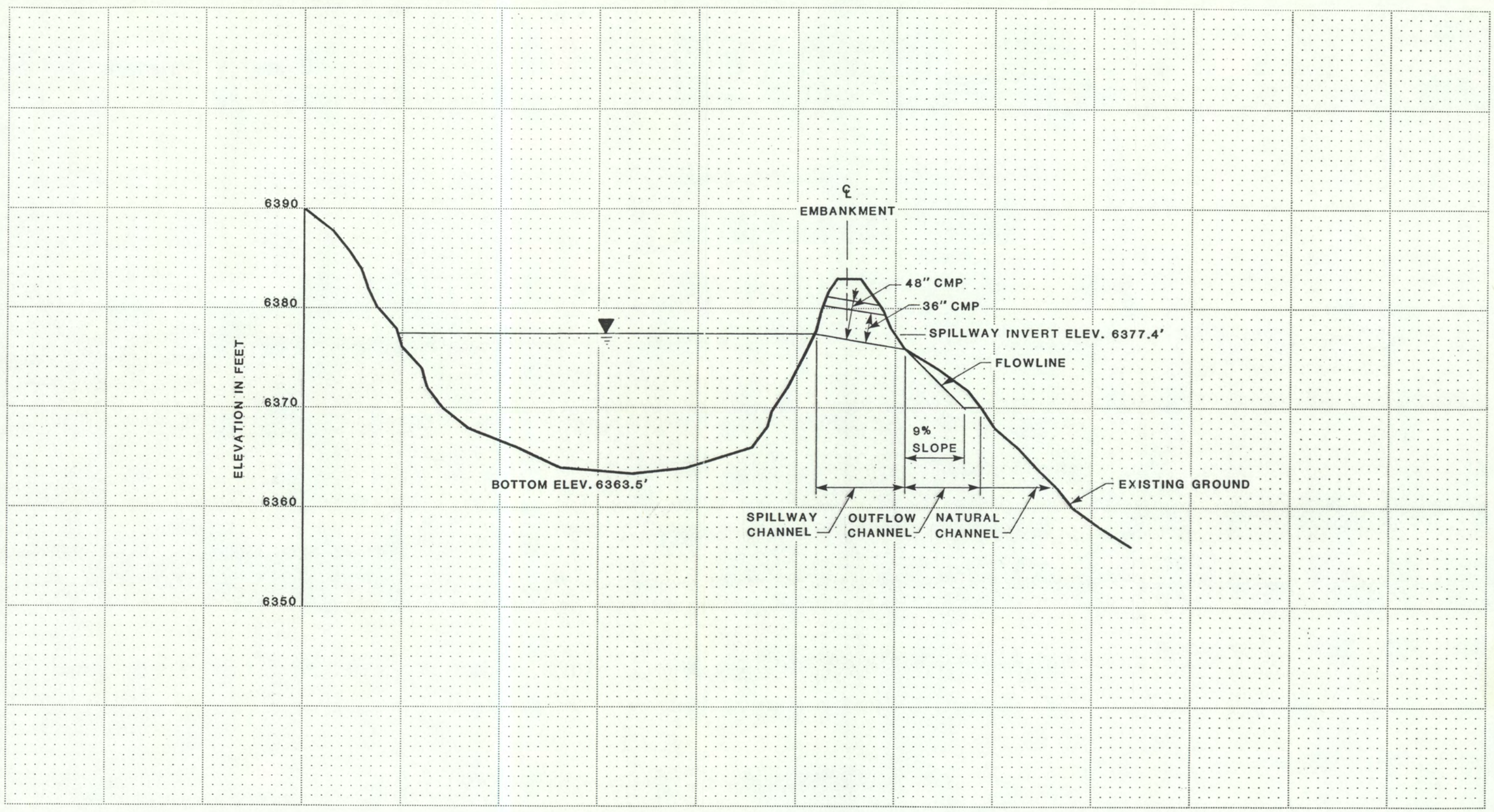
EROSION CONTROL FACTOR

P = 1.0

SEDIMENT INFLOW

$A = 40(0.203)(2.6)(1.0)(1.0) = 21.1$ ton/acre/year

$A = 21.1\left(\frac{1}{2047}\right)(52.0)(0.95) = 0.509$ acre-feet/year



SCALE
0 100 200
FEET

CHANNEL PROFILE B–B′
J7–M

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 4

DESIGN REPORT

Temporary Sedimentation Structure

J7-R

Black Mesa Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

APPROVED JUN 1998

Registered Professional Engineer (Civil) CERTIFICATE NO. 19782 JAMES GARY SCHLENVOGT Date Signed ..... ARIZONA, U.S.A.

MAR 16 1998

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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 J7-R and J7-R1 Sedimentation Pond Design

MAR 1998 APPROVED

INTRODUCTION

Sedimentation Structure J7-R will be an earthen embankment, designed and constructed by Peabody Western Coal Company as a temporary sedimentation structure designed to control runoff and sediment from portions of J7 disturbed surface mining area at the Black Mesa Mine. The location of Structure J7-R and its watershed boundary are shown on Drawing No. 85400 (Sheet K-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 J7-R that is in series with sedimentation structure J7-R1. 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 J7-R 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.

MAR 1998 APPROVED

SITE DESCRIPTION

LAND USE

The J7-R1 and J7-R Structures have a combined watershed of 260.1 acres and are located on a tributary upstream of Yucca Flat Wash at the Black Mesa Mine. The 15.5-acre watershed, which contributes directly to structure J7-R is classified as 65% spoil and 35%, disturbed.

DESIGN ANALYSES

GENERAL

Structure J7-R 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 J7-R is a Category A-3 embankment. 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 4:1 were assumed. Based on the total embankment height of approximately 14 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.

MAR 1998 APPROVED

SITE DESCRIPTION

LAND USE

The J7-R1 and J7-R Structures have a combined watershed of 260.1 acres and are located on a tributary upstream of Yucca Flat Wash at the Black Mesa Mine. Approximately 244.6 acres of the watershed is upstream of the J7-R1 structure and the remaining 15.5-acre watershed is between the J7-R1 and J7-R Structures. The 15.5-acre watershed, which contributes directly to structure J7-R is classified as 65% spoil and 35%, disturbed.

DESIGN ANALYSES

GENERAL

Structure J7-R 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 J7-R is a Category A-3 embankment. 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 4:1 were assumed. Based on the total embankment height of approximately 14 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.

JUN 1998 APPROVED

HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD+ (see Appendices A, B, and C). Structure J7-R will be constructed in series with proposed Structure J7-R1. Structure J7-R 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 storm. Structures J7-R and J7-R1 were conservatively assumed to be full to the emergency spillway at the time of 100-year storm event. The storage capacity of structure J7-R 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 Yucca Flat Wash.

