DESIGN REPORT

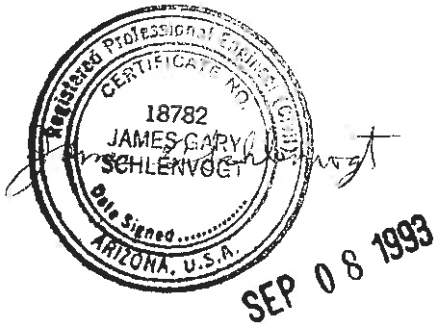
Sedimentation Structure

N11-G1

Kayenta Mine

Navajo County, Arizona

PEABODY COAL COMPANY

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# DESIGN REPORT

Sedimentation Structure

N11-G1

Black Mesa Complex

Navajo County, Arizona

PEABODY WESTERN COAL COMPANY

TABLE OF CONTENTS



## Introduction

Sedimentation Structure N11-G1 is an earthen embankment, designed and constructed by Peabody Western Coal Company as a temporary sedimentation structure to control runoff and sediment from the N-11 surface mining area at the Black Mesa Complex. The location of Structure N11-G1 and its watershed boundary is shown on Drawing No. 85400 (Sheet L-7), and Drawing No. 85405. The site-specific general construction plans are shown on the attached Exhibit 1.

This design report contains information specific to Structure N11-G1 which is located in series with sedimentation structure N11-G. Mine-wide design, construction, and reclamation information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody 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 construction site of Structure N11-G1 was inspected by a Registered Professional Engineer from Peabody Western Coal Company to ensure that the location was suitable and no adverse conditions existed to prevent the successful construction of the structure. A detailed geotechnical investigation was not performed, rather, the information in Chapter 6, Attachment D was utilized for embankment design. A conservative embankment category of (A-3) with a 27-foot total embankment height was utilized for the design.

## Site Description

### Land Use

The two N11-G series structures have a 706.49 acre combined drainage area and is located on a tributary to Coal Mine Wash at the Black Mesa Complex. The watershed is classified as 11 percent disturbed, 82 percent pinon-juniper and 7 percent sagebrush-grass. Structure N11-G1 has a 667.1-acre drainage area.

## Design Analyses

### General

Structure N11-G1 was designed by a Registered Professional Engineer from Peabody Western Coal Company. The design was performed in accordance with applicable 30 CFR 780 and 816 regulations of the United States Department of the Interior, Office of Surface Mining (OSM) and included a review of available project files. The most current information contained in the Peabody Western Coal Company files includes topographic maps developed from aerial photography flown in 2008 and was used in the analyses of the structure.

### Stability

A homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 20 feet wide on top will be constructed. An upstream slope of 3:1 (horizontal to vertical) and a downstream slope of 5:1 were assumed. Based on a total embankment height of 27 feet, these slopes are equal to or flatter than the recommended slopes in Table 3-6, Attachment D, Chapter 6; therefore, the embankment will be stable. The emergency spillway will be a minimum 56-foot wide riprap-lined trapezoidal channel.

### Hydrology

The hydrologic analysis was completed using the computer program SEDCAD+ (see Appendices A, B, and C). Structure N11-G1 is located in series with structure N11-G. Structure N11-G1 is classified as a low hazard structure. No coal mining activities will occur downstream of the N11-G series embankments. In addition, the mine area is sparsely populated with no one living in the downstream flood plain. The structure will impound less than 20 acre-feet and be less than 20 feet in vertical height from the upstream toe of embankment of the natural stream elevation to the emergency spillway elevation. The two structures have a combined capacity that is greater than 20 acre-feet; therefore, the spillway was analyzed using the 25-year, 6-hour storm for the downstream ponds in series. Structures N11-G and N11-G1 were conservatively assumed to be full to the emergency spillway at the time of the 25-year storm. The storage capacity requirement of Structure N11-G1 was analyzed using the 10-year, 24-hour storm. The combined ponds in series were conservatively assumed to completely contain the 10-year, 24-hour storm without discharge downstream to Coal Mine Wash; plus, provide adequate sediment storage volume.

