

INSPECTION REPORT
Sedimentation Structure
N2-RC
Kayenta Mine
Navajo County, Arizona
for
PEABODY COAL COMPANY



Dames & Moore
10139-011-22

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INTRODUCTION

Sedimentation Structure N2-RC is a totally incised impoundment in the N-2 reclaimed area, designed and constructed in 1983 by Peabody Coal Company as a permanent sedimentation structure to control runoff and sediment from the reclaimed mining areas of the Kayenta Mine. The location of Structure N2-RC is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure N2-RC. 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 N2-RC was inspected on September 17, 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 N2-RC project files and a field inspection of the structure. The most current information contained in the Peabody Coal Company files includes maps developed in 1985 by Peabody Coal Company, which were 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 N2-RC has a 156.2-acre tributary drainage area and is located near Coal Mine Wash at the Kayenta Mine. The watershed is classified as 87% reclaimed and 13% Pinion/Juniper.

EMBANKMENT

Structure N2-RC is a totally incised structure in a reclaimed area of the Kayenta Mine.

ANALYSES

STABILITY

Structure N2-RC is a special category structure without an embankment. No stability analyses were performed.

HYDROLOGY

The hydrologic analysis was completed using the U.S. Army Corps of Engineers generalized computer program HEC-1, Flood Hydrograph Package. Structure N2-RC is not in series with any other structure and does not have a spillway. Therefore, the structure was designed to contain the Probable Maximum Precipitation (PMP).

The following parameters were used in the hydrologic analysis:

1. Water Course length, L	0.715	mi
2. Elevation Difference, H	180	ft
3. Time of Concentration, T_c	0.238	h
4. Lag time, $0.6T_c$	0.143	h
5. SCS Curve Number	82	
6. Rainfall Depth,		
10-year, 24-hour Storm	2.1	in.
Probable Maximum Precipitation		
Local Storm (6 hour)	8.8	in.
General Storm (72 hour - August)	11.1	in.
7. Drainage Area	156.2	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.

N2-RC HYDRAULICS

	Units	10-year 24-hour Storm	General Storm PMP
Initial Reservoir Volume Condition		Empty	Empty
Inflow			
Peak Flow	cfs	144	108
Volume	acre-ft	9.11	115.1
Storage			
Peak Stage	ft	6805.65	6818.82
Maximum Allowable Water Surface Elevation	ft	6819.00	6819.00
Peak Storage	acre-ft	9.11	115.1
Storage Capacity . . .	acre-ft	118.1	118.1
Outflow			
Peak Flow	cfs	0	0
Berm Crest Elevations.	ft	6820.00	6820.00

Spillway Channel

The structure presently has no spillway.

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 2, Volume-Elevation Curve, N2-RC.

The calculations for the sediment load entering Structure N2-RC were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.384
3. Slope Factor, LS 4.165
4. Cover Factor, C 0.149
5. Erosion Control Factor, P 1.0

The hydrologic analysis gives the storage volume required to contain the PMP, and the remaining storage volume available for storing sediment. The existing storage capacity of N2-RC and the results of the sediment inflow analysis are summarized in the following table.

N2-RC STORAGE

Total Storage Capacity	118.1	acre-ft
PMP Inflow	115.1	acre-ft
Available Sediment Storage Capacity . .	3.0	acre-ft
Sediment Inflow Rate	0.654	acre-ft/yr
Sediment Storage Life	5	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

Structure N2-RC needs three low berms constructed at the locations shown on Plate 1, Site Plan N2-RC. The berms may be constructed out of suitable plant growth material at flat, gentle slopes to blend in with existing slopes. No stability analyses were performed on these berms and although, some settlement due to the weight of the berms may occur it is our opinion that these berms will be stable. Some localized sloughing and settlement cracks may develop during the life of this structure, however, these are considered a periodic maintenance task.

