

INSPECTION REPORT

Temporary Impoundment

J3-H

Black Mesa Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY



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## INTRODUCTION

Temporary impoundment J3-H is an earthen embankment at Black Mesa Mine. The location, site-specific plans and watershed boundary of temporary impoundment J3-H are shown in Appendix A.

This design report contains information specific to temporary impoundment J3-H. Mine-wide design, construction, and reclamation information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona, for Peabody Western Coal Company", December, 1985 (PAP), Chapter 6, Attachment D, Volume 2, along with the methods and results of analyses used for slope stability, hydrology, and hydraulics, and in Chapter 6, Pages 11 to 42, "Sediment and Water Control Facility Plan".

## INSPECTION

The existing temporary impoundment J3-H was inspected by a Registered Professional Engineer from Peabody Western Coal Company in June 1999 to assure that the existing structure is stable and no adverse conditions exist. A detailed geotechnical investigation was not performed, rather, the information in Chapter 6, Attachment D was utilized for embankment design to assure that the design embankment configuration would be stable.

## SITE DESCRIPTION

### LAND USE

The J3-H structure has a watershed of 20.2 acres. The 20.2 acre watershed that contributes directly to structure J3-H is classified as 100% reclaimed.

## DESIGN ANALYSES

### GENERAL

Structure J3-H was inspected under the supervision of a Registered Professional Engineer from Peabody Western Coal Company. The design analysis was performed in accordance with applicable 30 CFR 780 and 816 regulations of the United States Department of Interior, Office of Surface Mining (OSM). The most current information contained in the Peabody Western Coal Company files includes topographic maps developed by Cooper Aerial aerial surveys in 1999 and was used in the analyses of the structure.

### STABILITY

Structure J3-H is a category B-1 embankment. A homogenous earthen embankment with an approximately 26 feet wide embankment width. An upstream slope of 2:1 (horizontal to vertical) and a downstream slope of 3.2:1 was utilized. Based on the total embankment height of approximately 10 feet, these slopes are equal to or flatter than the recommended "worst case" embankment/foundation condition slopes in Table 3-6, Attachment D, Chapter 6: therefore, the embankment is stable.

## HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD 4 (see Appendix B). Structure J3-H is classified as a low hazard structure. In addition, the mine area is sparsely populated with no one living in the downstream floodplain. The structure will impound less than 20 acre-feet and be less than 20 vertical feet in height from the upstream toe of the embankment of the natural stream elevation to the top of embankment elevation.

Adequate storage capacity will be maintained in the impoundment above the normal operating level and below the top of the embankment to contain the storm runoff from the 100-year, 6-hour storm event with no discharge over the top of the embankment. To assure that adequate storm water storage capacity is available, the operating water level in the impoundment will be maintained at or below elevation 6605.8. Impoundment dewatering will be conducted in accordance with Chapter 6, Sedimentation Ponds and Impoundment, Maintenance and Reclamation.

The storage capacity of structure J3-H was analyzed using the 100-year, 6-hour storm event. The impoundment was verified to completely contain the 100-year, 6-hour storm event, and provide adequate sediment storage volume, without discharging.

The following parameters were used in the hydrologic analysis:

|    |  |          |       |
|----|--|----------|-------|
| 1. | Water Course length, L                 | 0.2889   | mi.   |
| 2. | Elevation Difference, H                | 58.2     | ft    |
| 3. | Time of Concentration, $T_c$           | 0.129 hr |       |
| 4. | SCS Curve Number                       | 87       |       |
| 5. | Rainfall Depth, 100-year, 6-hour storm | 2.4 in   |       |
| 6. | Drainage Area                          | 20.2     | acres |

#### HYDRAULICS

The SEDCAD 4 computer program was used to evaluate inflow to the sedimentation structure. J3-H does not incorporate an emergency spillway, instead the peak runoff from the 100-yr, 6-hr event will be contained with a minimum of one foot of freeboard. The initial conditions and results of the analysis are summarized in the following table (supporting calculations are presented in Appendix B).

### J3-H TEMPORARY IMPOUNDMENT HYDRAULICS TABLE

|                                    | Units | 100-Yr, 6-Hr<br>Storm |
|------------------------------------|-------|-----------------------|
| Initial Reservoir Volume Condition |       | 6605.8                |
| Inflow                             |       |                       |
| Peak Flow                          | Cfs   | 32.47                 |
| Volume                             | Ac-ft | 2.07                  |
| Storage                            |       |                       |
| Peak Stage                         | Msl   | 6606.5                |
| Max. Operating Elev.               | Msl   | 6605.8                |
| Peak Storage                       | Ac-ft | 8.81                  |
| Storage Capacity                   | Ac-ft | 6.74                  |
| Embankment Crest Elev.             | Msl   | 6607.5                |
| Freeboard                          | Ft    | 1.0                   |

Notes: The Storage Capacity figure reflects available pond storage up to the defined Operating Elevation. The Peak Storage figures reflects available pond storage up to the Peak Storage elevation and includes Storage Capacity plus stormwater inflow volume (6.74 + 2.07).