The following parameters were used in the hydrologic analysis:

| | | 10-Year 24-Hour Storm | 25-Year 6-Hour Storm |
|---|---|---|---|
| 1. | Water Course Length, L | 1.676 mi | 1.676 mi |
| 2. | Elevation Difference, H | 374.3 ft | 374.3 ft |
| 3. | Time of Concentration, Tc | 0.481 hr | 0.481 hr |
| 4. | SCS Curve Number | 78 | 78 |
| 5. | Rainfall Depth | 2.1 in | 2.4 in |
| 6. | Drainage Area | 667.1 ac | 667.1 ac |

Hydraulics

The SEDCAD+ and Dodson-Trapezoidal Channel computer programs were used to evaluate inflow to the sedimentation structure, outflow from the structure, and the resulting water surface elevations. The 10-year and 25-year storm was routed through Structure N11-G1 into Structure N11-G as will be the worst-case scenario during mining and reclamation. The initial conditions and results of the analysis are summarized in the following N11-G1 hydraulics table:

N11-G1 HYDRAULICS TABLE

| | Units | 10-Yr, 24-Hr Storm | 25-Yr, 6-Hr Storm |
|---|---|---|---|
| Initial Reservoir Volume Condition | | Empty | Full to emergency spillway elevation |
| Inflow | | | |
| Peak Flow | cfs | 166.4 | 183.2 |
| Volume | ac-ft | 24.0* | 19.1 |
| Storage | | | |
| Peak Stage | msl | N/A | 6766.3 |
| Emerg. Spillway Elev. | msl | 6760.8 | 6760.8 |
| Peak Storage | ac-ft | N/A | 23.3 |
| Storage Capacity | ac-ft | 19.91 | 19.91 |
| Outflow | | | |
| Peak Flow | cfs | N/A | 183.2 |
| Spillway Elevation | msl | 6760.8 | 6760.8 |
| Embankment Crest Elev. | msl | 6770.0 | 6770.0 |
| Peak Stage | msl | --- | 6762.0 |
| Freeboard | ft | --- | 8.0 |
| Emergency Spillway Channel | | | |
| Flow Depth | ft | --- | 0.7 |
| Critical Velocity | fps | --- | 4.6 |
| Mannings "n" | --- | --- | 0.048 |
| Width | ft | --- | 56 |
| Outflow Channel | | | |
| Slope | % | --- | 12.4 |
| Normal Velocity | fps | --- | 6.5 |
| Normal Depth | ft | --- | 0.5 |
| Mannings "n" | --- | --- | 0.049 |

*Inflow volume for the drainage area structure N11-G1.

Emergency Spillway and Outlet Channel

The emergency spillway and outlet channel for N11-G1 will be a trapezoidal channel, the alignment and dimensions are shown on Exhibit 1 and includes with the following dimensions:

| | |
|---|---|
| Minimum Channel Depth (Spillway) | 1.7 ft. |
| (Outflow) | 1.5 ft. |
| Channel Width | 56 ft. |
| Channel Length (Spillway) | 86 ft. |
| (Outflow) | 190 ft. |
| Side Slopes (Horizontal to Vertical) | 3:1 or flatter |
| Average Slope (Spillway) | 0 % |
| Maximum Slope (Outflow) | 12.4 % |
| Spillway Elevation | 6760.8 |

A minimum 15-foot long riprap channel will be constructed beyond the toe of the embankment as a transition into the downstream natural channel.

Storage Capacity

The impoundment stage-capacity table (see Exhibit 1) is based on the 2008 aerial topographic mapping conducted for Peabody Western Coal Company. The total storage capacity of Structure N11-G1 is designed to contain approximately 19.91 acre-feet.

