CHAPTER 6

FACILITIES

# CHAPTER 6

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CHAPTER 6

FACILITIES

## Introduction

This chapter contains a description of the existing and proposed structures to be used in connection with or to facilitate the surface coal mining and reclamation activities at the Black Mesa and Kayenta Mines as described in this mine plan. For existing structures, a showing is made regarding compliance with the performance standards of 30 CFR Chapter VII, Subchapter K. For this purpose, the consulting engineering firm of Dames and Moore was retained to assist engineers at Peabody Western Coal Company (PWCC). Where necessary, a compliance plan is included which details the proposed modifications needed to assure compliance with the above standards. In addition, a construction schedule is included for such modifications (see Drawing No. 85406 and Table 10).

The need for new facilities is discussed. Where required for compliance or operations, new facilities have been identified and a schedule for design submission is included (see Table 1). In the case of diversions, the design information has been included in this submittal.

It is important to remember that the Black Mesa and Kayenta Mines are existing mines which require numerous support facilities. All facilities are either pre-law or have been approved under previous or current permits.

## Facilities Design Schedule

New facility designs which are not already included in Volumes 2 through Volume 7 and required in connection with or to facilitate the life-of-mine surface coal mining and reclamation plan are identified in Table 1 along with the estimated date of submission of the design plans. The location of these facilities may be found on the mine plan, facilities, and sediment and water control structures maps (Drawings 85210, 85400, 85405, and 85460 to 85490).

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TABLE 1

Facility Design Schedule

| Mining Subarea | Facility I.D. | Actual or Estimated Submittal Date* |
|---|---|---|
| N6 | J2-A MSHA Dam | 5/14/85 (2020) |
| J-3 | J3-G | 12/16/85 (2020) |
| J-21 | J21-A | 12/16/85 (2009) |
| N-6 | N5-A | 12/16/85 (2015) |
| Overland Conveyor | TPF-E | 1996 (2020) |
| J-21 | J21-C | 1/89 (2014) |
| N-11 | N11-G | (1993) |
| J-1 | J1-RA | (2006) |
| J-1 | J1-RB | (2006) |
| N-6 | N5-A2 | 2006 |
| Black Mesa Mine Haul Road | Moenkopi Crossing | 2005 |
| J-7 | J7-R | 1997 (2003) |
| J-19 | J7-JR MSHA Dam | (2020) |
| N-6 | N6-L | (2020) |
| N-10 | N10-A1 | (2020) |
| N-10 | N10-D | (2020) |
| N-10 | N10-F | 2010 |
| N-10 | N10-G | (2010) |
| N-10 | N10-G1 | 2010 |
| J-16 | J16-G | (2006) |
| N-14 | N14-F | (2006) |
| N-14 | N14-G | (2006) |
| N-14 | N14-H | (2006) |
| J-19 | J19-RB | (2020) |
| J-3 | J3-D | (2020) |
| J-3 | J3-E | (2020) |

TABLE 1 (Cont.)

Facility Design Schedule

| Mining Subarea | Facility I.D. | Actual or Estimated Submittal Date* |
|---|---|---|
| J-7 | J7-Dam | (2020) |
| J-16 | J16-A | (2020) |
| J-19 | J16-L | (2020) |
| N-6 | N12-C | (2020) |
| N-14 | N14-D | (2020) |
| Overland Conveyor | TPF-D | (2020) |
| Overland Conveyor | TPF-E | (2020) |
| J-28 | J28-SL | 2012 |
| N-99 | N11-H | 2007 |
| N-99 | N11-I | 2004 |
| N-99 | N11-I1 | 2004 |
| N-99 | N11-I2 | 2004 |
| N-99 | N11-J | 2004 |
| N-99 | N11-J1 | 2004 |
| N-99 | N11-J2 | 2004 |
| N-99 | N6-M (N-11 Ext. Remedial Work) | 2010 |
| N-99 | N6-M1 | 2010 |
| N-99 | N6/N11 CONVEYOR CROSSING/NORTH ROAD | 2004 |
| N-99 | N11 EXTENSION SOUTH ROAD | 2004 |
| N-99 | N11 EXTENSION SOUTH ROAD CULVERT DESIGN | 2010 |
| N-9 | N9 DEADHEAD & PRIMARY ROAD | 2005 |

*Dates in parentheses indicate permanent impoundment design submittal date. Submittal date based on calendar year.

TABLE 1 (Cont.)

Facility Design Schedule

| Mining Subarea | Facility I.D. | Actual or Estimated Submittal Date* |
|---|---|---|
| N-9 | N9-A | 2005 |
| N-9 | N9-A1 | 2005 |
| N-9 | N9-A2 | 2005 |
| N-9 | N9-B | 2005 |
| N-9 | N9-B1 | 2005 |
| N-9 | N9-B2 | 2005 |
| N-9 | N9-C | 2005 |
| N-9 | N9-C1 | 2005 |
| N-9 | N9-D | 2005 |
| N-9 | N9-E | 2005 |
| N-9 | N9-F | 2005 |
| N-9 | N9-G | 2005 |
| N-9 | N9-H | 2005 |
| N-9 | N9-I | 2005 |
| N-9 | N9-J | 2005 |
| N-9 | N9-J1 | 2005 |
| N-9 | N9-J2 | 2005 |
| N-9 | N9-J3 | 2005 |
| N-9 | N9-K | 2005 |

Dates in parentheses indicate permanent impoundment design submittal date. Submittal date based on calendar year.

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Diversions

PWCC constructed five diversions from 1980 to 1983 on the Black Mesa leasehold as presented in Attachment B. They include the Coal Mine Wash Channel Change (C.M.W.-C.C.), J-16 Channel Change (J16-C.C.), N-7/8 Channel Change (N-7/8-C.C.), N-14 Channel Change (N14-C.C.), and the N14-S Diversion. All of these structures were previously permitted under Permit AZ-0001. In addition, in 1993 PWCC constructed the Reed Valley Channel Diversion. The "as-built" was included in the April 19, 1994 J-19 Haul Road construction certification submittal. Design plans are included as Attachment C. This diversion is required to facilitate the J-19 Haul Road crossing of the Reed Valley Wash, to enable PWCC to maximize coal recovery, and to perform final reclamation grading in the J-19 mining area next to the J-19 Haul Road crossing. The location of these diversions are located on Drawing No. 85400, Drainage Area and Facilities Map and Drawing No. 85405, Sediment and Water Control Structures Map.

Most of the streams on the Peabody leasehold flow only in direct response to precipitation in the immediate watershed or in response to melting snow and ice. These streams have a channel bottom that is above the local water table. Large quantities of sediment are transported from the undisturbed areas during these runoff events (see Chapter 15). As these natural channels are highly erodible, it becomes impractical to design a relocated channel which is nonerodible and which will not carry a large sediment load. It is, instead, more appropriate to design a relocated channel which approximates the sediment transport capabilities and erosion characteristics of the natural channel. Table 2 contains measured average velocities in natural channels from runoff occurring as a result of precipitation events that are generally less than the design event (i.e., 10-year, 6-hour storm or 100-year, 6-hour storm). Most average velocities range from 6 to 10 feet per second(fps); however, velocities as high as 16.8 fps have been observed. These flows occurred in areas not influenced by mining or where the runoff from mining was controlled by sedimentation structures. One of the reasons existing channels can withstand such velocities is that storm runoff is heavily silt-laden. This fact is corroborated by actual measurements of total suspended solids concentrations in streamflows in the area (see Table 3 and Chapter 15). In addition, similar conclusions have been made by Simons, Li and Associates in a case study of a nearby coal mine in the Four-Corners area of New Mexico (Simons, Li and Associates, "Engineering Analysis of Fluvial Systems", undated).

Existing Pre-July 1990 Diversions (Interim Permit). Based on the construction dates of these structures, and the requirements of the Jurisdictional Permit and Affected Lands

TABLE 2

Measured Natural Channel Velocities on Black Mesa

| Site No. 1 | A.ppt2a. '•I cation | Stream | Date | Discharge (cfs) | Velocity (fps) | Method of Measurement |
|---|---|---|---|---|---|---|
| 37 | Upstream of the confluence with Dugout Wash | Reed Valley | July 16, 1984 | 500 | 11.3 | Slope-area |
| | | | July 27, 1984 | 105 | 8.6 | Surface floats |
| | | | Sept. 1, 1984 | 240 | 10.1 | Surface floats |
| 35 | 4 miles northeast of Reed Valley Site | Moenkopi Wash | July 23, 1984 | 380 | 7.2 | Surface floats |
| 25 | 8 miles southwest of Reed Valley Site | Coal Mine Wash | July 23, 1984 | 415 | 6.5 | Surface floats |
| 26 | 7 miles southwest of Reed Valley Site | Moenkopi Wash | July 23, 1984 | 240 | 8.7 | Surface floats |
| 50 | 8 miles northwest of Reed Valley Site | Upper Yellow Water Canyon | Aug. 10, 1983 | 220 | 7.7 | Current meter |
| | | | Sept.30, 1983 | 89 | 6.7 | Current meter |
| 78 | 4.5 miles southeast of Reed Valley Site | Upper Dinnebito Wash | Sept.30, 1983 | 557 | 7.2 | Current meter |
| 85 | 5 miles southwest of Reed Valley Site | Yucca Flat Wash | July 23, 1984 | 570 | 7.7 | Surface floats |
| | | | Aug. 14, 11584 | 3,900 | 16.8 | Surface floats |

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TABLE 2 (Cont.)

Measured Natural Channel Velocities on Black Mesa

| Site No. | Approximate Location | Stream | Date | Discharge (cfs) | Velocity (fps) | Method of Measurement |
|---|---|---|---|---|---|---|
| 155 | 7 miles southwest of Reed Valley Site | Red Peak Valley | Aug. 5, 1981 | 343 | 8.6 | Surface floats |
| 15 | 8 miles northwest of Reed Valley Site | Lower Yellow Water Canyon | Aug. 9, 1983 | 141 | 6.2 | Current meter |

1See Drawing No. 85600

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TABLE [illegible]

Observed Total Suspended Solids

Concentrations in Streamflows

| Site No.[1] | Stream | Date | Discharge (cfs) | Simultaneous Total Suspended Solids Concentration (mg/l) |
|---|---|---|---|---|
| 35 | Moenkopi Wash | Sept. 20, 1985 | 79 | 101,525 |
| 16 | Upper Coal Mine Wash 6 miles northwest of Reed Valley Site | July 29, 1985 | 12[illegible] | 38[illegible],[illegible]96 |
| 50 | Upper Yellow Water Canyon | July 18, 198[illegible] | 330 | 1,056,254 |
| 37 | Reed Valley Wash | Aug. 24, 1986 | 81 | 12[illegible],572 |
| 37 | Reed Valley Wash | July 23, 1986 | 44 | 94,36[illegible] |
| 25 | Coal Mine Wash at confluence with Moenkopi Wash | Aug. 21, 1986 | 116 | 131,912 |

[1]See Drawing No. 85600

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Map, Drawing No. 85360, these structures were permitted and approved in the AZ-0001 permit. The five pre-July, 1990 existing diversions were inspected during October, 1985 by a team of engineers from Dames & Moore. Attachment A contains the methodology employed during the analysis of these diversions. Attachment B presents the results of the diversion analysis and recommended remedial work where appropriate. The remedial work has been completed.

All of the diversion channels are designed to divert flows from undisturbed areas around disturbed lands associated with mining. There are no underground mines or workings on the leasehold. Flow from the N14 and J16 channel changes are part of the watershed to the N14-D and J16-A MSHA dams. Based on the results of Dames & Moore's analysis (Attachment B), all of these diversions are designed, located, constructed, maintained, and used to:

1. Be stable;
2. Provide protection against flooding and resultant damage to life and property; (the combination of channel, bank, and flood plain configuration is adequate to safely pass the peak runoff of a 10-year, 6-hour precipitation event for a permanent diversion handling miscellaneous flows);
3. Prevents, to the extent possible using the best technology currently available (i.e., MSHA-size dams, concrete fabriform, riprap, revegetation, etc.), additional contributions of suspended solids to streamflow outside the permit area; and
4. Comply with all applicable local, State, and Federal laws and regulations.

The proposed remedial activities have been completed. These channel changes and diversions will be maintained throughout the life of the mine and will preserve the existing hydrologic system, facilitate the removal of the coal resource, and provide satisfactory service throughout the life of the structures. The performance of such structures will be monitored and maintenance-will be performed as required.

Existing Post-July 1990 Diversion (Permanent Program Permit). The Reed Valley diversion was designed by Peabody to facilitate the J-19 Haul Road crossing of Reed Valley Wash based on the requirements of 30CFR816.43. The diversion site was inspected for existing conditions. The diversion is only approximately 700 feet long. Due to economics and to minimize disturbance to the natural wash, Peabody realigned approximately 250 feet of channel upstream of the J-19 Haul Road crossing and 450 feet of channel downstream. Attachment C presents the design for the Reed Valley Channel Diversion. The attachment discusses the general analytical methodologies employed. This diversion was constructed in 1993. The ker-s'id?/i divert miscellaneous flows or an ephemeral stream around the mining areas and under the J-19 Haul Road; however, it will drain a watershed larger than one square mile; therefore, based on OSM's regulation, it is also classified as an intermittent stream. This diversion is designed as a permanent diversion; therefore, a 100-year 6-hour precipitation event is used in the design. When the J-19 Haul Road is reclaimed, the 108-inch diameter culvert will be removed, and the channel under the culvert will be widened and riprapped to blend into the upstream and downstream channels (see the haul road and culvert reclamation procedures in the Transportation Facilities section of Chapter 6). The flow from the diversion is part of the J16-L, Reed Valley MSHA Dam s watershed. Based on the results of Peabody s design in Attachment C, this diversion was designed, located, constructed, maintained, and used to:

1. Be stable;
2. Provide protection against flooding and resultant damage to life and property;
3. Prevent, to the extent possible using the best technology currently available (i.e., J16-L MSHA Dam), additional contributions of suspended solids to streamflow outside the permit area;
4. Comply with all applicable local, State, and Federal laws and regulations; and
5. Be revegetated in accordance with the approved reclamation plan.

This channel design preserves the existing hydrologic system, facilitates the removal of the coal resource, and provides satisfactory service throughout the life of the structure. This channel diversion was designed and constructed to approximate the premining characteristics of the original stream channel.

Sediment and Water Control Facility Plan

In accordance with 30CFR816.45, PWCC will design, construct, and maintain appropriate sediment control measures to prevent, to the extent possible, additional contributions of sediment to streamflow or to runoff outside the permit area due to mining activity and to minimize erosion to the extent possible. Sediment control measures include practices utilized within and adjacent to the mining disturbance areas. The sedimentation storage capacity practices in and downstream from the disturbed areas will reflect the degree to which successful mining and reclamation techniques are applied to reduce erosion and control sediment. Sediment control measures will consist of the utilization of proper mining and reclamation methods and sediment control practices, singley or in combination. Sediment control methods may include, but not be limited to, the following:

1. Disturbing the smallest practicable area at any one time during the mining and construction operation;

to promote a reduction in the rate and volume if runoff;

3. Retaining sediment within disturbed areas;

4. Diverting runoff away from disturbance areas including stockpiles, backslopes, and material storage;

5. Diverting runoff through disturbed areas using stabilized earth channels, culverts, or pipes so as to prevent, to the extent possible, additional contributions of sediment to streamflow or to runoff outside the permit area;

6. Using straw dikes, silt fences, small V-ditches, riprap, mulches, check dams, ripping, contour furrowing, vegetative sediment filters, small depressions, sediment traps, and other measures that will reduce overland flow velocity, reduce runoff volume, or trap sediment; and

7. Treating traffic areas with water or dust suppressant to reduce the potential for wind and water erosion.

Siltation structures or sedimentation ponds are primarily utilized for controlling sediment from all disturbed areas, except those permitted areas exempted by the requirements of these regulations. Other alternative sediment control methods may be used in conjunction with the siltation structures or, in the case of the permitted areas which are exempt (e.g., roads) they may be utilized individually. The alternative sediment control methods will be constructed using the following or similar publications for guidance:

1. Handbook of Alternative Sediment Control Methodologies for Mined Lands; March, 1985; OSM;

2. Design of Sediment Control Measures for Small Areas in Surface Coal Mining; May, 1983; OSM;

3. Surface Mining Water Diversion Design Manual; September, 1982; OSM; and

4. Field Manual-Engineering for Conservation Practices; April, 1975; Natural Resource Conservation Service (MRCS).

Detailed procedures and methodology for the use of alternate sediment control practices are provided in Chapter 26. The location of all the existing and proposed impoundment structures can be found on Drawing No.85400, Drainage Area and Facilities Map and Drawing 85405, Sediment and Water Control Structures Map. A discussion of the purpose and design of the siltation structures and impoundments can be found in the following section, Sedimentation..-ETTts ~and Impoundments.

Sedimentation Ponds and Impoundments

Introduction. In accordance with 30CFR816.46, 816.47, 816.49, and 816.56, PWCC Coal will primarily use sedimentation ponds to prevent, to the extent possible, additional contributions of suspended solids sediment to streamflow or runoff outside the permit area due to mining disturbance. All surface drainage from the disturbed areas will be passed through a siltation structure before leaving the permit area, except in permit areas which are exempt from these regulations (see "Exemptions" section in this chapter). In the exempt areas, alternative sediment control structures may be used to meet or reduce additional contributions of sediment off the permit area.

After a careful evaluation of all the watershed boundaries and continual consultation with OSM, as of January 2008, PWCC has determined the need for approximately 188 sedimentation structures and impoundments over the life of the mine. In addition, due to changes in the regulations over the years, the redundancy of certain structures, and the changes in topography over time, 70 structures have been approved for reclamation by the regulatory authority. The location of these 258 structures (all impoundment structures, plus structures to be reclaimed) can be found on Drawing 85405, Sediment and Water Control Structures Map. The watershed boundaries for each of these structures can be found on Drawing 85400, Sheets 1 through 26, Drainage and Facilities Map. Table 4 provides a reference index of where design information can be found in the PAP for each structure. In 2004 to 2005, PWCC obtained final approval to permanently release 3 structures in the N-1/N-2 RLRA.

