

DESIGN REPORT
Sedimentation Structure
N6-G
Black Mesa Mine
Navajo County, Arizona
for
PEABODY COAL COMPANY



Dames & Moore
10139-011-22

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INTRODUCTION

Sedimentation Structure N6-G 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 Black Mesa Mine. The location of Structure N6-G is shown on Plate 1, Site Plan.

This design report contains information specific to Structure N6-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

The proposed site of Structure N6-G 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 N6-G has a 52.5-acre tributary drainage area and is located near Coal Mine Wash at the Black Mesa Mine. The watershed is classified as 100% reclaimed.

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 N6-G 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 1985 for Peabody Coal Company and was used in the analyses of the structure.

STABILITY

The slopes of Structure N6-G 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 N6-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 N6-G was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1. Water Course length, L	0.466	mi
2. Elevation Difference, H	149	ft
3. Time of Concentration, T	0.156	h
4. Lag time, $0.6T_c$	0.094	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	52.5	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.

N6-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	53	62
Volume	acre-ft	2.89	2.23
Storage			
Peak Stage	ft	6466.99	--
Spillway Elevation . .	ft	6470.50	--
Peak Storage	acre-ft	2.89	--
Storage Capacity . . .	acre-ft	4.93	--
Outflow			
Peak Flow	cfs	0	3
Embankment Crest			
Elevation	ft	--	6472.50
Peak Stage	ft	--	6471.28
Freeboard	ft	--	1.22
Spillway Channel			
Flow Depth	ft	--	0.78
Critical Velocity . . .	fps	--	1.8
Manning's "n"		--	0.035
Outflow Channel			
Slope	%	--	8
Normal Velocity	fps	--	2.3
Normal Depth	ft	--	0.09
Manning's "n"		--	0.035

Spillway Channel

The spillway for N6-G will be a trapezoidal channel with the following dimensions:

Channel depth 1.9 ft
Channel width 15 ft
Channel length 50 ft
Side slopes (horizontal to vertical). . 3:1
Average exit slope 0 percent

Outflow Channel

The outflow channel for Structure N6-G will be a trapezoidal channel with the following dimensions:

Channel width 15 ft
Channel length 20 ft
Side slopes (horizontal to vertical). . 3:1
Average exit slope 8 percent

The alignment of the spillway and outflow channel are shown on Plate 1. The channel profile is shown on Plate 3 and the required dimensions are shown on Plate 4. Both the spillway and outflow channel should be protected against erosion using geotextile and gravel as shown on Plate 4.

STORAGE CAPACITY

The impoundment volume-elevation curve shown on Plate 2, Volume-Elevation Curve, N6-G 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 N6-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 1.46
4. Cover Factor, C 0.15
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 N6-G is shown on Plate 2, Volume-Elevation Curve, N6-G, and the results of the sediment inflow analysis are summarized in the following table.

