INSPECTION REPORT

PERMANENT IMPOUNDMENT STRUCTURE

N2-PA

Kayenta Mine

Navajo County, Arizona

by

PEABODY COAL COMPANY

INDEX

Introduction

Structure N2-RA 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-RA is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure N2-RA. 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-RA was inspected on September 17, 1985 by engineers from Dames and Moore and on November 21, 1985 by engineers from Peabody Coal Company. 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.

These inspections were performed in accordance with applicable 30 CFR 780 and 816 regulations and included a review of the N2-RA project files and field inspection of the structure. The most current information contained in the Peabody Coal Company files includes the 1985 survey, design and construction quality assurance data. The survey data developed in 1985 was used in the analyses of the structure. Results of the field inspection are included in this report.

Site Description

Land Use. Structure N2-RA has a 317.0-acre tributary drainage area and is located near Reed Valley at the Kayenta Mine. The watershed is classified as 100% reclaimed.

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

Analyses

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

Hydrology. The hydrologic analysis was completed using the University of Kentucky's hydrology and sedimentology computer program SEDIMOT II. Structure N2-RA is not in series with any other structure with active storage over 20 acre-ft. Therefore the spillway was analyzed using the 50-year, 6-hour storm. The storage capacity of Structure N2-RA was analyzed using the 100-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1. Water Course Length, L . . . . . 1.03 mi
2. Elevation Difference, H . . . . . 257 ft
3. Time of Concentration in hours, T_c . . . . . 0.32 h
4. SCS Curve Number 61.0
5. Rainfall Depth, 10-year, 24-hour storm . . . . . 2.1 in
   " " , 50-year, 6-hour storm . . . . . 2.2 in
   " " , 100-year, 24-hour storm . . . . . 3.0 in
6. Drainage Area . . . . . 317.0 acres

Hydraulics. Presently, N2-RA does not have an excavated spillway.

Storage Capacity. The impoundment Stage-Capacity Curve is based on site specific surveys conducted for Peabody Coal Company's August 1984 inspection, and 1985 resurveys, where available. Additionally, the most recent topographic maps available were used in developing Plate 2, Stage-Capacity Curve, N2-RA.

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

1. Soil Erodibility Factor, K 0.42
2. Average Slope 11.8%
3. Average Length of Slope . . . . . 690 ft
4. Erosion Control Factor, P 1.0

The hydrologic analysis give the storage volume required to contain the 100-year, 24-hour storm event with the remaining storage volume available for sediment storage. The

existing storage capacity of N2-RA is shown on Plate 2. Stage-Capacity Curve, N2-RA, and the results of the sediment inflow analysis are summarized in the following table.

N2-RA STORAGE

Total Storage Capacity (excluding permanent pool below elevation 6539.0)	60.51 acre-ft
Total Storage Capacity	72.0 acre-ft
100-year, 24-hour Inflow	34.70 acre-ft
Available Sediment Storage Capacity	25.81 acre-ft
Sediment Inflow, 10-year, 24-hour Storm (M.U.S.L.E.)	8.95 acre-ft
Sediment Storage	2.88 10-year, 24-hour Storms

Remedial Compliance Plan

Geotechnics. The inspections of N2-RA indicate that there are no geotechnical problems at this time.

Hydraulics. The storage capacity of Structure N2-RA is adequate to contain the 100-year, 24-hour storm; however, a trapezoidal spillway needs to constructed and the embankment crest needs to be constructed to a minimum elevation of 6558.5 to allow for adequate freeboard. With the spillway channel discharging into the downstream natural channel, no outflow channel is required.