### STORAGE CAPACITY

The impoundment stage-capacity table (see Appendix A) is based on the 1999 topographic mapping conducted by Cooper Aerial surveys. Structure J3-H is designed to contain approximately 11.63 acre-feet at the top of embankment elevation.

The calculations for the sediment load entering structure J3-H were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

|    |                            |      |
|----|----------------------------|------|
| 1. | Rainfall Factor, R         | 40   |
| 2. | Soil Erodibility Factor, K | 0.42 |
| 3. | Slope Factor, LS           | 2.21 |
| 4. | Cover Factor, C            | 0.2  |
| 5. | Erosion Control Factor, P  | 1.0  |

The sediment inflow calculations are included in Appendix A. The hydrologic analysis gives the storage volume required to contain the 100-year, 6-hour storm and the remaining storage volume available for storing sediment. The existing storage capacity of J3-H and the results of the sediment inflow analysis are summarized in the following table.



Storage for Structure J3-H

|   | <u>J3-H</u>       |
|---|-------------------|
| Total Storage Capacity                            | 11.63 acre-ft     |
| 100-Year, 6-Hour Storm Inflow plus 1 ft Freeboard | 2.82 acre-ft      |
| Available Sediment Storage Capacity               | 8.81 acre-ft      |
| Sediment Inflow Rate/Year                         | 0.052 acre-ft /yr |
| Sediment Storage Life                             | 169 yrs           |

\* \* \*

The following appendices and drawing are attached and complete this design report.

- Appendix A     - Hydrology, Hydraulic, and Sedimentation Calculations
- Watershed Map
- Stage Storage Table
- Appendix B     - SEDCAD4 100-Year, 6-Hour Storm Event
- Exhibit #1      - J3-H Temporary Impoundment

## APPENDIX A

Hydrology, Hydraulic and Sedimentation Calculations

Watershed Map

Stage Storage Table

J3-H

01-Mar-00

TIME OF CONCENTRATION

|                         |                        |                         |                            |
|-------------------------|------------------------|-------------------------|----------------------------|
| ELEV. DIFFERENCE (H):   | <u>H (HI)</u><br>6656  | <u>H (LO)</u><br>6597.8 | <u>H</u><br>58.2           |
| WATERCOURSE LENGTH (L): | <u>L (FT.)</u><br>1525 |                         | <u>L (MI.)</u><br>0.288826 |

$$TC = [(11.9 \times (L^3)) / H] ^ 0.385$$

$$TC = 0.129308$$

SCS CURVE NUMBER

| <u>COVER</u><br><u>TYPE</u> | <u>HYDROLOGIC</u><br><u>CONDITION</u> | <u>SOIL</u><br><u>TYPE</u> | <u>CN</u> | <u>AREA</u><br><u>(Ac.)</u> | <u>CN*AREA</u> |
|-----------------------------|---------------------------------------|----------------------------|-----------|-----------------------------|----------------|
| RECLAIMED                   | FAIR                                  | C                          | 87        | 20.2                        | 1757.4         |

$$CN = 87$$

DRAINAGE BASIN AREA

$$ACRES = 20.2 \quad \quad \quad SQ. MILES = 0.031563$$

**PEABODY WESTERN COAL COMPANY  
CALCULATED SEDIMENTOLOGY DATA**

**PROJECT: J3-H**

The following spreadsheet calculates the predicted sediment yield for the project area. The gross sediment yield is determined according to the Revised Universal Soil Loss Equation.

| PARAMETER DESCRIPTION           | VALUE                              |
|---------------------------------|------------------------------------|
| Soil Erodibility Factor         | 0.420                              |
| Length Slope Factor             | 2.21                               |
| Cover Factor                    | 0.2                                |
| Practice Factor                 | 1.0                                |
| Annual Rainfall Factor          | 40                                 |
| Gross Annual Sediment Yield     | 5.58 <i>tons/acre/year</i>         |
| Sediment Density                | 94 pcf                             |
| Gross Annual Sediment Yield     | 0.00273 <i>acre-feet/acre/year</i> |
| Sediment Delivery Ratio (SDR)*  | 95 %                               |
| Estimated Annual Sediment Yield | 0.0026 <i>acre-feet/acre/year</i>  |
| Watershed Area                  | 20.2 <i>acres</i>                  |
| Watershed Annual Sediment Yield | 0.0523 <i>acre-feet/year</i>       |
| Number of years                 | 1 <i>years</i>                     |
| Required Pond Sediment Storage  | 0.052 <i>acre-feet</i>             |

\*SDR = 0.95 for drainage basins less than 100 acres  
SDR=0.90 for drainage basins greater than 100 acres