The following parameters were used in the hydrologic analysis:

		10yr-24hr Storm	
1.	Water Course length, L	0.303	mi.
2.	Elevation Difference, H	190	ft
3.	Time of Concentration, T_c	0.087	hr
4.	SCS Curve Number	88	
5.	Rainfall Depth, 10-year, 24-hour storm	2.1	in
	100-year, 6-hour storm	2.4	in
6.	Drainage Area, 10-year, 24-hour storm	15.5	acres
	100-year, 6-hour storm	260.1	acres

JUN 1998 APPROVED

Pond J7-R is designed in series with Pond J7-R1 (see Appendices B and C of the Design Report). The 15.5 acres is only the drainage area between Pond J7-R and Pond J7-R1: whereas, the 260.1-acre figure is the total combined watershed for both ponds. For both the 10-year and 100-year storms, the total combined watershed is routed through both ponds. The 10-year, 24-hour storm inflow is utilized on page 7 of the Design Report to determine the storage requirement. Values reported represent the watershed, which drains directly to Pond J7-R. Hydrologic input parameters for upstream structure

J7-R1 is presented in the Design Report for J7-R1.

Muskingum routing parameters were utilized to route the 10-year and 100-year hydrographs between the J7-R and J7-R1 structures. The routing parameters are presented in Appendices A, B, and C, and are shown on a sub-watershed 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 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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J7-R 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	16.9	277.3
Volume	ac-ft	1.4	22.9
Storage			
Peak Stage	msl	N/A	6319.0
Emerg. Spillway Elev.	msl	6317	6317
Peak Storage	ac-ft	N/A	18.9
Storage Capacity	ac-ft	14.9	14.9
Outflow			
Peak Flow	cfs	N/A	234.9
Spillway Elevation	msl	6317	6317
Embankment Crest Elev.	msl	6320	6320
Peak Stage	msl	--	6319.0
Freeboard	ft	--	1.0
Emergency Spillway Channel			
Flow Depth	ft	--	2.0
Critical Velocity	fps	--	5.9
Mannings "n"	--	--	.031
Width	ft	--	30
Outflow Channel			
Slope	%	--	25
Normal Velocity	fps	--	9.1
Normal Depth	ft	--	0.8
Mannings "n"	--	--	.067
Riprap D_{50}	in	--	9

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for J7-R 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)	30	ft
	(Outflow)	60	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25	%
Spillway Elevation		6317.0	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 J7-R is designed to contain approximately 14.9 acre-feet.

The calculations for the sediment load entering structure J7-R were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.16
3.	Slope Factor, LS	4.65
4.	Cover Factor, C	1.0
5.	Erosion Control Factor, P	0.87

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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 J7-R has sufficient storage to contain the 10-year, 24-hour storm and has excess capacity to store additional flow from J7-R1. 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 J7-R1 and J7-R

	J7-R1	J7-R	Combined
Total Storage Capacity	8.1	14.9	23.0 acre-ft
10-Year, 24-Hour Storm Inflow	16.6	1.4	18.0 acre-ft
Available Sediment Storage Capacity	------	-------	5.0 acre-ft
Sediment Inflow Rate/Year	0.80	0.17	0.97 acre-ft
Sediment Storage Life	--------	------	5.2 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 J7-R and J7-R1 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: J7-R

TIME OF CONCENTRATION (Haul Road):

Start Elevation (ft) =	6500
End Elevation (ft) =	6310
Elevation Difference, E (ft) =	190
Watercourse Length (ft) =	1600
Watercourse Length, L (mi) =	0.303
Tc = (11.9L^3/E)^0.385 =	0.087 hours

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Spoil	B	86	10	860
Disturbed	D	91	5.5	500.5
TOTAL:			15.5	1360.5

Weighted CN = Total CN*Area/ Total Area = 88

DRAINAGE BASIN AREA:

15.50 Acres

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Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: ACZ, INC.
Filename: J:\861\0350\SEDCAD\J7R25 User: TEL
Date: 10-18-1997 Time: 12:02:38
PEABODY WESTERN COAL COMPANY: POND J7-R AND R1 (100-YR, 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	300.17	3.33	5.48	0.02	0.015	0.381

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT: J7-R

SOIL ERODIBILITY FACTOR:

Soil Type	Soil Group	Erodibility Factor, K	Area (acres)	K*Area
Spoil	B	0.12	10	1.2
Disturbed	D	0.22	5.5	1.21
TOTAL:			15.5	2.41

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

Weighted K = Total K*Area/ Total Area = 0.155

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
1150	70	6.1%	0.5	3.5	2.73
200	50	25.0%	0.6	14.0	6.57

Average LS = 4.65

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 > or = 9%*

Where:

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

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PROJECT: J7-R POND

COVER AND PRACTICE FACTORS:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C*Area	Practice Factor, P	P*Area
Spoil	0%	0%	10	1	10	0.80	8
Disturbed	0%	0%	5.5	1.00	5.5	1.00	5.5
TOTAL:			15.5		15.5		13.5

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

Weighted P = Total P*Area/ Total Area = 0.87

RAINFALL FACTOR:

R = 40

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: J7-R

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	0.16	
Length Slope Factor	4.65	
Cover Factor	1.00	
Practice Factor	0.87	
Gross Annual Sediment Yield	25.18	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0123	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0111	acre-feet/acre/year
Watershed Area	15.5	acres
Watershed Annual Sediment Yield	0.1716	acre-feet/year
Number of years	1	years
Required Pond Sediment Storage	0.172	acre-feet

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SEDCAD+ RIPRAP CHANNEL DESIGN

J7-R OUTFLOW

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	234.90 cfs	
Slope	25.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	30.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.80 ft
with Freeboard	1.10 ft
Top Width	34.79 ft
with Freeboard	36.59 ft
Velocity	9.08 fps
Cross Sectional Area	25.87 sq ft
Hydraulic Radius	0.74 ft
Manning's n	0.067
Froude Number	1.86
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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J7-R SPILLWAY
Worksheet for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	j7
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.031	
Channel Slope	0.013858	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	30.00	ft
Discharge	234.90	cfs

Results		
Depth	1.19	ft
Flow Area	39.94	ft^2
Wetted Perimeter	37.52	ft
Top Width	37.14	ft
Critical Depth	1.19	ft
Critical Slope	0.013859	ft/ft
Velocity	5.88	ft/s
Velocity Head	0.54	ft
Specific Energy	1.73	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 J7-R AND R1 (10-YR, 24-HR)

by

Name: TEL

Company Name: ACZ, INC.
File Name: J:\861\0350\SEDCAD\J7R-R1

Date: 10-18-1997

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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 J7-R AND R1 (100-YR, 6-HR)

by

Name: TEL

Company Name: ACZ, INC.
File Name: J:\861\0350\SEDCAD\J7R25

Date: 10-18-1997

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Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: ACZ, INC.
Filename: J:\861\0350\SEDCAD\J7R25 User: TEL
Date: 10-18-1997 Time: 12:02:38
PEABODY WESTERN COAL COMPANY: POND J7-R AND R1 (100-YR, 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	244.60	84	F	0.307	0.000	0.000	0.0	21.18	294.73
		Type: Pond			Label: POND J7-R1					
111	Structure	244.60							21.18	
111	Total IN	244.60							21.18	294.73
111	Total OUT								21.18	271.33
112	1	15.50	88	F	0.087	0.000	0.000	0.0	1.67	30.12
		Type: Pond			Label: POND J7-R					
112	Structure	15.50							22.85	
112	Total IN	260.10							22.85	277.30
112	Total OUT								22.85	234.90
111 to 112 Routing						0.015	0.381			