Spillway Channel. The spillway for N2-RA will be a trapezoidal channel with the following dimensions:

Channel depth	2.0 ft
Channel width	75.0 ft
Channel length	30.0 ft
Side Slope (horizontal to vertical)	15 : 1
Average Exit Slope	0 percent

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

SEDIMOT II program was utilized 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-RA HYDRAULICS TABLE

	Units	100-year 24-hour Storm	50-year 6-hour Storm
Initial Reservoir Volume Condition		Full to elevation 6539.0	Full to the spillway elevation
Inflow			
Peak Flow	cfs	286	219
Volume	acre-ft	34.70	19.41
Storage			
Peak Stage	ft	6554.0	6557.2
Spillway Elevation	ft	6556.5	--
Peak Storage	acre-ft	60.5	--
Storage Capacity	acre-ft	72.0	--
Outflow			
Peak Flow	cfs	0	105
Embankment Crest Elevation	ft	--	6558.5
Peak Storage	ft	--	6557.2
Freeboard	ft	--	1.3
Spillway Channel			
Flow Depth	ft	--	0.75
Critical Velocity	fps	--	3.2
Manning's "n"		--	0.035

APPENDIX A

PEABODY 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 Avg. 14%			
a. Adequate grass cover?	X		
b. Any erosion?		X	
c. Are trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Adequate riprap protection?	N.A.		
g. Any stone deterioration?	N.A.		
h. Visual depressions or bulges?		X	
i. Visual settlements?		X	
j. Animal burrows?		X	
3. DOWNSTREAM SLOPE 4%			
a. Adequate grass cover?	X		
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?	N.A.		
i. Are the relief wells flowing?	N.A.		
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?			
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?			

ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			
a. Location:	N.A		None
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			
a. Location:	N.A		
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

APPENDIX B

DAMES AND MOORE INSPECTION CHECK LIST

PEABODY COAL COMPANY

Arizona Division

GENERAL DATA SHEET AND VISUAL INSPECTION CHECKLIST

N2-RA

Name of Sediment Impoundment:

Name of Inspectors: **Date**

Geotechnical	[X]	Evernash	4/17/85
Hydrology	[ ]		
Hydraulic	[ ]		

	No	Yes
Remedial Geotechnical Action Required	[X]	[ ]
Remedial Hydrological Action Required	[ ]	[ ]

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?	✓		about 40-50% cover
b. Any erosion?	✓		minor - rills
c. Are trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Adequate riprap protection?	NA		
g. Any stone deterioration?	NA		
h. Visual depressions or bulges?	NA		
i. Visual settlements?	NA		
j. Animal burrows?	NA		
3. DOWNSTREAM SLOPE	NA		
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?		X	
k. Is seepage present?			
l. Animal burrows?			
4. ABUTMENT CONTACT. RIGHT			
a. Any erosion?	✓		minor - rills
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			mine waste
5. ABUTMENT CONTACT. LEFT			
a. Any erosion?	✓		minor - rills
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			mine waste

ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			No spill. Impoundment appears to be drained through 12" ϕ slotted CMP tower. No pipeline, no outlet observed. Drainage by infiltration to foundation. Top of CMP 9' above W.L.
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?			
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?		NA	(Elev.) feet
b. Water present?	Yes		(Elev.) ~6537 feet
c. Siltation?	Yes		water obscures amount
d. Watershed matches soil map?			

9. GENERAL COMMENTS

Vegetation cover of water shed about 50-60%. Vegetation is "grass"; canopy cover is 0.
Sideslopes were contour-disked and mulched

Compaction test results available from construction

APPENDIX C

Hydrology and Hydraulic Calculations

112 - P1

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = [illegible] - [illegible] = [illegible]

