

INSPECTION REPORT  
Sedimentation Structure

J7-H

Black Mesa Mine  
Navajo County, Arizona

for

PEABODY COAL COMPANY



Dames & Moore  
10139-011-22



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## INTRODUCTION

Sedimentation Structure J7-H is an earthen embankment, designed and constructed in 1980 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 J7-H is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure J7-H. 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 J7-H was inspected on September 2, 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 J7-H project files and a field inspection of the structure. The most current information contained in the Peabody Coal Company files includes the 1984 and current survey data and inspections performed in 1984 and 1985 by

Peabody Coal Company. The survey data developed in August 1984 was 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 J7-H has a 33.0-acre tributary drainage area and is located near the Yucca Flats Wash at the Black Mesa Mine. The watershed is classified as 34% reclaimed, 33% Sagebrush/grass, and 33% disturbed.

EMBANKMENT

Structure J7-H is a homogeneous earthen embankment classified as a sidehill embankment. Physical characteristics of the embankment are listed in the following table:

Structure J7-H

Embankment . . . . .	Residual Shale/Sandstone Soils
Foundation . . . . .	Residual Shale Soils
Right Abutment . . . . .	Residual Shale Soils
Left Abutment . . . . .	Residual Shale Soils
Height . . . . .	7.3 ft
Crest Width . . . . .	22 ft
Upstream Slope . . . . .	2.5 H : 1 V
Downstream Slope . . . . .	7.5 H : 1 V

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section J7-H, A-A'.

## ANALYSES

### STABILITY

Structure J7-H is a category B-1 embankment. A standard category B-1 embankment has static and seismic factors of safety of 1.5 and 1.2, respectively, under the following conditions:

1. Maximum height = 10 ft
2. Maximum upstream slope = 1.5 H : 1 V
3. Maximum downstream slope = 2.5 H : 1 V
4. Normal pool with steady seepage saturation conditions

The J7-H embankment is lower in height and has flatter slopes than the category standard; therefore, the embankment has factors of safety greater than the design minimum.

### HYDROLOGY

The hydrologic analysis was completed using the U.S. Army Corps of Engineers generalized computer program HEC-1, Flood Hydrograph Package. Structure J7-H is located upstream from Structure J7-I. The two structures have a combined storage capacity that is greater than 20 acre-feet. However, the spillway for J7-H was analyzed using the 25-year, 6-hour storm because J7-H is the upstream structure. The storage capacity of Structure J7-H was analyzed using the 10-year, 24-hour storm.





J7-H HYDRAULICS

Units	10-year 24-hour Storm	25-year 6-hour Storm
<b>Initial Reservoir Volume</b>		
Condition	Empty	Full to the spillway elevation
<b>Inflow</b>		
Peak Flow . . . . . cfs	45	53
Volume . . . . . acre-ft	2.45	2.09
<b>Storage</b>		
Peak Stage . . . . . ft	6371.25	6375.12
Spillway Elevation . . ft	6373.80	—
Peak Storage . . . . . acre-ft	2.47	—
Storage Capacity . . . acre-ft	4.82	—
<b>Outflow</b>		
Peak Flow . . . . . cfs	0	9
Embankment Crest		
Elevation . . . . . ft	—	6376.30
Peak Stage . . . . . ft	—	6375.05
Freeboard . . . . . ft	—	1.25
<b>Spillway Channel</b>		
Flow Depth . . . . . ft	—	1.25
Critical Velocity . . . fps	—	2.6
Manning's "n" . . . . .	—	0.035
<b>Outflow Channel</b>		
Slope . . . . . %	—	5
Normal Velocity . . . . fps	—	3.1
Normal Depth . . . . . ft	—	0.19
Manning's "n" . . . . .	—	0.035

Spillway Channel

The existing spillway for J7-H has a trapezoidal channel with the following dimensions:

Channel depth . . . . .	2.5 ft
Channel width . . . . .	16 ft
Channel length . . . . .	80 ft
Side slopes (horizontal to vertical). .	2:1
Average exit slope . . . . .	2 percent

There is presently only grass for erosion protection within the channel.