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Company Name: ACZ, INC.
Filename: J:\861\0350\SEDCAD\J7R25 User: TEL
Date: 10-18-1997 Time: 12:02:38
PEABODY WESTERN COAL COMPANY: POND J7-R AND R1 (100-YR, 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
POND J7-R1

Drainage Area from J1, B1, S1, SWS(s)1: 244.6 acres
Total Contributing Drainage Area: 244.6 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	6319.5
Crest Length (ft)	30.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	22.0

POND RESULTS:

Permanent Pool (ac-ft)
8.0

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	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	21.18	294.73
OUT	21.18	271.33

Peak Elevation	Hydrograph Detention Time (hrs)
6322.0	0.16

****

J1, B1, S2
POND J7-R

Drainage Area from J1, B1, S2, SWS(s)1: 15.5 acres
Total Contributing Drainage Area: 260.1 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	6317.0
Crest Length (ft)	30.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	30.0

POND RESULTS:

	Permanent Pool (ac-ft)

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==========
14.9

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	22.85	277.30
OUT	22.85	234.90

Peak Elevation	Hydrograph Detention Time (hrs)
6319.0	0.16

****

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Company Name: ACZ, INC.
Filename: J:\861\0350\SEDCAD\J7R25 User: TEL
Date: 10-18-1997 Time: 12:02:38
PEABODY WESTERN COAL COMPANY: POND J7-R AND R1 (100-YR, 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
POND J7-R1

Drainage Area from J1, B1, S1, SWS(s)1: 244.6 acres
Total Contributing Drainage Area: 244.6 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6302.00	0.00	0.02	0.00	0.00	
6303.00	1.00	0.04	0.03	0.00	
6304.00	2.00	0.07	0.08	0.00	
6305.00	3.00	0.11	0.17	0.00	
6306.00	4.00	0.15	0.30	0.00	
6307.00	5.00	0.20	0.48	0.00	
6308.00	6.00	0.24	0.70	0.00	
6309.00	7.00	0.32	0.98	0.00	
6310.00	8.00	0.40	1.34	0.00	
6311.00	9.00	0.45	1.77	0.00	
6312.00	10.00	0.51	2.25	0.00	
6313.00	11.00	0.57	2.78	0.00	
6314.00	12.00	0.63	3.38	0.00	
6315.00	13.00	0.72	4.06	0.00	
6316.00	14.00	0.81	4.82	0.00	
6317.00	15.00	0.87	5.66	0.00	
6318.00	16.00	0.94	6.56	0.00	
6319.00	17.00	1.01	7.53	0.00	
6319.50	17.50	1.05	8.05	0.00	Stage of SW#1
6320.00	18.00	1.09	8.58	17.95	
6320.20	18.20	1.10	8.80	25.13	
6320.30	18.30	1.11	8.91	32.46	
6320.40	18.40	1.12	9.02	40.48	
6320.50	18.50	1.13	9.14	49.16	
6321.00	19.00	1.17	9.71	108.67	
6321.50	19.50	1.21	10.30	177.77	
6322.00	20.00	1.25	10.92	267.25	
6322.02	20.02	1.26	10.94	271.33	Peak Stage
6322.50	20.50	1.30	11.55	377.75	
6323.00	21.00	1.36	12.22	506.08	

****

J1, B1, S2
POND J7-R

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Drainage Area from J1, B1, S2, SWS(s)1: 15.5 acres
Total Contributing Drainage Area: 260.1 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6306.00	0.00	0.90	0.00	0.00	
6307.00	1.00	1.01	0.96	0.00	
6308.00	2.00	1.13	2.03	0.00	
6309.00	3.00	1.15	3.17	0.00	
6310.00	4.00	1.18	4.34	0.00	
6311.00	5.00	1.27	5.56	0.00	
6312.00	6.00	1.36	6.87	0.00	
6313.00	7.00	1.45	8.28	0.00	
6314.00	8.00	1.55	9.78	0.00	
6315.00	9.00	1.65	11.38	0.00	
6316.00	10.00	1.75	13.08	0.00	
6317.00	11.00	1.86	14.88	0.00	Stage of SW#1
6317.70	11.70	1.94	16.21	33.86	
6317.80	11.80	1.95	16.41	43.66	
6317.90	11.90	1.96	16.60	54.33	
6318.00	12.00	1.97	16.80	65.85	
6318.50	12.50	2.04	17.80	143.99	
6319.00	13.00	2.11	18.84	233.39	
6319.01	13.01	2.11	18.85	234.90	Peak Stage
6319.50	13.50	2.18	19.91	347.63	
6320.00	14.00	2.26	21.02	486.90	

