

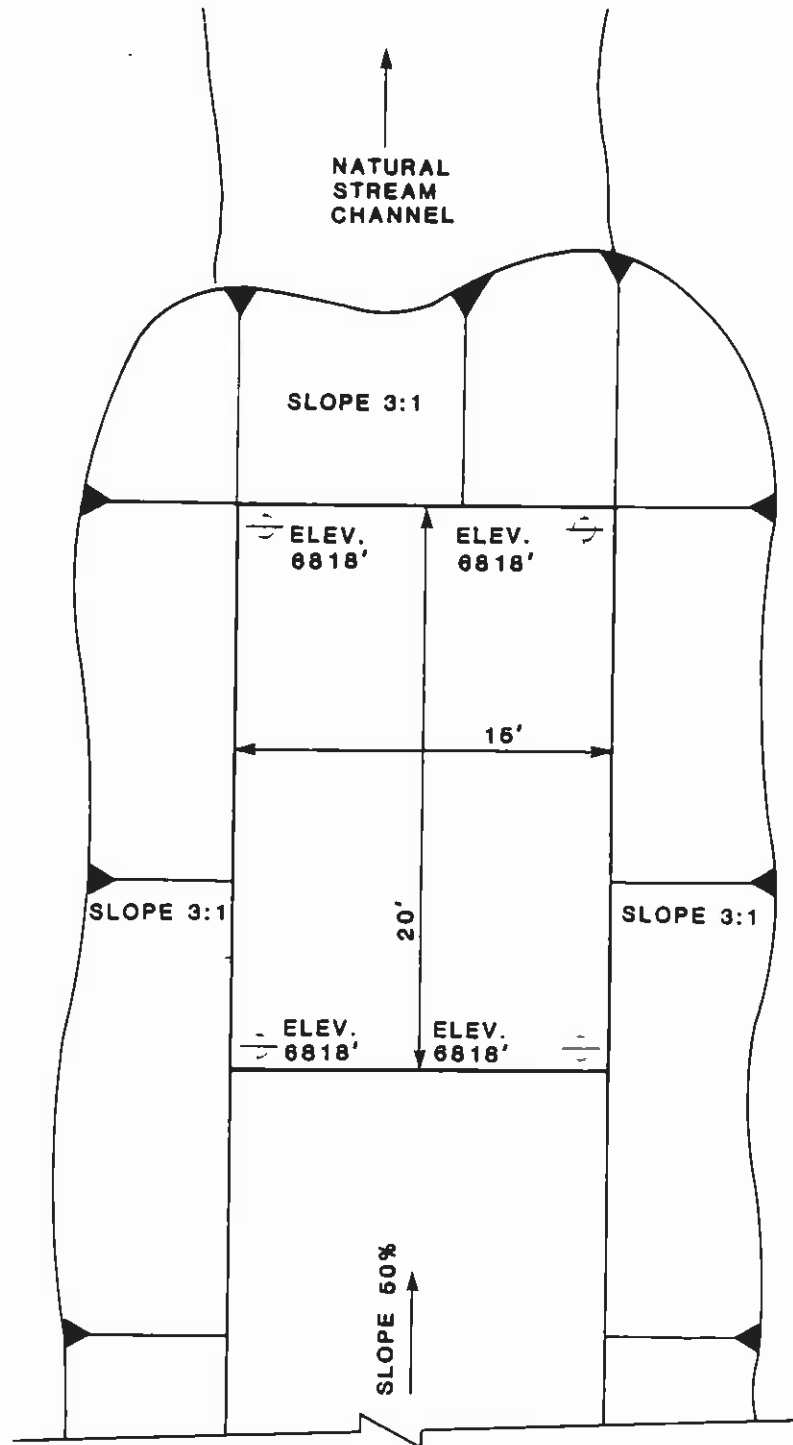
SPILLWAY CHANNEL

D = 2.9'
 LENGTH = 30'
 FLOWLINE ELEV. = 6873.00'

OUTFLOW CHANNEL

D = 2.0'