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 3, Volume-Elevation Curve, J7-H.

The calculations for the sediment load entering Structure J7-H were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R . . . . . 40
2. Soil Erodibility Factor, K . . . . . 0.22
3. Slope Factor, LS . . . . . 1.65
4. Cover Factor, C . . . . . 0.394
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 J7-H is shown on Plate 3, Volume-Elevation Curve, J7-H, and the results of the analysis are summarized in the following table.

J7-H STORAGE

Total Storage Capacity . . . . .	4.82	acre-ft
10-year, 24-hour Storm Inflow . . . . .	2.45	acre-ft
Available Sediment Storage Capacity . . . . .	2.35	acre-ft
Sediment Inflow Rate . . . . .	0.095	acre-ft/yr
Sediment Storage Life . . . . .	25	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure J7-H indicated that the only geotechnical problem is rill erosion on the upstream slope and the side slopes and bottom of the spillway channel. Correction of erosion is considered a periodic maintenance task and does not require remedial action.

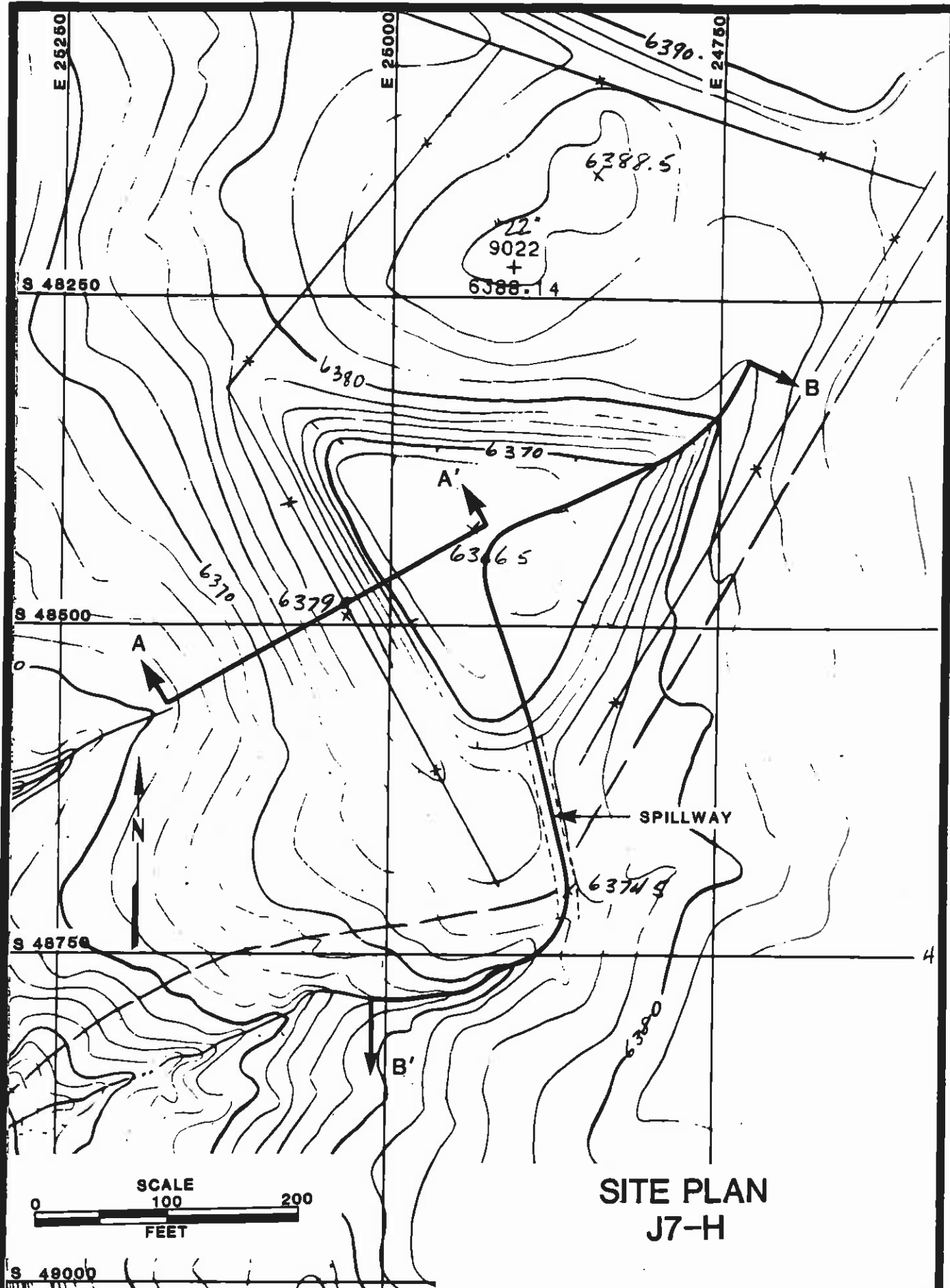
## HYDRAULICS

The storage capacity and spillway capacity of Structure J7-H are adequate; however, the spillway does not have an outflow channel or adequate erosion protection. A trapezoidal outflow channel should be constructed along the alignment B-B' shown in Plate 1. The channel profile is shown in Plate 4 and the required dimensions are shown in Plate 5. Both the spillway and outflow channel should be protected against erosion using geotextile and gravel as shown in Plate 5.

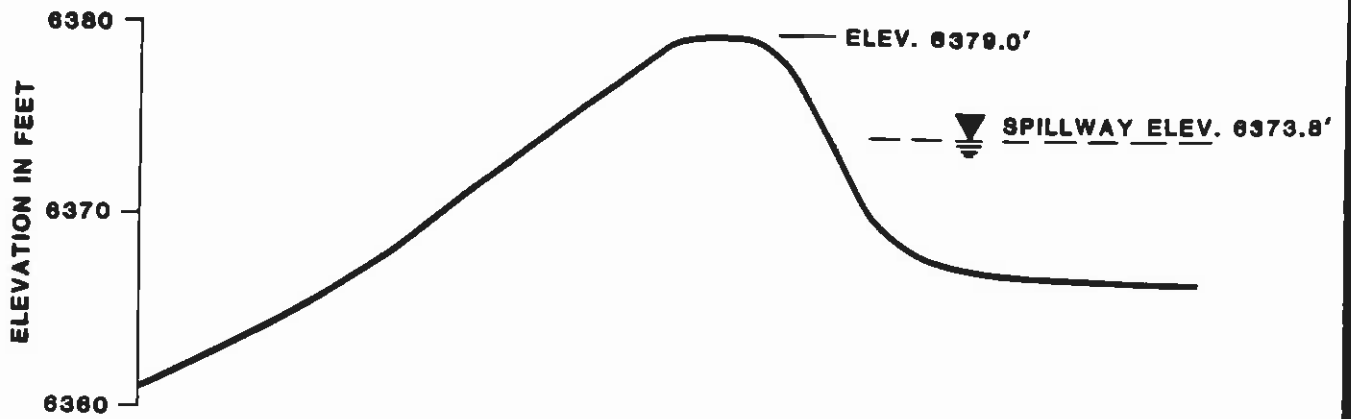
\* \* \*

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

- Plate 1 - Site Plan J7-H
- Plate 2 - Existing Maximum Cross Section J7-H, A-A'
- Plate 3 - Volume-Elevation Curve J7-H
- Plate 4 - Channel Profile J7-H, B-B'
- Plate 5 - Spillway and Outflow Channel Cross Section J7-H
- Appendix A - Inspection Check List
- Appendix B - Hydrology and Hydraulic Calculations



