

DESIGN REPORT
Sedimentation Structure
J21-A1
Kayenta Mine
Navajo County, Arizona
for
PEABODY COAL COMPANY



Dames & Moore
10139-011-22

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INTRODUCTION

Sedimentation Structure J21-A1 will be 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 J21-A1 is shown on Plate 1, Site Plan.

This design report contains information specific to Structure J21-A1. 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 J21-A1 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 J21-A1 has a 462.7-acre tributary drainage area and is located near Dinnebito Wash at the Kayenta Mine. The watershed is classified as 47% reclaimed, 37% Pinion/Juniper, and 16% Sagebrush/grass.

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.

DESIGN ANALYSES

GENERAL

Structure J21-A1 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 1976 for Peabody Coal Company and was used in the analyses of the structure.

STABILITY

The slopes of Structure J21-A1 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 J21-A1 is located upstream from Structure J21-A. The two structures have a combined storage capacity that is greater than 20 acre-feet. However, the spillway for J21-A1 was analyzed using the 25-year, 6-hour storm because the structure is located upstream from J21-A. The storage capacity of Structure J21-A1 was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1. Water Course length, L 1.62 mi
2. Elevation Difference, H 247 ft
3. Time of Concentration, T_c 0.545 h
4. Lag time, $0.6T_c$ 0.327 h
5. SCS Curve Number 78
6. Rainfall Depth, 10-year, 24-hour storm . 2.1 in.
25-year, 6-hour storm. . 1.9 in.
7. Drainage Area 462.7 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.

J21-A1 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	207	227
Volume acre-ft	20.44	15.42
Storage		
Peak Stage ft	6979.08	--
Spillway Elevation . . ft	6978.00	--
Peak Storage acre-ft	--	--
Storage Capacity . . . acre-ft	15.40	--
Outflow		
Peak Flow cfs	4	124
Embankment Crest		
Elevation ft	--	6981.50
Peak Stage ft	--	6980.43
Freeboard ft	--	1.07
Spillway Channel		
Flow Depth ft	--	2.43
Critical Velocity . . . fps	--	5.6
Manning's "n"	--	0.040
Outflow Channel		
Slope %	--	8
Normal Velocity fps	--	8.4
Normal Depth ft	--	0.83
Manning's "n"	--	0.040

Spillway Channel

The spillway for J21-A1 will be a trapezoidal channel with the following dimensions:

Channel depth	3.5 ft
Channel width	15 ft
Channel length	40 ft
Side slopes (horizontal to vertical). .	3:1
Average exit slope	0 percent

Outflow Channel

The outflow channel for Structure J21-A1 will be a trapezoidal channel with the following dimensions:

Channel width	15 ft
Channel length	90 ft
Side slopes (horizontal to vertical). .	3:1
Average exit slope	8 percent

The alignment of the spillway, outflow channel and stilling basin are shown on Plate 1. The channel profile and stilling basin are 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, J21-A1 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 J21-A1 were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.342
3. Slope Factor, LS 2.81
4. Cover Factor, C 0.143
5. Erosion Control Factor, P 1.0

The hydrologic analysis gives the storage volume required to contain the 10-year, 24-hour storm, and the remaining storage volume available for storing sediment.

During the 10-year, 24-hour storm, Structure J21-A1 contributes outflow to Structure J21-A located downstream. Therefore, the storage capacity analysis must consider the combined storage in the two structures. The following table summarizes the results of the sediment inflow analysis.