Data describing each of the 188 structures can be found on Drawing No. 85406, Siltation and Impoundment Structures Data. This is a summary table of all the existing and proposed structures. Within the 188 structures, 40 structures are proposed as permanent impoundments, and 148 structures are proposed as a temporary.

TABLE 4
SEDIMENT AND WATER CONTROL STRUCTURES REFERENCE INDEX
BLACK MESA/KAYENTA MINES

| OBS | STRUCTURE | TEXT LOCATION FOOTNOTE | DESIGN (1) LOCATION | PRIMARY PERMIT CATEGORY | ENGINEERING REVIEW |
|---|---|---|---|---|---|
| 1 | BM-A1 | 1 | 2H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 2 | BM-B | 1 | 2H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 3 | BM-FWP | 4 | 2H | Temporary Impoundment (2006-2010) | Peabody Western Coal Co. |
| | BM-SS | 1 | 2H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 5 | BM-T | 4 | 2H | Temporary Impoundment (2006-2010) | Peabody Western Coal Co. |
| 6 | BM-TW | 4 | 2H | Temporary Impoundment (2006-2010) | Peabody Western Coal Co. |
| 7 | CW-A | 4 | 2H | Temporary Impoundment (2006-2010) | Peabody Western Coal Co. |
| 8 | CW-B | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 9 | J16-A | 3,5 | 3H, 7K, 7L, 7T | Permanent Impoundment (MSHA) | Sergent, Hauskins, and Beckwith |
| 10 | J16-B | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 11 | J16-C | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 12 | J16-D | 1 | 3H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 13 | J16-E | 1 | 3H | Temporary Sediment Pond (2000-2005) | Dames and Moore |
| 14 | J16-F | 1 | 3H | Temporary Sediment Pond (2000-2005) | Dames and Moore |
| 15 | J16-G | 1,5 | 3H, 7T | Permanent Impoundment | Dames and Moore |
| 16 | J16-H | 7 | N/A | Structure Reclaimed(SAE) (Interim Program) | Peabody Western Coal Co. |
| 17 | J16-I | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 18 | J16-J | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 19 | J16-K | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 20 | J16-L | 3,5 | 7K, 7L, 7T | Permanent Impoundment (MSHA) | Rollin, Brown, Gunnell |
| 21 | J19-A | 1 | 3H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 22 | J19-B | 1 | 3H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 23 | J19-D | 1 | 3H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 24 | J19-E | 1 | 3H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 25 | J19-RA | 4 | 3AH | Temporary Impoundment | Peabody Western Coal Co. |
| 26 | J19-RB | 5 | 3AH, 7T | Permanent Impoundment | Peabody Western Coal Co. |
| 27 | J21-A | 1,5 | 3AH, 7T | Permanent Impoundment | Dames and Moore. |
| 28 | J21-A1 | 1 | 3AH | Temporary Sediment Pond (2000-2005) | Dames and Moore |
| 29 | J21-B | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 30 | J21-C | 1,5 | 3AH, 7T | Permanent Impoundment | Peabody Western Coal Co. |
| 31 | J21-C2 | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 32 | J21-D | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 33 | J21-E | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 34 | J21-F | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 35 | J21-F1 | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 36 | J21-G | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 37 | J21-G1 | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 38 | J21-H | [illegible] | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 39 | J21-H1 | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 40 | J21-I | 1,5 | 3AH, 7T | Permanent Impoundment | Peabody Western Coal Co. |
| 41 | J21-I1 | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 42 | J21-I2 | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 43 | J21-J | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 44 | J21-T1 | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 45 | J21-T2 | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 46 | J21-T3 | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 47 | J21-T4 | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |



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TABLE (Cont.)
SEDIMENT AND WATER CONTROL STRUCTURES REFERENCE INDEX
BLACK MESA/KAYENTA MINES

| OBS | STRUCTURE | TEXT LOCATION FOOTNOTE | DESIGN (1) LOCATION | PRIMARY PERMIT CATEGORY | ENGINEERING REVIEW |
|---|---|---|---|---|---|
| 48 | J27-A | 1 | 3AH | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 49 | J27-B | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 50 | J27-RA | 1,5 | 4H,7T | Permanent Impoundment | Peabody Western Coal Co. |
| 51 | J27-RB | | 4H,7T | Permanent Impoundment | Peabody Western Coal Co. |
| 52 | J27-RC | 1 5 | 4H,7T | Permanent Impoundment | Peabody Western Coal Co. |
| | J28 A | | N/A | Structure Reclaimed | Dames and Moore |
| | J28-B | | 4H | Temporary Impoundment | Dames and Moore |
| | J28-C | 4 | 4H | Temporary Impoundment | Dames and Moore |
| | J28-D | | 4H | Temporary Impoundment | Dames and Moore |
| | J28-E | | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| | J28-F | | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| | J28-G | 4 | 4H | Temporary Impoundment | Dames and Moore |
| | J28-H | 6 | N/A | Structure Reclaimed | Peabody Western. Coal Co. |
| | J28-I | | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| | J28-SL | | 4H | Temporary Impoundment | Peabody Western Coal Co. |
| | J1 A | 1 | | Temporary Impoundment | Peabody Western Coal Co. |
| | J1-RA | 5 | 2H,7T | Permanent Impoundment | Peabody Western Coal Co. |
| | J1-RB | 5 | 2H,7T | Permanent Impoundment | Peabody Western Coal Co. |
| | J2-A | 3,5 | 7T | Permanent Impoundment (MSHA) | Sergent, Hauskins, and Beckwith |
| | J3-A | 1 | 2H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J3-B | 1 | 2H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J3-C | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| | J3-D | 1,5 | 2H,7T | Permanent Impoundment | Dames and Moore |
| | J3 E | 1,5 | 2H,7T | Permanent Impoundment | Dames and Moore |
| | J3 F | 1 | 2H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J3-G | 1,5 | 2H,7T | Permanent Impoundment | Dames and Moore |
| | J3-H | 4 | 2H | Temporary Impoundment | Peabody Western Coal Co. |
| | J3 SL | 4 | 2H | Temporary Impoundment | Peabody Western Coal Co. |
| | J7-A | 1 | 2H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-B | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| | J7-B1 | 1 | 2H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-CD | 1 | 2H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-DAM | 3,5 | 7K,7R,7T | Permanent Impoundment (MSHA) | Sergent, Hauskins, and Beckwith |
| | J7-E | 1 | 2H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-F | 1 | 3H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-G | 1 | 3H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-H | 1 | 3H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-I | 1 | 3H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-J | 1 | 3H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-JR | 3,5 | 7T | Permanent Impoundment (MSHA) | Montgomery Watson |
| | J7-K | 1 | 3H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-L | 6 | N/A | Structure Reclaimed | Dames and Moore |
| | J7-M | 6 | 3H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| | J7-N | 6 | N/A | Structure Reclaimed | Dames and Moore |
| | J7-O | 6 | N/A | Structure Reclaimed | Dames and Moore |
| | J7-P | 6 | N/A | Structure Reclaimed | Dames and Moore |
| | J7-Q | 6 | N/A | Structure Reclaimed | Dames and Moore |
| | J7 Q1 | 6 | N/A | Structure Reclaimed | Dames and Moore |



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TABLE ,Cont.)
SEDIMENT AND WATER CONTROL STRUCTURES REFERENCE INDEX
BLACK MESA/KAYENTA MINES

| OBS | STRUCTURE | TEXT LOCATION FOOTNOTE | DESIGN (1) LOCATION | PRIMARY PERMIT CATEGORY | ENGINEERING REVIEW |
|---|---|---|---|---|---|
| 96 | J7-R | 1,5 | 3H,7T | Permanent Impoundment | Peabody Western Coal Co. |
| 97 | J7-R1 | 1 | 3H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 98 | J7-S | 1 | 3H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 99 | J7-T | 1 | 3H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 100 | J7-U | 1 | 3H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 101 | J7-V | 1 | 3H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 102 | KM-A | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 103 | KM-A2 | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 104 | KM-A3 | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 105 | KM-B | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 106 | KM-C | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 107 | KM-D | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 108 | KM-E | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 109 | KM-E1 | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 110 | KM-FWP | 3 | 7K,7R | MSHA Size Structure | Sergent, Hauskins, and Beckwith |
| 111 | KM-TPB | 1 | 4H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 112 | KM-TPB1 | 1 | 4H. | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 113 | KP | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 114 | LF-1 | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 115 | LF-2 | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 116 | LF-3 | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 117 | MW-A | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 118 | MW-B | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 119 | N10-A | 1 | 6H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 120 | N10-A1 | 1,5 | 6H,7T | Permanent Impoundment | Dames and Moore |
| 121 | N10-A2 | 1 | 6H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 122 | N10-B | 1 | 6H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 123 | N10-B1 | 1 | 6H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 124 | N10-C | 1 | 6H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 125 | N10-D | 1,5 | 6H,7T | Permanent Impoundment | Dames and Moore |
| 126 | N10-D1 | 1 | 6H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 127 | N10-E | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 128 | N10-F | 2 | | Temporary Sediment Pond (2005-2022) | Peabody Western Coal |
| 129 | N10-G | 2,5 | 7T | Permanent Impoundment (2005-2022) | Peabody Western |
| 130 | N10-G1 | 2 | | Temporary Sediment Pond (2005-2022) | Peabody Western Coal Co. |
| 131 | N11-A | 1,5 | 6H,7T | Permanent Impoundment | Peabody Western Coal Co. |
| 132 | N11-A1 | 1 | 6H | Temporary Sediment Pond (2006-2010) | Peabody Western |
| 133 | N11-A2 | 1 | 6H | Temporary Sediment Pond (2006-2010) | Peabody Western |
| 134 | N11-C | 1 | 6H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 135 | N11-E | 1 | 6H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 136 | N11-G | 1,5 | 6H,7T | Permanent Impoundment | Peabody Western Coal Co. |



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TABLE 4 (Cont.)

SEDIMENT AND WATER CONTROL STRUCTURES REFERENCE INDEX

BLACK MESA/KAYENTA MINES

| OBS | STRUCTURE | TEXT LOCATION | DESIGN [1] LOCATION | PRIMARY PERMIT CATEGORY | ENGINEERING REVIEW |
|---|---|---|---|---|---|
| 137 | N11-G | 1 | 6H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 138 | N11-da | 1 | 6H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 139 | N11-G3 | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 140 | N11-H | | | Temporary Sediment Pond (2006-2010) | Montgomery Watson |
| 141 | N11-I | | 6H | Temporary Sediment Pond (2006-2010) | Montgomery Watson |
| 142 | N11-I1 | 1 | 6H | Temporary Sediment Pond (2006-2010) | Montgomery Watson |
| 143 | N11-I2 | 1 | 6H | Temporary Sediment Pond (2006-2010) | Montgomery Watson |
| 144 | N11-J | 1 | 6H | Temporary Sediment Pond (2006-2010) | Montgomery Watson |
| 145 | N11-J1 | 1 | 6H | Temporary Sediment Pond (2006-2010) | Montgomery Watson |
| 146 | N11-J2 | 1 | 6H | Temporary Sediment Pond (2006-2010) | Montgomery Watson |
| 147 | N12-A | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 148 | N12-C | 1,5 | 6AH,7T | Permanent Impoundment | Dames and Moore |
| 149 | N12-C1 | 1 | 6AH | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 150 | N12-C2 | 1 | 6AH | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 151 | N12-F | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 152 | N12-G | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 153 | N12-H | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 154 | N12-I | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 155 | N12-J | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 156 | N12-K | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 157 | N12-L | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 158 | N12-M | 1 | 6AH | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 159 | N12-N | 1 | 6AH | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 160 | N13-A | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 161 | N13-B | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 162 | N13-C | 7 | N/A | Structure Reclaimed (SAE) | Peabody Western Coal Co. |
| 163 | N13-D | 7 | N/A | Structure Reclaimed (SAE) | Peabody Western Coal Co. |
| 164 | N13-E | 7 | N/A | Structure Reclaimed (SAE) | Peabody Western Coal Co. |
| 165 | N14-A | 7 | N/A | Structure Reclaimed (SAE) | Peabody Western Coal Co. |
| 166 | N14-B | 1 | 6AH | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 167 | N14-C | 1 | 6AH | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 168 | N14-D | 3,5 | 7K,7T | Permanent Impoundment (MSHA) | Sergent, Hauskins, and Beckwith |
| 169 | N14-E | 3 | 7K | MSHA Size Structure | Sergent, Hauskins, and Beckwith |
| 170 | N14-F | 3,5 | 7K,7J,7T | Permanent Impoundment (MSHA) | Sergent, Hauskins, and Beckwith |
| 171 | N14-G | 3,5 | 7K,7T | Permanent Impoundment (MSHA) | Sergent, Hauskins, and Beckwith |
| 172 | N14-H | 3,5 | 7K,7T | Permanent Impoundment (MSHA) | Sergent, Hauskins, and Beckwith |
| 173 | N14-L | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 174 | N14-M | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 175 | N14-N | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 176 | N14-O | 7 | N/A | Structure Reclaimed (SAE) | Peabody Western Coal Co. |
| 177 | N14-P | 1 | 6AH | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 178 | N14-Q | 1 | 6AH | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 179 | N14-R | 7 | N/A | Structure Reclaimed (SAE) | Peabody Western Coal Co. |
| 180 | N14-S | 7 | N/A | Structure Reclaimed (SAE) | Peabody Western Coal Co. |
| 181 | N14-T | 1 | 7Y | Temporary Sediment Pond (2000-2005) | Peabody Western Coal Co. |
| 182 | N1-AC | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 183 | N1-F | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |

TABLE 4 (Cont.)
SEDIMENT AND WATER CONTROL STRUCTURES REFERENCE INDEX
BLACK MESA/KAYENTA MINES

| OBS | STRUCTURE | TEXT LOCATION FOOTNOTE | DESIGN (1) LOCATION | PRIMARY PERMIT CATEGORY | ENGINEERING REVIEW |
|---|---|---|---|---|---|
| 184 | N1-L | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 185 | N1-M | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 186 | N1-N | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 187 | N1-O | 1 | 4H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 188 | N2-G | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 189 | N5-A | 1,5 | 5H,7T | Permanent Impoundment | Dames and Moore |
| 190 | N5-Ai | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 191 | N5-A2 | 1 | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 192 | N5-D | 1 | 5H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 193 | N5-E | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 194 | N5-F | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 195 | N5-G | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 196 | N6-C | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 197 | N6-D | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 198 | N6-D1 | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 199 | N6-E | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 200 | N6-F | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 201 | N6-G | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 202 | N6-H | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 203 | N6-I | 1 | 5H | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| 204 | N6-J | 1 | 5H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 205 | N6-K | 2 | 5H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 206 | N6-K1 | 1 | 5H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 207 | N6-L | 1,5 | 5H,7T | Permanent Impoundment | Peabody Western Coal Co. |
| 208 | N6-M | 1 | 5H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 209 | N6-M1 | 1 | 5H | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| 210 | N6-T1 | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 211 | N6-T2 | 6 | N/A | Structure Reclaimed | Peabody Western Coal Co. |
| 212 | N7-A1 | 6 | Interim, Vol 54, 5H | Structure Reclaimed | Peabody Western Coal Co. (AZ-0001) |
| 213 | N7-B | 6 | Interim, Vol 54 | Structure Reclaimed (AZ-0001) | Peabody Western Coal Co. |
| 214 | N7-C | 6 | Interim, Vol 54 | Structure Reclaimed (AZ-0001) | Peabody Western Coal Co. |
| 215 | N7-D | 1,5 | 5H,7T | Permanent Impoundment | Dames and Moore |
| 216 | N7-E | 1,5 | 5H,7T | Permanent Impoundment | Dames and Moore |
| 217 | N7-E1 | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 218 | N8-A | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 219 | N8-B | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 220 | N8-B1 | 6 | N/A | Structure Reclaimed | Dames and Moore |
| 221 | N8-RA | 5 | 6H,7T | Permanent Impoundment | Peabody Western Coal Co. |

| | | | | |
|---|---|---|---|---|
| N9-A | 4 | * | Temporary Sediment Pond (2006-2037) | Peabody Western Coal Co. |
| N9-A1 | | * | Temporary Sediment Pond (2006-2037) | Peabody Western Coal Co. |
| N9-A2 | 1 | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-B | 1 | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-B1 | | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-B2 | 1 | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-C | 1 | * | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-C1 | 1 | * | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-D | 1 | * | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-E | | * | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-F | 1 | * | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-G | | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-H | | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-I | | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-J | | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-J1 | | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-J2 | | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-J3 | | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| N9-K | | | Temporary Sediment Pond (2006-2010) | Peabody Western Coal Co. |
| TPC-A | 6AH | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| TPF-A | 6AH | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| TPF-B | N/A | | Structure Reclaimed (SAE) | Peabody Western Coal Co. |
| TPF-C | N/A | | Structure Reclaimed (SAE) | Peabody Western Coal Co. |
| TPF-D | 6AH, 7T | | Permanent Impoundment | Dames and Moore |
| TPF-E | 6AH, 7T | | Permanent Impoundment | Peabody Western Coal Co. |
| TS-A | 6AH | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| TS-B | 6AH | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| WW-2 | 6AH | | Temporary Impoundment | Dames and Moore |
| WW-3 | 6AH | | Temporary Impoundment | Dames and Moore |
| WW-4 | 6AH | | Temporary Sediment Pond (2006-2010) | Western Technologies |
| WW-5 | 6AH | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| WW-6 | 6AH | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| WW-9 | 6AH | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| WW-9A | 6AH | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| WW-9B | 6AH | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| WW-9C | 6AH | | Temporary Sediment Pond (2006-2010) | Dames and Moore |
| WW-9D | N/A | | Structure Reclaimed | Dames and Moore |





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Footnotes:

Text Location footnote:

1. Temporary sedimentation pond (2000-2005) - See Volume 1, Chapter 6, and Volume 22, Drawing No. 85406 of the PAP. Also see Attachments D, H, S, and U.

2. Temporary sedimentation pond (2006-2011)(Life-of-Mine) - See Volume 1, Chapter 6, and Volume 22, Drawing No. 85406 of the PAP. Also see Attachment I.

3. MSHA-sized dams - See Volume 1, Chapter 6, and Volume 22, Drawing No. 85406 of the PAP. Also see Attachments E, J, K, R, and U.