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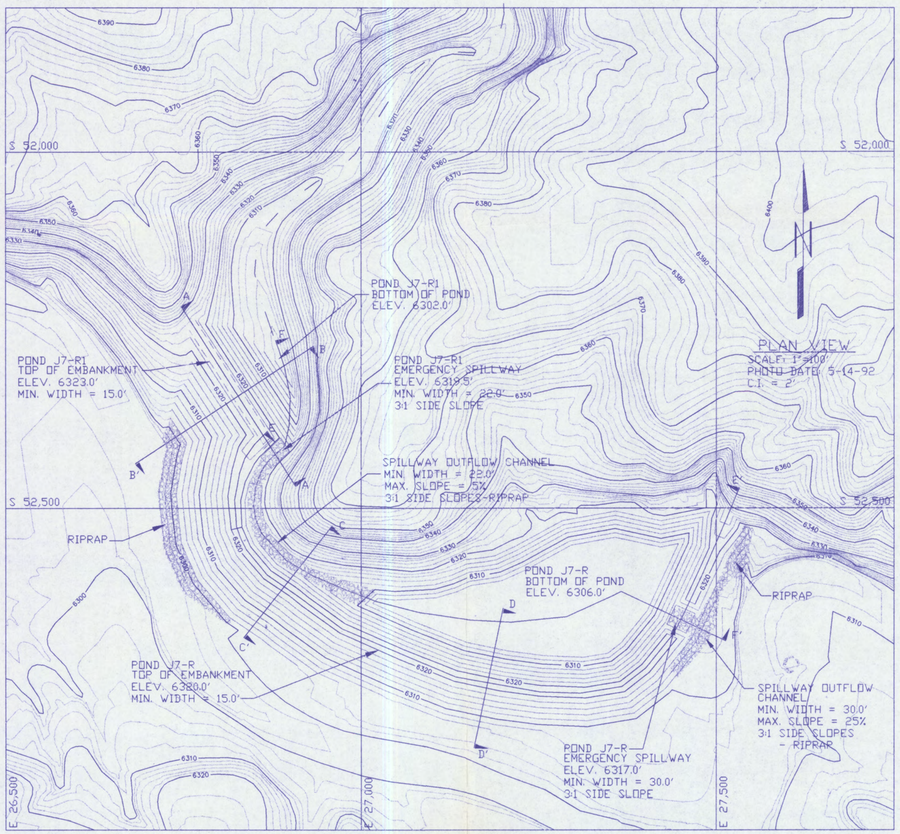
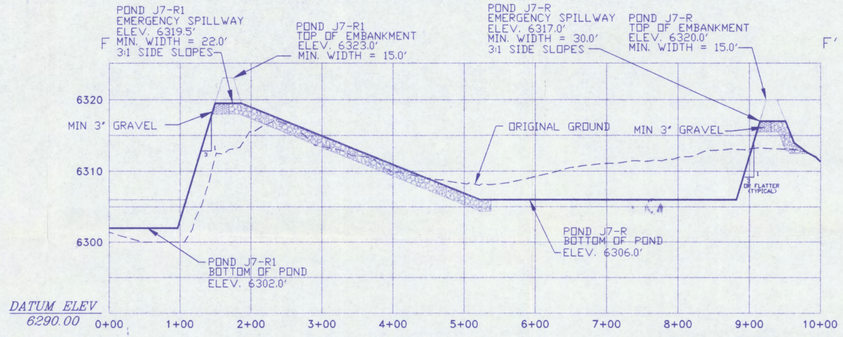
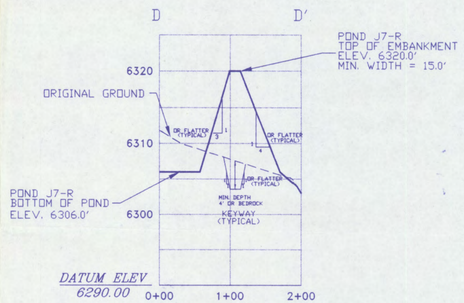




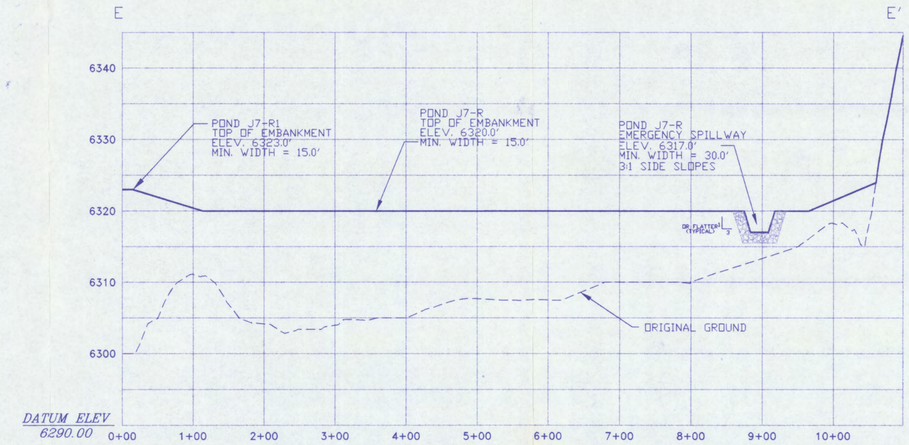
SECTION F - F'

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



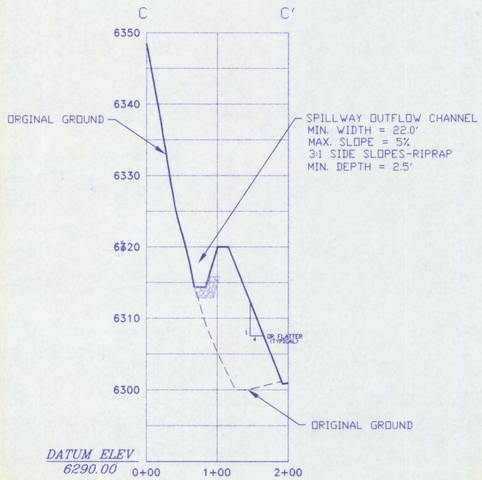
SECTION D - D'

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



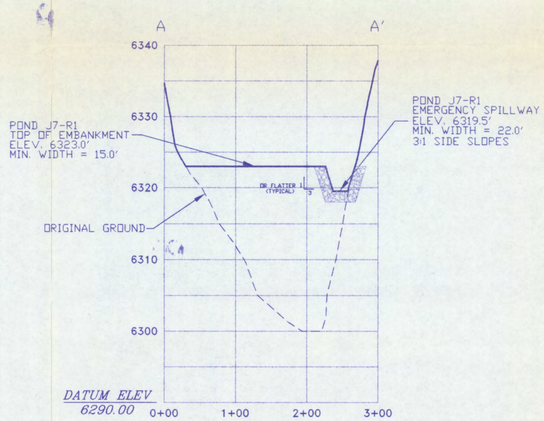
SECTION E - E'

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



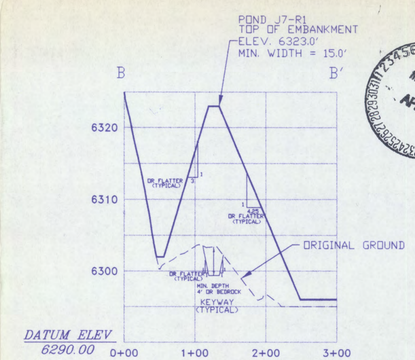
SECTION C - C'

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



SECTION A - A'

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

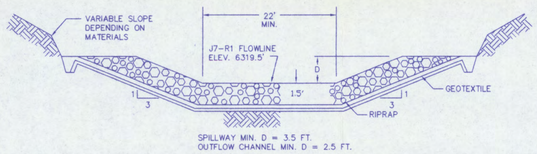


SECTION B - B'

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

J7-R1 POND STAGE CAPACITY

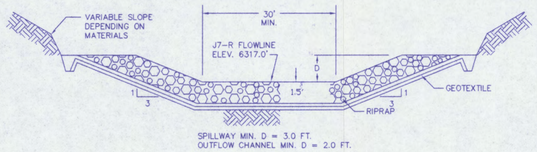
ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6302.0	0.00	0.02	0.00	0.00	BOTTOM OF POND
6304.0	2.00	0.07	0.08	0.08	
6306.0	4.00	0.15	0.22	0.30	
6308.0	6.00	0.24	0.40	0.70	
6310.0	8.00	0.40	0.64	1.34	
6312.0	10.00	0.51	0.91	2.25	
6314.0	12.00	0.63	1.13	3.38	
6316.0	14.00	0.81	1.44	4.82	
6318.0	16.00	0.94	1.74	6.56	
6319.5	17.50	1.05	1.49	8.05	EMERGENCY SPILLWAY
6320.0	18.00	1.09	0.53	8.58	
6322.0	20.00	1.25	2.34	10.92	
6323.0	23.00	1.36	1.30	12.22	TOP OF EMBANKMENT