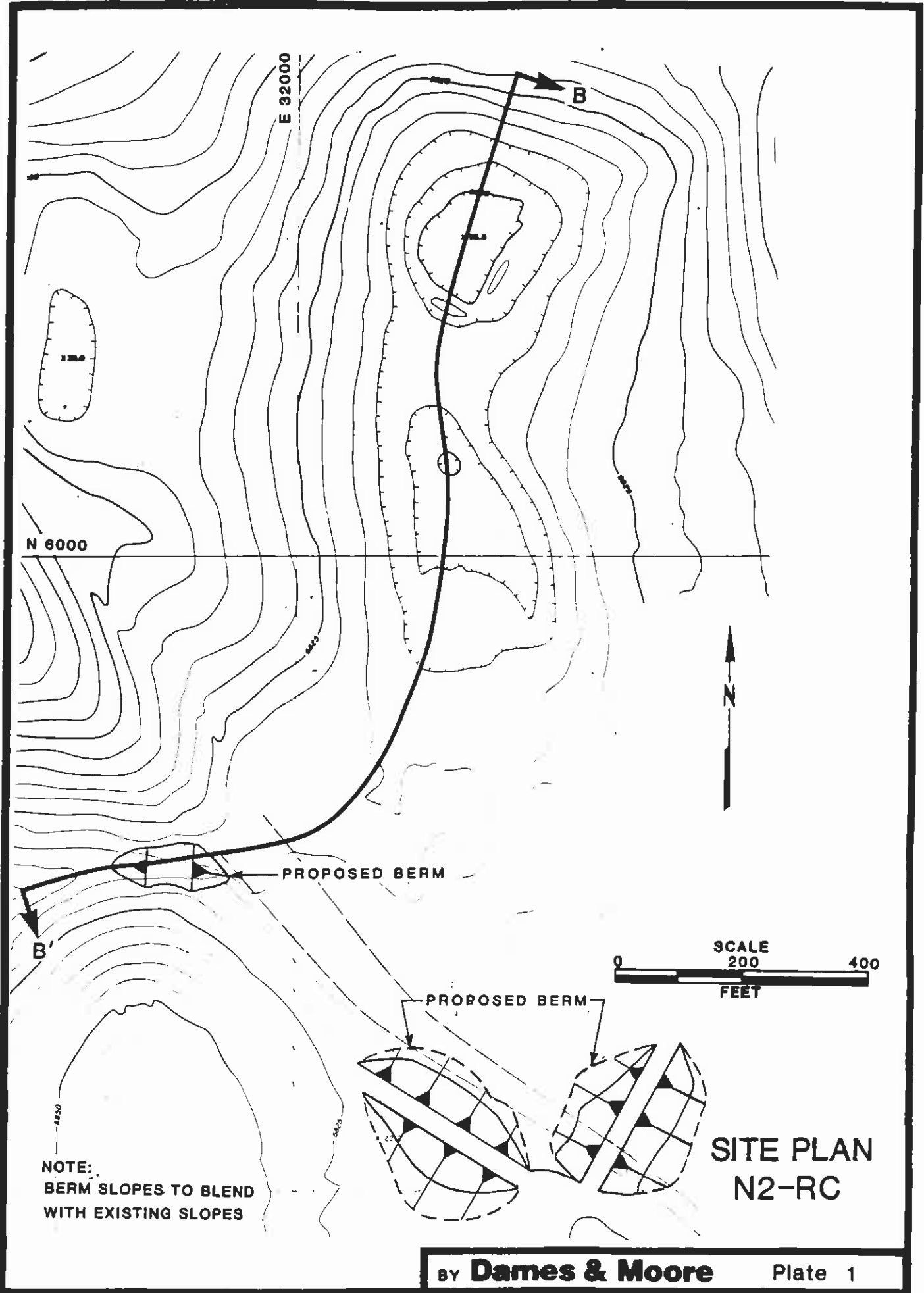
HYDRAULICS

The storage capacity of Structure N2-RC is adequate to contain the PMP with the proposed embankment construction. Therefore, no spillway is required to bring the structure into compliance with the regulations.