WATER COURSE LENGTH = [illegible] / 5280 = [illegible] MI

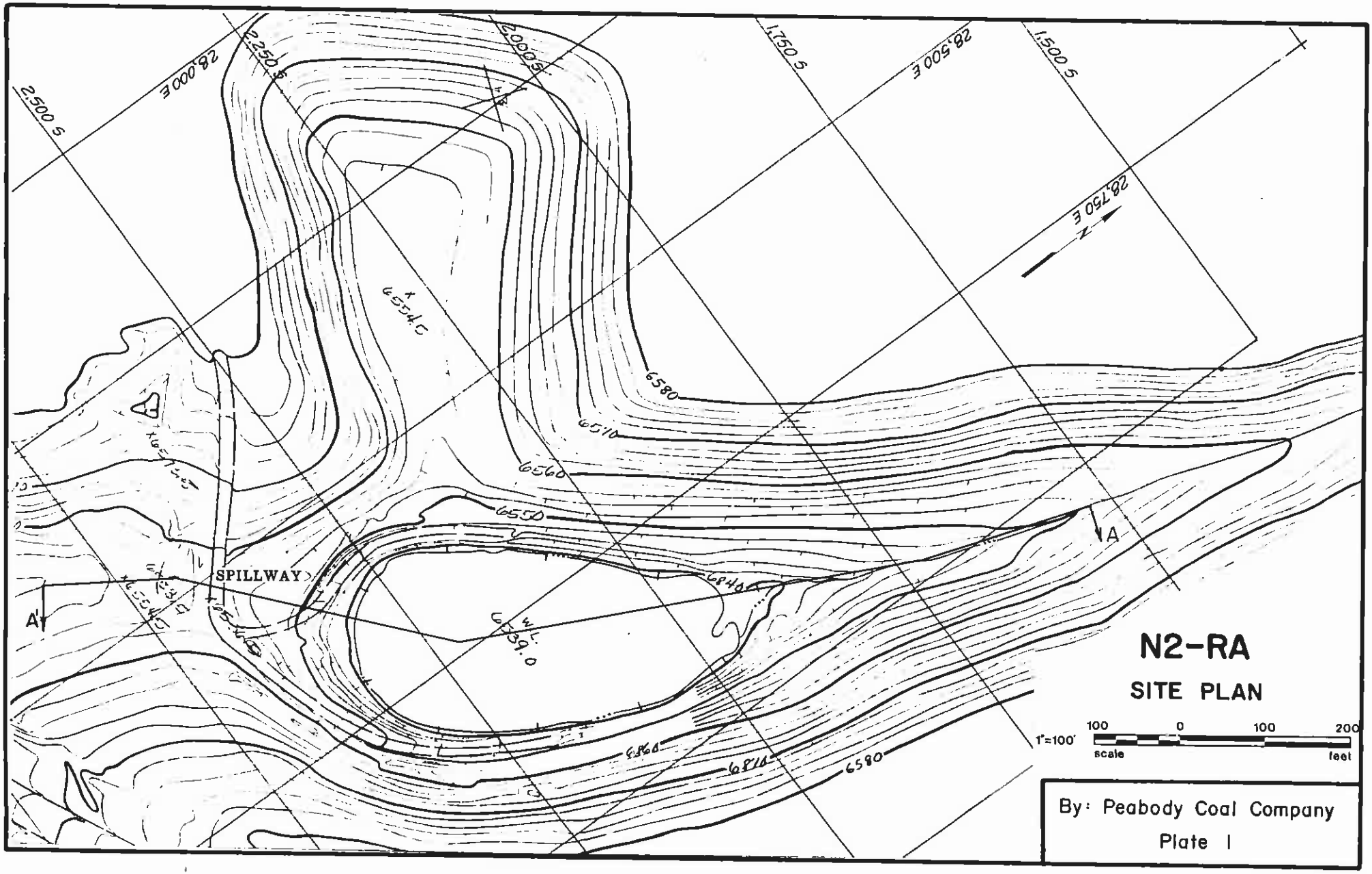
$$T_c = \left(\frac{11.9\,(\text{[illegible]})^3}{\text{[illegible]}}\right)^{0.385} = \text{[illegible]} \text{ HR.}$$