PROPOSED J7-R1 POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)

J7-R POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6306.0	0.00	0.90	0.00	0.00	BOTTOM OF POND
6308.0	2.00	1.13	2.03	2.03	
6310.0	4.00	1.18	2.31	4.34	
6312.0	6.00	1.36	2.53	6.87	
6314.0	8.00	1.55	2.91	9.78	
6316.0	10.00	1.75	3.30	13.08	
6317.0	11.00	1.86	1.80	14.88	EMERGENCY SPILLWAY
6318.0	12.00	1.97	1.92	16.80	
6320.0	14.00	2.26	4.22	21.02	TOP OF EMBANKMENT



PROPOSED J7-R POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)

ENGINEER'S CERTIFICATION

JAMES G. SCHIENWOLD
CORPORATE ENGINEER MANAGER
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: OCT 24 1997

NOTES:
1) General location, see Drawing No. 85400, Sheet K-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 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 #1
PROPOSED J7-R & J7-R1 POND
SEDIMENTATION POND DESIGN
BLACK MESA MINE
PEABODY WESTERN COAL COMPANY
1300 SOUTH YALE ST. FLAGSTAFF, ARIZONA 86001

DESIGNED BY: TEL	SCALE: 1"=100'
DRAWN BY: JMB	DRAWING DATE: 10-24-97
CHECKED BY: JGS	PHOTO DATE: 05-14-92
CONTOUR INTERVAL: 2 FT.	DWG FILE: J7R POND~1.DWG

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DESIGN REPORT

Temporary Sedimentation Structure

J7-R1

Black Mesa Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

APPROVED
MAR 1998

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

OCT 24 1997

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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 J7-R and J7-R1 Sedimentation Pond Design

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INTRODUCTION

Sedimentation Structure J7-R1 will be an earthen embankment, designed and constructed by Peabody Western Coal Company as a temporary sedimentation structure designed to control runoff and sediment from portions of J7 disturbed surface mining area at the Black Mesa Mine. The location of Structure J7-R1 and its watershed boundary are shown on Drawing No. 85400 (Sheet K-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 J7-R1 that is in series with sedimentation structure J7-R. 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 J7-R1 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 J7-R1 and J7-R Structures have a combined watershed of 260.1 acres and are located on a tributary upstream of Yucca Flat Wash at the Black Mesa Mine. The 244.6 acres watershed, which contributes directly to structure J7-R1 is classified as 35% spoil, 56% reclaimed and 9%, disturbed.

DESIGN ANALYSES

GENERAL

Structure J7-R1 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 J7-R1 is a Category A-3 embankment. 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 4.25:1 were assumed. Based on the total embankment height of approximately 23 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 22-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 J7-R1 will be constructed in series with proposed Structure J7-R. Structure J7-R1 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 J7-R1 and J7-R were conservatively assumed to be full to the emergency spillway at the time of 100-year storm event. The storage capacity of structure J7-R1 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 Yucca Flat Wash.

The following parameters were used in the hydrologic analysis:

		10yr-24hr Storm	
1.	Water Course length, L	0.890	mi.
2.	Elevation Difference, H	180	ft
3.	Time of Concentration, T_c	0.307	hr
4.	SCS Curve Number	84	
5.	Rainfall Depth, 10-year, 24-hour storm	2.1	in
	100-year, 6-hour storm	2.4	in
6.	Drainage Area	244.6	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 Appendices A, B, and C.

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J7-R1 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	163.2	294.7
Volume	ac-ft	16.6	21.2
Storage			
Peak Stage	msl	N/A	6322.0
Emerg. Spillway Elev.	msl	6319.5	6319.5
Peak Storage	ac-ft	N/A	10.9
Storage Capacity	ac-ft	8.1	8.1
Outflow			
Peak Flow	cfs	N/A	271.3
Spillway Elevation	msl	6319.5	6319.5
Embankment Crest Elev.	msl	6323	6323
Peak Stage	msl	--	6322.0
Freeboard	ft	--	1.0
Emergency Spillway Channel			
Flow Depth	ft	--	2.5
Critical Velocity	fps	--	6.5
Mannings "n"	--	--	.031
Width	ft	--	22
Outflow Channel			
Slope	%	--	5.0
Normal Velocity	fps	--	7.9
Normal Depth	ft	--	1.3
Mannings "n"	--	--	.046
Riprap D_{50}	in	--	6

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for J7-R1 will be a trapezoidal channel with dimensions listed below. The alignment and dimensions are shown on Exhibit 1.

Minimum Channel Depth	(Spillway)	3.5	ft
	(Outflow)	2.5	ft
Channel Width		22	ft
Channel Length	(Spillway)	30	ft
	(Outflow)	250	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	5.0	%
Spillway Elevation		6319.5	ft

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 J7-R1 is designed to contain approximately 8.1 acre-feet.

The calculations for the sediment load entering structure J7-R1 were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.28
3.	Slope Factor, LS	2.18
4.	Cover Factor, C	0.52
5.	Erosion Control Factor, P	0.59

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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 J7-R1 does not have sufficient storage to contain the 10-year, 24-hour storm by itself; however, in series with structure J7-R, sufficient storage is achieved. 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 J7-R1 and J7-R

	J7-R1	J7-R	Combined
Total Storage Capacity	8.1	14.9	23.0 acre-ft
10-Year, 24-Hour Storm Inflow	16.6	1.4	18.0 acre-ft
Available Sediment Storage Capacity	--	--	5.0 acre-ft
Sediment Inflow Rate/Year	0.80	0.17	0.97 acre-ft
Sediment Storage Life	--	--	5.2 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 J7-R and J7-R1 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: J7-R1

TIME OF CONCENTRATION (Haul Road):

Start Elevation (ft) =	6480
End Elevation (ft) =	6300
Elevation Difference, E (ft) =	180
Watercourse Length (ft) =	4700
Watercourse Length, L (mi) =	0.890
Tc = (11.9L^3/E)^0.385 =	0.307 hours

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Spoil	B	86	84.8	7292.8
Reclaimed	C	81	137.8	11161.8
Disturbed	D	91	22	2002
TOTAL:			244.6	20456.6

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

DRAINAGE BASIN AREA:

244.60 Acres

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CALCULATED SEDIMENTOLOGY DATA

PROJECT: J7-R1

SOIL ERODIBILITY FACTOR:

Soil Type	Soil Group	Erodibility Factor, K	Area (acres)	K*Area
Spoil	B	0.12	84.8	10.176
Reclaimed	C	0.38	137.8	52.364
Disturbed	D	0.22	22	4.84
TOTAL:			244.6	67.38