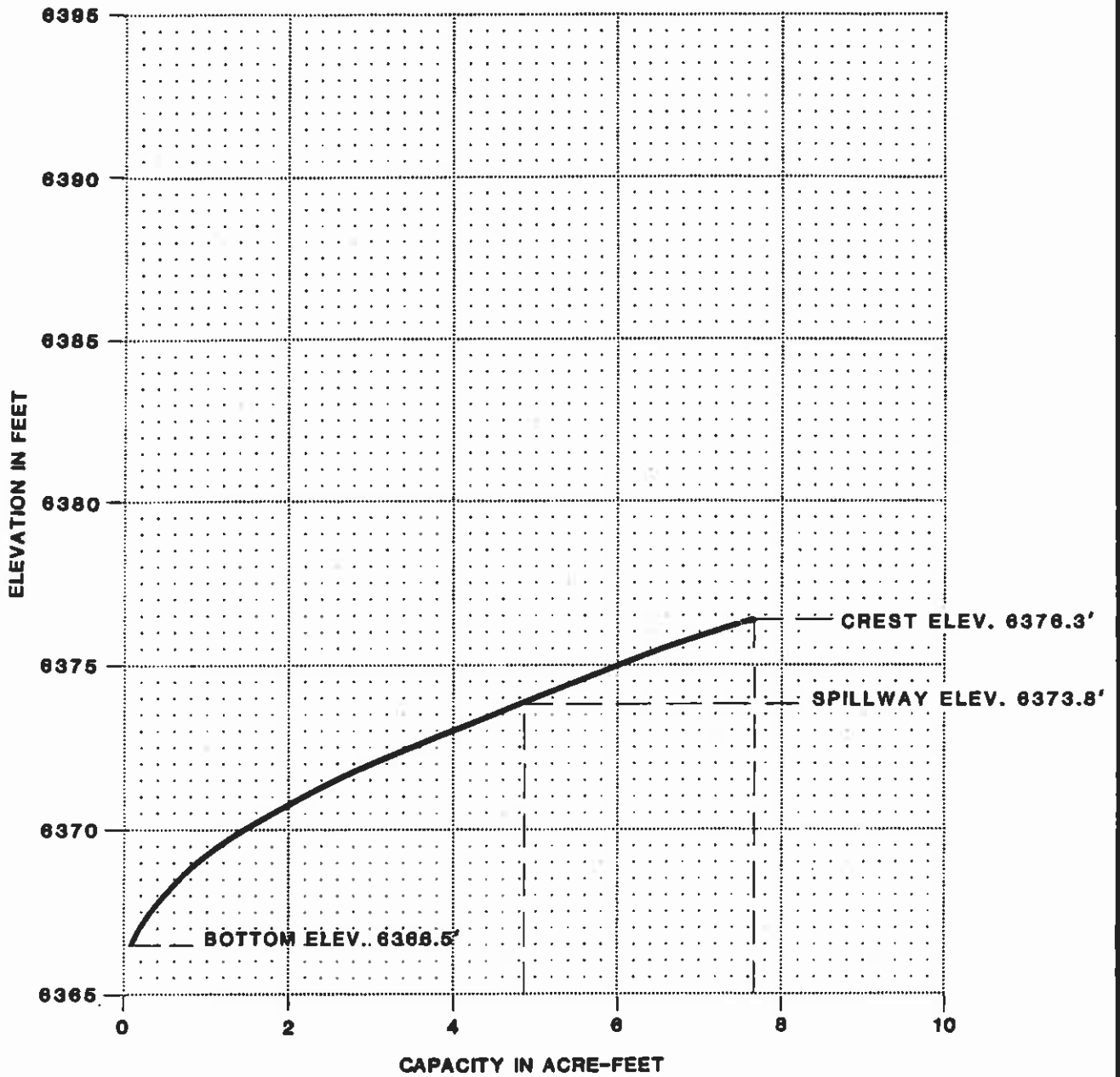
**SITE PLAN  
J7-H**