The calculations for the sediment load entering Structure N11-G1 were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

| | | |
|---|---|---|
| 1. | Rainfall Factor, R | 40 |
| 2. | Soil Erodibility Factor, K | 0.17 |
| 3. | Slope Factor, LS | 9.08 |
| 4. | Cover Factor, C | 0.18 |
| 5. | Erosion Control Factor, P | 0.95 |

The hydrologic analysis gives the storage volume required to treat the 10-year, 24-hour storm, and the remaining storage volume available for storing sediment. Structure N11-G1 does not have sufficient storage by itself; however, it will be in series with Structure N11-G downstream. The combined sediment storage capacity was determined for the two structures in series and the results of the analysis are presented in the following table.

Combined Storage for Structures N11-G1 and N11-G

| | N11-G1 | N11-G | Combined |
|---|---|---|---|
| Total Storage Capacity | 19.91 | 19.98 | 39.89 ac-ft |
| 10-Year, 24-Hour Storm Inflow | 24.02 | 1.78 | 25.80 ac-ft |
| Available Sediment | | | |
| Storage Capacity | -4.11 | 18.2 | 14.09 ac-ft |
| Sediment Inflow Rate/Yr | 3.37 | 0.53 | 3.92 ac-ft/yr |
| Sediment Storage Life | --- | --- | 3.6 yrs |

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

Appendix A - Hydrology, Hydraulic, and Sedimentation Calculations

Appendix B - SEDCAD+ (Input and Output) 10-year, 24-hour Storm Event

Appendix C - SEDCAD+ (Input and Output) 25-year, 6-hour Storm Event

Appendix D - N11-G1 INLET CHANNEL, SEDCAD+ (Input and Output) 100-year, 6-hour Storm Event

Exhibit 1 - N11-G and N11-G1 Sedimentation Ponds

# APPENDIX A

## HYDROLOGY, HYDRAULIC, AND SEDIMENTATION CALCULATIONS

## N11-G1

Project: N11-G1 Pond

Time of Concentration:

Elevation Difference = 7122 - 6747.7 = 374.3 ft.

Watercourse Length = 8846.54 ft. = 1.676 mi

Tc = [11.9(W.L.)^3/(E.D.)]^0.385 = 0.481 hr

SCS Curve Number:

| Cover Type | Soil Group | CN | Area (Acres) | CN*Area |
|---|---|---|---|---|
| Reclaimed | B | 81 | 73.99 | 5993.2 |
| Pinon-Juniper | B | 65 | 130.62 | 8490.3 |
| Pinon-Juniper | D | 83 | 414.82 | 34430.1 |
| Sage Brush | B | 60 | 47.67 | 2860.2 |
| | | | 667.1 | 51773.8 |

Weighted CN = 51773.8/667.1 = 77.61 = Use 78

Drainage Basin Area:

667.1 acres 1.04 sq. miles

SEDCAD Utility - Routing Parameter:

K = 0.000 hr

X = 0.000 hr

Revised USLE Calculations:

Project: N11-G1 Pond

Soil Erodibility Factor:

| Soil Type | Soil Group | K | Area (Acres) | K * Area |
|---|---|---|---|---|
| 15A | B | 0.28 | 47.56 | 13.32 |
| 16CE | B | 0.05 | 60.86 | 3.04 |
| 16F | B | 0.05 | 37.04 | 1.85 |
| 1AB | D | 0.16 | 10.38 | 1.66 |
| 3AB | D | 0.16 | 5.59 | 0.89 |
| 3CD | D | 0.16 | 113.48 | 18.16 |
| 3DE | D | 0.16 | 68.19 | 10.91 |
| 3F | D | 0.02 | 63.42 | 1.27 |
| 5 | B | 0.49 | 1.54 | 0.76 |
| 6AB | B | 0.49 | 28.53 | 13.98 |
| P | B | 0.02 | 0.27 | 0.01 |
| TS | B | 0.38 | 7.7 | 2.93 |
| 15A | B | 0.28 | 2.49 | 0.70 |
| 25 | D | 0.19 | 0.04 | 0.01 |
| 2B | D | 0.43 | 15.2 | 6.54 |
| 3D | D | 0.15 | 1.2 | 0.18 |
| 3E | D | 0.15 | 0.15 | 0.02 |
| 42 | D | 0.16 | 137.17 | 21.95 |
| Graded Spoil | B | 0.21 | 43.48 | 9.13 |
| Newly Reclaimed | B | 0.38 | 22.81 | 8.67 |
| | | | 667.1 | 115.96 |