PEABODY WESTERN COAL COMPANY  
CALCULATED SEDIMENTOLOGY DATA

PROJECT: J3-H

SOIL ERODIBILITY FACTOR:

| Soil Type | Soil Group | Erodibility Factor, K | Area (Acres) | K*Area |
|-----------|------------|-----------------------|--------------|--------|
| Reclaimed | C          | 0.42                  | 20.2         | 8.484  |
| TOTAL :   |            |                       | 20.2         | 8.48   |
|           |            |                       |              |        |

$$\text{Weighted K} = \text{Total K*Area} / \text{Total Area} = \underline{\underline{0.420}}$$

LENGTH SLOPE FACTOR:

| Length (ft) | Elevation Change (ft) | Slope (%) | m   | Slope Angle (deg) | LS Factor |
|-------------|-----------------------|-----------|-----|-------------------|-----------|
| 250         | 30                    | 12.0%     | 0.6 | 6.8               | 3.15      |
| 262         | 20                    | 7.6%      | 0.5 | 4.4               | 1.62      |
| 305         | 25                    | 8.2%      | 0.5 | 4.7               | 1.87      |

$$\text{Average LS} = \underline{\underline{2.21}}$$

The LS Factor was calculated by:

$$LS = (\text{Slope Length} / 72.6)^m * (10.8 * \sin(\text{slope angle}) + 0.03) \text{ for Slopes} < 9\%$$

$$LS = (\text{Slope Length} / 72.6)^m * (16.8 * \sin(\text{slope angle}) - 0.5) \text{ for Slopes} > \text{ or } = 9\%$$

Where:

$$\begin{aligned} \text{Slope} < \text{ or } = 3\% & \quad m = 0.3 \\ \text{Slope} = 4\% & \quad m = 0.4 \\ 5\% > \text{Slope} < 10\% & \quad m = 0.5 \\ \text{Slope} > 10\% & \quad m = 0.6 \end{aligned}$$

COVER AND PRACTICE FACTORS:

| Cover Type | Cover (%) | Canopy (%) | Area (acres) | Cover Factor, C | C*Area | Practice Factor, P | P*Area |
|------------|-----------|------------|--------------|-----------------|--------|--------------------|--------|
| Reclaimed  | 40        | 0          | 20.2         | 0.15            | 3.03   | 1                  | 20.2   |
| TOTAL      |           |            | 20.2         |                 | 3.03   |                    | 20.2   |

$$\text{Weighted C} = \text{Total C*Area} / \text{Total Area} = \underline{\underline{0.15}}$$

$$\text{Weighted P} = \text{Total P*Area} / \text{Total Area} = \underline{\underline{1.00}}$$

RAINFALL FACTOR:

$$R = 40$$



LAST REVISION: 3/1/00

**J3-H**

| ELEVATION<br>(ft-msl) | STAGE<br>(ft) | AREA<br>(acres) | CAPACITY<br>(ac-ft) | TOTAL CAPACITY<br>(ac-ft) | DESCRIPTION       |
|-----------------------|---------------|-----------------|---------------------|---------------------------|-------------------|
| 6597.8                | 0.0           | 0.00            | 0.00                | 0.00                      | BOTTOM OF POND    |
| 6599.8                | 2.0           | 0.14            | 0.14                | 0.14                      |                   |
| 6601.8                | 4.0           | 0.62            | 0.76                | 0.90                      |                   |
| 6603.8                | 6.0           | 1.44            | 2.06                | 2.96                      |                   |
| 6605.8                | 8.0           | 2.43            | 3.87                | 6.83                      |                   |
| 6607.5                | 9.7           | 3.22            | 4.80                | 11.63                     | TOP OF EMBANKMENT |

## APPENDIX B

SEDCAD4 (Input and Output) 100-Year, 6-Hour Storm Event



# **J3-H**

# **Temporary Impoundment**

***100 yr - 6 hr Design Storm***

Christopher Irwin

## ***General Information***

### ***Storm Information:***

|                 |               |
|-----------------|---------------|
| Storm Type:     | NRCS Type II  |
| Design Storm:   | 100 yr - 6 hr |
| Rainfall Depth: | 2.400 inches  |

***Structure Summary:***

|    | Immediate<br>Contributing<br>Area<br>(ac) | Total<br>Contributing<br>Area<br>(ac) | Peak<br>Discharge<br>(cfs) | Total<br>Runoff<br>Volume<br>(ac-ft) |
|----|---|---------------------------------------|----------------------------|--------------------------------------|
| #1 | 20.200                                    | 20.200                                | 32.47                      | 2.07                                 |

## ***Subwatershed Hydrology Detail:***

| Stru #   | SWS # | SWS Area (ac) | Time of Conc (hrs) | Musk K (hrs) | Musk X | Curve Number | UHS | Peak Discharge (cfs) | Runoff Volume (ac-ft) |
|----------|-------|---------------|--------------------|--------------|--------|--------------|-----|----------------------|-----------------------|
| #1       | 1     | 20.200        | 0.129              | 0.000        | 0.000  | 87.000       | F   | 32.47                | 2.07                  |
| $\Sigma$ |       | <b>20.200</b> |                    |              |        |              |     | <b>32.47</b>         | <b>2.07</b>           |