4. Temporary impoundments (2000-2023) - See Volume 1, Chapter 6, and Volume 22, Drawing 85406 of the PAP. Also see Attachments D, H, S, U, and I.

5. Permanent impoundments - See Volume 1, Chapter 6, and Volume 22, Drawing No. 85406 of the PAP. Also see Attachments D, H, and T.

6. Impoundment to be reclaimed - See Volume 1, Chapter 6, and Volume 22, Drawing No. 85406 of the PAP.

7. Structure Reclaimed (SAE) - Small Area Exemption - see Chapter 6 "Exemption" section of the PAP and Volume 22, Drawing No. 85406.

Design Location:

(1) Denotes PAP volume and attachment
* Detailed design plans to be provided per schedule, Table 1

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The 40 permanent impoundments were identified in consultation with OSMRE and the Tribes as part of the postmining land use.

Sedimentation ponds and impoundments are designed to comply with the requirements of 30CFR780.11, 780.12, 780.25, 816.45, 816.46, 816.47, 816.49, 816.56, and other applicable regulations. Attachment H in Volumes 2 through 6A contains the individual "Sedimentation and Impoundment Structures Inspection and Design Reports" in alphabetical order. Included in each report is a description of the field inspection, a site description, input and output results of the stability, hydrology, and hydraulics analysis for each structure, a remedial compliance plan for the geotechnical and hydraulic aspects of the structure when necessary, a copy of the field inspection report for the structure, and a copy of hydrology and Universal Soil Loss Equation (USLE) or Revised Universal Soil Loss Equation (RUSLE) calculations when applicable.

Three structures in N-10 are required for the life-of-mine plan (2010-2023). Two of these structures are temporary structures. These structures are required to control sediment generated by the mining operations occurring beyond the year 2005. It is the intent of PWCC to design these ponds to contain the runoff from a 10-year, 24-hour precipitation event and, at the minimum, contain the sediment from more than one design storm event [i.e., Modified Universal Soil Loss Equation (MUSLE) calculations or 2 years of USLE or RUSLE calculations].

The following is an outline of the procedures used to design these structures:

1. Identify the need and probable location of the proposed structure from the 1" = 400' scale Drainage Area maps (Drawing 85400);
2. Determine the size and hydrologic parameters of the watershed using detailed procedures described in the "General Report, Geotechnic, Hydrologic, and Hydraulic Evaluation of Sedimentation Structures" by Dames & Moore (Attachment D); and
3. Determine the quality of runoff and sediment generated by the watershed using the University of Kentucky's hydrology and sedimentology computer model SEDIMOT II, SEDCAD+, and/or RUSLE calculations.

Attachment I contain the typical input used for SEDIMOT II. Drawing No. 85406 contains a list of the ponds, the location, map number (Drawing 85400), proposed construction date, proposed reclamation date, hydrology design input and output variables, and the proposed minimum design storage capacity. The three ponds will be designed alone or in series to handle the runoff and sediment based on the 30CFR780 and 816 regulations. These results are preliminary; detailed designs will be submitted for approval, according to the schedule provided in Table 1 before construction is initiated.

The Black Mesa is part of the Colorado Plateau Province characterized by flat-topped mesas and plateaus, isolated buttes, and desert valleys. The mesa covers approximately 2.1 million acres. Along its northern boundary, the mesa rises abruptly in a 1,200 to 2,000 foot high uneven wall, then descends gently downward through rolling hills to the Little Colorado River. The maximum elevation at the rim is roughly 8,200 feet. The elevation of PWCC's leases ranges from approximately 7,200 to 6,200 feet and the leases include approximately 64,858 acres.

The regional topography is a result of large scale, shallow folding which occurred during the Laramide Orogeny when strata were regionally unwarped and folded into broad, gentle domes and saddles accompanied by minor faulting. Subsequent erosion created the mesas during the relatively stable period lasting from the late Cretaceous to the present. The topography is characterized by steeply-incised and extensive drainage systems.

An arid-steppe climate is experienced on the Black Mesa. Typically, the mine area has long dry periods, dry clear air with low humidity, and a high percentage of sunshine. The average annual precipitation is approximately ten inches occurring primarily in the form of convectional showers during the summer months. Long periods often occur with little or no precipitation. Average annual temperatures range from about 30°F in January to 75°F in July. The elevation of the mesa keeps the location relatively cool. The prevailing wind direction is from the south and southwest. The frost-free period extends for approximately 150 days from mid-May into September.

The lease area is within the Colorado River drainage system. Streamflows are generally to the southwest in parallel drainage patterns toward the Little Colorado River. The drainage network on the lease is generally from the northeast to southwest and includes Yellow Water Canyon Wash, Coal Mine Wash, Moenkopi Wash, and Dinnebito Wash. These drainages reach their confluence with the Little Colorado River approximately 75 miles southwest of the lease area. Most of the stream channels on the lease area are classified as ephemeral channels with minor reaches being classified as intermittent; however, due to OSM's 30 CFR 701.5 definition of intermittent streams, the downstream reach of the ephemeral streams are also classified as intermittent streams if a stream channel or read channel drains a watershed of at least one square mile.

All new sedimentation ponds and impoundments will be designed, certified by a professional engineer, submitted to and approved by the regulatory authority, constructed under the supervision of a professional engineer, and the as-built drawing will be submitted to the regulatory authority prior to the occurrence of mining disturbance in the watershed. Sedimentation ponds and impoundments will be inspected and maintained until the disturbed areas have been stabilized and successfully revegetated, and will not be removed sooner than two (2) years after the last augmented seeding or prior to approval by the regulatory authority. When temporary siltation structures and impoundments are removed, the land on which the structure was located will be regraded and revegetated in accordance with the reclamation plan (Chapter 23).

When sedimentation ponds are used, they will be used individually or in series to control the designed runoff and sediment storage. Ponds will be located as near as possible to disturbed areas and out of perennial streams. The stream channels in the proposed permit area are classified as ephemeral streams with minor portions of some reaches being intermittent (Chapter 15).

All of the sedimentation ponds will be designed and constructed to contain or treat, in addition to the design storm runoff volume, a minimum of two-years of sediment storage based on USLPE or RUSLE calculations or more than one equivalent design storm's sediment inflow based on MUSLE calculations. When the pond's sediment storage volume becomes less than one year of sediment based on USLE or RUSLE calculations or less than a minimum of one equivalent design storm's sediment inflow based on MUSLE calculations, Peabody will restore the above minimum sediment storage volume. Any material excavated from the ponding area will be inspected or analyzed by a soil scientist to determine whether the rhtt a::,represents suitable plant growth media. If the material is suitable, it will be s(ad iSi-t'nin the pond disturbance area or on reclaimed areas of the mine. If the m tbrial S not suitable, it will be disposed of in accordance with PWCC's backfilling grading:15lan, a minimum of four feet below the final reclaimed surface.

Sonds6z4'l be inspected and maintained to contain or treat the runoff from one 10-year, 2'b'-hour precipitation event and to contain at least one year of sediment storage based on USLE or RUSLE calculations. This minimum storage level beneath the spillway will be determined by: field surveys or aerial surveys; measuring the difference between the spillway elevation and the water or sediment level, then using the stage-capacit curve to determine if adequate capacity remains in the pond; by staking at the level beneath the principal spillway elevation where the capacity is equal to the runoff from the design storm; or by other acceptable methods as directed by PWCC's Professional engineer. The storage level beneath this minimum storage volume may be used for, but not limited to, the following purposes:

1. Additional sediment storage to reduce the frequency of storage capacity maintenance; and
2. Additional runoff or pumpage from local facilities (i.e., transfer wash down water, pumpage from other ponds, pumpage from sumps and pits, pumpage and runoff from the redrilling or testing of Peabody's Navajo acquifer wells, runoff from local public water supply due to water spillage or washing of vehicles, etc.). This additional runoff or pumpage is too unpredictable to obtain accurate volume estimates; therefore, some ponds are oversized and periodically inspected to account for this eventuality.

All of the sedimentation ponds will be designed, constructed, and maintained to contain or treat the runoff from a 10-year, 24-hour precipitation event plus a minimum sediment storage; therefore, all sedimentation ponds will provide adequate detention time to allow the effluent from the ponds to meet State and Federal effluent limitations.

In addition, all ponds will be designed and constructed to minimize, to the extend possible, short circuiting. With virtually all of the sedimentation ponds designed to completely contain the runoff from at least the 10-year, 24-hour precipitation event, short circuiting discharge through the spillway outlet should not be a problem in order to meet State and Federal effluent limitation.

All water and sediment control facilities have been designed according to acceptable engineering practices and applicable regulatory requirements. Specific design criteria and procedures considered applicable are described in this mine permit.

Hydrological methods developed by organizations such as the U.S. Department of Agriculture-Natural Resources Conservation Service (MRCS), the U.S. Army Corps of Engineers, the [illegible] eclamation, and the U.S. Department of Transportation are utilized by PWCC. Since NRCS methods are widely used domestically and internationally for analysis of both rural and urban watersheds, these methods are used for most hydrological analysis. For more specialized hydrological problems, computer programs will be utilized such as HEC-1 developed by the Corps of Engineers, SEDIMOT II. developed by the University of Kentucky, and SEDCAD+ developed by Civil Software of Lexington, Kentucky. Attachments D, I, O, and S contain a general description of HEC-1, SEDIMOT II, and SEDCAD, and the generic input parameters.

However, PWCC's engineers may, on occasion, use methods which differ from the design procedures submitted herein if, in their judgment, such deviation is warranted. Submittals utilizing a methodology other than described herein will be explained and justified. Designs will be submitted to the regulatory agency and approved prior to construction. During construction, any required major deviations from the approved design will be noted in the certified "as-built" report to the regulatory authorities and a request for a permit revision to the original design will be requested. Until the permit revision is approved, no additional mining disturbance will occur in the watershed. In all cases, a professional engineer will review the deviations during construction, and the requirements of the regulations will be followed. Construction deviations reviewed and approved by the Registered Professional Engineer which are considered to be more conservative or which still allows the structure to exceed the minimum design standard described in this chapter and in the regulations, will not require a permit revision. During construction, unforeseen topographic, geological, or other conditions may be encountered which could require minor realignment of the embankment, changes to the size of the ponding area, or other minor deviations. In no case will the ponding area be constructed less than the design precipitation event sJ.dequate volume for sediment storage when required by the regulations. This will allow .Fie flexibility required by PWCC to make field decisions during construction iiithout'-u duly interrupting the construction schedule for each structure.

H'arolo1#$ Design Frequency. Design frequency as it is commonly used in hydrologic desicjn. describes how often a storm runoff event of a particular magnitude or larger is 1. ly to occur. This event is usually expressed in terms of years, meaning that a storm runoff event will be equaled or exceeded on the average of one time during the interval. The probability of an event occurring in any one year is the reciprocal of the frequency. Conversely, further probability analyses can determine the required design frequency when the design life and an acceptable probability of the stru'' re de52.gn capacity being exceeded during the design life is specified.

Mandatory minimum design frequencies for each type of water and sediment control facility, except for impoundments, have been specified by the regulatory agency. The following minimum frequencies are used by PWCC to design sediment and water control structures. Due to the rural location of the mine site and with no one living in close proximity downstream in the floodplain, all structures' Impoundment Hazard Classification are classified as Class (A) structures, (see Drawing No. 85406).

| Structure Type (Class - A) | Minimum Frequency | |
|---|---|---|
| | Storage | Spillway |
| Temporary Sedimentation Ponds | 10-year, 24-hour | 25-year, 6-hour |
| MSHA-size Dams | 10-year, 24-hour | 100-year, 6-hour |
| Temporary Impoundments | As Designed | 25-year, 6-hour |
| Permanent Impoundments | As Designed | 50-year, 6-hour |
| Structure ? 77.216(a) criteria w/out spillway | General Storm PMP, 6-hour | Not Applicable |
| Structure 5 77.216(a) criteria w/out spillway | 100-year, 6-hour | Not Applicable |

Rainfall amounts for the Black Mesa mining complex are obtained from "NOAA Atlas 2, Precipitation Frequency Atlas of the Western United States, Volume VIII, Arizona." Selected precipitation maps for the 10-, 25-, 50-, and 100-year, 6-hour and 24-hour events are presented in Attachment F. The 6-hour and 24-hour return periods for applicable precipitation events obtained from the atlases are as follows:

| | Precipitation (Inches) | |
|---|---|---|
| Return Period (years) | 6-Hour | 24-Hour |
| 2 | 1.09 | 1.4 |
| 5 | 1.4 | 1.8 |
| 10 | 1.6 | 2.1 |
| 25 | 1.9 | 2.5 |
| 50 | 2.2 | 2.7 |
| 100 | 2.4 | 3.0 |
| General Storm PMP | 4.7 | |

Curve Number Selection

Perhaps n[illegible]n hydrology is as subjective as the selection of the proper runoff curve number for a given watershed. Traditional methods of curve number estimation involve the engineer or hydrologist, with some soils and vegetation information, visiting the watershed in question, observing the vegetation and soils, and then selecting a curve number. Curve number selection relies heavily upon the judgment of the designer, but this selection process usually performs satisfactorily in practice. Curve numbers are a function of three principal variables: vegetation type, revegetation cover, and the hydrologic soil group of the watershed soils. The curve numbers are weighted based on major soil groups and vegetation types in the watershed. Table 5 is the basis for all curve numbers used by PWCC. These curve numbers are part of the revised NRCS, TR-55 publication (see Attachment G).

PWCC will primarily be using the curve numbers within the rangeland use. The reclaimed areas will be evaluated using the herbaceous land use. The undisturbed areas will be evaluated using the Pinon-Juniper and the sagebrush-grass land use. PWCC's lease area is approximately 70-75 percent pinon-juniper and 25-30 percent sagebrush-grass ground cover in the undisturbed areas (Chapter 9). These curve numbers correspond closely to Figure S-3 from the NRCS's publication "Procedures for Determining Peak Flows in Colorado", March, 1980, which is also in Attachment G. Curve numbers for disturbed areas will mainly be based on the curve numbers for "Street and Roads", curve numbers for "Newly Graded Areas", and a review of the land use during the life of mining and reclamation. PWCC will use these curve numbers when reviewing existing structures and when designing all new structures.

Where the cost of a proposed facility might be extremely large, more extensive analysis will be performed.

TABLE 5

## NRCS Curve Numbers

### Kayenta and Black Mesa Mines, Arizona

| Cover Type | Vegetation Cover | Hydrologic Conditions | Hydrologic Soil Type B | C | D |
|---|---|---|---|---|---|
| Reclaimed Areas (Herbaceous) | | | | | |
| Pre-law (1977) | | poor | - | 87 | |
| Post-law (1977) Contoured | | fair | - | 81 | |
| | | | | | |
| Undisturbed Areas | | | | | |
| Pinon-Juniper | | | | | |
| Poor Conditions | 0-30% | poor | 75 | 85 | 89 |
| Average Mine Conditions | 35% | - | 65 | 78 | 83 |
| Fair Conditions | 30-70% | fair | 58 | 73 | 80 |
| Sagebrush-Grass | | | | | |
| Poor Conditions | 0-30% | poor | 67 | 80 | 85 |
| Average Mine Conditions * | 30% | - | 60 | 73 | 79 |
| Fair Conditions | 30-70% | fair | 51 | 63 | 70 |
| | | | | | |
| Disturbed Areas | | | | | |
| Paved w/open ditches (including right-of-way) | | | 89 | 92 | 93 |
| Gravel roads (including right-of-way) | | | 85 | 89 | 91 |
| Dirt roads (including right-of-way) | | | 82 | 8[illegible] | 89 |
| Newly graded areas or bare ground | | | 86 | 91 | 94 |

Sources: Revised NRCS Technical Release No. 55.

Communication with Colorado and Arizona NRCS State Hydrologist (8-5-85).

Note:

Interpolated from Figure S-3, MRCS s publication "Procedures for Determining Peak Flows in Colorado", March16VdO(us-6r a tachment G).

The calculated values for curve numbers reflect an Antecedent Moisture Condition (AMC) II. MRCS criteria defines AMC II as between 0.5 inches and 1.1 inches of rainfall in the five days prior to the design event for the vegetation. "dormant" season and between 1.9 inches and 2.1 inches during the growing season. As the most intense precipitation events are summer thunderstorms during the growing season, using AMC II requires that a minimum 2-year, 24-hour event occurs in the five days preceding the design event in question. To insure conservatism in design, PWCC utilizes AMC II, a condition that may be atypical for the mine site. This procedure adds conservativeness to PWCC's runoff calculations.

On June 26, 1985 and July 10, 1985, Peabody engineers met with the OSM technical staff in Denver, Colorado to obtain clarifications of the new 30CFR regulations applicable to Indian lands and to discuss Peabody's general approach to the engineering and hydrology sections of these regulations. During August of 1985, Peabody retained the firm of Dames & Moore to assist in the evaluation and preparation of the necessary documentation for the geotechnical, hydrological, and hydraulic evaluation of facilities on the proposed permit area. On August 29, 1985 and in subsequent conversations, Peabody's engineers, Dames & Moore's engineers, and OSM's technical staff have exchanged ideas and arrived at a formal understanding as far as what OSM considers acceptable methods in complying with the regulations. These methods are incorporated into the evaluation of existing and proposed structures. The General Report (Attachment D), presents a summary of assumptions, data, and methodologies that were used to evaluate structure compliance with the 30 CFR Part 780 and 816 regulations. Individual analyses have previously been performed for structures meeting the requirements of 30CFR77.216 regulations by independent engineering consultants and, therefore, these structures were not included in Peabody's and Dames & Moore's evaluation. The General Report is intended to serve as a companion document to the individual inspection and design reports that have been prepared for each of the sedimentation and impoundment structures. Detailed reports were prepared for those structures required during the current permit term (Attachment H), or will be submitted to OSMRE for approval (see Table 1). In addition, general information such as location and storage requirements is being submitted for ponds to be reclaimed after permit approval and the remaining life-of-mine structures.