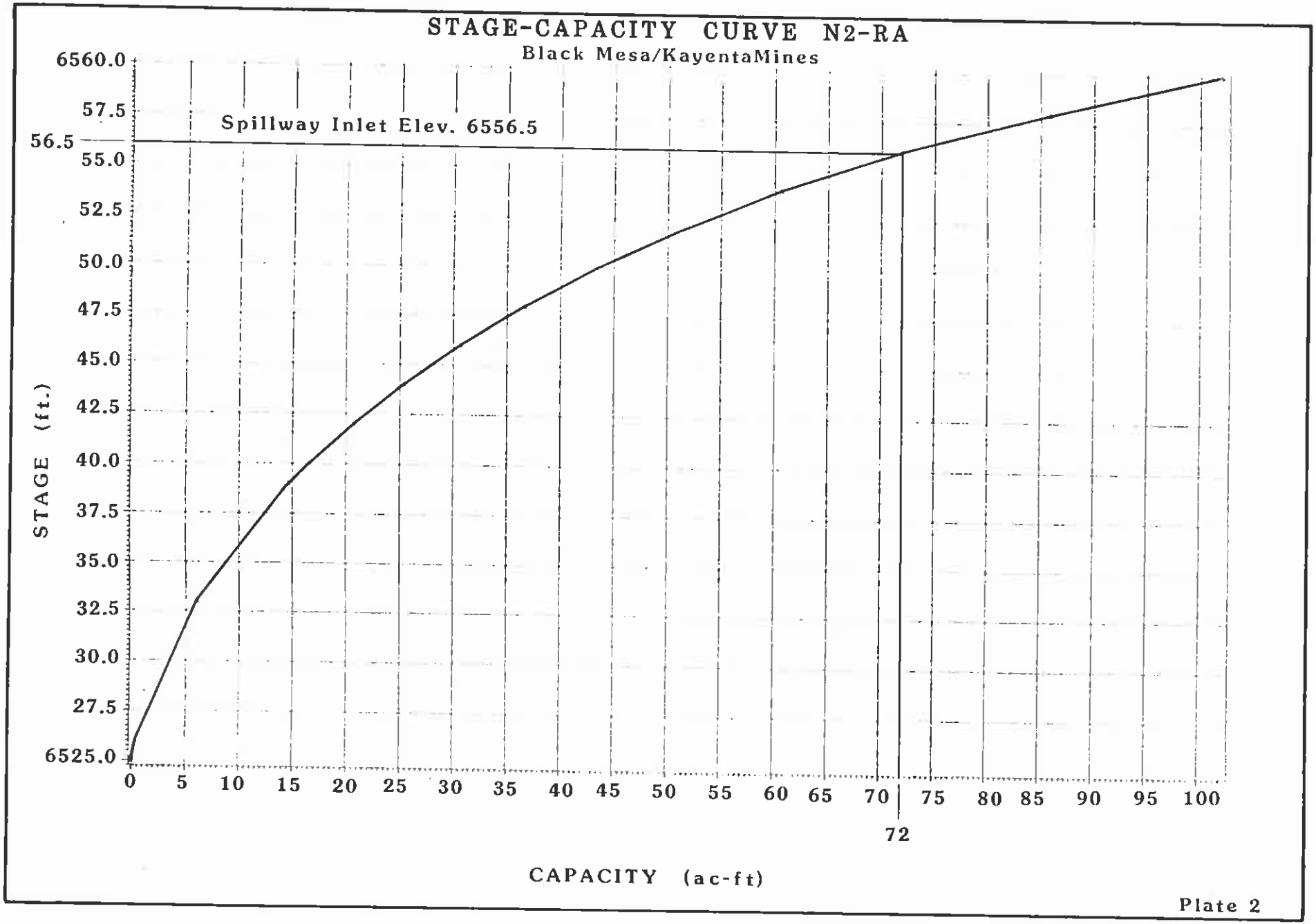
SCS CURVE NUMBER

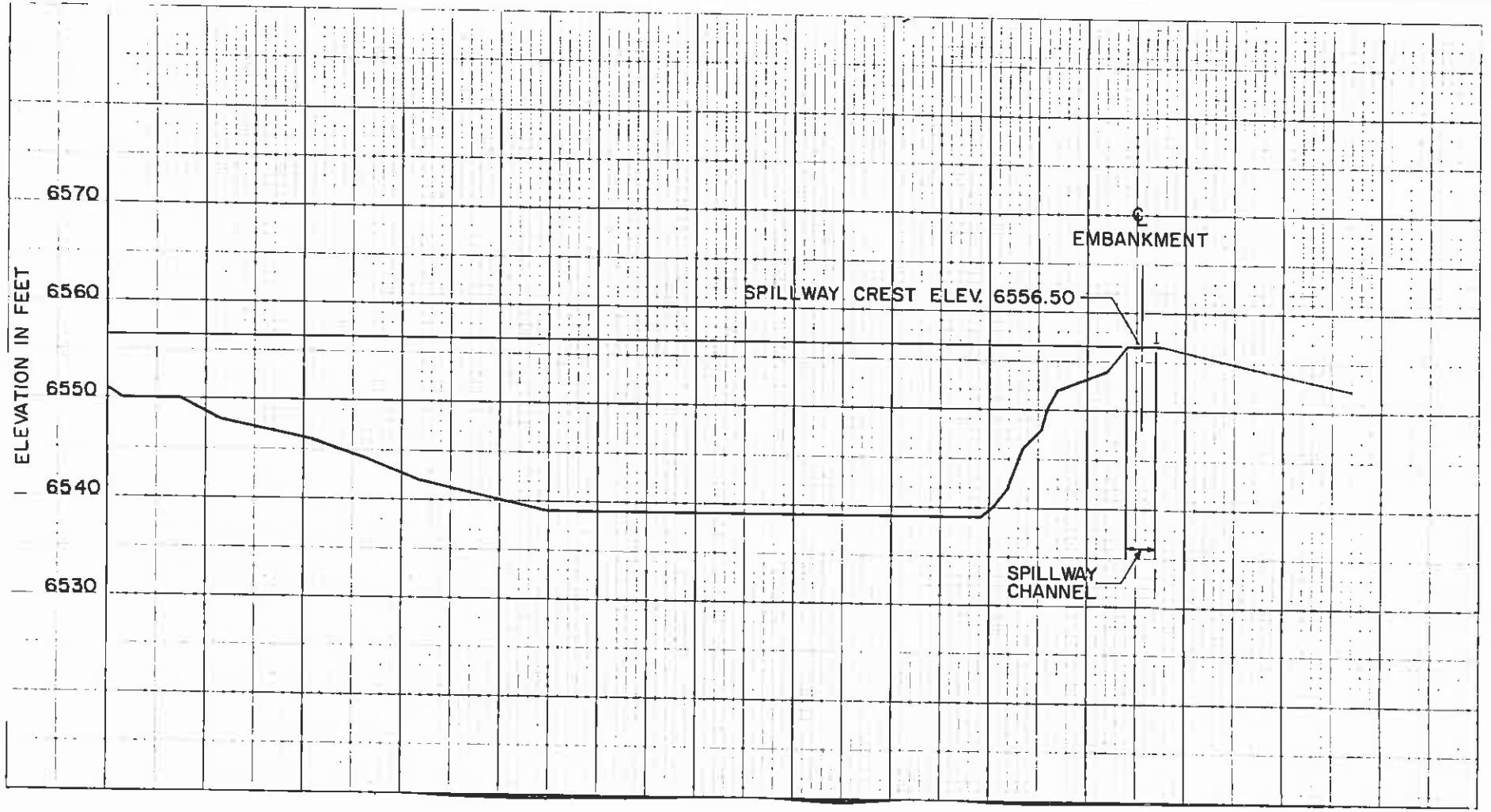
DRAINAGE AREA (ACRES)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NO.
[illegible]	DISTURBED			
[illegible]	RECLAIMED			
[illegible]	P-J			
[illegible]	SAGE-GRASS			