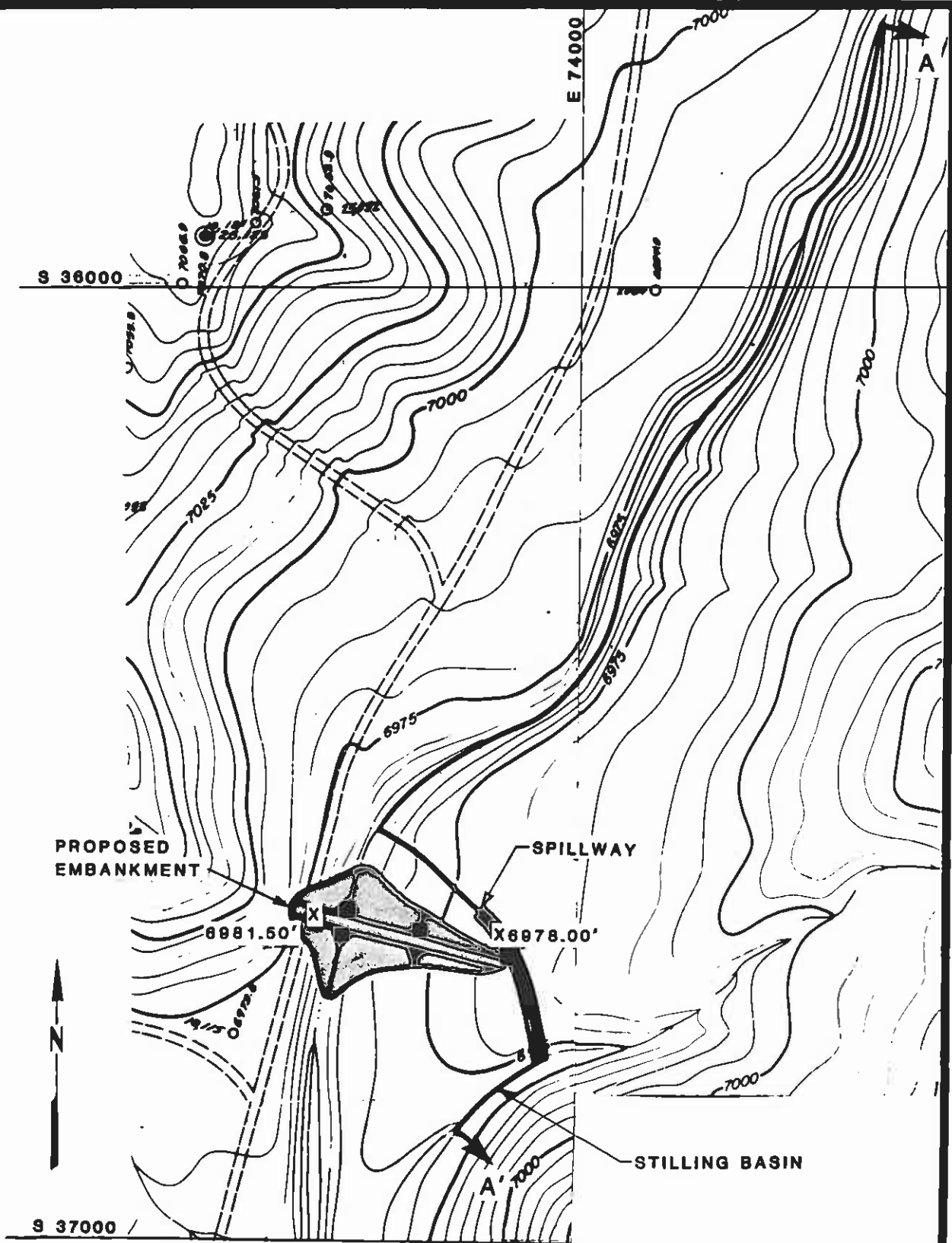
COMBINED STORAGE J21-A AND J21-A1

	<u>J21-A1</u>	<u>J21-A</u>	<u>Total</u>	
Total Storage Capacity	15.40	19.60	35.00	acre-ft
10-year, 24-hour Storm Inflow	20.44	2.64	23.08	acre-ft
Available Sediment Storage Capacity	—	—	11.92	acre-ft
Sediment Inflow Rate	1.12	0.295	1.42	acre-ft/yr
Sediment Storage Life	—	—	8	yrs