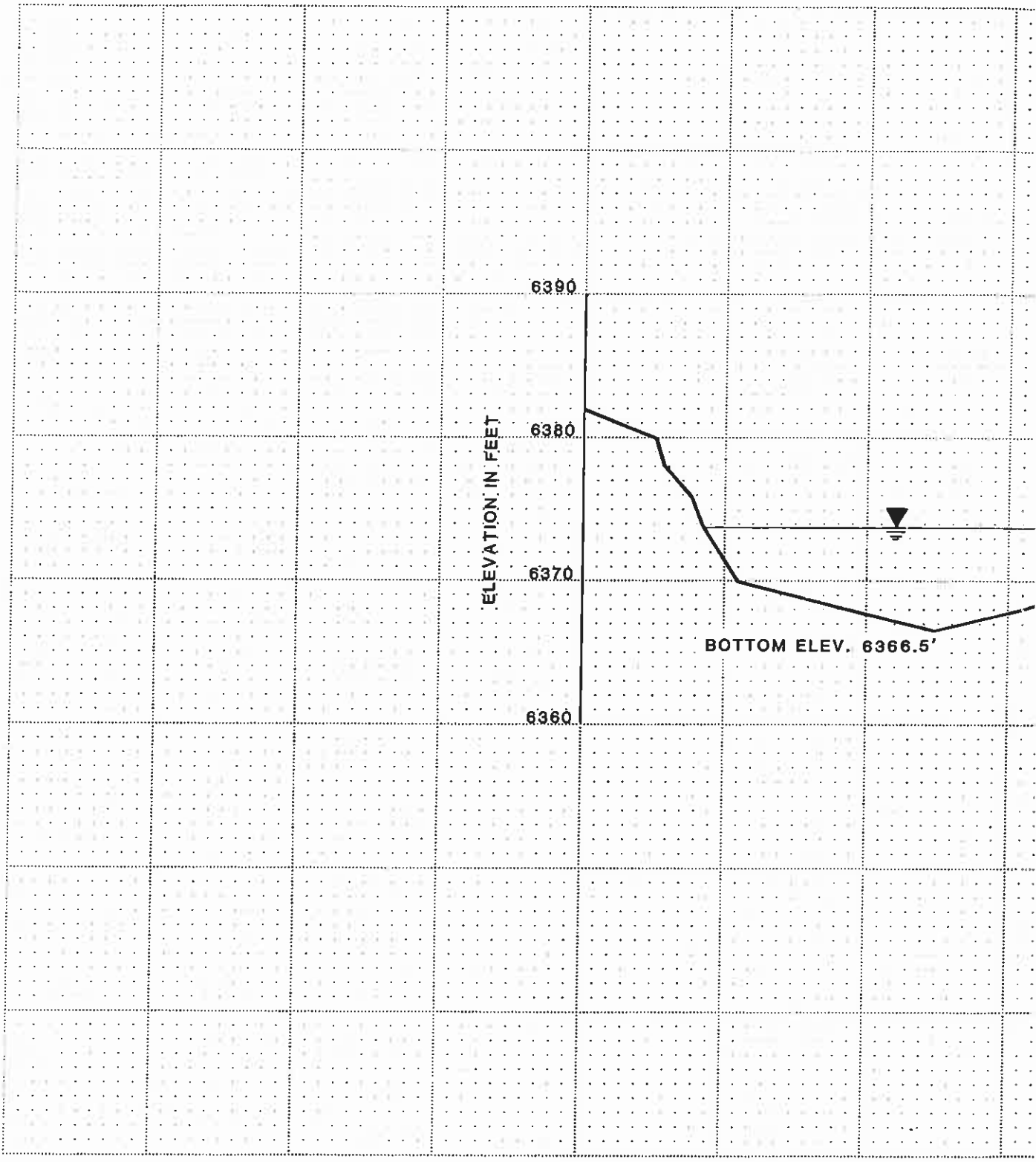
EXISTING  
MAXIMUM CROSS-SECTION  
A-A'  
J7-H