Weighted k = 115.96/667.1 = 0.17 Use 0.17

Slope Factor:

| Length (ft) | Elev. Diff (ft) | Slope (%) | M | Theta (Degrees) | LS (L/72.6)^M*[17.2Sin(Theta)-0.55] |
|---|---|---|---|---|---|
| 500 | 70 | 12.73 | 0.6 | 7.25 | 5.46 |
| 700 | 90 | 12.86 | 0.6 | 7.33 | 6.41 |
| 500 | 99 | 19.80 | 0.6 | 11.20 | 8.88 |
| 500 | 100 | 20.00 | 0.6 | 11.31 | 8.99 |
| 550 | 174 | 31.64 | 0.6 | 17.56 | 15.64 |

Avg. LS = 9.08

Cover and Practice Factors:

| Cover Type | Cover (%) | Canopy (%) | Area (Acres) | C | C * Area | P | P * Area |
|---|---|---|---|---|---|---|---|
| Pinon-Juniper | 40 | 25 | 545.44 | 0.14 | 76.36 | 1.0 | 545.44 |
| Sage Brush | 40 | 25 | 47.67 | 0.13 | 6.20 | 1.0 | 47.67 |
| Newly Reclaimed | -- | -- | 73.99 | 0.725 | 53.64 | 0.336 | 24.86 |
| | | | 667.1 | | 136.20 | | 617.97 |

Weighted C = 136.20/667.1 = 0.20

Weighted P = 617.97/667.1 = 0.93

Rainfall Factor: R = 40

Revised USLE Calculations:

A = R*K*LS*C*P = 21.17 Ton/acre

A = 40 * 0.17 * 9.08 * 0.20 * 0.93 = 11.48 tons/acre

Sediment Inflow Rate:

DA = 667.1

SDR = 0.9

SI = (A*DA*SDR*94)/192,400 = 3.37 ac-ft/yr

APPENDIX B

N11-G1 SEDCAD+ (INPUT AND OUTPUT)

10-YEAR, 24-HOUR STORM EVENT

# N11-G1 POND DESIGN
# 10YR - 24HR STORM

Gary Altsisi, P.E.

Peabody Western Coal Co.
P.O. Box 650
Kayenta, AZ 86033

Phone: 928-677-3201

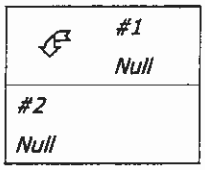
# *General Information*

## *Storm Information:*

| | |
|---|---|
| Storm Type: | NRCS Type II |
| Design Storm: | 10 yr - 24 hr |
| Rainfall Depth: | 2.100 inches |

# *Structure Networking:*

| Type | Stru # | (flows into) | Stru # | Musk. K (hrs) | Musk. X | Description |
|---|---|---|---|---|---|---|
| Null | #1 | ==> | #2 | 2.409 | 0.188 | N11-G1 Spillway |
| Null | #2 | ==> | End | 0.000 | 0.000 | |




# *Structure Routing Details:*

| Stru # | Land Flow Condition | Slope (%) | Vert. Dist. (ft) | Horiz. Dist. (ft) | Velocity (fps) | Time (hrs) |
|---|---|---|---|---|---|---|
| #1 | 2. Minimum tillage cultivation | 4.23 | 374.30 | 8,846.60 | 1.02 | 2.409 |
| **#1** | **Muskingum K:** | | | | | **2.409** |