SPILLWAY AND
 OUTFLOW CHANNEL
 CROSS SECTION
 TPF-E



MINIMUM HEIGHT OF RIPRAP
ALONG SIDEWALLS ABOVE
THE BASIN FLOOR = 5.4'

MINIMUM DEPTH OF BASIN FLOOR
BELOW NATURAL STREAMBED = 3.1'

SPILLWAY STILLING BASIN PLAN TPF-E

APPENDIX A
HYDROLOGY AND HYDRAULIC CALCULATIONS

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = $7343 - 6860 = 483$ ✓
 WATER COURSE LENGTH = $3364' = .637$ miles ✓
 $T_c = .143$ hrs ✓
 LAG TIME = $0.6 T_c = .086$ hrs ✓

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
10.1	disturbed (road)	—	—	91 (.16)
53.4	P-J	ave	D	83 (.84)
				84.28
EH # 30 100%				
				<u>was 85</u> ✓

DRAINAGE BASIN AREA

63.5 ACRES 0.099 SQ. MILES ✓

REVISIONS
 BY _____ DATE _____ TO EO _____
 BY _____ DATE _____ TO EO _____

BY _____ DATE _____
 CHECKED BY BAM 11/5/85
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UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

$R = 40$

SOIL ERODIBILITY FACTOR

SOIL TYPE = 100% EA + 30 = .14

$K = \underline{0.14}$

SLOPE FACTOR

<u>LENGTH (ft.)</u>	<u>Δ ELEV (ft.)</u>	<u>SLOPE (%)</u>	<u>LS</u>
1100	190	17%	10.41 (.3)
500	210	42%	20 (.70)
			<u>17.12</u>

off chart ↗

COVER FACTOR

<u>AREA (ac)</u>	<u>COVER TYPE</u>	<u>% COVER</u>	<u>CANOPY (%)</u>	<u>WEIGHTED C</u>
84%	P-J	40	25	.84 (.14)
16%	disturbed	—	—	.16 (1.0)
				<u>C = .278</u>

EROSION CONTROL FACTOR

$P = 1.0$

SEDIMENT INFLOW

$A = 40 (.14) (17.12) (.278) (1.0) = 26.65$ ton/acre/year

$A = 26.65 \left(\frac{1}{2047} \right) (63.5) (95) = .78$ acre-feet/year

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DESIGN REPORT
Sedimentation Structure
TPF-E
Kayenta Mine
Navajo County, Arizona

for
PEABODY COAL COMPANY



Dames & Moore
10139-011-22

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INTRODUCTION

Sedimentation Structure TPF-E will be a partially incised structure with an earthen embankment, designed and constructed by Peabody Coal Company as a temporary sedimentation structure to control runoff and sediment from the disturbed mining areas of the Kayenta Mine. The location of Structure TPF-E is shown on Plate 1, Site Plan.

This design report contains information specific to Structure TPF-E. 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

The proposed site of Structure TPF-E was inspected by a senior geotechnical engineer from Dames & Moore in October, 1985 to ensure that the site is suitable and no adverse conditions exist to prevent the successful construction of the structure. A detailed geotechnical investigation was not performed.

SITE DESCRIPTION

LAND USE

Structure TPF-E has a 63.5-acre tributary drainage area and is located near Yellow Water Canyon at the Kayenta Mine. The watershed is classified as 84% Pinion/Juniper and 16% disturbed.

EMBANKMENT

A homogeneous earthen embankment was assumed for the hydraulic analysis and to develop the volume-elevation curve shown on Plate 2. Upstream and downstream slopes of 2:1 and 3:1 (horizontal to vertical), respectively, were used. The assumed slopes were not evaluated for geotechnical considerations such as slope stability since the foundation or embankment material types have not been determined. The incised portion of the structure will be excavated at 3:1 (horizontal to vertical) slopes.

DESIGN ANALYSES

GENERAL

Structure TPF-E was designed by an interdisciplinary team of engineers from Dames & Moore. 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 Coal

Company files includes topographic maps developed from aerial photography flown in 1982 for Peabody Coal Company and was used in the analyses of the structure.