To ensure Construction Procedures [illegible]sive settlement and to maintain stable slopes and compaction of the pond's embankment, PWCC will use, but not be limited to, the following [illegible]tru[illegible] [illegible]fns or procedures:

1. All pond locations will be cleared and grubbed which will consist of removing all trees, debris, underbrush, or any other undesirable materials from within the project grading limits. All clearing will be restricted to the smallest area practicable.
2. Topsoil will be removed from the project grading limits and stockpiled for later respreading on the graded slopes above the ponding limits.
3. A keyway trench will be excavated a minimum of four feet below natural grade or until impervious foundation material is encountered along the embankment centerline and extending the length of the embankment up to an elevation equal to the principal spillway flowline. The width of the keyway will be adequate to ensure compaction across the entire trench. If unsuitable material is exposed, the trench will be further excavated into a relatively impervious material satisfactory to PWCC's professional engineer.
4. The entire foundation area below the embankment will be graded to remove uneven surfaces, scarified, and prepared to receive fill material.
5. Embankment material will be free of large roots, sod, frozen soil, acid- or toxic-forming coal processing waste, coal smut, rocks or hard lumps greater than ten inches in diameter, or pockets of highly pervious sand, gravel, or scoria.
6. The top of the embankment will be constructed with a minimum camber equal to five percent of the design height over the natural stream channel to allow for settlement.
7. Construction of the embankment will start at the lowest point and proceed in compacted horizontal lifts not exceeding twelve inches in thickness. Unless noted otherwise, compaction will be a minimum of 92 percent of the Standard Proctor Density. Care will be taken to ensure bonding between successive lifts. The moisture content will be adequate to obtain the required compaction.
8. All finished grading of the spillway will be within plus or minus 0.2 of a foot measured at right angle to the spillway. All slopes will be trimmed neat and graded into the surrounding topography.
9. The embankment's upstream and downstream side slopes will not be steeper than those shown in Table 3-6, "Results of Stability Analyses" (see Chapter 6, Attachment D, Dames & Moore's "General Report - Geotechnic, Hydrologic, and Hydraulic Evaluation of Sedimentation Structures"), based on the embankment material classification and the height of the embankment. This will ensure a minimum static safety factor of 1.5, for the normal pool with steady seepage saturation conditions and a seismic safety factor of at least 1.2 for the stability of the embankment. For embankments of greater height or different embankment material, an individualistic geotechnical investigation will be rmed.

All impoundments will have a constructed minimum freeboard of one foot plus or minus 0.2 feet to resist overtopping by waves and by sudden increases in storage volume.

Once all remedial earthwork is completed at each impoundment site, all slopes above the high waterline will be mulched and revegetated in accordance with PtdCC's reclamation plan to protect against surface erosion at the site. The upstream and downstream slopes of the impoundments will be riprapped or otherwise stabilized when required by the professional engineer in the impoundment design. As-built reports for all the necessary remedial work identified in Drawing No. 85406 and in the Design and/or Inspection Report will be produced, certified by a professional engineer, and kept on file at the minesite. These as-built reports will be completed no later than 45 days following completion of all the necessary work.

All temporary sedimentation ponds and impoundments not meeting the size requirements of 30CFR77.216(a) will have a single spillway that will, at a minimum, safely discharge the runoff from a 25-year, 6-hour precipitation event. All spillway channels will be constructed of nonerodible material and will be capable of maintaining sustained flows. Spillways will be cut in natural earth or rock wherever possible. In addition, the spillways will not be earth or grass-lined.

All permanent sedimentation ponds and impoundments not meeting the size requirements of 30CFR77.216(a) will have a spillway that will safely discharge the runoff from a 50-year, 6-hour precipitation event.

All sediment ponds or impoundments meeting the criteria of 30CFR77.216(a) (i.e. MSHA-size structures) will comply with all MSHA requirements and will have principal and emergency spillways that, in combination, will safely pass a 100-year, 6-hour precipitation event.

Unless noted otherwise on the plans, each pond or impoundment will be constructed with a trapezoidal channel spillway. The spillway capacity will be calculated based on 2:1 side slopes for sedimentation ponds even though the typical cross sections for spillway and outflow channels in Attachment D show 3:1 side slopes. During remedial work and future construction, side slopes will not exceed 2:1. However, flatter slopes may result (e.g., 2.5:1). In these cases, the spillway capacity would still be conservative since a 2:1 slope was used in the original design. In other words, side slopes flatter than a 2:1 will provide more cross sectional area, more capacity, and lower velocity.

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Precise locations and dimensions of the spillway will be determined at the site by PWCC's project engineer in order to fit the spillway to the existing field conditions after embankment construction and to assure that the outflow channel extends a minimum of 15 feet beyond the toe of the embankment into the natural channel.

The spillway and outflow channel will be undercut and brought back to grade as necessary to allow for the proper application of topsoil or geotextile and rock-lining. Where culverts are used for spillways in order to provide access across the embankment, the inlet of the culverts will be equipped with trash racks to prevent plugging during precipitation events larger than the design storage event.

No other treatment facilities in lieu of sedimentation ponds are planned at this time; however, if other treatment facilities are required, they will be designed and constructed to treat the 10-year, 24-hour precipitation event unless a lesser design event is approved.

Exemptions. Examination of the Sediment and Water Control Structures Map (see Drawing Nos. 85405 and 85400) demonstrates that PWCC will have full sediment control coverage including ponds or Best Technology Currently Available (BTCA) structures or Best Management Practices for the post-law mining disturbance areas as required by the regulations, except for certain portions of the overland conveyor which extends from the Kayenta Mine J-28 facilities to the railroad loadout facility. The BTCA structures may include rock check dams, rock downdrains, silt fence, straw bale dikes, revegetation, etc. These BTCA structures and locations are shown on Drawing No. 85400. Of the 15.9 miles of conveyor, there are only three watersheds identified between the Transfer "F" site and the railroad loadout facilities that do not drain to a sedimentation pond or do not have BTCA structures in the watershed. The following is a breakdown of each exempt segment of these watersheds and the drawing and sheet number(s) where they are shown.

| Watershed | Conveyor Length (Miles) | Drawing No. |
|---|---|---|
| V | 0.14 | 85400, (J-[illegible] |
| VI | 0.35 | 85400, (J-[illegible] |
| (85400) VII | J-6, | J-7) |
| Total | 0.55 miles | |

The area from N-8 to the silos was constructed prior to SMCRA and, therefore, no provision for sediment control was considered during right-of-way acquisition, design, and construction. To go into the 100-foot plus wide right-of-way and build sediment control structures would not be practical or feasible. All of these segments are located in rugged topographic conditions where massive rock outcrops create difficult or impossible excavation conditions, potentially requiring drilling and blasting or in areas where overland flow is difficult or impossible to concentrate at a particular point at the conveyor. Much of the undisturbed upstream area runoff flows as overland or channelized flow into and across the conveyor's right-of-way; therefore, any sediment control would also have to contain this runoff, increasing the size of a siltation structure considerably. The remaining sections of conveyor have been adequately controlled by sedimentation ponds or BTCA structures, (see Chapter 6, Figures 36 and 37, and Drawing Nos. 85400 and 85405).

These three segments of the overland conveyor were evaluated for an exemption from providing sedimentation control using the SEDIMOT II or SEDCAD+ Hydrology Computer Model. In addition, due to the rugged terrain and the inability to concentrate the runoff directly within the conveyor beltline's disturbance, a theoretical worst-case approach was used. This approach assumed all runoff and sediment would be transported to one location in each segment. Each segment was analyzed for three worst-case conditions:

1. Assume an approximate segment width of ten feet under the beltline could be drained to one point for each segment and fully *contained;*
2. Containment of the upstream undisturbed watershed only; and
3. Assume the upstream watershed and the combined conveyor beltline area could be drained to one point for each segment and *contained* in accordance with the regulations.

The results of the analysis are presented in Tables 6 and 7.

TABLE 6

Conveyor Sediment Control Evaluation Summary

| Area (Drwg. No. 85400) | Drainage Area (Acres) | Curve Number | Time of Concentration (Hrs) | Peak Flow (cfs) | Runoff Volume (Ac-ft) | Sediment (Tons) | % Area of Total Area | % Peak Flow of Total Area | % Runoff Volume of Total Area | % Sediment of Total Area |
|---|---|---|---|---|---|---|---|---|---|---|
| #5 Belt Only | 0.17 | 89 | 0.137 | 0.18 | 0.016 | 0.60 | 7.23 | 7.14 | 7.55 | 4.06 |
| #5 Undisturbed Area | 2.18 | 89 | 0.064 | 2.49 | 0.202 | 14.10 | 92.77 | 98.91 | 95.28 | 95.40 |
| #5 Total Area | 2.35 | 89 | 0.137 | 2.52 | 0.212 | 14.78 | - | - | - | |
| #6 Belt Only | 0.42 | 89 | 0.211 | 0.43 | 0.039 | 1.14 | 2.61 | 4.17 | 3.56 | 1.70 |
| #6 Undisturbed Area | 15.68 | 83 | 0.087 | 13.07 | 0.999 | 72.56 | 97.39 | 126.65 | 91.32 | 108.44 |
| #6 Total Area | 16.10 | 84 | 0.211 | 10.32 | 1.094 | 66.91 | - | - | - | |



Revised 11/26/03

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TABLE 7

Conveyor Sediment Control Evaluation Summary

| Area (Drwg. No. 35400) | Drainage Area (Acres) | Curve Number | Time of Concentration (Hrs) | Peak Flow (cfs) | Runoff Volume (Ac-ft) | Sediment (Tons) | % Area of Total Area | % Peak Flow of Total Area | % Runoff Volume of Total Area | % Sediment of Total Area |
|---|---|---|---|---|---|---|---|---|---|---|
| H7 Belt Only | 0.07 | 89 | 0.027 | 0.08 | 0.006 | 0.26 | 0.02 | 0.05 | 0.03 | 0.003 |
| H7 Undisturbed Area | 303.95 | 84 | 0.427 | 148.37 | 20.660 | 8687.28 | 99.99 | 100.64 | 100.00 | 100.34 |
| H7 Total Area | 304.02 | 84 | 0.433 | 147.43 | 20.660 | 8657.49 | - | - | - | |
| H5,H6,H7 Belt Only | 0.66 | | | | | | 0.20 | | | |
| H5,H6,H7 Undisturbed Area | 321.81 | | | | | | 99.80 | | | |
| H5,H6,H7 Total Area | 322.47 | | | | | | | | | |

Note: Percentages may exceed 100% due to differences in time of concentrations

The exemption available in 30 CFR 816,46(e) is appropriate for the overland conveyor based on a review of local topographic maps, a site visit, and Tables 6 and 7. The total drainage area, based on measurements from 1" = 400' scale topographic maps, is a very insignificant area within the total area. This represents less than one percent of the total area. The potential sediment generation from only the beltline area is less than 0.03 percent of the total sediment generated from the total watersheds of the three segments. Again, this is a very insignificant contribution to the watershed's water quality of the three segments. This small disturbance area will contribute no measurable impact to the downstream water quality; the effects of dilution would be so high that the water quality as a result of the runoff from the upstream-undisturbed areas would be virtually undetectable, (see Chapters 15 through 19 for additional discussion of natural background water quality). Finally, in order to treat the equivalent of 0.061 ac-ft of runoff for all three-conveyor segments, approximately 22 ac-ft of storage for the runoff and additional storage for the sediment would be theoretically required in order to contain the runoff. For the 0.66 acres of initial disturbance, .this would be an astronomical amount of storage required, creating more surface disturbance from pond construction than what was to have been controlled for conveyor disturbance. Therefore, these types of small disturbances represent the type of minor disturbance, which the regulations attempted to exclude sediment control and allow sediment control exemptions.

The input for the SEDIMOT II and the SEDCAD+ models was developed using the 10-year, 24-hour precipitation event and standard engineering methods referred to elsewhere in this chapter. The following sediment particle size distribution information was utilized for this analysis:

| Particle Size (mm) | Percent Finer (%) |
|---|---|
| 38.100 | 100.0 |
| 4.760 | 100.0 |
| 2.380 | 100.0 |
| 1.190 | 99.5 |
| 0.590 | 99.2 |
| 0.297 | 99.0 |
| 0.149 | 94.0 |
| 0.074 | 70.0 |
| 0.037 | 43.0 |
| 0.019 | 29.0 |
| 0.009 | 23.0 |
| 0.005 | 18.0 |
| 0.002 | 15.0 |
| 0.001 | 13.0 |
| 0.000 | 0.0 |

"K" factor = 0.43

CP Value = 1.0

Specific Gravity = 2.58

Submerged Bulk Specific Gravity = 1.25

Particle Size Distribution(s)

| Size (mm) | PSD-1 % Finer | PSD-2 % Finer |
|---|---|---|
| 38.100 | 100.00 | 100.00 |
| 4.760 | 95.00 | 71.50 |
| 2.380 | 91.00 | 68.00 |
| 1.190 | 90.03 | 66.00 |
| 0.590 | 90.02 | 64.00 |
| 0.297 | 90.01 | 62.00 |
| 0.149 | 90.00 | 43.00 |
| 0.074 | 89.00 | 27.00 |
| 0.037 | 85.00 | 22.00 |
| 0.019 | 77.00 | 15.00 |
| 0.009 | 64.00 | 13.00 |
| 0.005 | 55.00 | 12.00 |
| 0.002 | 43.00 | 9.00 |
| 0.001 | 35.00 | 7.00 |
| 0.000 | 0.00 | 0.00 |

Specific Gravity = 2.68

Submerged Bulk Specific Gravity = 1.25

The disturbance area under the overland conveyor, from Transfer 24-25 to where Coal Mine Wash drains underneath the conveyor, is contained in the watershed for Ponds N10-B1, N6-M, and N10-C. The conveyor maintenance road on the north side of the conveyor is higher than the area under the conveyor; therefore, the runoff follows the slope of the conveyor or drains to the south into the watershed for Ponds 010-B1, W6-M, or. N10-C, (see Figure ].A and

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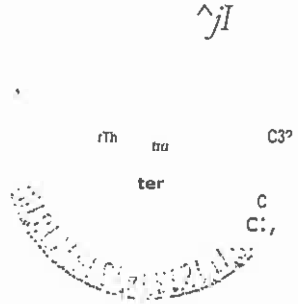

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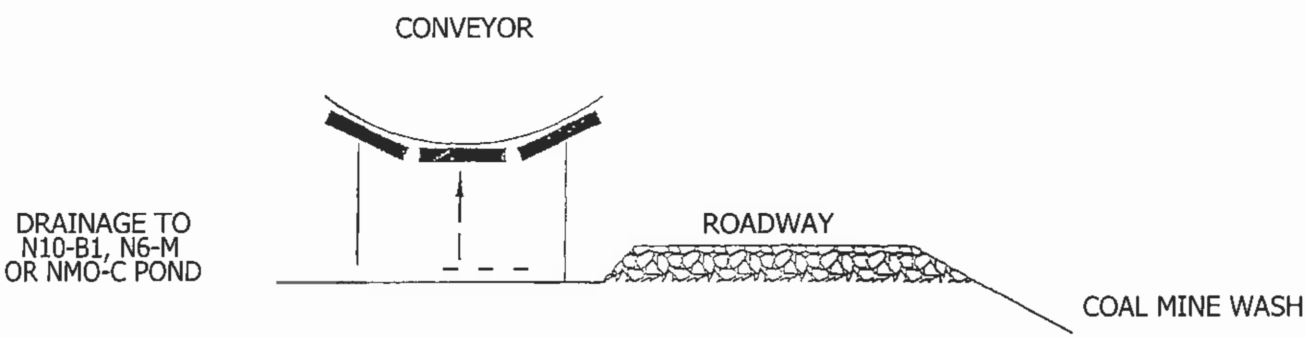
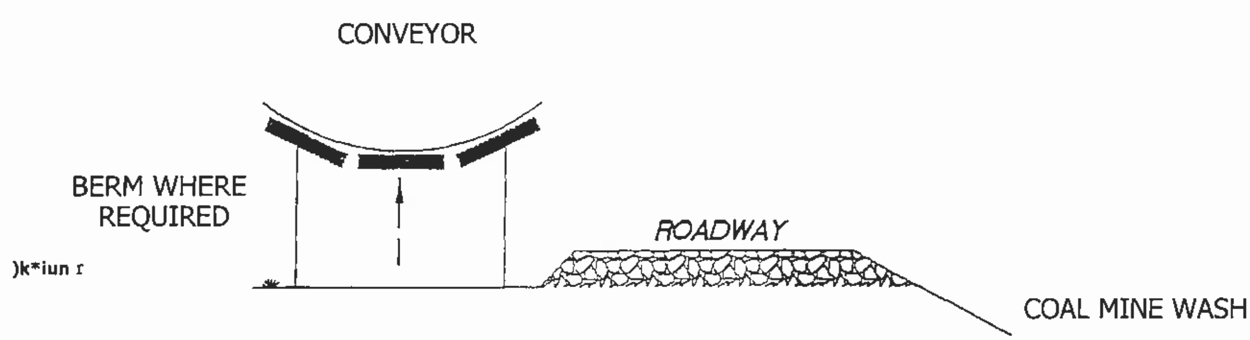



*TYPICAL CROSS-SECTION*
*FROM COAL MINE WASH CROSSING*
*TO TRANSFER 24/25*




*TYPICAL CROSS-SECTION*
*ALONG DOWNSTREAM SIDE OF POND N6-M*

## LEGEND

DRAINAGE DIRECTION

FIGURE 1A
DATE 8/11/97

8/97 J.Aner

REVISIONS DRAWN BY

TerraMatrix
MONTGOMERY WATSON

PROJECT Ka, CO-MG

NM-110

PEABODY WESTERN COAL COMPANY - KAYENTA MINE

TYPICAL CROSS-SECTION
OVERLAND CONVEYOR
TRANSFER 24/25 TO CMW CROSSING



Revised 12/04/97

In conclusion, the exemption available in 30 CFR 816.46(e) is appropriate for the three segments of the overland conveyor based on a review of the local topographic maps, a site visit, and Tables 6 and 7. The total percentage of drainage area, peak flow, runoff volume, and sediment runoff of the total area is relatively small. These disturbed areas have an *insignificant* affect on the total watershed's water quality for the three areas. This small disturbance area will contribute no measurable impact to the downstream water quality, the effects of dilution with the runoff from the upstream undisturbed areas will be so high that the downstream water quality effect will be insignificant, (see Chapters 15 through 19 for additional discussions of natural background water quality). Treating the runoff from the entire watershed will require disturbing new areas or areas previously reclaimed; therefore, more surface disturbance and additional retention of runoff will be required. These types of small disturbances represent the type of minor disturbance that the regulations attempted to exclude sediment control and allow sediment control exemptions.