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

Weighted K = Total K*Area/ Total Area = 0.275

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
500	30	6.0%	0.5	3.4	1.78
700	40	5.7%	0.5	3.3	2.01
200	30	15.0%	0.6	8.5	3.66
600	30	5.0%	0.5	2.9	1.64
600	50	8.3%	0.5	4.8	2.66
400	20	5.0%	0.5	2.9	1.34
500	40	8.0%	0.5	4.6	2.34
400	30	7.5%	0.5	4.3	1.97
600	30	5.0%	0.5	2.9	1.64
400	40	10.0%	0.5	5.7	2.75

Average LS = 2.18

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 > or = 9%*

Where:

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

l::

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT J7-R1 POND

COVER AND PRACTICE FACTORS:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C*Area	Practice Factor, P	P*Area
Spoil	0%	0%	84.8	1	84.8	0.80	67.84
Reclaimed	40%	0%	137.8	0.15	20.67	0.40	55.12
Disturbed	0%	0%	22	1.00	22	1.00	22
TOTAL:			244.6		127.47		144.96

Weighted C = Total C*Area/ Total Area = 0.52

Weighted P = Total P*Area/ Total Area = 0.59

RAINFALL FACTOR:

R = 40

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: J7-R1

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	0.28	
Length Slope Factor	2.18	
Cover Factor	0.52	
Practice Factor	0.59	
Gross Annual Sediment Yield	7.41	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0036	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0033	acre-feet/acre/year
Watershed Area	244.6	acres
Watershed Annual Sediment Yield	0.7968	acre-feet/year
Number of years	1	years
Required Pond Sediment Storage	0.797	acre-feet

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SEDCAD+ RIPRAP CHANNEL DESIGN

J7-R1 OUTFLOW

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	271.33 cfs	
Slope	5.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	22.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	1.33 ft
with Freeboard	1.63 ft
Top Width	29.96 ft
with Freeboard	31.76 ft
Velocity	7.88 fps
Cross Sectional Area	34.45 sq ft
Hydraulic Radius	1.13 ft
Manning's n	0.046
Froude Number	1.29
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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J7-R1 SPILLWAY
Worksheet for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	j7
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.031	
Channel Slope	0.013023	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	22.00	ft
Discharge	271.30	cfs

Results		
Depth	1.56	ft
Flow Area	41.55	ft²
Wetted Perimeter	31.85	ft
Top Width	31.35	ft
Critical Depth	1.56	ft
Critical Slope	0.013023	ft/ft
Velocity	6.53	ft/s
Velocity Head	0.66	ft
Specific Energy	2.22	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 J7-R AND R1 (10-YR, 24-HR)

by

Name: TEL

Company Name: ACZ, INC.
File Name: J:\861\0350\SEDCAD\J7R-R1

Date: 10-18-1997

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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: J:\861\0350\SEDCAD\J7R-R1 User: TEL
Date: 10-18-1997 Time: 08:58:58
PEABODY WESTERN COAL COMPANY: POND J7-R AND R1 (10-YR, 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	244.60	84	F	0.307	0.000	0.000	0.0	16.62	163.15
		Type: Null			Label: POND J7-R1					
111	Structure	244.60							16.62	
111	Total IN/OUT	244.60							16.62	163.15
112	1	15.50	88	F	0.087	0.000	0.000	0.0	1.35	16.90
		Type: Null			Label: POND J7-R					
112	Structure	15.50							17.97	
112	Total IN/OUT	260.10							17.97	166.47
111 to 112 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

PEABODY WESTERN COAL COMPANY: POND J7-R AND R1 (100-YR, 6-HR)

by

Name: TEL

Company Name: ACZ, INC.
File Name: J:\861\0350\SEDCAD\J7R25

Date: 10-18-1997

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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: J:\861\0350\SEDCAD\J7R25 User: TEL
Date: 10-18-1997 Time: 12:02:38
PEABODY WESTERN COAL COMPANY: POND J7-R AND R1 (100-YR, 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	244.60	84	F	0.307	0.000	0.000	0.0	21.18	294.73
		Type: Pond			Label: POND J7-R1					
111	Structure	244.60							21.18	
111	Total IN	244.60							21.18	294.73
111	Total OUT								21.18	271.33
112	1	15.50	88	F	0.087	0.000	0.000	0.0	1.67	30.12
		Type: Pond			Label: POND J7-R					
112	Structure	15.50							22.85	
112	Total IN	260.10							22.85	277.30
112	Total OUT								22.85	234.90
111 to 112 Routing						0.015	0.381			

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Company Name: ACZ, INC.
Filename: J:\861\0350\SEDCAD\J7R25 User: TEL
Date: 10-18-1997 Time: 12:02:38
PEABODY WESTERN COAL COMPANY: POND J7-R AND R1 (100-YR, 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
POND J7-R1

Drainage Area from J1, B1, S1, SWS(s)1: 244.6 acres
Total Contributing Drainage Area: 244.6 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	6319.5
Crest Length (ft)	30.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	22.0

POND RESULTS:

	Permanent Pool (ac-ft)
	8.0

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	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	21.18	294.73
OUT	21.18	271.33

Peak Elevation	Hydrograph Detention Time (hrs)
6322.0	0.16

****

J1, B1, S2
POND J7-R

Drainage Area from J1, B1, S2, SWS(s)1: 15.5 acres
Total Contributing Drainage Area: 260.1 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	6317.0
Crest Length (ft)	30.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	30.0

POND RESULTS:

	Permanent Pool (ac-ft)

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```
=========
  14.9

                Runoff     Peak
                Volume   Discharge
                (ac-ft)    (cfs)
              ========================
         IN     22.85     277.30
         OUT    22.85     234.90