* * *

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

- Plate 1 - Site Plan N2-RC
- Plate 2 - Volume-Elevation Curve N2-RC
- Plate 3 - Basin Profile N2-RC, B-B'
- Appendix A - Inspection Check List
- Appendix B - Hydrology and Hydraulic Calculations



N 6000

E 32000

PROPOSED BERM

B'

SCALE
0 200 400
FEET

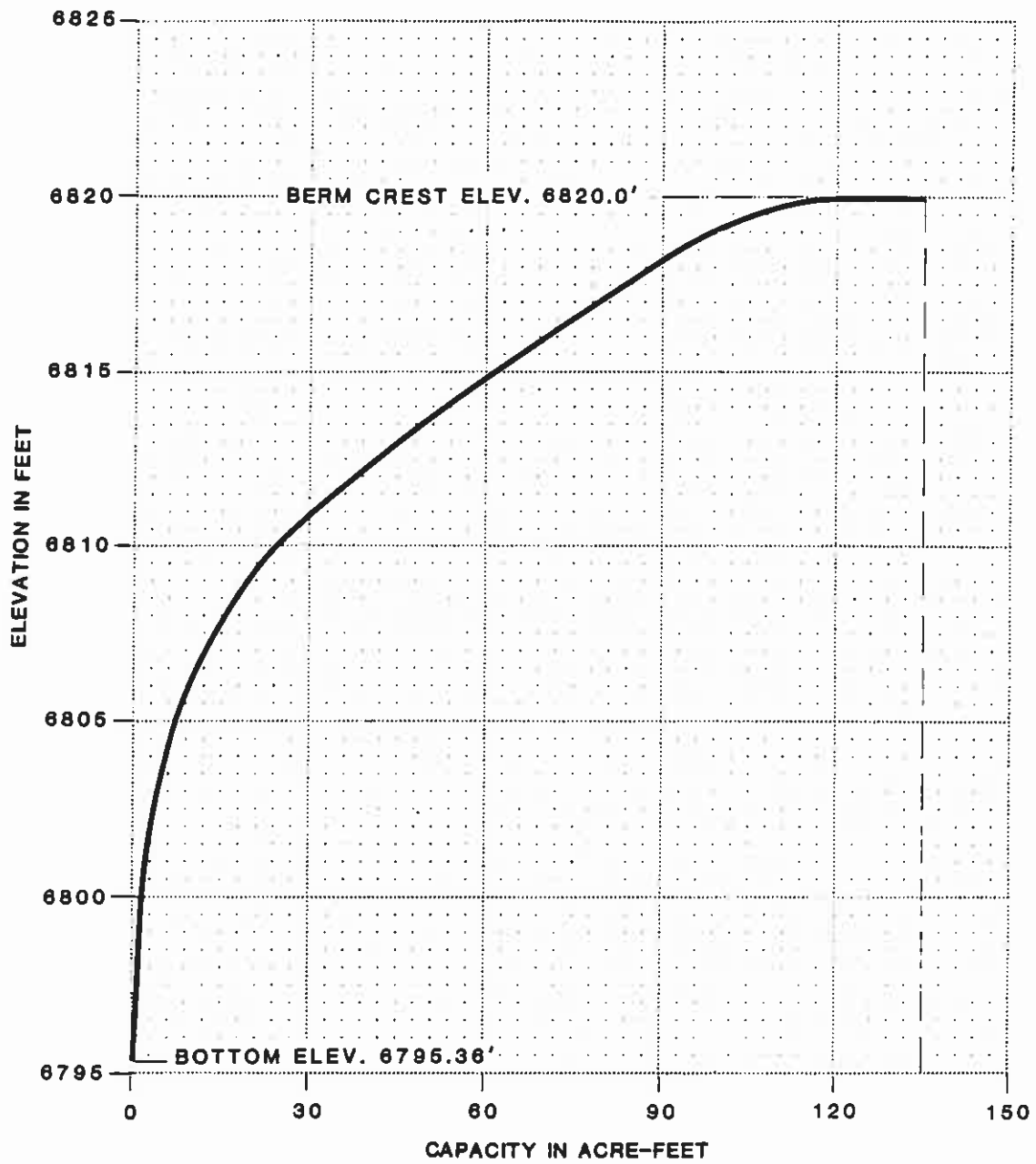
PROPOSED BERM

NOTE:
BERM SLOPES TO BLEND
WITH EXISTING SLOPES

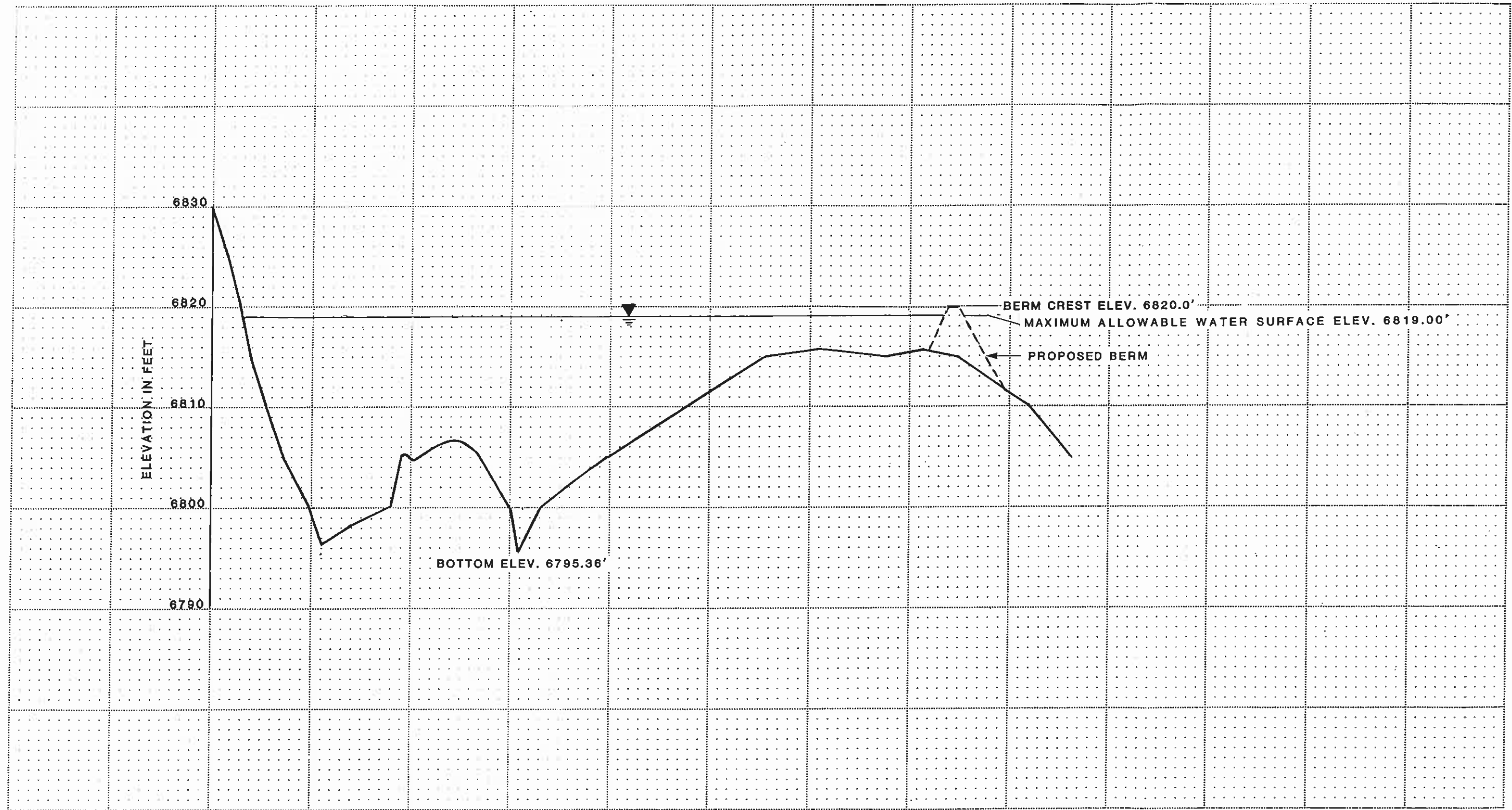
SITE PLAN
N2-RC

BY **Dames & Moore**

Plate 1



VOLUME-ELEVATION
CURVE
N2-RC



**BASIN PROFILE B-B'
N2-RC**



FOR LOCATION SEE PLATE 1

APPENDIX A
INSPECTION CHECK LIST

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST			
a. Any visual settlements?	✓		
b. Misalignment?	✓		
c. Cracking?	✓		
2. UPSTREAM SLOPE			
a. Adequate grass cover?	✓		<i>Southern flank of impoundment is designated the "dam".</i>
b. Any erosion?	✓		
c. Are trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Adequate riprap protection?		X	
g. Any stone deterioration?		X	
h. Visual depressions or bulges?		X	
i. Visual settlements?		X	
j. Animal burrows?	✓		
3. DOWNSTREAM SLOPE			<i>No downstream slope</i>
a. Adequate grass cover?			/
b. Any erosion?			
c. Are trees growing on slope?			
d. Longitudinal cracks?			
e. Transverse cracks?			
f. Visual depressions or bulges?			
g. Visual settlements?			
h. Is the toe drain dry?			