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A qualified registered professional engineer or other qualified personnel under the professional engineer's supervision, will inspect the impoundments a minimum of weekly during active construction and at "critical points" during construction which would include after keyway excavation, and upon completion of construction. As-built reports will be produced, certified by a professional engineer, and kept on file at the minesite. As-built reports for new construction will be completed and submitted to the regulatory authority prior to any mining disturbance in the watershed.

A qualified registered professional engineer or other qualified personnel under a professional engineer's supervision will inspect and examine impoundments at least annually until removal of the structure or release of the performance bond. An annual inspection and examination summary will be provided to the regulatory authority in a certified report documenting the present condition of the impoundment and whether or not remedial work is required. Attachment E contains an example of Peabody's Annual Impoundment Inspection Report. Inspection reports for 1985 prepared by Dames & Moore and Peabody are included as Attachment H. A copy of these reports will be kept at the mine site.

In addition, 30 CFR 780.25 and 816.49 requires an additional design evaluation for any impoundments meeting the Class B or C criteria for dams defined in the USDA, NRCS Technical Release No. 60, "Earth Dams and Reservoirs" manual. All the impoundments on Table 4, Drawing No. 85406, and Drawing No. 85408 were evaluated based on the following NRCS definition of Class B, and C dams:

Class (A). - Dams located in rural or agricultural areas where failure may damage farm buildings, agricultural land, or township and country roads.

Class (B). - Dams located in predominantly rural or agricultural areas where failure may damage isolated homes, main highways, or minor railroads or cause interruption of use or service of relatively important public utilities.

Class (C). - Dams located where failure may cause loss of life, serious damage to homes, industrial and commerical buildings, important public utilities, main highways, or railroads.

The existing structures were field inspected in the fourth quarter of 1994 and classified under the supervision of a professional engineer. The eleven existing and proposed MSHA-size structures have been evaluated based on MSHA's regulations. The Black Mesa Complex is located in a remote and rural area with few public roads, utilities, buildings, or private buildings located in the downstream floodplain; therefore, based on the field inspection and the NRCS definition, all of the non-MSHA-size structures are classified as Class F. structures (see Drawing No. 85406).

MSHA-sized dams are inspected weekly by a certified NISHA darn inspector and reported annually as required by 30CFR77.216. The weekly and annual inspection report forms are presented in Attachment E.

In addition to the regular inspections, PWCC has numerous personnel including engineers, technicians, environmental scientists, reclamation personnel, and operational personnel that work within the permit area daily who will be observing the condition of the impoundments on a periodic basis. If a hazard is discovered during an inspection which threatens the protection of the public, PWCC will inform the regulatory authorities of the finding and of the emergency procedures formulated for public protection and remedial action. The remedial action will be determined on a case-by-case basis, based on the nature or scope of the hazard.

Initially ~~Maintenance and Reclamation~~ faces associated with all facilities will be stabilized by applying topsoil :. suitable scell material _bo^v_ _ high waterline

t^2 ij^

APPROVED 123456789 DEC 2004

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and revegetated with the standard seed mix in accordance with the reclamation plan or by applying crushed rock, riprap, concrete fabriform blankets, geotextiles, or other appropriate methods to minimize erosion or deterioration. However, excavated slopes in bedrock, fractured scoria, or other competent materials which are steeper than 1:1 will not be topsoiled or further stabilized. Maintenance will be performed in such a manner that the integrity of all facilities will be maintained, and the facility will function as designed. Other minor remedial reconstruction will be performed as necessary to maintain each facility.

Discharge from sedimentation ponds, permanent and temporary impoundments, and diversions will be controlled by energy dissipators, riprapped portion of the channels, and other 'devices, where necessary, to reduce erosion and to minimize disturbance of the hydrologic balance. Discharge structures will be designed, where necessary, according to standard engineering design procedures.

After the effluent in the sedimentation ponds has had adequate detention time to meet State and Federal effluent limitations, PWCC will use pumps with an intake screen attached to a flotation device as a nonclogging dewatering device or other means to lower the water level in the pond and restore the runoff capacity for the 10-year, 24-hour precipitation event. The flotation device will be attached to the pump's intake hose to prevent suction of poor quality water at the bottom or side of the pond or impoundment. The water removed from the pond will be disposed of in a manner consistent with PWCC's approved NPDES permit. PWCC has the pumps and hose, or pipe shown in Table 8 available on Black Mesa to dewater sedimentation ponds.

In addition, PWCC has access to many pump and hose supply vendors throughout the "Four Corner's" regional area. When PWCC dewaters an impoundment or pond, the water will be discharged in one of the following methods in order to restore adequate storage capacity and to minimize erosion downstream:

1. The water may be pumped to another pond that has sufficient capacity. The water in the second pond will be used as a dust control agent, in the construction of earth embankments, or mine-related activity.
2. If the water is not pumped to another pond, the water will be discharged through the decant system or pumped into the principal or emergency spillway and discharged downstr[illegible] [illegible]ce with the NPDES permit.



Revised 02/21/00

TABLE 6

## Black Mesa Complex Dewatering Equipment List

Pumps

| Unit # | Make | Model | Size | @ 20' G.P.M. Rate |
|---|---|---|---|---|
| **Kayenta Mine** | | | | |
| 950 | Gorman Rupp | 84A2DD | 4" | 800 |
| 951 | Gorman Rupp | 84A2DD | 4" | 800 |
| 952 | Gorman Rupp | 84A2DD | 4" | 800 |
| 953 | Gorman Rupp | 84A2DD | 4" | 800 |
| 954 | Gorman Rupp | 14C2-DD | 6" | 700 |
| 955 | Gorman Rupp | S6B1 | 6" | 2000 |
| 956 | Gorman Rupp | S6B1 | 6" | 2000 |
| **Black Mesa Mine** | | | | |
| 693 | Gorman Rupp | 86A1-(F3L) | 6" | 1800 |
| 695 | Gorman Rupp | 86A1-(F3L) | 6" | 1800 |
| 696 | Gorman Rupp | S6BL | 6" | 2000 |
| Warehouse | Gorman Rupp | S6BL | 6" | 2000 |
| **Joint Use** | | | | |
| 41041 | Detroit Diesel-Gorman | 84A2DD | 4" | 800 |
| TOTAL: | | | | 16,300 |

Hose

| | | |
|---|---|---|
| BM | 3,000' | 6" Flex Hose |
| KM | 1,200' | 4" Flex Hose |
| Joint Use | 500' | 6" Alum. |
| | 3,000' | 3" Alum. |
| **Total** | 7,700' | |





Revised 02/2:/00

3. If the spillway is not designed to handle the discharge velocities of the dewatering system, the water will be discharged downstream of the toe of the embankment in the natural channel. The discharge point will be located at a nonerodible bedrock or rocky colluvial location. The exit velocity and initial impact of the discharge will be absorbed by the rock and the water will be quickly spread over a larger cross-sectional area; therefore, the channel velocities will be reduced. Based on the following equation:

$$Q = V (A)$$

where

Maximum Q = 4.5 cfs (2,000 gal/min)

Maximum V = 5 fps

when the cross-sectional area of the rock exit channel equals or exceeds 0.9 $ft^2$, the velocities will be nonerodible. Note the above will vary based on the discharge from the dewatering system and site-specific conditions. PWCC will construct a nonerodible channel based on the minimum cross-sectional area if a nonerodible exit channel does not exist.

4. If the downstream channel consists of natural erodible material, PWCC will construct an impact or energy dissipator basin. The basin will consist of durable, nonerodible type material. The velocity at the outlet of the dewatering system will be determined by using Manning's equation for open channel flow or the following equation for the discharge from a circular pipe or conduit:

$$V = \frac{[illegible]\ gpm}{d^2}$$

V = Velocity of flow (ft/sec)

gpm = Gallons per minute

d = diameter of circular pipe or conduit (inches)

(Reference: "Cameron Hydraulic Data", 1984 by Ingersoll-Rand Publications)

Once the velocity is determined, the operator of the dewatering system has several options to minimize erosion at the outlet of the dewatering system:

(a) If the velocity is too high for the energy dissipater or downstream channel, reduce the quantity of flow or gallons per minute discharged. This will reduce the velocity and minimize erosion.

(b) If the velocity is too high for the energy dissipator or. downstream channel, increase the diameter of the discharge pipe or increase the cross-sectional area of the discharge channel. This will also reduce the velocity and minimize the erosion.

(c) If the quantity of flow or cross-sectional area of the dewatering system cannot be adjusted to minimize the velocity and erosion in the downstream channel, an energy dissipator or impact basin will need to be constructed at the outlet of the dewatering system.

Typically, for the dewatering equipment listed in Table 8, an erosion resistant lining will be required that will take the initial impact of the discharge and spread the water over enough cross-sectional area in the impact basin to reduce the exit velocity. The impact basin will be sized using procedures described in Design of Small Dams (USBR, 1977). The conjugate depth for the hydraulic jump will be estimated using Figure 268 in Design of Small Dams with an estimated head loss of 30 percent. The tailwater depth below the stilling basin will be estimated using Manning's equations for a trapezoidal channel with dimensions similar to the outflow channel. The length of the stilling basin will be estimated based on research reported in Hydraulic Design of Spillways (USACE, 1965), where basin lengths of five times the hydraulic jump conjugate depth proved adequate. The depth of the stilling basin below the natural streambed elevation will be calculated by subtracting the tailwater depth from the hydraulic jump conjugate depth.

Riprap lining for the stilling basin will be sized using the calculated velocity in the outflow channel leading to the stilling basin. The minimum height of riprap along the sidewalls of the stilling basin will be set equal to the hydraulic jump conjugate depth plus freeboard. Freeboard will be calculated using the following empirical equation from Design of Small Dams (USBR, 1977).

$$FB = 0.1\,(V + d2)$$

Where FB = Freeboard in feet

V = Velocity of flow entering the basin in feet per second

d2 = Hydraulic jump conjugate depth in feet

Freeboard values will be rounded to the nearest half foot. The walls of the exit channel will be transitioned so that the exit channel cross section of the basin approximates the cross section of the natural channel. This will avoid any abrupt transition zone which could increase erosion potential. Typical design configurations of this basin will be similar to thew:Rd in discussed in Chapter 6, Attachments D and H.

The rate of discharge will be governed by the size of the dewatering system. Normally, when a pumping system is used to dewater the impoundment or pond, the discharge rate will be in the range of one to five cubic feet per second. Some of the larger MSHA-size structures have valve controlled dewatering systems that may have discharge rates from zero to 100 cubic feet per second. Whereas, if a siphon or other means of dewatering is used, the discharge rate will be limited by the size of the dewatering system and the number of dewatering devices.

Chapter 11 of the PAP contains a discussion of the precipitation on Black Mesa. Typically, the mine area has long dry periods, dry clear air with low humidity, and a high percentage of sunshine. The average annual precipitation is approximately ten inches, occurring primarily in the form of convectional showers during the summer months. Long periods often occur with little or no precipitation; therefore, pond dewatering is not currently necessary for the majority of impoundments.

As a result of the NPDES monitoring during 1985, 1986, and 1987, PWCC has recorded only nine ponds that have exceeded the EPA's 10-year, 24-hour storage level. Since these levels were recorded, PWCC has received, on December 2[illegible], 1987, a NPDES Permit Modification that authorized PWCC to discharge storm water runoff from the water retention ponds in the absence of precipitation events. Also, PWCC has constructed the J2-A dam downstream of the CW-A pond. As a result of the new NPDES permit and the remedial work, PWCC anticipates having to dewater only five of the nine ponds in the future. Therefore, based on the above, PWCC has the available equipment to dewater the ponds when the maximum allowable storage level is exceeded. In addition, PWCC has a fully equipped water quality lab located at the mine site, a full fleet of construction equipment available, and approximately 750 employees at the mine site available to maintain access and water levels at all of the sedimentation ponds.

As an alternative to mechanical dewatering devices, such as pumps, some ponds will be designed with principal spillways such as a perforated drop inlet or a trickle tube. In these situations the principal spillways will be designed to dewater the pond of the runoff from the designed precipitation event, within 10 days following an even[illegible]. These dewatering devices will be designed to be non-clogging.

Final reclamation for all temporary siltation and temporary impoundment structures not required to support mining operations will be reclaimed a manner consistent with the reclamation plan. Unless these structures are specifically identified as a Permanent structure (see Drawing Mos. 85324, 85405, and 85406) or a request is made by the Tribe and local residents in public comment meetings (i.e., public comment meetings, local Chapter meetings, or the Black Mesa Review Board meetings, etc..), or a written request is sent directly to PWCC's management, each structure is classified as temporary and therefore will be reclaimed. Each request will be evaluated by PWCC to assure the structure is regulatory and economically feasible to remain as a permanent structure. Sediment control facilities will be retained until reclamation requirements for disturbed lands are met and approval is granted by the regulatory authorities to remove the structures.

All structures not approved as part of the final reclamation plan will be reclaimed by grading the embankment material into the surrounding topography, removing culverts, re-establishing drainage, preparing the graded surface in accordance with the reclamation plan, topsoiling, seeding, and mulching. Permanent sedimentation ponds and impoundments will be maintained and will meet the requirements of the approved reclamation plan for permanent structures and impoundments. PWCC will renovate such strucures, where necessary, to conform to the approved reclamation plan.

MSHA-Size Structure (2000-2022)

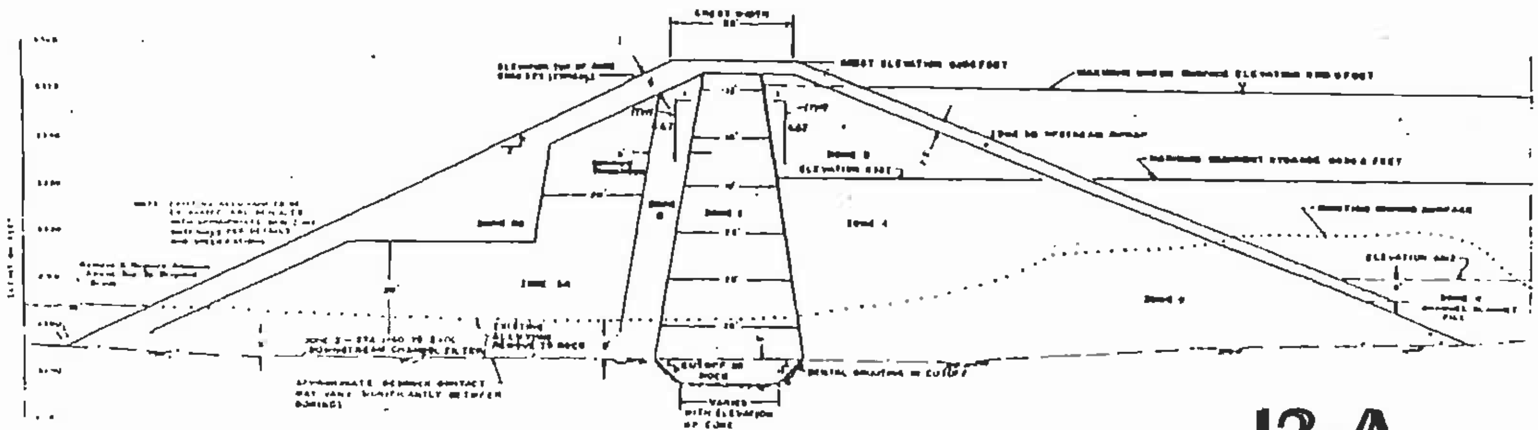
PWCC will utilize eleven structures that meet the criteria of 30CFR77.216(a). Eight structures were constructed prior to September 28, 1984, one structure (1'114-H) was constructed in 1985, one structure (J2-A) was constructed in 1986 and another structure (J7-JR) was constructed in 2001. Two structures will be temporary and nine structures will be permanent. The primary purpose of these structures, except for the Kayenta Mine Fresh-Water Pond (KM-FWP), is to control sediment from disturbed mining areas. KM-FWP's purpose is to hold fresh water pumped from a nearby Wavajo aquifer well. ' The location of all the MSHA structures can be found on Drawing No. 85405. The drainage area for each structure is delineated on Drawing No 85400, Sheets 1 through 26. All of the detailed design information and site descriptions for these structures constructed before 1995 have been [illegible] required for 30CFR780.11, 780.12, and [illegible] number, [illegible] date, remedial work schedule, drainage area, storage capacity, and spillway information for the existing structures is included on Drawing No. 85406. Attachment h contains the inspection report for each existing dam.

Following is a description of each MSHA-sized structure and where additional information tan be found:

I. J2-A (Wild Ram Valley Dam), MSHA I.D. No. 1211-AZ-09-00533-02. J2-A design information was transmitted to OSM on 5/14/85. Approval was received and structure completed in 1986. J2-A drains a watershed of approximately 2, 761 acres and has a total storage capacity of approximately 177.7 acre-feet. Drawing No. 85410, Volume 22, Sheets 1 and 2 shows the proposed site plan and stage-capacity curve. Drawing No. 85411, Volume 7A, Sheets 1 and 2 show the "as-built" condition and stage-capacity chart for J2-A dam. The dam's primary purpose is to control runoff from mining areas. The dam is a zoned embankment dam extending to bedrock. Figure 1 depicts a typical cross section of the zoned embankment. More detailed design information can be found in the Sargent, Hauskins, and Beckwith (SHB) "Geotechnical Investigation and Design Development Report" submitted 5/14/85.

II. J7-Jr Dam, MSHA I.D. No. 1211-AZ-09-01195-09. Detailed plans in Volume 7.1 for J7-Jr Dam were approved by OSMRE and MSHA on January 11, 2001. J7-Jr Dam was constructed in 2001. J7-Jr Dam drains a watershed of approximately 3,960 acres and has a total storage capacity of approximately 724 acre-feet. The dam's primary purpose is to control runoff from the J-19 and J-21 mining areas. The J7-Jr MSHA Dam Design Report and more detailed design information can be found in Volume 7.1, Chapter 6, Attachment AI and the as-built is in Volume 7A.