      Peak              Hydrograph
    Elevation         Detention Time
                          (hrs)
              ============================
      6319.0              0.16
```

****

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Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: ACZ, INC.
Filename: J:\861\0350\SEDCAD\J7R25 User: TEL
Date: 10-18-1997 Time: 12:02:38
PEABODY WESTERN COAL COMPANY: POND J7-R AND R1 (100-YR, 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
POND J7-R1

Drainage Area from J1, B1, S1, SWS(s)1: 244.6 acres
Total Contributing Drainage Area: 244.6 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6302.00	0.00	0.02	0.00	0.00	
6303.00	1.00	0.04	0.03	0.00	
6304.00	2.00	0.07	0.08	0.00	
6305.00	3.00	0.11	0.17	0.00	
6306.00	4.00	0.15	0.30	0.00	
6307.00	5.00	0.20	0.48	0.00	
6308.00	6.00	0.24	0.70	0.00	
6309.00	7.00	0.32	0.98	0.00	
6310.00	8.00	0.40	1.34	0.00	
6311.00	9.00	0.45	1.77	0.00	
6312.00	10.00	0.51	2.25	0.00	
6313.00	11.00	0.57	2.78	0.00	
6314.00	12.00	0.63	3.38	0.00	
6315.00	13.00	0.72	4.06	0.00	
6316.00	14.00	0.81	4.82	0.00	
6317.00	15.00	0.87	5.66	0.00	
6318.00	16.00	0.94	6.56	0.00	
6319.00	17.00	1.01	7.53	0.00	
6319.50	17.50	1.05	8.05	0.00	Stage of SW#1
6320.00	18.00	1.09	8.58	17.95	
6320.20	18.20	1.10	8.80	25.13	
6320.30	18.30	1.11	8.91	32.46	
6320.40	18.40	1.12	9.02	40.48	
6320.50	18.50	1.13	9.14	49.16	
6321.00	19.00	1.17	9.71	108.67	
6321.50	19.50	1.21	10.30	177.77	
6322.00	20.00	1.25	10.92	267.25	
6322.02	20.02	1.26	10.94	271.33	Peak Stage
6322.50	20.50	1.30	11.55	377.75	
6323.00	21.00	1.36	12.22	506.08	

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J1, B1, S2
POND J7-R

Drainage Area from J1, B1, S2, SWS(s)1: 15.5 acres
Total Contributing Drainage Area: 260.1 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6306.00	0.00	0.90	0.00	0.00	
6307.00	1.00	1.01	0.96	0.00	
6308.00	2.00	1.13	2.03	0.00	
6309.00	3.00	1.15	3.17	0.00	
6310.00	4.00	1.18	4.34	0.00	
6311.00	5.00	1.27	5.56	0.00	
6312.00	6.00	1.36	6.87	0.00	
6313.00	7.00	1.45	8.28	0.00	
6314.00	8.00	1.55	9.78	0.00	
6315.00	9.00	1.65	11.38	0.00	
6316.00	10.00	1.75	13.08	0.00	
6317.00	11.00	1.86	14.88	0.00	Stage of SW#1
6317.70	11.70	1.94	16.21	33.86	
6317.80	11.80	1.95	16.41	43.66	
6317.90	11.90	1.96	16.60	54.33	
6318.00	12.00	1.97	16.80	65.85	
6318.50	12.50	2.04	17.80	143.99	
6319.00	13.00	2.11	18.84	233.39	
6319.01	13.01	2.11	18.85	234.90	Peak Stage
6319.50	13.50	2.18	19.91	347.63	
6320.00	14.00	2.26	21.02	486.90	

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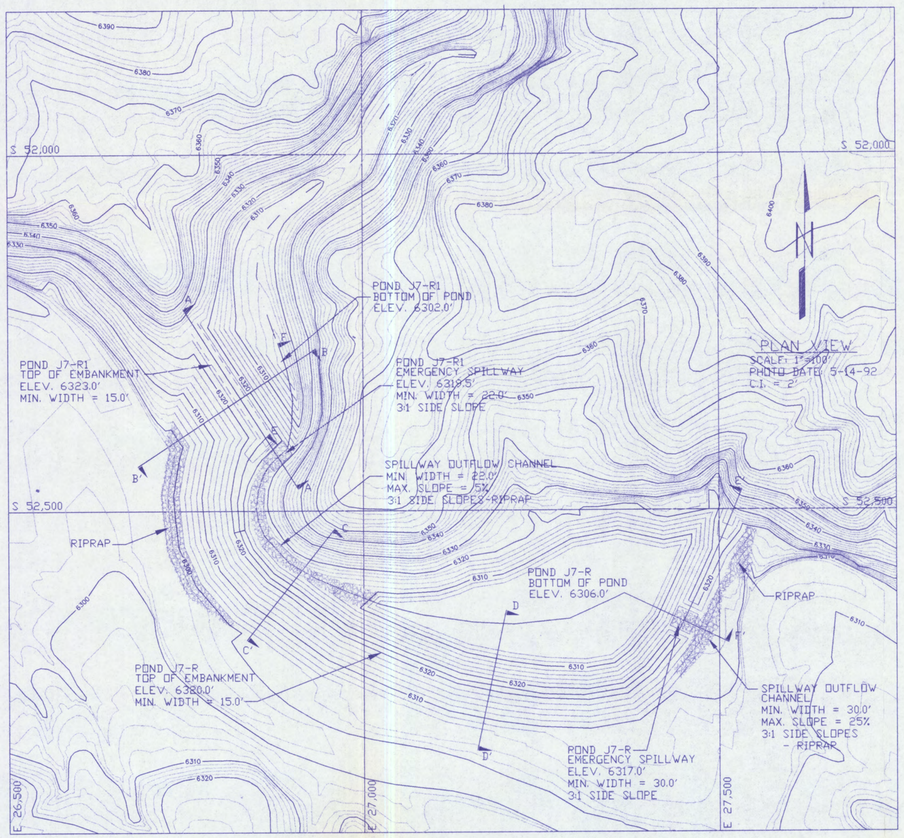
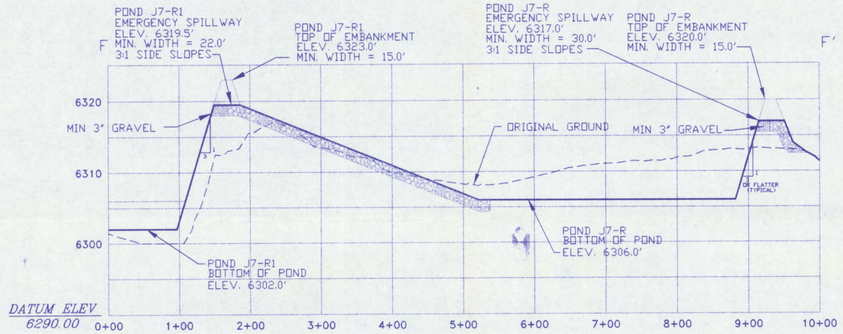