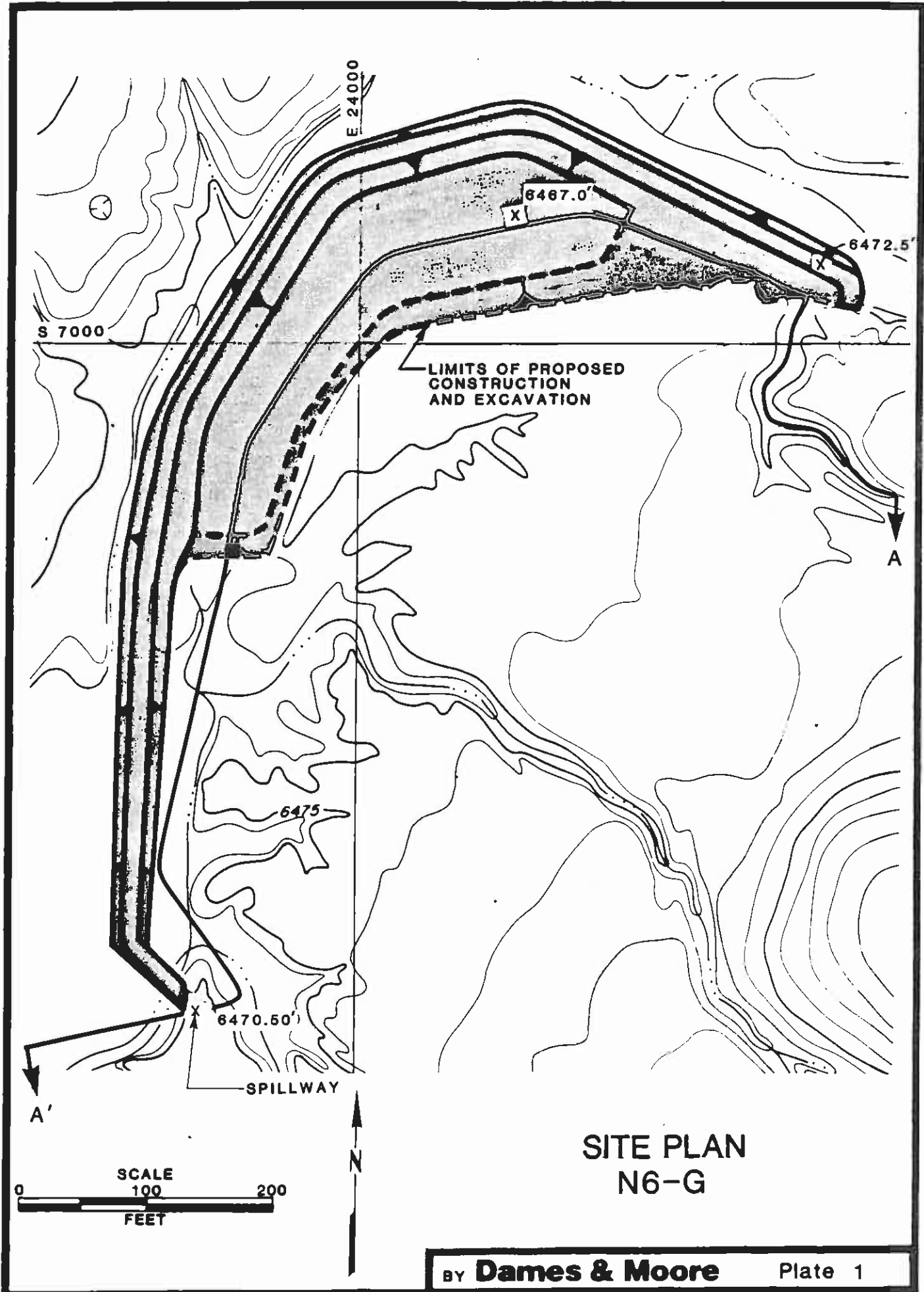
N6-G STORAGE

Total Storage Capacity	4.93	acre-ft
10-year, 24-hour Storm Inflow	2.89	acre-ft
Available Sediment Storage Capacity	2.04	acre-ft
Sediment Inflow Rate	0.090	acre-ft/yr
Sediment Storage Life	23	yrs

* * *

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

- Plate 1 - Site Plan N6-G
- Plate 2 - Volume-Elevation Curve N6-G
- Plate 3 - Channel Profile N6-G, A-A'
- Plate 4 - Spillway and Outflow Channel Cross Section N6-G
- Appendix A - Hydrology and Hydraulic Calculations