## *Structure Summary:*

| | Immediate Contributing Area (ac) | Total Contributing Area (ac) | Peak Discharge (cfs) | Total Runoff Volume (ac-ft) |
|---|---|---|---|---|
| #1 | 667.100 | 667.100 | 166.43 | 24.02 |
| #2 | 0.000 | 667.100 | 118.19 | 24.02 |

## *Structure Detail:*

*Structure #1 (Null)*

*N11-G1 Spillway*

*Structure #2 (Null)*

# *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 | 667.100 | 0.481 | 0.000 | 0.000 | 78.000 | M | 166.43 | 24.020 |
| | **Σ** | **667.100** | | | | | | **166.43** | **24.020** |
| **#2** | **Σ** | **667.100** | | | | | | **118.19** | **24.020** |

# APPENDIX C

N11-G1 SEDCAD+ (INPUT AND OUTPUT)

25-YEAR, 6-HOUR STORM EVENT

# N11-G1 POND DESIGN

# 25YR-6HR STORM

Gary Altsisi, P.E.

Peabody Western Coal Co.
P.O. Box 650
Kayenta, AZ 86033

Phone: 928-677-3201

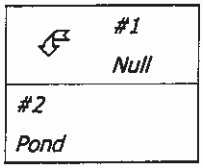
# *General Information*

## *Storm Information:*

| | |
|---|---|
| Storm Type: | NRCS Type II |
| Design Storm: | 25 yr - 6 hr |
| Rainfall Depth: | 1.900 inches |

# *Structure Networking:*

| Type | Stru # | (flows into) | Stru # | Musk. K (hrs) | Musk. X | Description |
|---|---|---|---|---|---|---|
| Null | #1 | ==> | #2 | 0.000 | 0.000 | |
| Pond | #2 | ==> | End | 0.000 | 0.000 | N11-G1 Spillway |



# *Structure Summary:*

| | | Immediate Contributing Area (ac) | Total Contributing Area (ac) | Peak Discharge (cfs) | Total Runoff Volume (ac-ft) |
|---|---|---|---|---|---|
| #1 | | 667.100 | 667.100 | 183.16 | 19.05 |
| #2 | In | 0.000 | 667.100 | 183.16 | 19.05 |
| | Out | | | 141.71 | 19.05 |

# *Structure Detail:*

*Structure #1 (Null)*

*Structure #2 (Pond)*

*N11-G1 Spillway*

Pond Inputs:

| | |
|---|---|
| Initial Pool Elev: | 6,760.80 ft |
| Initial Pool: | 19.91 ac-ft |

Emergency Spillway

| Spillway Elev | Crest Length (ft) | Left Sideslope | Right Sideslope | Bottom Width (ft) |
|---|---|---|---|---|
| 6,760.80 | 86.00 | 3.00:1 | 3.00:1 | 56.00 |

Pond Results:

| | |
|---|---|
| Peak Elevation: | 6,762.01 ft |
| Dewater Time: | 0.28 days |

*Dewatering time is calculated from peak stage to lowest spillway*

Elevation-Capacity-Discharge Table

| Elevation | Area (ac) | Capacity (ac-ft) | Discharge (cfs) | Dewater Time (hrs) |
|---|---|---|---|---|
| 6,747.70 | 0.221 | 0.000 | 0.000 | |
| 6,748.20 | 0.334 | 0.138 | 0.000 | |
| 6,748.70 | 0.469 | 0.338 | 0.000 | |
| 6,749.20 | 0.628 | 0.611 | 0.000 | |
| 6,749.70 | 0.810 | 0.970 | 0.000 | |
| 6,750.00 | 0.930 | 1.230 | 0.000 | |
| 6,750.20 | 0.955 | 1.419 | 0.000 | |
| 6,750.70 | 1.017 | 1.912 | 0.000 | |
| 6,751.20 | 1.082 | 2.437 | 0.000 | |
| 6,751.70 | 1.149 | 2.994 | 0.000 | |
| 6,752.20 | 1.218 | 3.586 | 0.000 | |
| 6,752.70 | 1.289 | 4.213 | 0.000 | |
| 6,753.20 | 1.361 | 4.875 | 0.000 | |
| 6,753.70 | 1.436 | 5.574 | 0.000 | |
| 6,754.20 | 1.513 | 6.312 | 0.000 | |
| 6,754.70 | 1.592 | 7.088 | 0.000 | |