STABILITY

The slopes of Structure TPF-E will be chosen based on the stability analyses performed for existing structures in the General Report. The embankment fill materials and the type of foundation will be identified in the field and the stable slopes chosen based on the category classification of the structure.

HYDROLOGY

The hydrologic analysis was completed using the U.S. Army Corps of Engineers generalized computer program HEC-1, Flood Hydrograph Package. Structure TPF-E is located upstream from Structures TPF-A and TPF-D. The three structures have a combined storage capacity that is greater than 20 acre-feet. However, the spillway for TPF-E was analyzed using the 25-year, 6-hour storm because TPF-E is the upstream structure. The storage capacity of Structure TPF-E was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1. Water Course length, L 0.637 mi
2. Elevation Difference, H 483 ft
3. Time of Concentration, T_c 0.143 h
4. Lag time, $0.6T_c$ 0.086 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 63.5 acres

HYDRAULICS

The HEC-1 program was used to evaluate inflow to the planned 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.

TPF-E 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	87	109
Volume	acre-ft	4.50	3.60
Storage			
Peak Stage	ft	6870.67	--
Spillway Elevation . .	ft	6873.00	--
Peak Storage	acre-ft	4.50	--
Storage Capacity . . .	acre-ft	5.91	--
Outflow			
Peak Flow	cfs	0	74
Embankment Crest			
Elevation	ft	--	6876.00
Peak Stage	ft	--	6874.85
Freeboard	ft	--	1.15
Spillway Channel			
Flow Depth	ft	--	1.85
Critical Velocity . . .	fps	--	4.9
Manning's "n"		--	0.040
Outflow Channel			
			<u>Section I</u> <u>Section II</u>
Slope	%	--	4 50
Normal Velocity	fps	--	5.7 12.7
Normal Depth	ft	--	0.76 0.36
Manning's "n"		--	0.040 0.040

Spillway Channel

The spillway for TPF-E will be a trapezoidal channel with the following dimensions:

Channel depth 2.9 ft
Channel width 15 ft
Channel length 30 ft
Side slopes (horizontal to vertical). . 3:1
Average exit slope 0 percent

Outflow Channel

The outflow channel for Structure TPF-E will be a trapezoidal channel with the following dimensions:

Channel width 15 ft
Channel length 210 ft
Side slopes (horizontal to vertical). . 3:1
Average exit slope 4-50 percent

The alignment of the spillway, outflow channel and stilling basin is shown on Plate 1. The channel profile is shown on Plate 3 and the required dimensions are shown on Plates 4 and 5. The spillway, outflow channel and stilling basin should be protected against erosion using geotextile and riprap as shown on Plate 4.

STORAGE CAPACITY

The impoundment volume-elevation curve shown on Plate 2, Volume-Elevation Curve, TPF-E is based on site specific topographic data developed for Peabody Coal Company in 1985, and 1985 site specific surveys, where available.

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

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.14
3. Slope Factor, LS 17.12
4. Cover Factor, C 0.278
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 TPF-E is shown on Plate 2, Volume-Elevation Curve, TPF-E, and the results of the sediment inflow analysis are summarized in the following table.