* * *

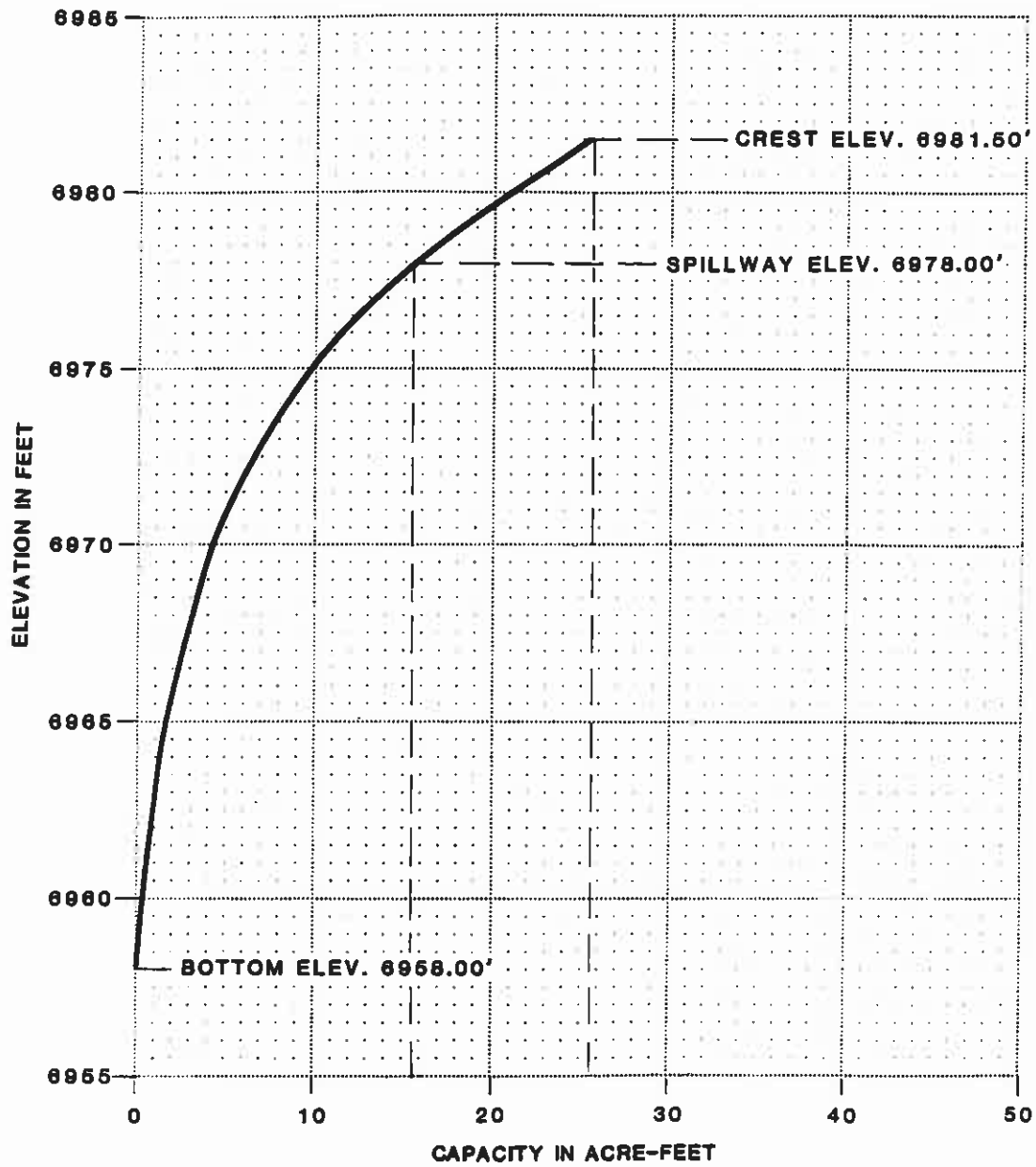
The following plates and appendix are attached and complete this design report.

- Plate 1 - Site Plan J21-A1
- Plate 2 - Volume-Elevation Curve J21-A1
- Plate 3 - Channel Profile J21-A1, A-A'
- Plate 4 - Spillway and Outflow Channel Cross Section J21-A1
- Plate 5 - Spillway Stilling Basin Plan J21-A1
- Appendix A - Hydrology and Hydraulic Calculations