| Elevation | Area (ac) | Capacity (ac-ft) | Discharge (cfs) | Dewater Time (hrs) | |
|---|---|---|---|---|---|
| 6,755.00 | 1.640 | 7.572 | 0.000 | | |
| 6,755.20 | 1.671 | 7.904 | 0.000 | | |
| 6,755.70 | 1.750 | 8.759 | 0.000 | | |
| 6,756.20 | 1.830 | 9.654 | 0.000 | | |
| 6,756.70 | 1.912 | 10.589 | 0.000 | | |
| 6,757.20 | 1.996 | 11.566 | 0.000 | | |
| 6,757.70 | 2.082 | 12.586 | 0.000 | | |
| 6,758.20 | 2.170 | 13.648 | 0.000 | | |
| 6,758.70 | 2.259 | 14.756 | 0.000 | | |
| 6,759.20 | 2.350 | 15.908 | 0.000 | | |
| 6,759.70 | 2.443 | 17.106 | 0.000 | | |
| 6,760.00 | 2.500 | 17.847 | 0.000 | | |
| 6,760.20 | 2.540 | 18.352 | 0.000 | | |
| 6,760.70 | 2.640 | 19.646 | 0.000 | | |
| 6,760.80 | 2.660 | 19.910 | 0.000 | | Spillway #1 |
| 6,761.20 | 2.737 | 20.991 | 32.288 | 4.40 | |
| 6,761.70 | 2.834 | 22.383 | 72.608 | 1.70 | |
| 6,762.01 | 2.896 | 23.272 | 141.712 | 0.70 | Peak Stage |
| 6,762.20 | 2.933 | 23.825 | 184.716 | | |
| 6,762.70 | 3.034 | 25.317 | 321.322 | | |
| 6,763.20 | 3.137 | 26.860 | 486.730 | | |
| 6,763.70 | 3.241 | 28.454 | 679.120 | | |
| 6,764.20 | 3.347 | 30.101 | 916.498 | | |
| 6,764.70 | 3.455 | 31.801 | 1,187.756 | | |
| 6,765.00 | 3.520 | 32.847 | 1,357.870 | | |
| 6,765.20 | 3.558 | 33.556 | 1,474.355 | | |
| 6,765.70 | 3.655 | 35.359 | 1,812.423 | | |
| 6,766.20 | 3.753 | 37.211 | 2,156.789 | | |
| 6,766.70 | 3.852 | 39.112 | 2,519.017 | | |
| 6,767.20 | 3.953 | 41.063 | 2,924.465 | | |
| 6,767.70 | 4.055 | 43.065 | 3,362.280 | | |
| 6,768.20 | 4.158 | 45.118 | 3,828.353 | | |
| 6,768.70 | 4.262 | 47.223 | 4,322.835 | | |
| 6,769.20 | 4.368 | 49.381 | 4,835.878 | | |
| 6,769.70 | 4.475 | 51.592 | 5,374.009 | | |
| 6,770.00 | 4.540 | 52.944 | 5,715.589 | | |