DRAINAGE BASIN AREA

[illegible] ACRES / 640 = [illegible] SQ. MILES


2,500 S
28,000 E
2,250 S
6,000 S
1,750 S
28,500 E
1,500 S
28,750 E
6580
6570
6560
6550
6540
6539.0
SPILLWAY
A
A'
N2-RA
SITE PLAN
1"=100'
100 0 100 200
scale
feet
By: Peabody Coal Company
Plate I


STAGE-CAPACITY CURVE N2-RA
Black Mesa/KayentaMines
Spillway Inlet Elev. 6556.5
6560.0
57.5
56.5
55.0
52.5
50.0
47.5
45.0
42.5
40.0
37.5
35.0
32.5
30.0
27.5
6525.0
STAGE (ft.)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
72
CAPACITY (ac-ft)
Plate 2



CHANNEL PROFILE A-A'

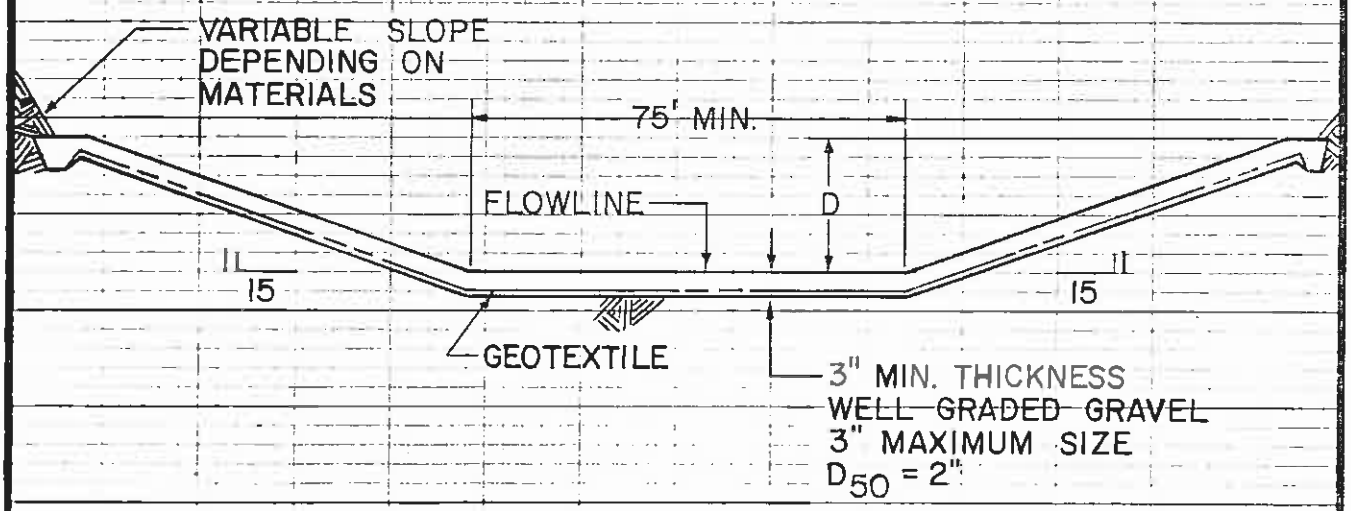
N2-RA

1"=100' scale 100 0 100 200 feet

FOR LOCATION SEE PLATE 1

BY Peabody Coal Company

Plate 3



SPILLWAY CHANNEL

D = 2.0'

LENGTH = 30'

FLOWLINE ELEV. = 6556.50

N2-RA
SPILLWAY AND OUTFLOW CHANNEL CROSS SECTION

BY Peabody Coal Company

Plate 4