i. Are the relief wells flowing?			
j. Are boils present at the toe?			
k. Is seepage present?			
l. Animal burrows?			
4. ABUTMENT CONTACT. RIGHT			
a. Any erosion?	✓		<i>Moderate slump</i>
b. Visual differential movement?	✓		
c. Any cracks noted?	✓		
d. Is seepage present?		X	
e. Type of Material?			<i>Mine waste</i>
5. ABUTMENT CONTACT. LEFT			
a. Any erosion?	✓		<i>Moderate</i>
b. Visual differential movement?		X	
c. Any cracks noted?	✓		<i>discontinuous</i>
d. Is seepage present?		X	
e. Type of Material?			<i>Mine waste</i>

ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			
a. Location:		NA	
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?			
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?			

ITEM	YES	NO	REMARKS
8. IMPOUNDMENT			
a. Sinkholes?	Yes*		(Elev.) feet
b. Water present?	Yes		(Elev.) feet
c. Siltation?	Yes		
d. Watershed matches soil map?	No		

9. GENERAL COMMENTS

* Tension crack around impoundment perimeter is eroding and taking form of sinkhole.

Vegetative cover of watershed is grass - about 35-45% coverage. 0 canopy

Slopes have been contour-dished.

Slopes around impoundment have been instrumented for rainfall -

meets etc.

Top of scarp (tension crack) varies from about 6' to 10' above base of impoundment. Movement appears to be occurring on slopes varying from 3:1 (steepest) to flatter than 6:1