BY **Dames & Moore**

Plate 2

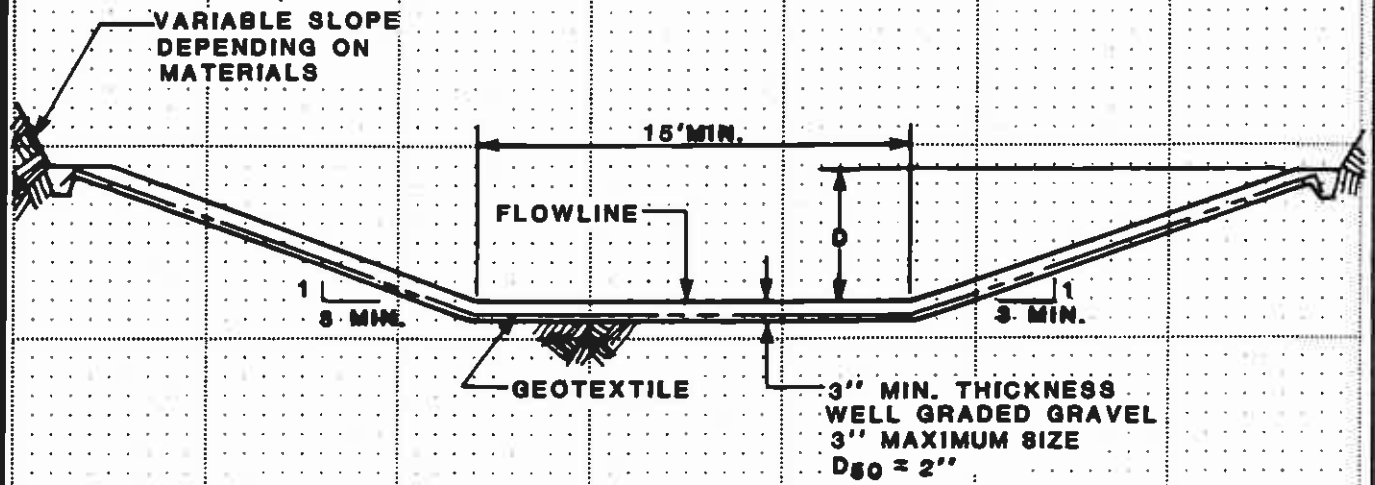


VOLUME-ELEVATION  
CURVE  
J7-H



FOR LOCATION SEE PLATE 1





**SPILLWAY CHANNEL**

**D = 2.3'**  
**LENGTH = 50'**  
**FLOWLINE ELEV. = 6373.80'**

**OUTFLOW CHANNEL**

**D = 1'**

**SPILLWAY AND  
 OUTFLOW CHANNEL  
 CROSS SECTION  
 J7-H**

APPENDIX A  
INSPECTION CHECK LIST

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
<b>1. CREST</b>			
a. Any visual settlements?		X	
b. Misalignment?		X	
c. Cracking?		X	
<b>2. UPSTREAM SLOPE</b>			
a. Adequate grass cover?		X	20% grass
b. Any erosion?	X		Rills
c. Are trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Adequate riprap protection?	X		
g. Any stone deterioration?			NA
h. Visual depressions or bulges?		X	
i. Visual settlements?		X	
j. Animal burrows?		X	
<b>3. DOWNSTREAM SLOPE</b>			
a. Adequate grass cover?		X	Rocky slope
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?			NA
i. Are the relief wells flowing?			NA
j. Are boils present at the toe?		X	
k. Is seepage present?		X	
l. Animal burrows?		X	
<b>4. ABUTMENT CONTACT. RIGHT</b>			
a. Any erosion?		X	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			brown SM
<b>5. ABUTMENT CONTACT. LEFT</b>			
a. Any erosion?		X	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			brown SM

ITEM	YES	NO	REMARKS
<b>6. SPILLWAY/NORMAL</b>			
<b>a. Location:</b>			
Left abutment?	X		
Right abutment?			
Crest of Embankments?			
<b>b. Approach Channel:</b>		X	
Are side slopes eroding?			NA
Are side slopes sloughing?			↓
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			↓
<b>c. Spillway Channel:</b>	X		
Are side slopes eroding?	X		Rills
Are side slopes sloughing?		X	
Bottom of channel eroding?	X		Rills
Obstructed?		X	
Erosion protection?	X	X	Partial Grass 60%
<b>d. Outflow Channel:</b>		X	
Are side slopes eroding?			NA
Are side slopes sloughing?			↓
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			↓
<b>e. Weir:</b>		X	
Condition?			
<b>7. SPILLWAY/EMERGENCY</b>			NA
<b>a. Location:</b>			
Left abutment?			
Right abutment?			
Crest of Embankments?			
<b>b. Approach Channel:</b>			
Are side slopes eroding?			
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
<b>c. Spillway Channel:</b>			
Are side slopes eroding?			
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
<b>d. Outflow Channel:</b>			
Are side slopes eroding?			
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
<b>e. Weir:</b>			
Condition?			