PLAN VIEW
SCALE: 1"=100'
PHOTO DATE: 5-14-92
C.I. = 2'



SECTION F - F'
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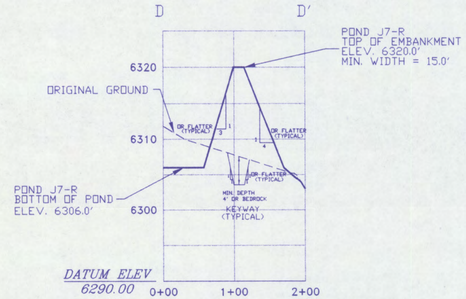

SECTION D - D'
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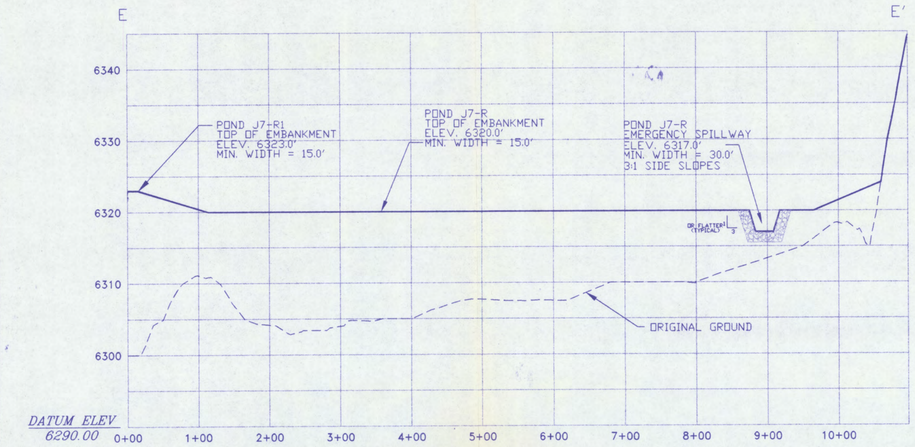

SECTION E - E'
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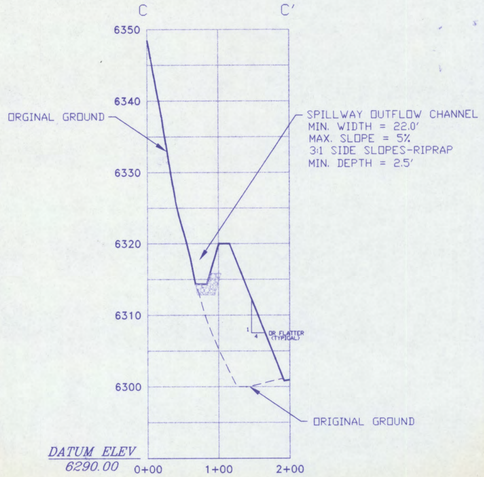

SECTION C - C'
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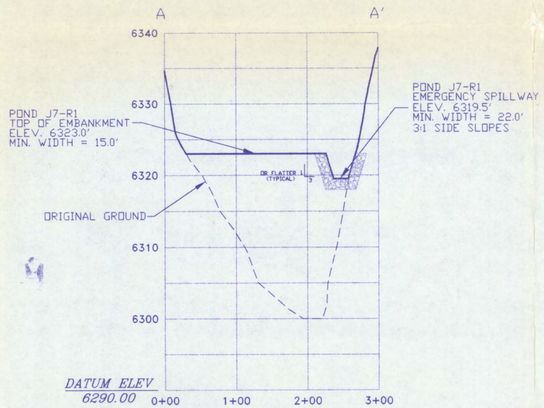
VERT. 1"=10'



SECTION A - A'
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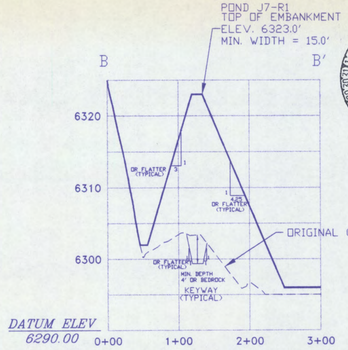
VERT. 1"=10'



SECTION B - B'
SCALE: HORIZ. 1"=100'
VERT. 1"=10'

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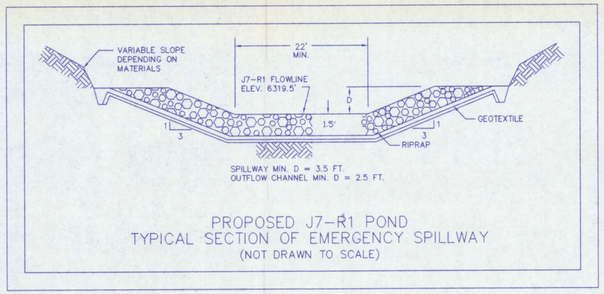
J7-R1 POND STAGE CAPACITY

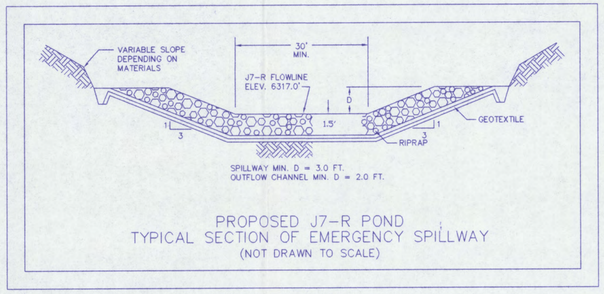
ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6302.0	0.00	0.02	0.00	0.00	BOTTOM OF POND
6304.0	2.00	0.07	0.08	0.08	
6306.0	4.00	0.15	0.22	0.30	
6308.0	6.00	0.24	0.40	0.70	
6310.0	8.00	0.40	0.64	1.34	
6312.0	10.00	0.51	0.91	2.25	
6314.0	12.00	0.63	1.13	3.38	
6316.0	14.00	0.81	1.44	4.82	
6318.0	16.00	0.94	1.74	6.56	
6319.5	17.50	1.05	1.49	8.05	EMERGENCY SPILLWAY
6320.0	18.00	1.09	0.53	8.58	
6322.0	20.00	1.25	2.34	10.92	
6323.0	23.00	1.36	1.30	12.22	TOP OF EMBANKMENT



PROPOSED J7-R1 POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)

J7-R POND STAGE CAPACITY

ELEV. (FT.-MSL)	STAGE (FT.)	AREA (ACRES)	CAP. (AC.-FT.)	TOT. CAP. (AC.-FT.)	DESCRIPTION
6306.0	0.00	0.90	0.00	0.00	BOTTOM OF POND
6308.0	2.00	1.13	2.03	2.03	
6310.0	4.00	1.18	2.31	4.34	
6312.0	6.00	1.36	2.53	6.87	
6314.0	8.00	1.55	2.91	9.78	
6316.0	10.00	1.75	3.30	13.08	
6317.0	11.00	1.86	1.80	14.88	EMERGENCY SPILLWAY
6318.0	12.00	1.97	1.92	16.80	
6320.0	14.00	2.26	4.22	21.02	TOP OF EMBANKMENT



PROPOSED J7-R POND
TYPICAL SECTION OF EMERGENCY SPILLWAY
(NOT DRAWN TO SCALE)

ENGINEER'S CERTIFICATION

Registered Professional Engineer (Civil)
CERTIFICATE NO. 18782
JAMES G. SCHLENVOGT
ARIZONA

JAMES G. SCHLENVOGT
CONSTRUCTION ENGINEER MANAGER
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: OCT 24 1997

NOTES:
1) General location, see Drawing No. 85400, Sheet K-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 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 #1
PROPOSED J7-R & J7-R1 POND
SEDIMENTATION POND DESIGN

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

DESIGNED BY: TEL	SCALE: 1"=100'
DRAWN BY: JMB	DRAWING DATE: 10-24-97
CHECKED BY: JGS	PHOTO DATE: 05-14-92
CONTOUR INTERVAL: 2 FT.	DWG FILE: J7R POND~1.DWG