INSPECTION REPORT

Sedimentation Structure

KM-A2

Kayenta Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Dames & Moore
10139-011-22

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INTRODUCTION

Sedimentation Structure KM-A2 is a partially incised structure with an earthen embankment, designed and constructed in 1982 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 KM-A2 is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure KM-A2. 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 KM-A2 was inspected on September 5, 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 KM-A2 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 KM-A2 has a 46.9-acre tributary drainage area and is located near Yellow Water Canyon at the Kayenta Mine. The watershed is classified as 69% disturbed, 26% Sagebrush/grass, and 5% Pinion/Juniper.

EMBANKMENT

Structure KM-A2 is a partially incised structure with a homogeneous earthen embankment classified as a cross-valley embankment. Physical characteristics of the embankment are listed in the following table:

Structure KM-A2

Embankment	Residual Sandstone Soils
Foundation	Sandstone
Right Abutment	Sandstone
Left Abutment	Residual Sandstone Soils/Sandstone
Height	1.4 ft
Crest Width	14 ft
Upstream Slope	2.1 H : 1 V
Downstream Slope	3.3 H : 1 V

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section KM-A2, A-A'. Grass provides erosion protection on the upstream and downstream slopes of the embankment.

ANALYSES

STABILITY

Structure KM-A2 is a category A-5 embankment. A standard category A-5 embankment has static and seismic factors of safety equal to or greater than 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 KM-A2 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 KM-A2 is located upstream from Structure KM-A3. The two structures have a combined storage capacity that is less than 20 acre-feet. Therefore, the spillway for KM-A2 was analyzed using the 25-year, 6-hour storm. The storage capacity of Structure KM-A2 was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.417	mi
2.	Elevation Difference, H	178	ft
3.	Time of Concentration, T_c	0.128	h
4.	Lag time, $0.6T_c$	0.077	h
5.	SCS Curve Number	90	
6.	Rainfall Depth, 10-year, 24-hour storm	2.1	in.
	25-year, 6-hour storm	1.9	in.
7.	Drainage Area	46.9	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.

APPENDIX A

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			26°
a. Adequate grass cover?		X	
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	
3. DOWNSTREAM SLOPE			14° for 1st 30 Flatter to toe
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		Bulges from uneven construction
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	
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?			Rock
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?			Rock

ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			
a. Location:			
Left abutment?			
Right abutment?	X		
Crest of Embankments?			
b. Approach Channel:	X		12' at top 25' at bottom
Are side slopes eroding?		X	
Are side slopes sloughing?		X	
Bottom of channel eroding?	X		Rills/gullys
Obstructed?		X	
Erosion protection?		X	
c. Spillway Channel:	X		12' wide 30' long
Are side slopes eroding?		X	
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?	X		Rock D50 6"
d. Outflow Channel:	X		12'. all the way 90' long
Are side slopes eroding?		X	
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?		X	
e. Weir:		X	
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?		X	(Elev.) feet
b. Water present?	X		(Elev.) feet
c. Siltation?	X		
d. Watershed matches soil map?		X	Disturbed Land % ?

9. GENERAL COMMENTS

OK

Canopy Cover - looks good but can't see all of the watershed

ground cover - same

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

FILE PEABODY COAL CO 10139-011-22
SUBJECT SEDIMENT POND HYDROLOGY
KM-E SHEET ___ OF ___

REVISIONS BY ___ DATE ___ TO EO ___ BY ___ DATE ___ TO EO ___

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6704 − 6500 = 204 ft.

WATER COURSE LENGTH = 8.0(400) = 3200 ft. = 0.606 mi.

$$T_c = \left(\frac{11.9\ (0.606)^3}{204}\right)^{0.385} = 0.188 \text{ hr.}$$

LAG TIME = $0.6 T_c$ = 0.113 hr.

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
63.6 (63%)	P-J	ave.	D	0.63(87) = 52.3
37.8 (37%)	DISTURBED (DIRT RD.)	—	D	0.37(89) = 32.9
			EH #25	85.2

USE 86

DRAINAGE BASIN AREA

101.4 ACRE 0.158 SQ MILE

(KM-FWP Fresh Water Pond SUBTRACTED)

KM-E1 = 12.4 AC 0.019 MI^2

CHECKED BY S. DOLAN DATE 9-9-85
COPY TO EO ___

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FILE PEABODY COAL CO 1039-011-22
SUBJECT SEDIMENT INFLOW
KM-E SHEET ___ OF ___

REVISIONS BY ___ DATE ___ TO EO ___ BY ___ DATE ___ TO EO ___

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

R = 40

SOIL ERODIBILITY FACTOR

SOIL TYPE = EH # 25 (100%) = .22

K = .22

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
800	100	12.5	5.44 (.30)
170	40	23.5	6.95 (.20
850	100	11.8	5.10 (.30)
400	80	20.0	8.16 (.10)
1000	70	7	2.61 (.10)
			use 5.63

COVER FACTOR

AREA (ac.)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
63%	P-J	40	25	.63 (.14)
37%	disturbed	—	—	.37 (1.0)
				C = .458

EROSION CONTROL FACTOR

P = 1.0

SEDIMENT INFLOW

BY ___ DATE ___ CHECKED BY ___ COPY TO EO ___

$A = 40(.22)(5.63)(.458)(1.0) = 22.69$ ton/acre/year

$A = 22.69\left(\frac{1}{2047}\right)(101.4)(.95) = 1.07$ acre-feet/year

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