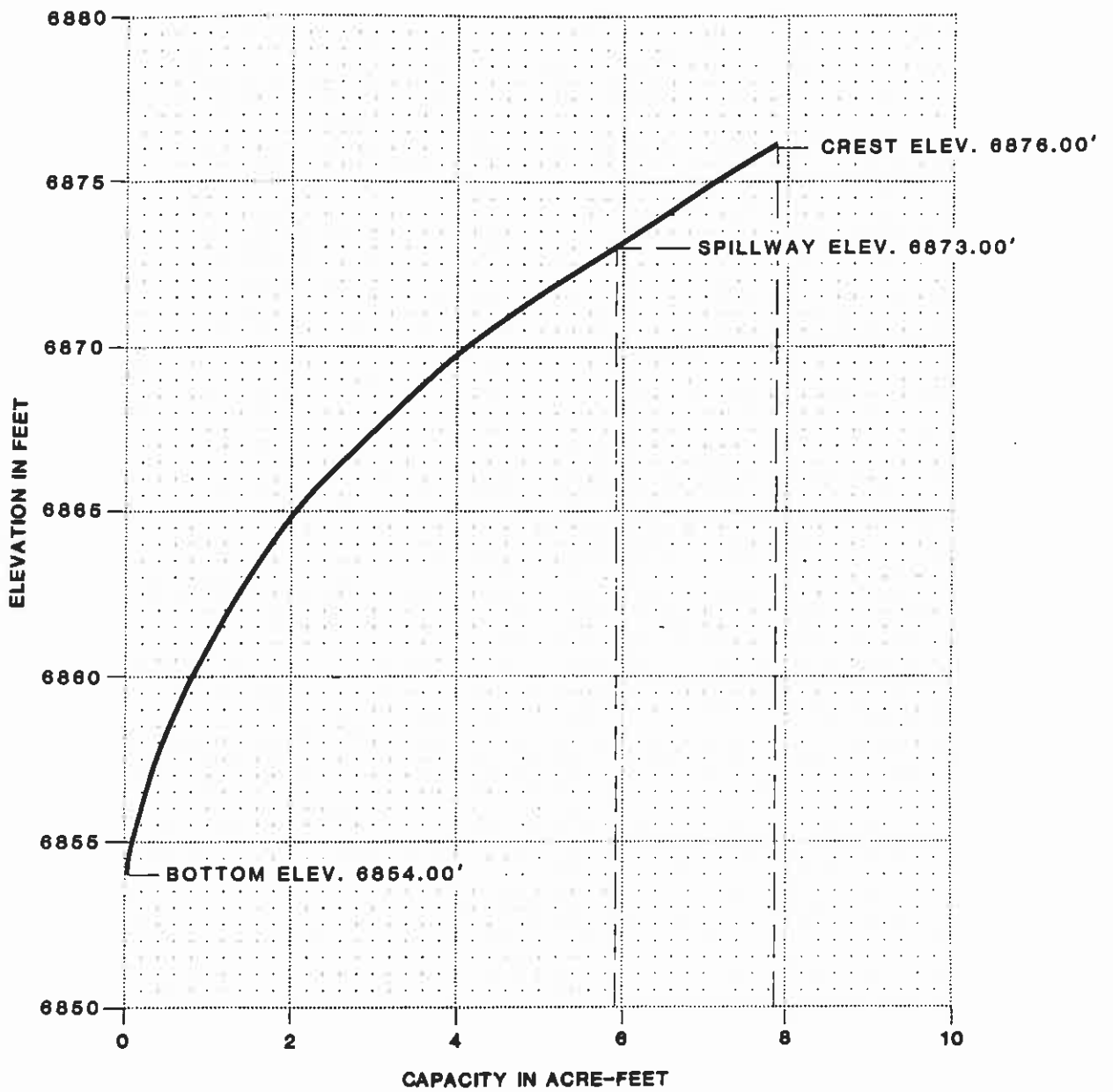
TPF-E STORAGE

Total Storage Capacity	5.91 acre-ft
10-year, 24-hour Storm Inflow	4.50 acre-ft
Available Sediment Storage Capacity	1.41 acre-ft
Sediment Inflow Rate	0.78 acre-ft/yr
Sediment Storage Life	2 yrs