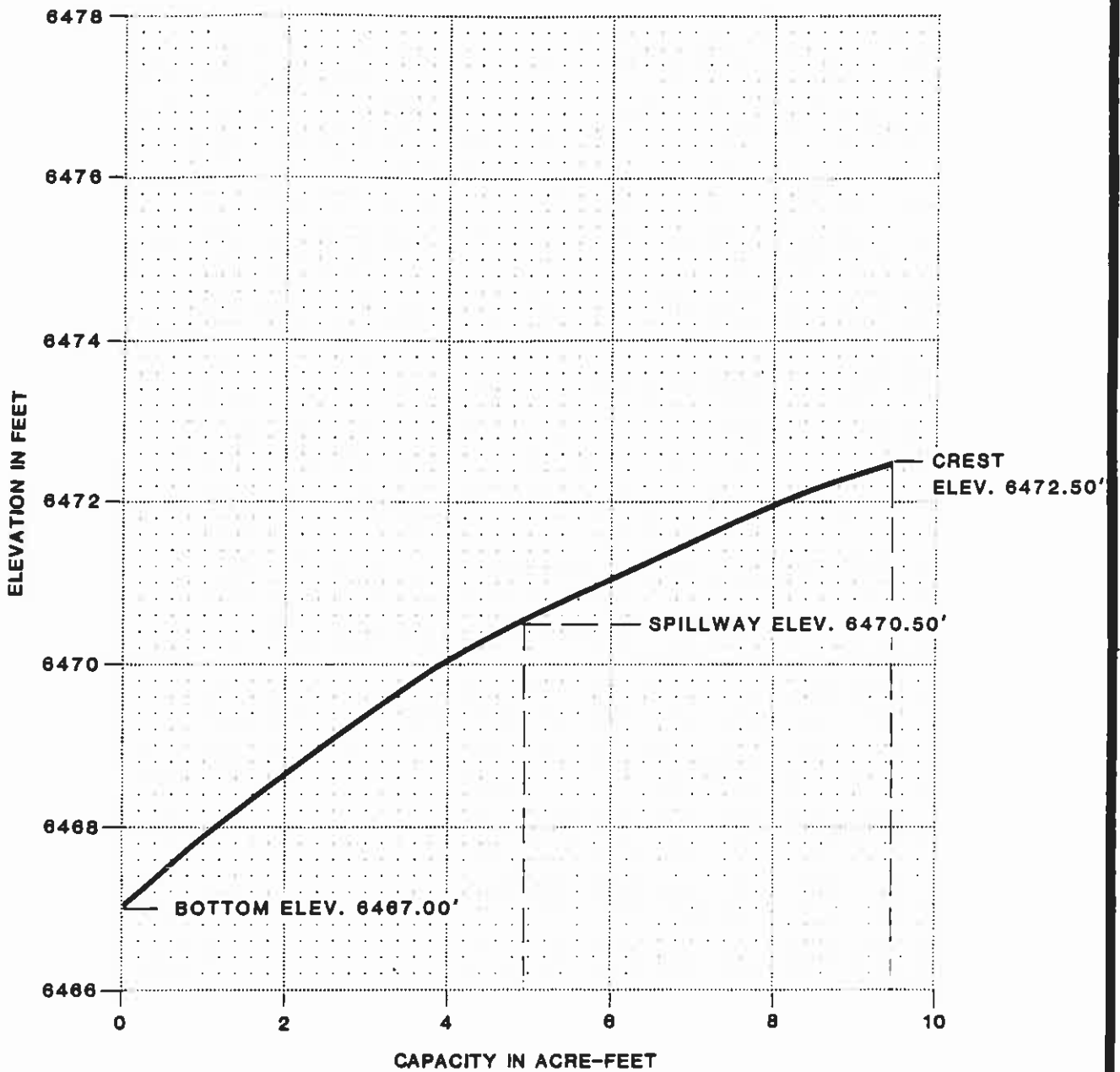


LIMITS OF PROPOSED
CONSTRUCTION
AND EXCAVATION

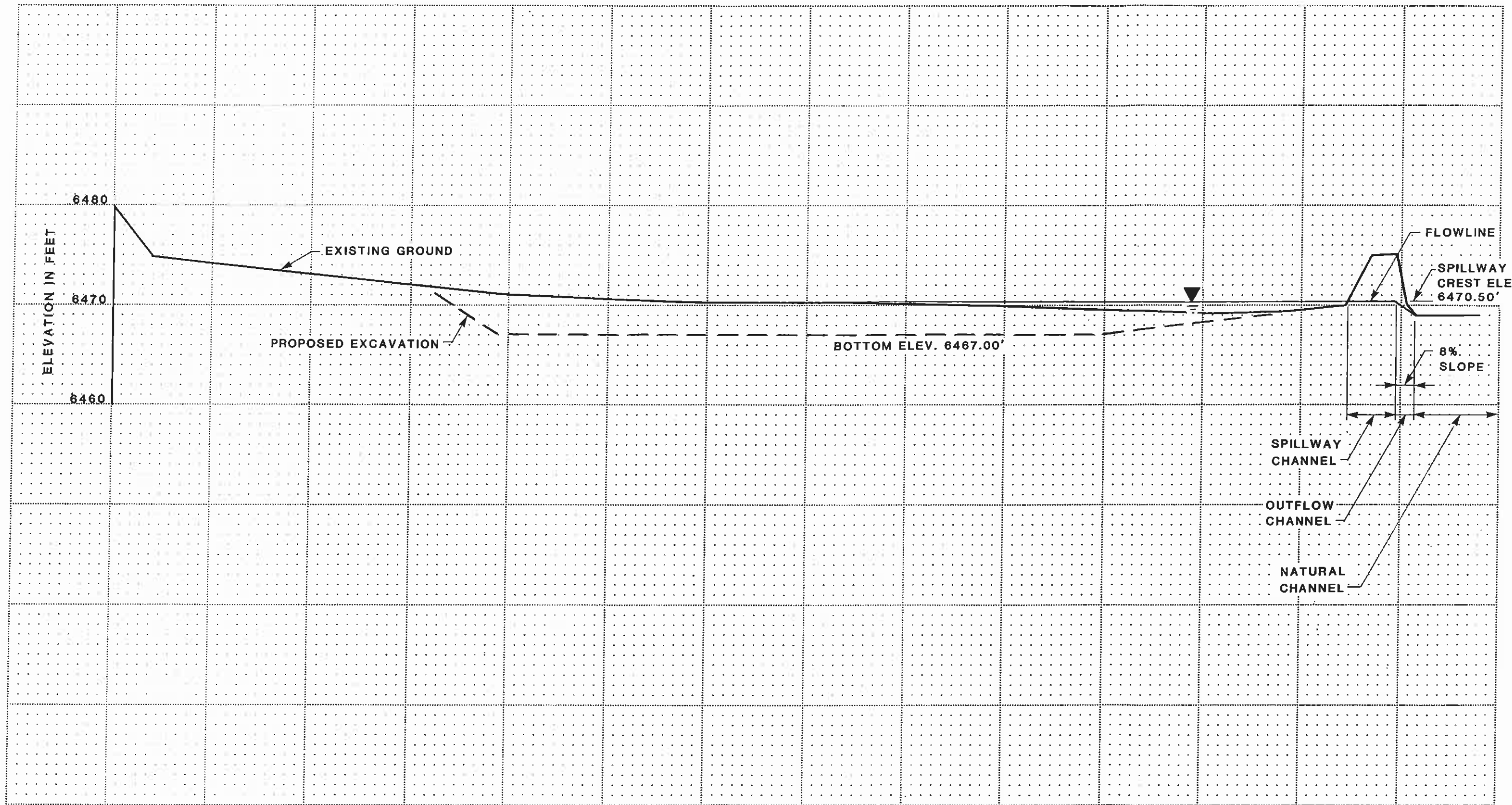
SPILLWAY

SITE PLAN N6-G





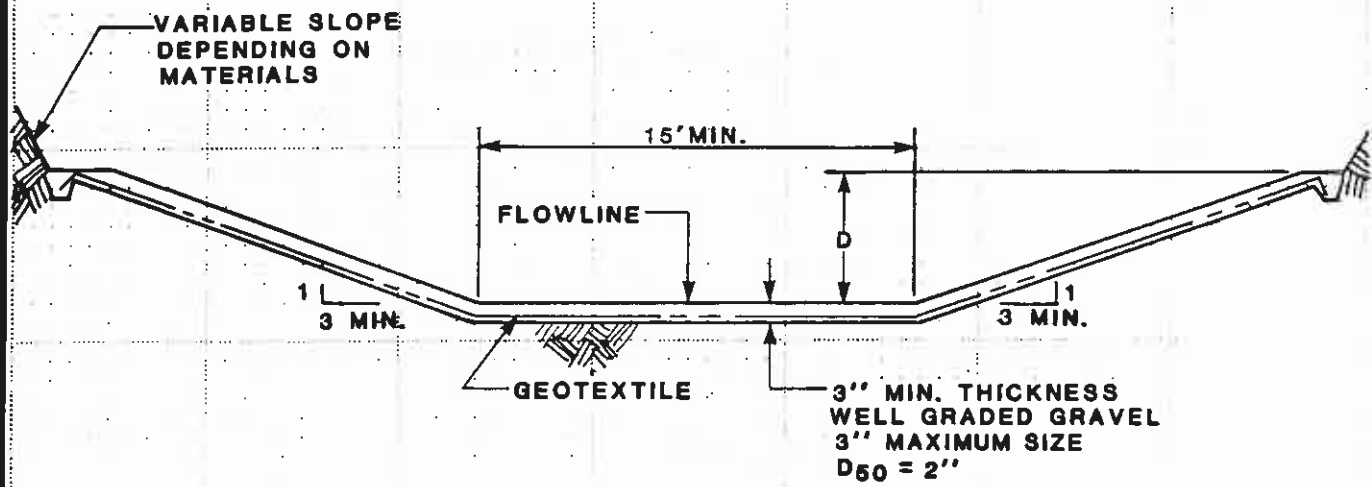
VOLUME-ELEVATION
CURVE
N6-G



CHANNEL PROFILE A-A'
N6-G



FOR LOCATION SEE PLATE 1



SPILLWAY CHANNEL

D = 1.8'
 LENGTH = 50'
 FLOWLINE ELEV. = 6470.50'

OUTFLOW CHANNEL

D = 1.0'

**SPILLWAY AND
 OUTFLOW CHANNEL
 CROSS SECTION
 N6-G**

APPENDIX A
HYDROLOGY AND HYDRAULIC CALCULATIONS

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = $6624 - 6475 = 149$

WATER COURSE LENGTH = $2461' = .466 \text{ mi}$