Detailed Discharge Table

| Elevation (ft) | Emergency Spillway (cfs) | Combined Total Discharge (cfs) |
|---|---|---|
| 6,747.70 | 0.000 | 0.000 |
| 6,748.20 | 0.000 | 0.000 |
| 6,748.70 | 0.000 | 0.000 |
| 6,749.20 | 0.000 | 0.000 |
| 6,749.70 | 0.000 | 0.000 |
| 6,750.00 | 0.000 | 0.000 |
| 6,750.20 | 0.000 | 0.000 |
| 6,750.70 | 0.000 | 0.000 |
| 6,751.20 | 0.000 | 0.000 |
| 6,751.70 | 0.000 | 0.000 |
| 6,752.20 | 0.000 | 0.000 |
| 6,752.70 | 0.000 | 0.000 |
| 6,753.20 | 0.000 | 0.000 |
| 6,753.70 | 0.000 | 0.000 |
| 6,754.20 | 0.000 | 0.000 |
| 6,754.70 | 0.000 | 0.000 |
| 6,755.00 | 0.000 | 0.000 |
| 6,755.20 | 0.000 | 0.000 |
| 6,755.70 | 0.000 | 0.000 |
| 6,756.20 | 0.000 | 0.000 |
| 6,756.70 | 0.000 | 0.000 |
| 6,757.20 | 0.000 | 0.000 |
| 6,757.70 | 0.000 | 0.000 |
| 6,758.20 | 0.000 | 0.000 |
| 6,758.70 | 0.000 | 0.000 |
| 6,759.20 | 0.000 | 0.000 |
| 6,759.70 | 0.000 | 0.000 |
| 6,760.00 | 0.000 | 0.000 |
| 6,760.20 | 0.000 | 0.000 |
| 6,760.70 | 0.000 | 0.000 |
| 6,760.80 | 0.000 | 0.000 |
| 6,761.20 | 32.288 | 32.288 |
| 6,761.70 | 72.608 | 72.608 |
| 6,762.20 | 184.716 | 184.716 |
| 6,762.70 | 321.322 | 321.322 |
| 6,763.20 | 486.730 | 486.730 |
| 6,763.70 | 679.120 | 679.120 |
| 6,764.20 | 916.498 | 916.498 |
| 6,764.70 | 1,187.756 | 1,187.756 |
| 6,765.00 | 1,357.870 | 1,357.870 |
| 6,765.20 | 1,474.355 | 1,474.355 |

| Elevation (ft) | Emergency Spillway (cfs) | Combined Total Discharge (cfs) |
|---|---|---|
| 6,765.70 | 1,812.423 | 1,812.423 |
| 6,766.20 | 2,156.789 | 2,156.789 |
| 6,766.70 | 2,519.017 | 2,519.017 |
| 6,767.20 | 2,924.465 | 2,924.465 |
| 6,767.70 | 3,362.280 | 3,362.280 |
| 6,768.20 | 3,828.353 | 3,828.353 |
| 6,768.70 | 4,322.835 | 4,322.835 |
| 6,769.20 | 4,835.878 | 4,835.878 |
| 6,769.70 | 5,374.009 | 5,374.009 |
| 6,770.00 | 5,715.589 | 5,715.589 |

# *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 | 667.100 | 0.481 | 0.000 | 0.000 | 78.000 | M | 183.16 | 19.046 |
| | **Σ** | **667.100** | | | | | | **183.16** | **19.046** |
| **#2** | **Σ** | **667.100** | | | | | | **183.16** | **19.046** |

# N11-G1 SPILLWAY CHANNEL

Material: Riprap

*Trapezoidal Channel*

| Bottom Width (ft) | Left Sideslope Ratio | Right Sideslope Ratio | Slope (%) | Freeboard Depth (ft) | Freeboard % of Depth | Freeboard Mult. x (VxD) |
|---|---|---|---|---|---|---|
| 56.00 | 3.0:1 | 3.0:1 | 12.4 | 1.00 | | |