III. J-7 Dam, MSHA I.D. No. 1211-AZ-09-00533-01. The J-7 Dam was constructed by PWCC in 1973. The embankment is utilized as a haul road, for sediment control, and to impound water for dust suppression water and as an emergency water supply for the Black Mesa Pipeline Company's coal slurry transportation system. The J-7 Dam drains a watershed of approximately 9,217 acres, which includes the J7-Jr Dam's watershed of 3,960 acres and the downstream area in the J-7 Dam's watershed of 5,257 acres. J-7 Dam has a total storage capacity of approximately 669 acre-feet. Drawing No. 85412 shows the current "as-built" conditions of the data site. Figure 2 illustrates the current stage capacity curve for the J-7 Dam. The J-7 Dam is included in the Permit AZ-50.001 area. The J-7 Dam was approved by MSHA on 5/12/80 and by 2311 on C.IV29/82. The embankment consists of a 60-foot wide



**J2-A**

1211-AZ-09-00533-02 (10/01/86)

# Dam Cross-Section
# Exhibit "A"
# Date: 11-15-85

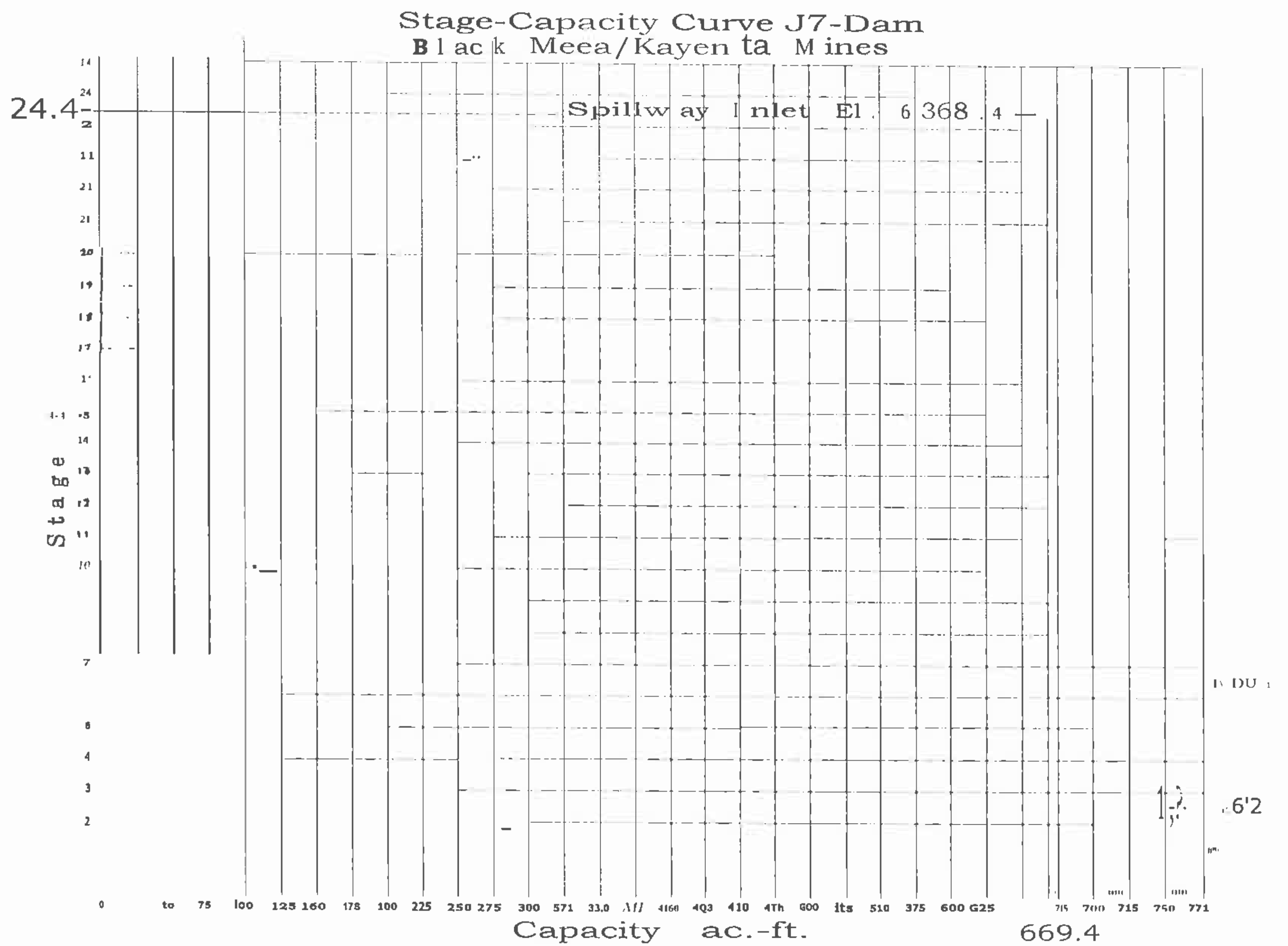

Stage-Capacity Curve J7-Dam
Black Meea/Kayenta Mines
Spillway Inlet El. 6368.4
24.4
Stage
Capacity ac.-ft.
669.4

FIGURE 2

compacted clay core. Figure 3 depicts the cross section of the embankment. More detailed design information can be found in the SHB Geotechnical Investigation Report (8/27/76) previously submitted to regulatory authorities and included in Attachment R.

IV. J16-A Dam, MSHA I.D. No. 1211-AZ-09-01195-07. The J16-A Dam was constructed in 1982 as a zoned rock-fill embankment. See Figure 4 for a typical cross section of the embankment. The design of J16-A was submitted in Permit AZ-0001, Volume 23. MSHA approved the design on 7/19/82 and OSM approved the design on 5/13/82. Drawing No. 85414 shows the current "as-built" conditions of the dam site. J16-A drains a watershed of approximately 2,684 acres with a total present storage capacity of approximately 333.0 acre-feet. Figure 5 depicts the current stage-capacity curve. More detailed design information can be found in the SHB Geotechnical Investigation Report previously submitted to OSM.

V. J16-L Dam, MSHA I.D. No. 1211-AZ-09-01195-08. The J16-L Dam (Reed Valley Dam) was constructed in 1984 as a zoned earth embankment to control runoff from mining areas (see Figure 6 for a typical cross section of the embankment). The detailed design was submitted as an amendment to Permit AZ-0001 in Volume 34. Approval was granted on 12/15/82 by MSHA and on 6/3/83 by OSM. In 1996, PWCC determined the ponding area had silted sufficiently to require increasing the capacity. A permit revision was submitted and approved to increase the height of the spillway and the top of embankment. Drawing No. 85416B shows the current "as-built" condition of the dam site. J16-L currently drains a watershed of approximately 7,873 acres with a total present storage capacity of approximately 399 acre-feet. Figure 7 depicts the current stage-capacity curve. More detailed design information can be found in Rollins, Brown and Gunnell, Inc.'s "Reed Valley Dam, Final Design Report" (8/26/82) previously submitted to OSM.

VI. Kayenta Mine-Fresh Water Reservoir (KM-FWP), MSHA I.D. No. 1211-AZ-09-01195-01. KM-FWP was constructed in 1972 as a surge pond to provide water for mine fac ties, for dust suppression, and to supply the Black Mesa Pipeline Comp y's coal slurry transportation system. The pond was lined with a 0.015- to 0.020-inch thick PVC membrane pond liner furnished by Water Saver mpany, Inc. The embankment was constructed out of locally available material, predominantly clayey silts and clayey sand material. See Figure 8 for a typical cross section of the embankment. The KM-FWP is in Permit AZ-0001 area. The KM-FWP was approved by MSHA on 3/28/79 and by OSM on 1/29/82. This pond collects

# Cross Section A-A'

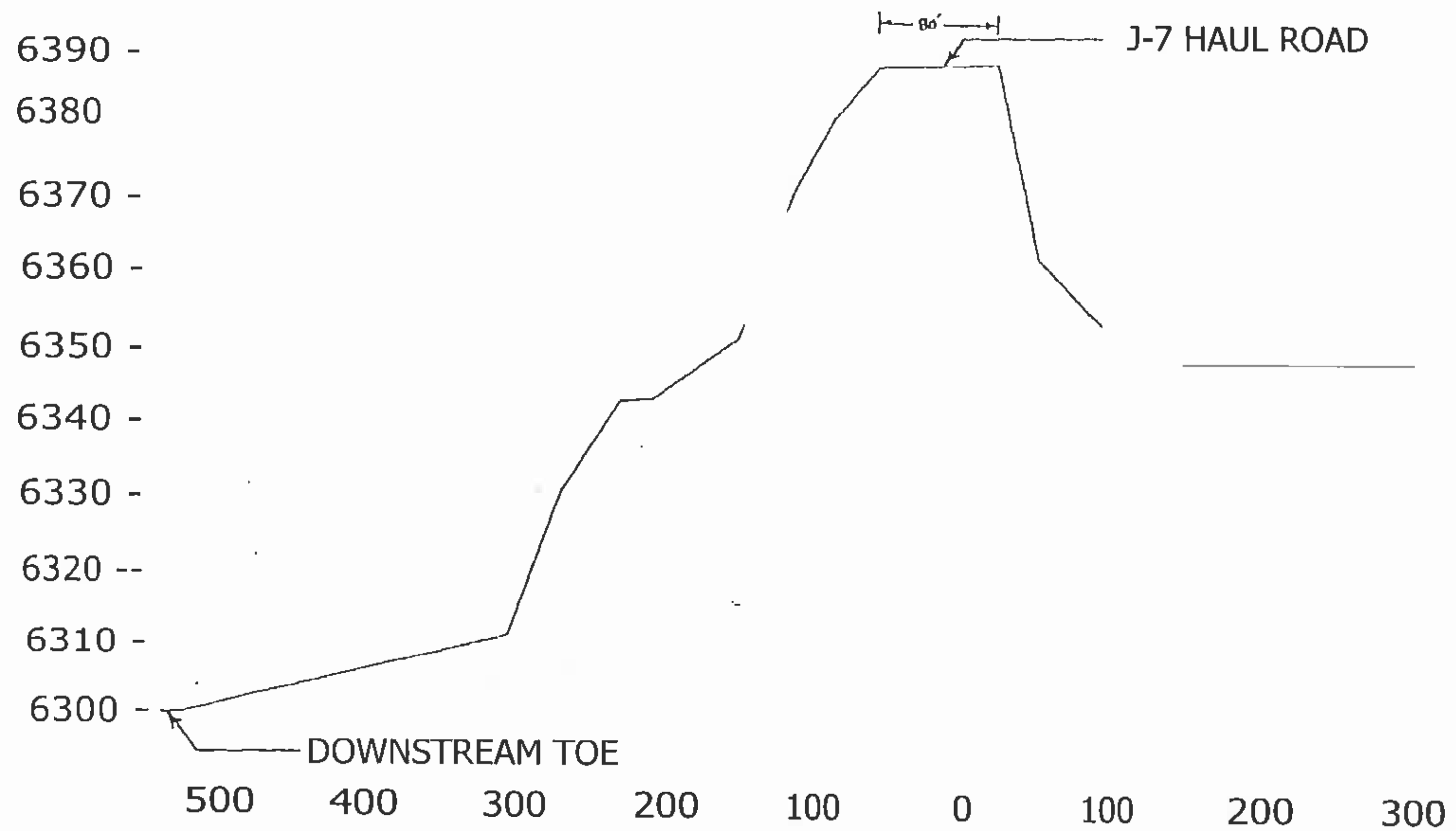



FIGURE 3

## J7-Dam

1211-AZ-09-00533-01 (10/01/86)

## Dam Cross-Section

## Exhibit "A"
## Date: 11-15-85

APPROVED
DEC 2004

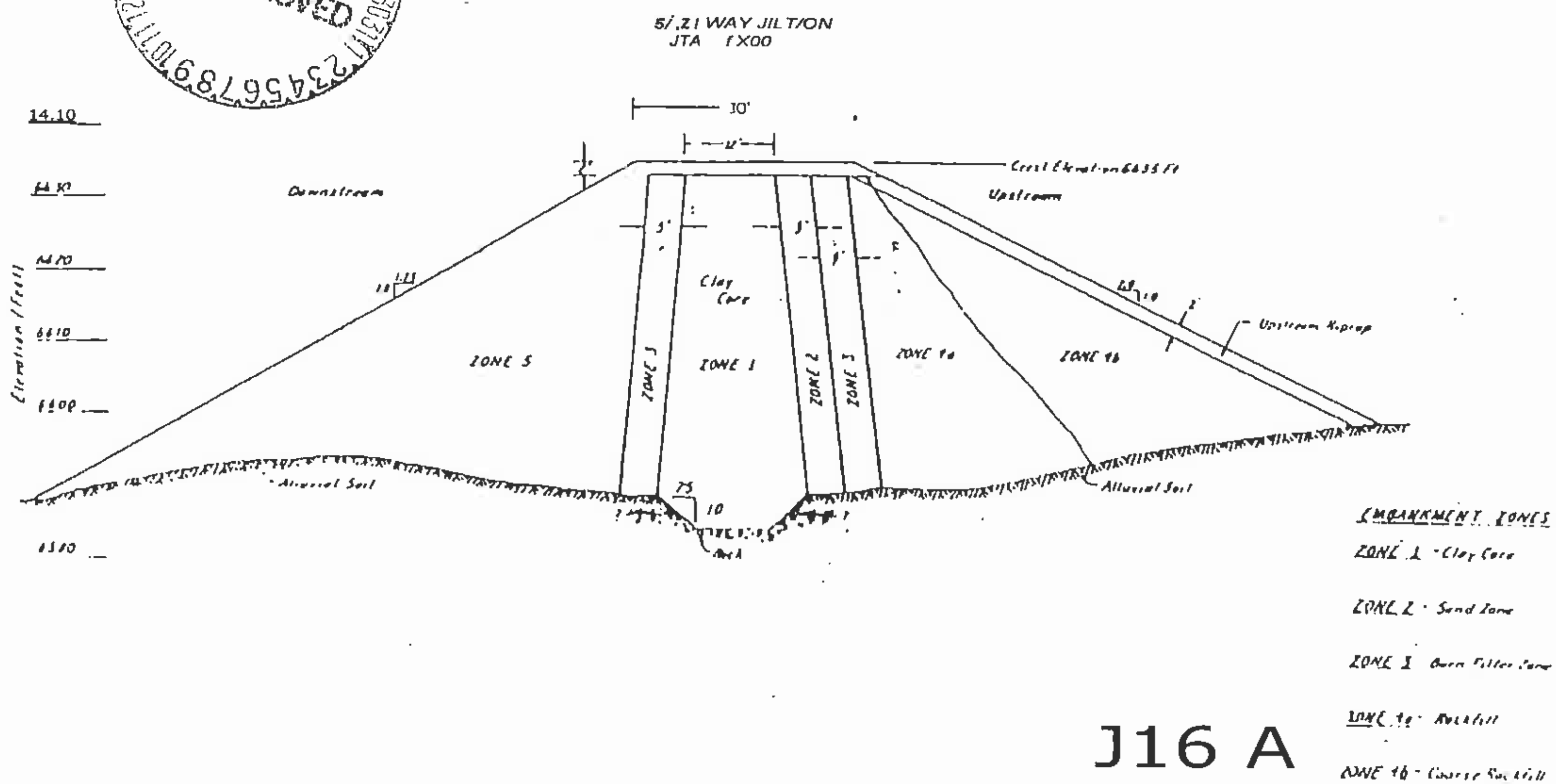



FIGURE 4

# J16 A

1211-AZ-09-01195-07 (10/01/86)