$T_c = 0.156 \text{ hr}$

Lag Time = $0.6T_c = 0.094 \text{ hr}$

SCS CURVE NUMBER

<u>DRAINAGE AREA (ac)</u>	<u>COVER TYPE</u>	<u>HYDROLOGIC CONDITION</u>	<u>SOIL TYPE</u>	<u>WEIGHTED CURVE NUMBER</u>
52.5	reclaimed (post-law)	fair	—	81

worst case is 100% reclaimed

DRAINAGE BASIN AREA

52.5 ACRES 0.082 SQ MILES

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

BY _____ DATE _____
 CHECKED BY BHM 11/5/85
 COPY TO EO _____

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

$R = 40$

SOIL ERODIBILITY FACTOR

SOIL TYPE = 100% EH #35

$K = \underline{\underline{0.42}}$

SLOPE FACTOR

<u>LENGTH (ft.)</u>	<u>Δ ELEV (ft.)</u>	<u>SLOPE (%)</u>	<u>LS</u>
500	45	9	2.64 (.3) ✓
1000	35	3.5	.67 (.30) ✓
350	25	7.1	1.59 (.2) ✓
200	10	5.0	.76 (.20) ✓
			<u>1.46</u> ✓

COVER FACTOR

<u>AREA (ac)</u>	<u>COVER TYPE</u>	<u>% COVER</u>	<u>CANOPY (%)</u>	<u>WEIGHTED C</u>
100%	reclaimed	—	—	<u>0.15</u>

EROSION CONTROL FACTOR

$P = 1.0$

SEDIMENT INFLOW

$A = 40(0.42)(1.46)(.15)(1.0) = 3.68$ ton/acre/year ✓

$A = 3.68 \left(\frac{1}{2047} \right) (52.5)(.95) = 0.090$ acre-feet/year ✓

REVISIONS
 BY _____ TO EO _____
 BY _____ TO EO _____

BY _____ DATE _____
 CHECKED BY BHM 11/5/85
 COPY TO EO _____