ITEM	YES	NO	REMARKS
8. IMPOUNDMENT			
a. Sinkholes?		<input checked="" type="checkbox"/>	(Elev.) feet
b. Water present?		<input checked="" type="checkbox"/>	(Elev.) feet
c. Siltation?	<input checked="" type="checkbox"/>		A Little 10%
d. Watershed matches soil map?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Reclaimed 50%

Have Roads & UN RECLAIMED LAND

9. GENERAL COMMENTS

FENCED POND

Canopy 10%  
 exposed 50%  
 bare 40%

APPENDIX B  
HYDROLOGY AND HYDRAULIC CALCULATIONS

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6397 - 6374 = 23 ft.

WATER COURSE LENGTH = 1550 ft. = 0.294 mi.

$T_c = \left( \frac{11.9 (0.294)^3}{23} \right)^{0.385} = 0.188 \text{ hr.}$

Lag Time =  $0.6 T_c = 0.113 \text{ hr.}$

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
11.0 (33 1/2)	S-G	ave.	D	0.33(79) = 26.1
11.0 (33 1/2)	Dist	—	D	0.33(94) = 31.0
11.0 (34 1/2)	Recu. (post law)	—	—	0.34(81) = 27.5
				84.6

EH#54  
 Assume worst case.

Use 85

DRAINAGE BASIN AREA

33.0 AC.      0.052 SQ. MI.

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 = EH#34

$K = 0.22$

SLOPE FACTOR

<u>LENGTH (ft.)</u>	<u>Δ ELEV (ft.)</u>	<u>SLOPE (%)</u>	<u>LS</u>
600	35	6	1.65

COVER FACTOR

<u>AREA (ac)</u>	<u>COVER TYPE</u>	<u>% COVER</u>	<u>CANOPY (%)</u>	<u>WEIGHTED C</u>
37%	RECLAIMED	50	—	0.33 (.15)
33%	DISTURBED	—	—	0.33 (1.0)
34%	S-G	40	25	0.34 (.13)

$C = .424$

EROSION CONTROL FACTOR

$P = 1.0$

SEDIMENT INFLOW

$A = 40(0.22)(1.65)(.424)(1.0) = 6.16$  ton/acre/year

$A = 6.16 \left( \frac{1}{2047} \right) (33.0) (0.95) = .095$  acre-feet/year

REVISIONS  
 BY \_\_\_\_\_ TO EO \_\_\_\_\_  
 BY \_\_\_\_\_ DATE \_\_\_\_\_ TO EO \_\_\_\_\_  
 BY \_\_\_\_\_ DATE \_\_\_\_\_ TO EO \_\_\_\_\_

BY \_\_\_\_\_ DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_  
 COPY TO EO \_\_\_\_\_



POND J7-H SPILLS INTO POND J7-I

WATER COURSE LENGTH = 400 FT. = 0.076 mi  
 ELEV. DIFFERENCE = 6374 - 6340 = 34'

$$T_c = \left( \frac{11.9 (0.076)^3}{34} \right)^{0.385} = 0.034 \text{ hr} = 2.0 \text{ min}$$

VELOCITY =  $400 / 2 \times 60 = 3.3 \text{ ft./sec.}$

SLOPE =  $34 / 400 = 8.5\%$

VELOCITY IS REASONABLE FOR THE SLOPE.

USE 2 MIN. LAG TIME FOR TRAVEL BETWEEN  
 J7-H AND J7-I

REVISIONS  
 BY \_\_\_\_\_ DATE \_\_\_\_\_ TO EO \_\_\_\_\_  
 BY \_\_\_\_\_ DATE \_\_\_\_\_ TO EO \_\_\_\_\_

BY GD DATE 9/21/85  
 CHECKED BY \_\_\_\_\_  
 COPY TO EO \_\_\_\_\_