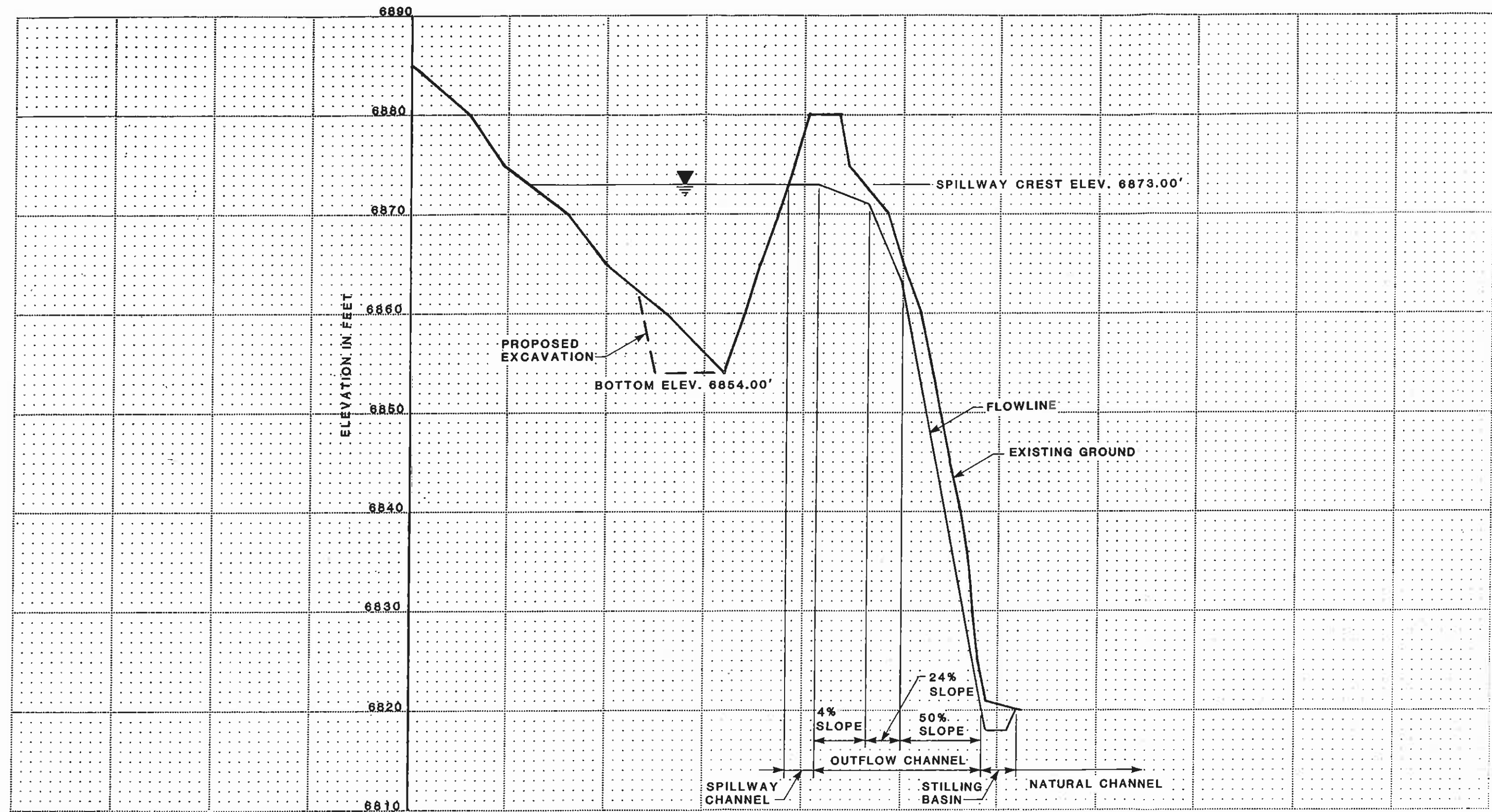
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The following plates and appendix are attached and complete this design report.

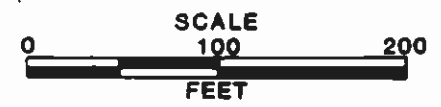
- Plate 1 - Site Plan TPF-E
- Plate 2 - Volume-Elevation Curve TPF-E
- Plate 3 - Channel Profile TPF-E, A-A'
- Plate 4 - Spillway and Outflow Channel Cross Section TPF-E
- Plate 5 - Spillway Stilling Basin Plan TPF-E
- Appendix A - Hydrology and Hydraulic Calculations



VOLUME-ELEVATION
CURVE
TPF-E



CHANNEL PROFILE A-A'
TPF-E



FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 3