PADER Method - Steep Slope Design

| | w/o Freeboard | w/ Freeboard |
|---|---|---|
| Design Discharge: | 183.16 cfs | |
| Depth: | 0.49 ft | 1.49 ft |
| Top Width: | 58.93 ft | 64.93 ft |
| Velocity: | 6.52 fps | |
| X-Section Area: | 28.09 sq ft | |
| Hydraulic Radius: | 0.475 ft | |
| Froude Number: | 1.66 | |
| Manning's n: | 0.0490 | |
| Dmin: | 3.00 in | |
| D50: | 6.00 in | |
| Dmax: | 9.00 in | |

TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION

May 5, 2009

PROGRAM INPUT DATA

| DESCRIPTION | VALUE |
|---|---|
| Flow Rate (cfs) | 183.16 |
| Channel Bottom Slope (ft/ft) | 0.0005 |
| Manning's Roughness Coefficient (n-value) | 0.048 |
| Channel Left Side Slope (horizontal/vertical) | 3.0 |
| Channel Right Side Slope (horizontal/vertical) | 3.0 |
| Channel Bottom Width (ft) | 56.0 |

COMPUTATION RESULTS

| DESCRIPTION | VALUE |
|---|---|
| Critical Depth (ft) | 0.68 |
| Critical Slope (ft/ft) | 0.0387 |
| Flow Velocity (fps) | 4.61 |
| Froude Number | 1.0 |
| Velocity Head (ft) | 0.33 |
| Energy Head (ft) | 1.01 |
| Cross-Sectional Area of Flow (sq ft) | 39.72 |
| Top Width of Flow (ft) | 60.11 |

# APPENDIX D

N11-G1 INLET CHANNEL

N11-G1 SEDCAD+ (INPUT AND OUTPUT)

100-YEAR, 6-HOUR STORM EVENT

# N11-G1 POND DESIGN
# 100YR-6HR STORM

Gary Altsisi, P.E.

Peabody Western Coal Co.
P.O. Box 650
Kayenta, AZ 86033

Phone: 928-677-3201

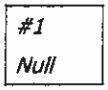
# General Information

## Storm Information:

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

# *Structure Networking:*

| Type | Stru # | (flows into) | Stru # | Musk. K (hrs) | Musk. X | Description |
|---|---|---|---|---|---|---|
| Null | #1 | ==> | End | 0.000 | 0.000 | |



# *Structure Summary:*

| | Immediate Contributing Area (ac) | Total Contributing Area (ac) | Peak Discharge (cfs) | Total Runoff Volume (ac-ft) |
|---|---|---|---|---|
| #1 | 667.100 | 667.100 | 326.06 | 32.11 |

# *Structure Detail:*

*Structure #1 (Null)*

# *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 | 667.100 | 0.481 | 0.000 | 0.000 | 78.000 | M | 326.06 | 32.108 |
| | **Σ** | **667.100** | | | | | | **326.06** | **32.108** |

# N11-G1 INLET CHANNEL

## Material: Riprap

*Trapezoidal Channel*

| Bottom Width (ft) | Left Sideslope Ratio | Right Sideslope Ratio | Slope (%) | Freeboard Depth (ft) | Freeboard % of Depth | Freeboard Mult. x (VxD) |
|---|---|---|---|---|---|---|
| 30.00 | 3.0:1 | 3.0:1 | 4.8 | 1.00 | | |

## PADER Method - Steep Slope Design

| | w/o Freeboard | w/ Freeboard |
|---|---|---|
| Design Discharge: | 326.06 cfs | |
| Depth: | 1.28 ft | 2.28 ft |
| Top Width: | 37.66 ft | 43.66 ft |
| Velocity: | 7.55 fps | |
| X-Section Area: | 43.17 sq ft | |
| Hydraulic Radius: | 1.134 ft | |
| Froude Number: | 1.24 | |
| Manning's n: | 0.0470 | |
| Dmin: | 3.00 in | |
| D50: | 6.00 in | |
| Dmax: | 9.00 in | |