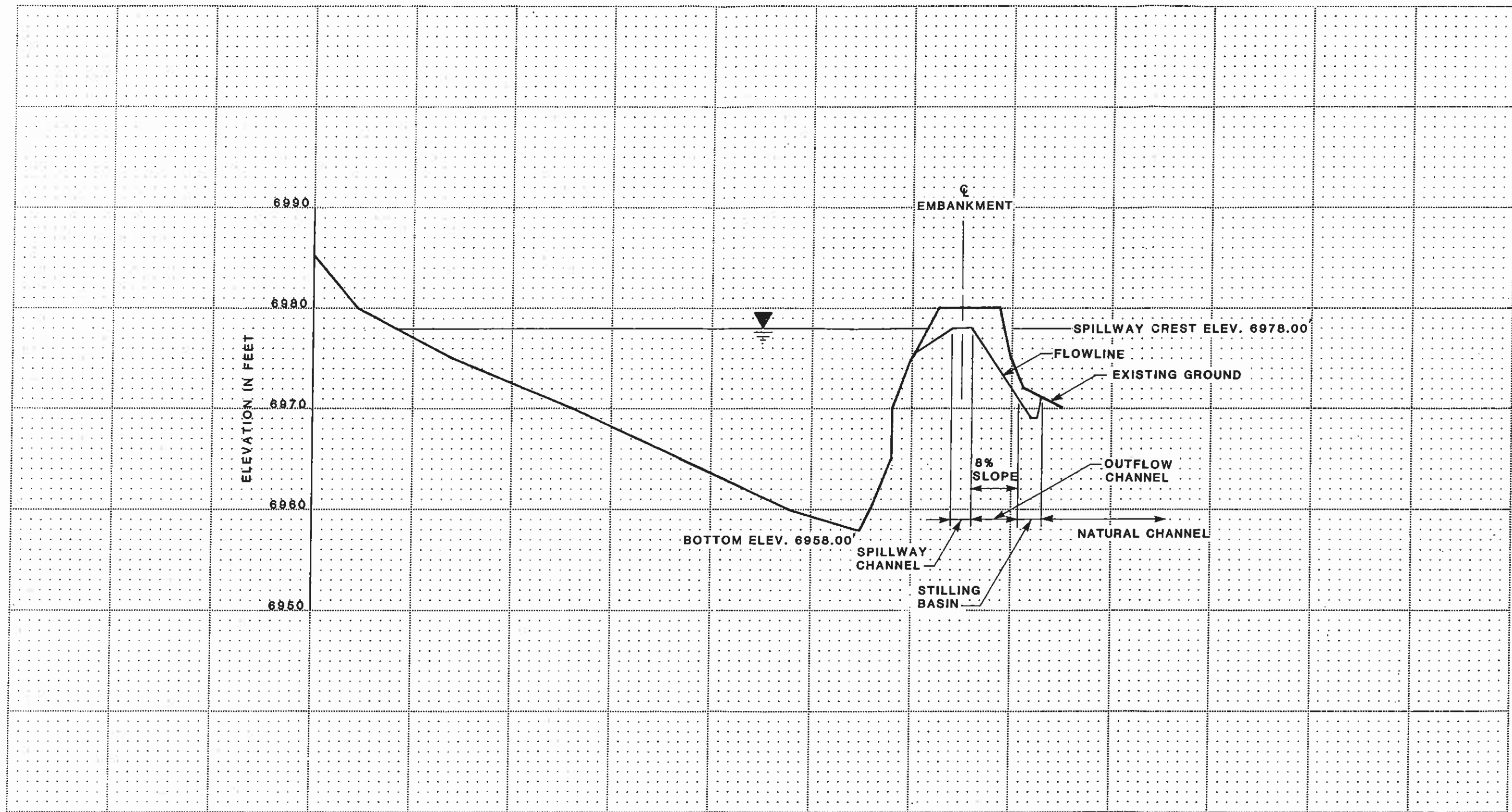


SITE PLAN
J21-A1





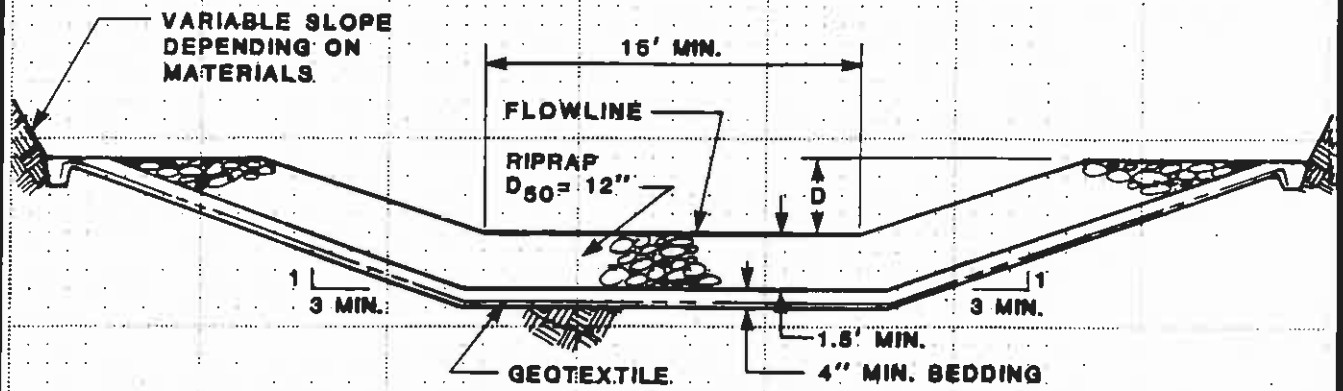
VOLUME-ELEVATION
CURVE
J21-A1



CHANNEL PROFILE A-A'
J21-A1



FOR LOCATION SEE PLATE 1



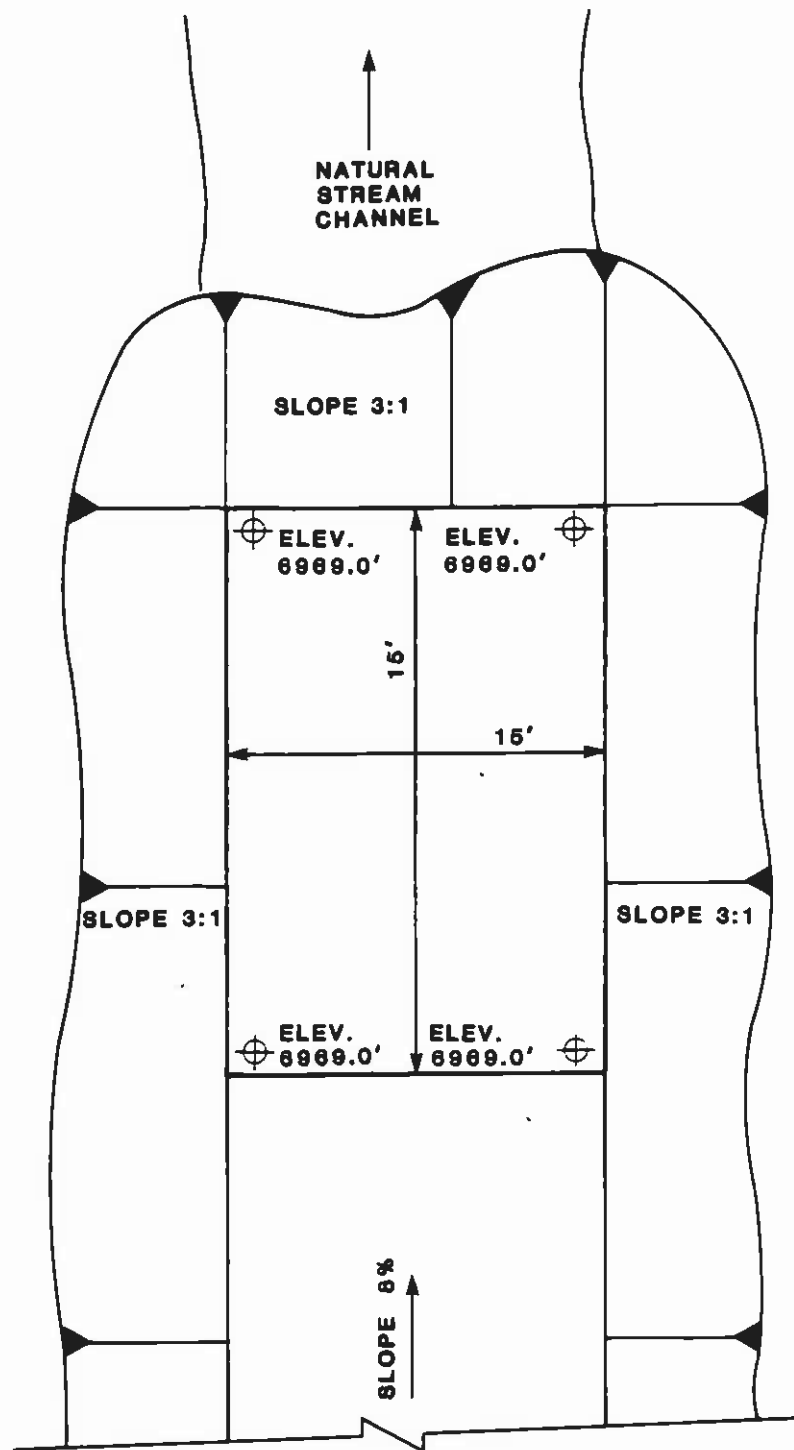
SPILLWAY CHANNEL

D = 3.5'
 LENGTH = 40'
 FLOWLINE ELEV. = 6978.00'

OUTFLOW CHANNEL

D = 2.0'

**SPILLWAY AND
 OUTFLOW CHANNEL
 CROSS SECTION
 J21-A1**



MINIMUM HEIGHT OF RIPRAP
ALONG SIDEWALLS ABOVE
THE BASIN FLOOR = 4.0'

MINIMUM DEPTH OF BASIN FLOOR
BELOW NATURAL STREAMBED = 1.8'

SPILLWAY STILLING BASIN PLAN J21-A1