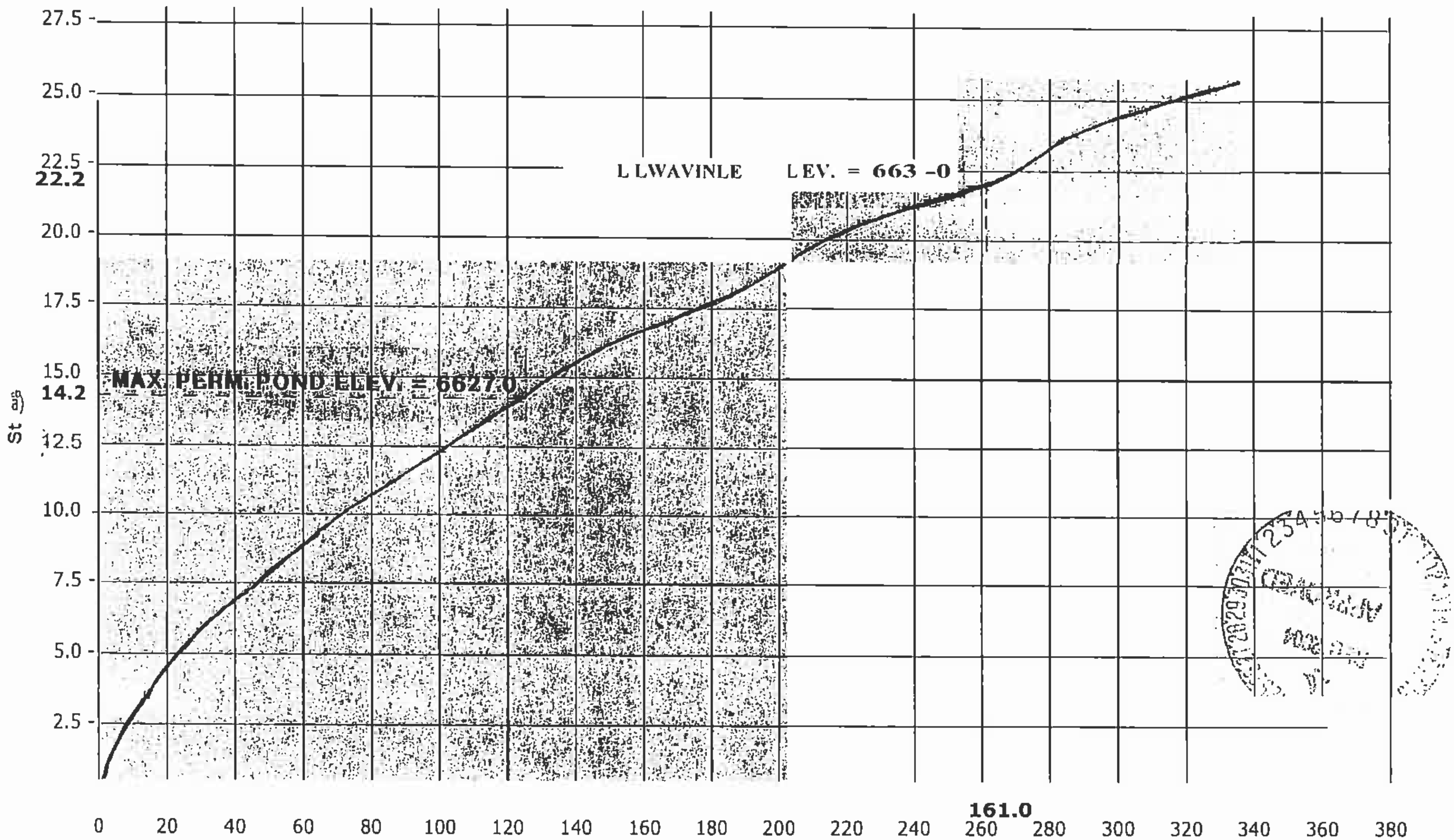
# Dam Cross-Section

# Exhibit "A"

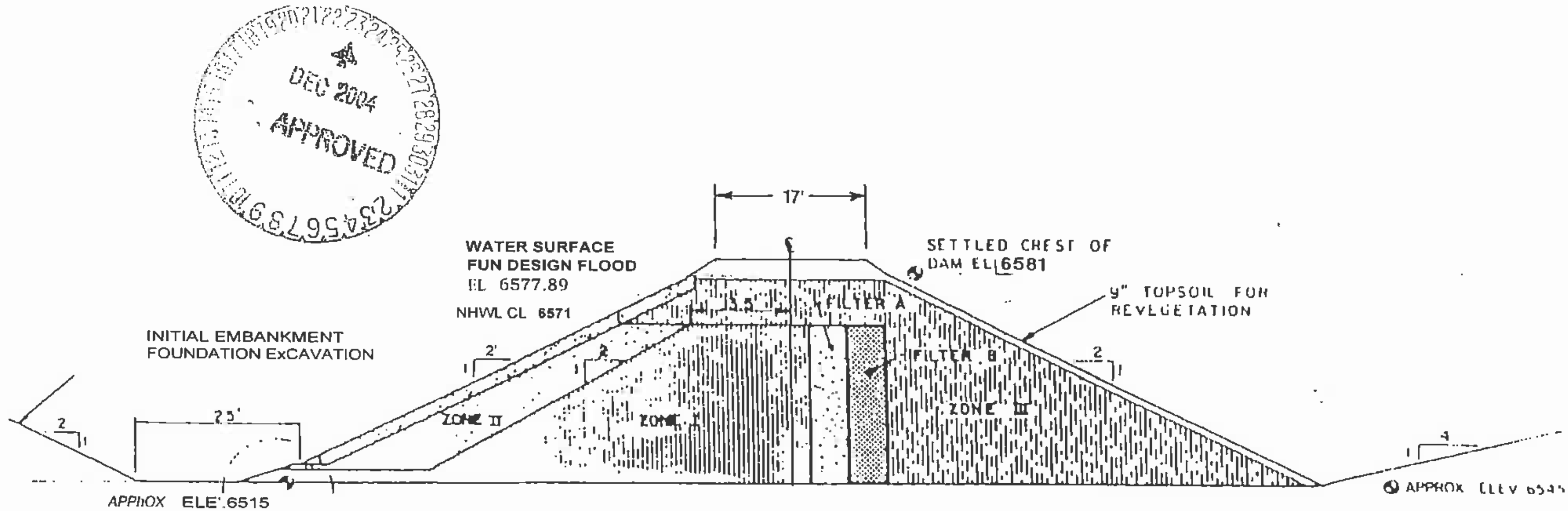
# Date: 11-15-85

REVISED 08/03/98

## Stage-Capacity Curve, J16-A
## Black MesalKayenta Mines




Capacity ac.-ft.
FIGURE 5




TYPICAL SECTION FROM STA. 2 +63 TO 4+50 AND STA. 7 +50 TO 9 +34

FIGURE d

# J16 L

1211-AZ-09-01195-08 (10/01/86)

# Dam Cross-Section
# Exhibit "A"
# Date: 11-15-85

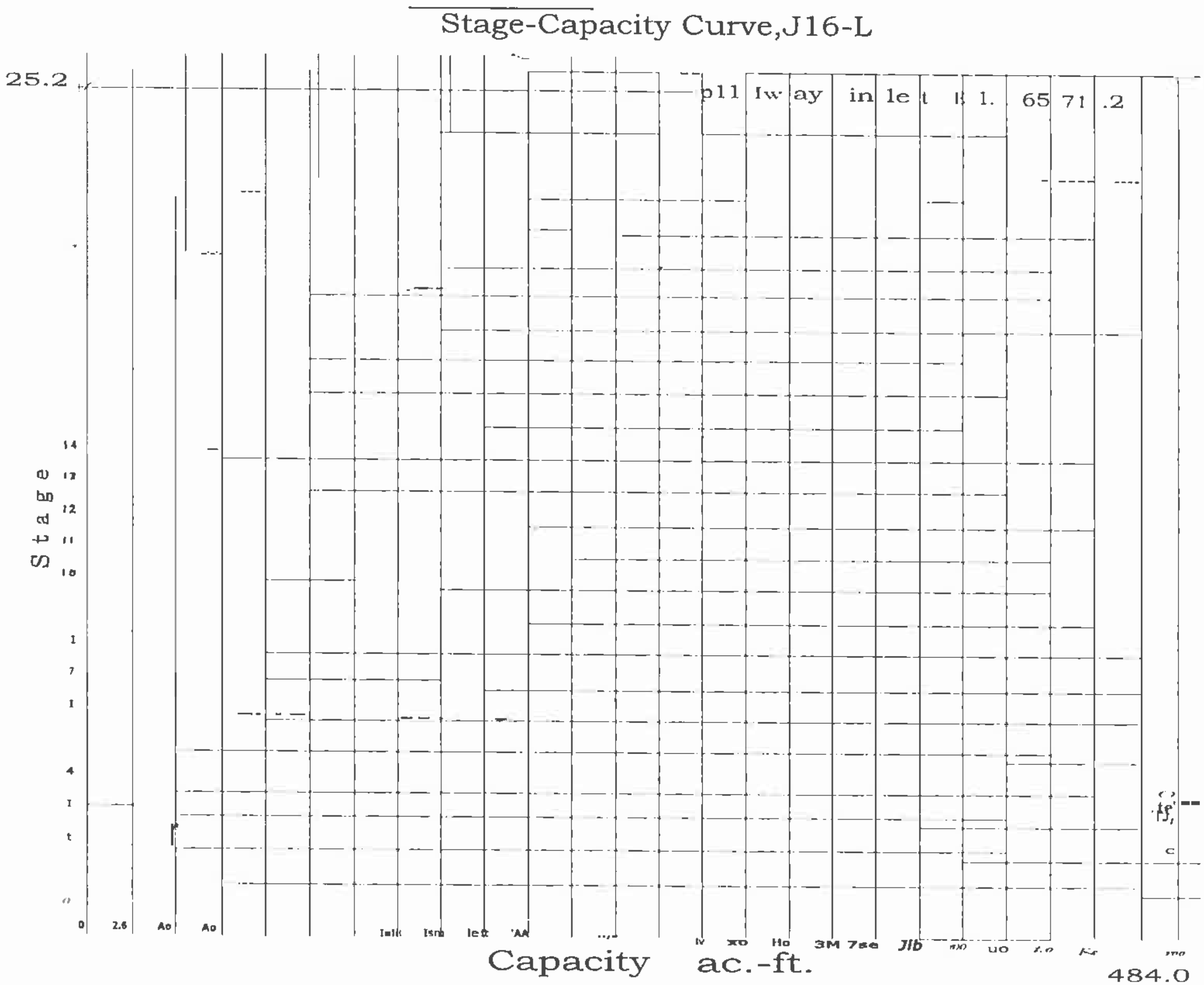
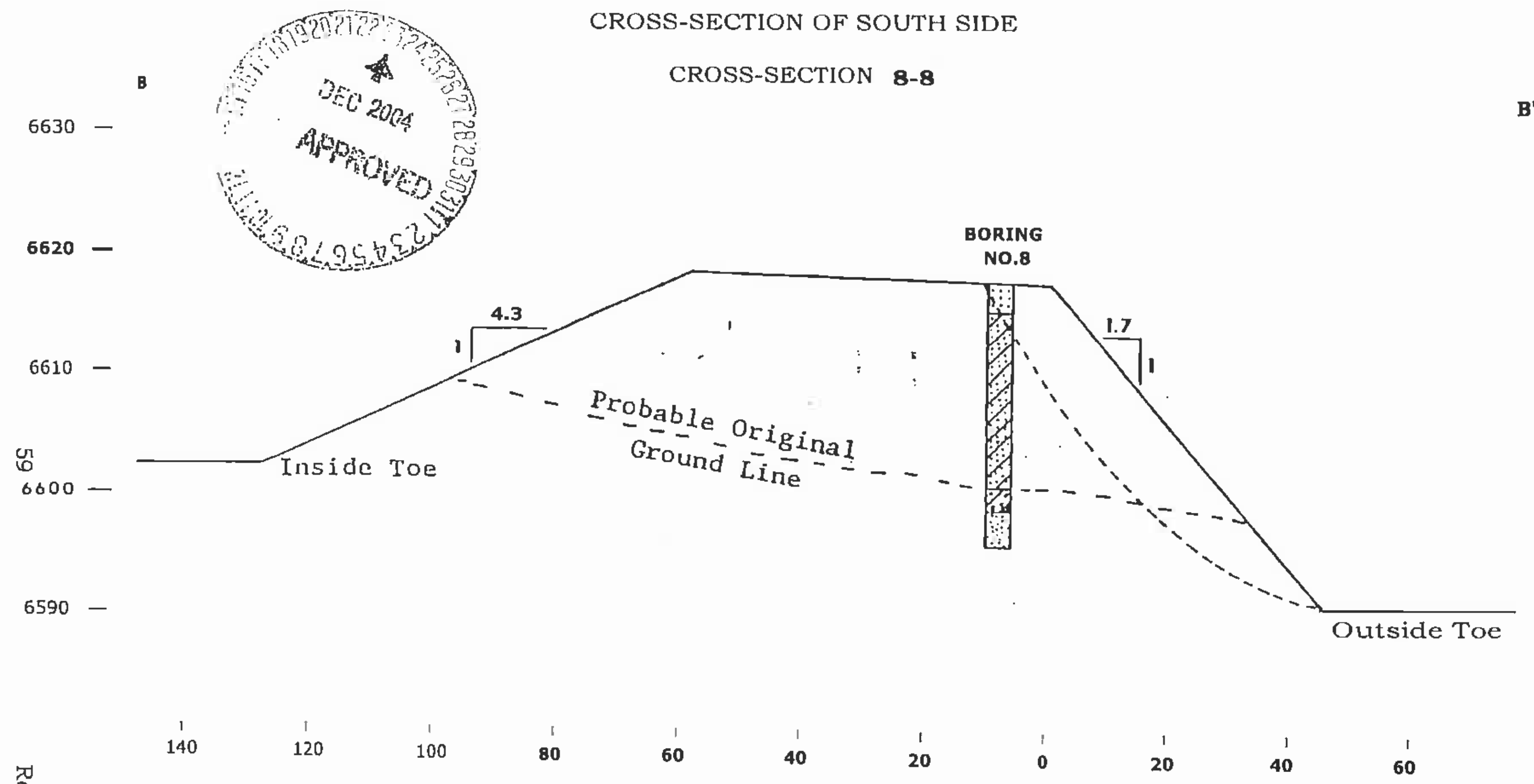



**FIGURE 7**

CROSS-SECTION OF SOUTH SIDE

CROSS-SECTION **8-8**




Revised 08/31/90

FIGURE 8

# KM-FWP

1211-AZ-09-01195-01 (10/01/86)

## Dam Cross-Section

## Exhibit "A,,

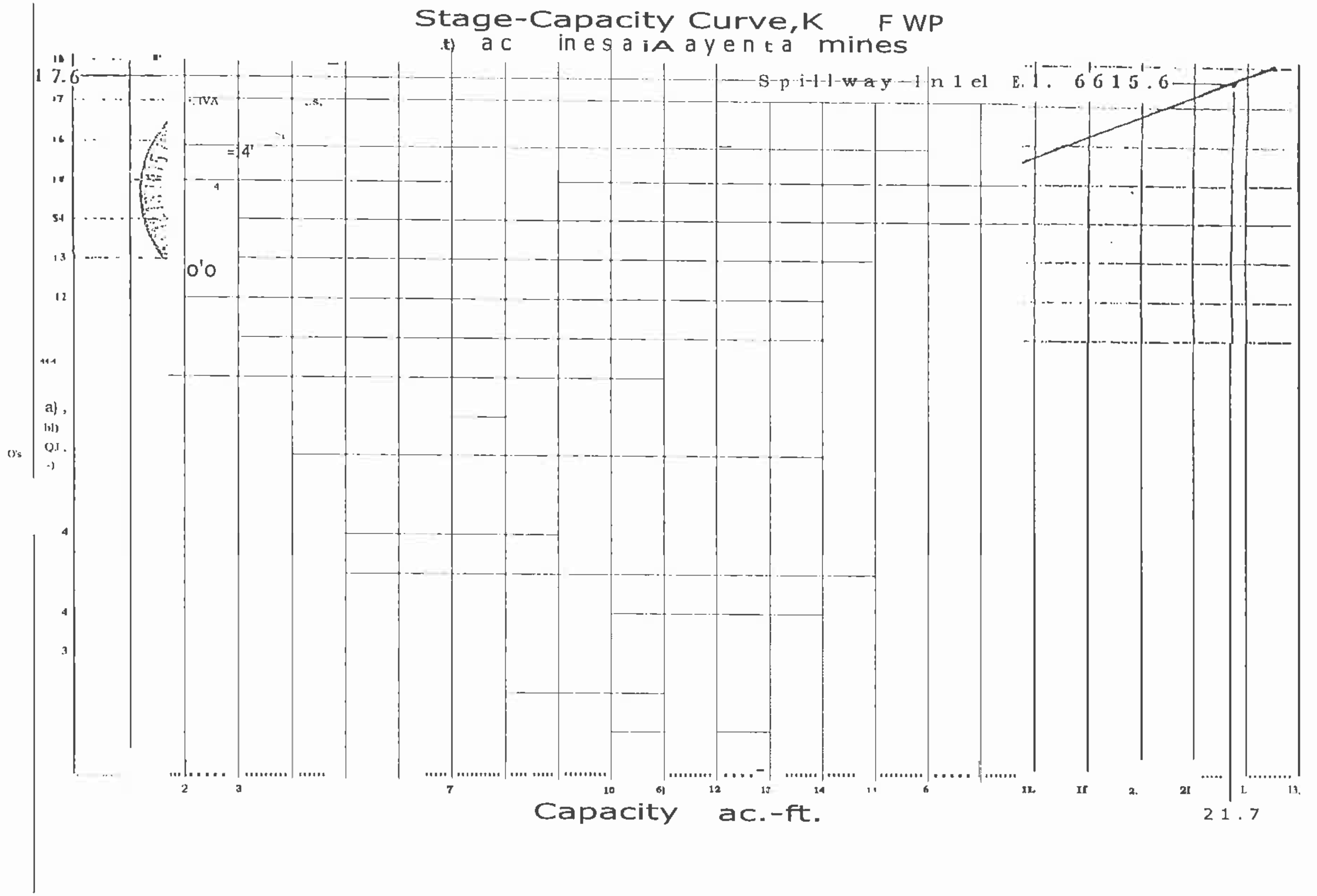
hat 2• 11 1 1Z.--12 ɛ

runoff only from the adjacent access road which is approximately one acre, with a total present storage capacity of approximately 21.7 acre-feet. Drawing No. 85418 shows the current "as-built" condition of the reservoir site. Figure 9 depicts the current stage-capacity curve for KM-FWP. More detailed design information can be found in SHB "Geotechnical Investigation Report, Dam No. 1" (8/16/76) previously submitted to OSM and included in Attachment R.

VII. N14-D, MSHA I.D. No. 1211-AZ-09-01195-02. N14-D is a multi-zoned earth dam constructed in 1982 to control runoff from mining areas and as part of the Kayenta Mine Road and PWCC's overland conveyor system (see Figure 10 for a typical cross section of the embankment. The detailed design for N14-D was submitted in Volume 19, Tab E of Permit AZ-0001. Approval was received from MSHA on 10/15/81 and from OSM on 7/23/81. Drawing No. 85420 shows the current "as-built" condition of the dam site. N14-D drains a watershed of approximately 1,836 acres with a total present storage capacity of approximately 559 acre-feet. Figure 11 depicts the current stage-capacity curve. More detailed design information can be found in SHB's "Geotechnical Investigation Report" (6/30/81) submitted previously to OSM.

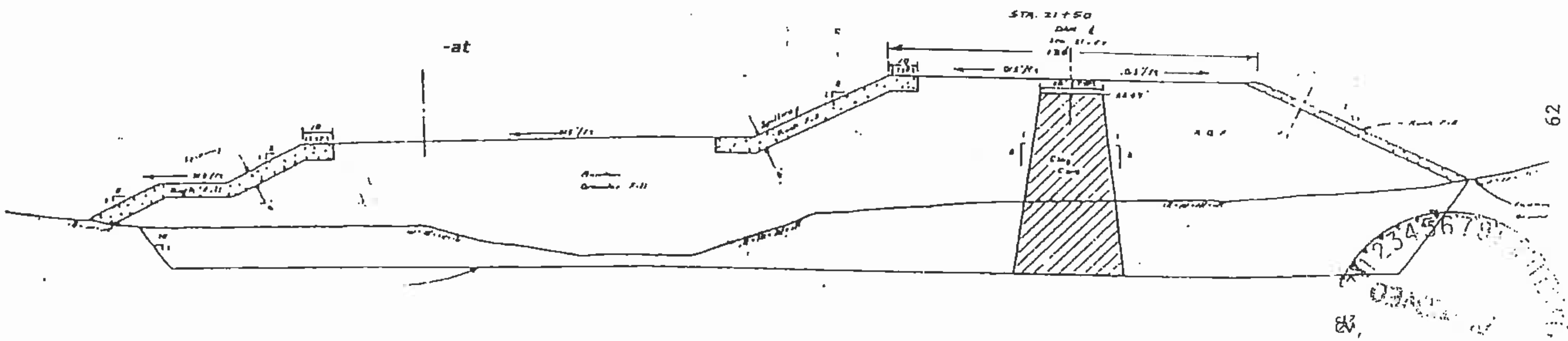
VIII. N14-E, MSHA I.D. No. 1211-AZ-09-01195-03. N14-E is a multi-zoned earth dam constructed in 1982 to control runoff from the mining areas and as part of PWCC's overland conveyor system (see Figure 12 for a typical cross section of the embankment). The detailed design of N14-E was submitted in a letter amendment (7/24/81) to Permit AZ-0001. Approval was received from MSHA on 12/8/81 and from OSM on 2/17/82. Drawing No. 85422 shows the current "as-built" condition of the dam site. N14-E drains a watershed of approximately 157 acres with a total present storage capacity of approximately 66 acre-feet. Figure 13 depicts the current stage-capacity curve. More detailed design information can be found in SHB's "Geotechnical Investigation Report" (7/24/81) submitted prior to OSM's approval.