CANOPY COVER 0%

GROUND COVER 45%

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 180'
 WATER COURSE LENGTH = 3774' = .715 mi
 $T_c = 0.238$ hr
 LAG TIME = $0.6 T_c = \underline{\underline{0.143}}$ hr

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
125.2	grass (pasture)	fair	—	81 (.872)
31.0	P-J	ave	D	83 (.128)
				<u>81.25</u>

156.2

DRAINAGE BASIN AREA

156.2 ACRES 0.244 SQ MILE

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

BY _____ DATE _____
 CHECKED BY _____
 COPY TO EO _____

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

$R = 40$

SOIL ERODIBILITY FACTOR

SOIL TYPE = 87%, E_s # 35 (0.42)(0.87)
 13%, E_s # 30 (0.14)(0.13)

 .384 ✓

$K = 0.384$

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
600	85	14.1	5.75471 (.3)
600	75	12.5	4.72386 (.2)
1200	100	8.3	3.61276 (.2)
800	60	7.5	2.58202 (.3)

3.397 4.165

COVER FACTOR

AREA (ac)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
87%	reclaimed	—	—	.15 (.87)
13%	P.T.	50	25	.12 (.13)
				<u><u>0.149</u></u> ✓

EROSION CONTROL FACTOR

$P = 1.0$

SEDIMENT INFLOW

$A = 40 (.384) (\frac{4.165}{3.397}) (.149) (1.0) = 7.77$ ton/acre/year

$A = \frac{9.53}{2047} (156.2) (.9) = 0.654$ acre-feet/year

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

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

SEE N2-RA DESIGN REPORT FOR
N2-RB AND N2-RC DESIGN REPORTS