IX. N14-F, MSHA I.D. No. 1211-AZ-09-01195-04. N14-F is a multi-zoned earth dam constructed in 1982 to control runoff from the mining areas and as part of the N14-14 East haul road (see Figure 14 for a typical cross section of the embankment). The detailed design of N14-F was submitted in Volume 21, Table C in an amendment to Permit AZ-0001. Approval was received from MSHA on 5/21/82 and from OSM on 3/25/82. Drawing No. 85424 shows the current "as-built" condition of the dam site. N14-F drains a watershed of approximately 376 acres with a total present storage capacity of approximately 61 acre-feet. Figure 15 depicts the current stage-capacity curve.



Stage-Capacity Curve,K F WP
Spillway Inlet El. 6615.6
Capacity ac.-ft.
21.7
17.6


FIGURE 9




N 14-

1211-AZ-09-01195-02 (10/01/86)

# Dam Cross-Section

Exhibit "A"

Date: 11-15-85

FIGURE *10*

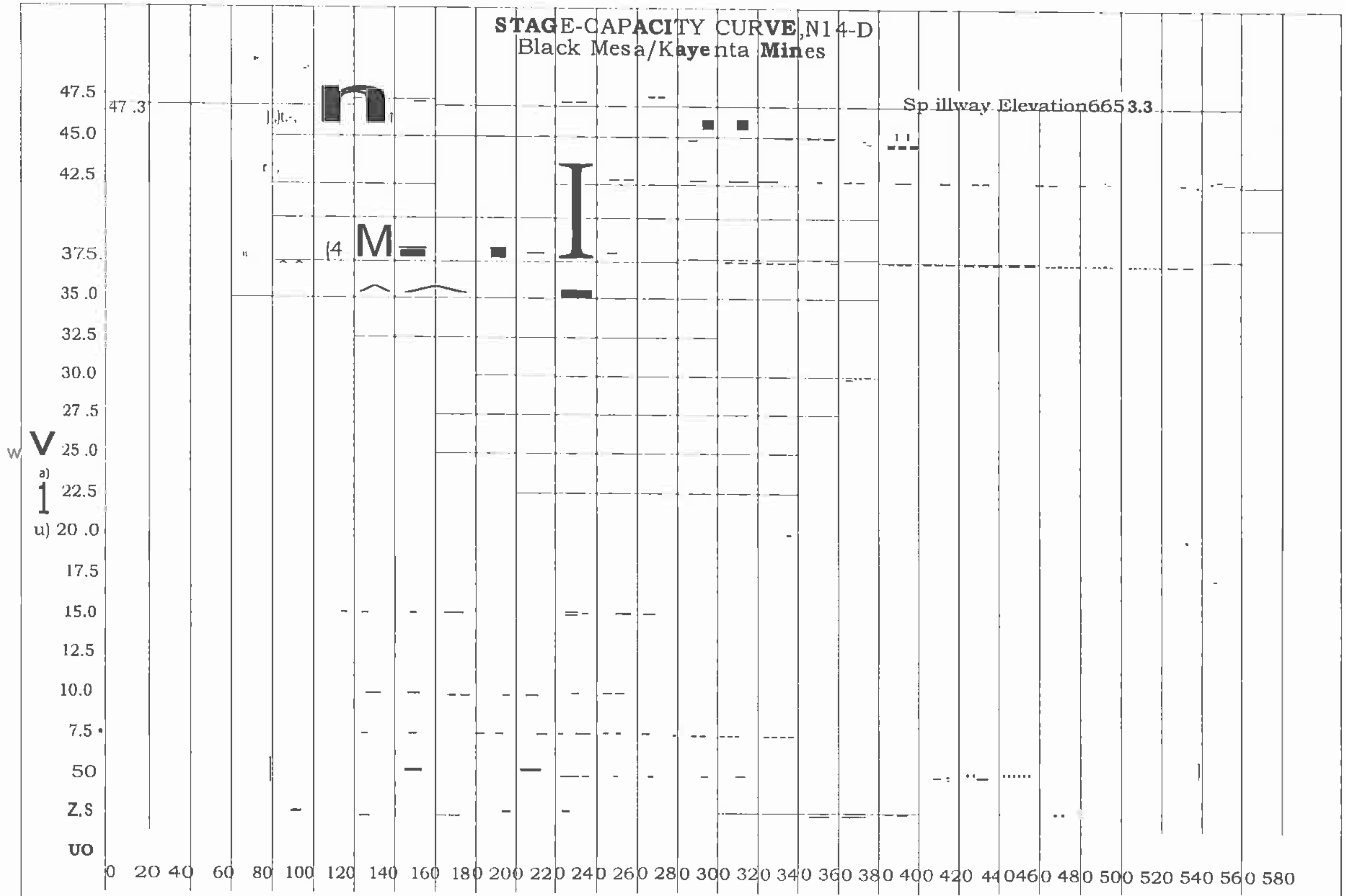
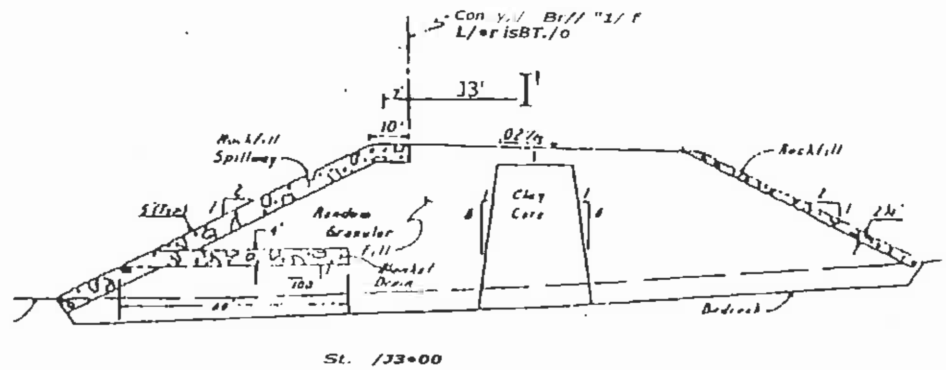

STAGE-CAPACITY CURVE,N14-D
Black Mesa/Kayenta Mines
Spillway Elevation6653.3
47.3
47.5
45.0
42.5
37.5
35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
50
Z.S
UO
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580
559.3
Capacity ac.ft.

FIGURE 11




N 14-E

1211-AZ-09-01195-03 (10/01/86)

Dara Cross-Section

Exhibit "A"

Date: 11-15-85

FIGURE 12

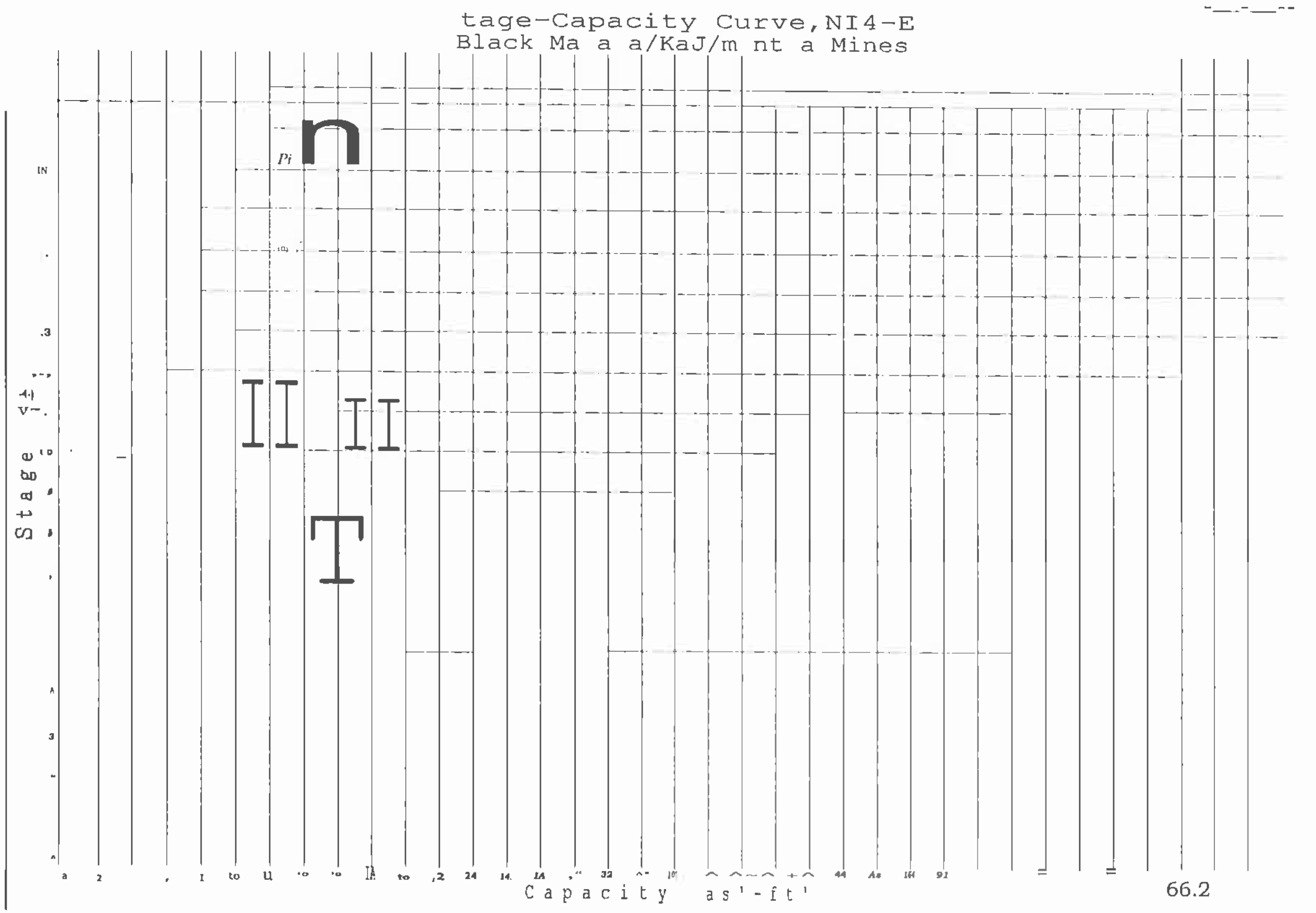

tage-Capacity Curve, NI4-E
Black Ma a a/KaJ/m nt a Mines
Stage
Capacity
66.2

**FIGURE 13**

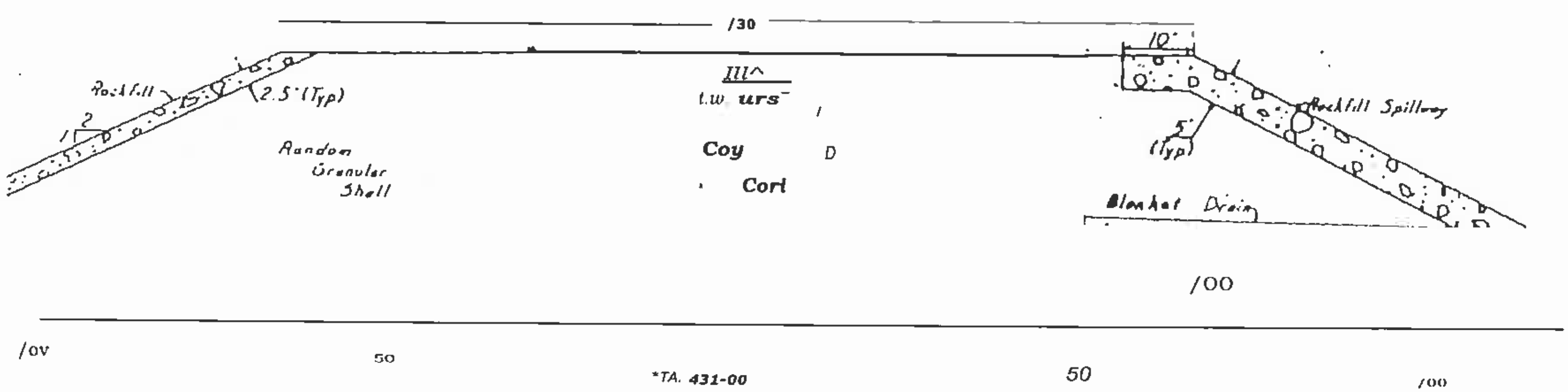



FIGURE 14

# N14F

1211-AZ-09-01195-00 (10/01/86)

# D-am Cross-Section

# Exhibit "A"

# Date: 11-15-85

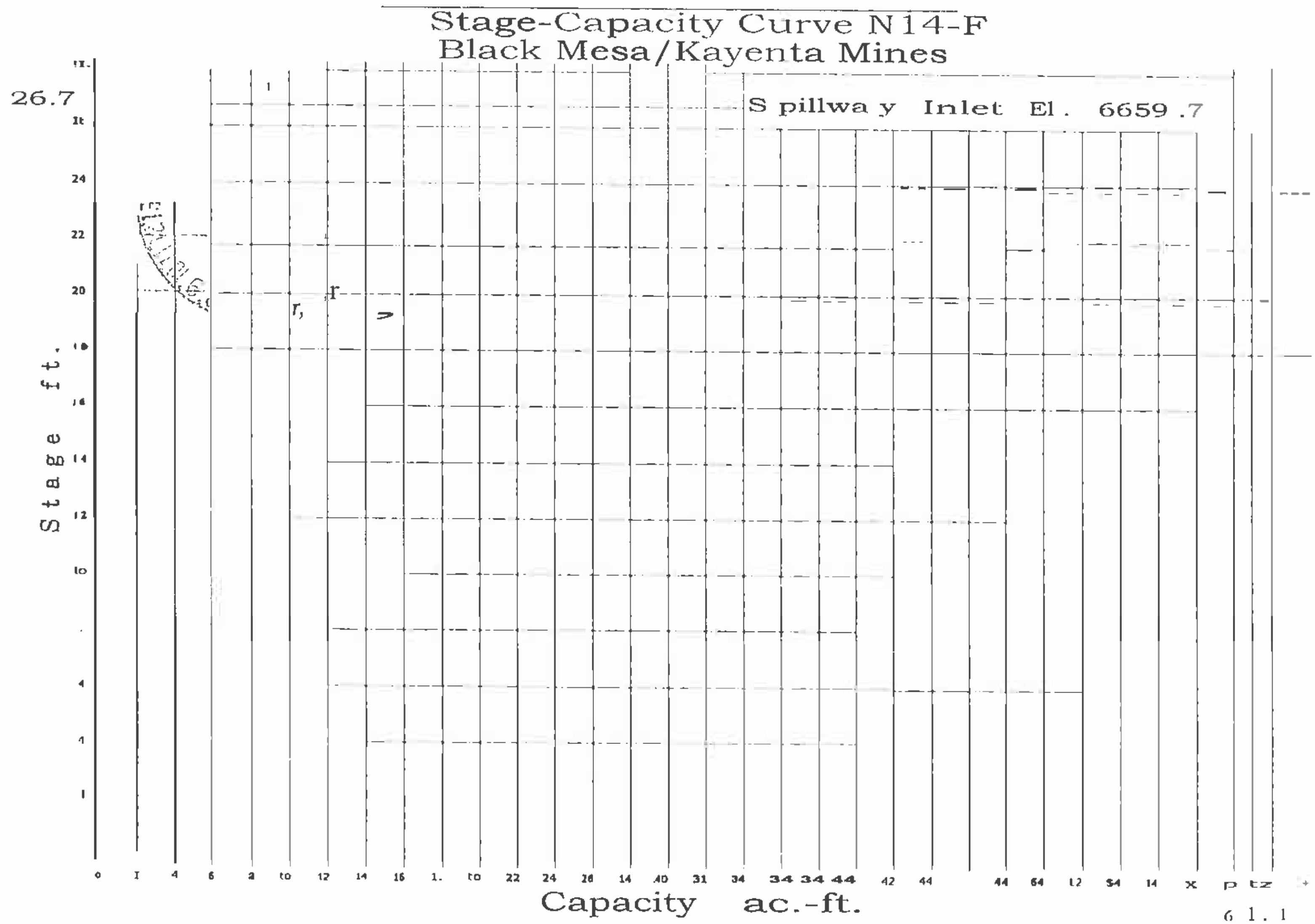

Stage-Capacity Curve N14-F
Black Mesa/Kayenta Mines
Spillway Inlet El. 6659.7
26.7
Stage ft.
Capacity ac.-ft.

FIGURE 16

1414-F has approximately sixty-five percent of its original design storage capacity. The total storage capacity was originally 94 acre-feet, and it currently has 61.1 acre-feet of capacity. This reduction resulted from mine spoil being placed in part of the ponding area. The embankment was not affected; therefore, Dames & Moore reviewed the current hydrology and hydraulics of the dam to assure compliance with the regulations (see Attachment J, Dames & Moore's "N14-F, Review Report"). The spillway is adequate to handle the 100-year, 6-hour storm and the ponding area can hold 20.37 acre-feet of runoff plus the equivalent of 33 years of sediment storage. More detailed design information can be found in SHB's "Geotechnical Investigation Report" (12/30/81) submitted prior to OSM's approval.

X. N14-G, MSHA I.D. No. 1211-AZ-09-01195-05. N14-G is a multi-zoned earth dam constructed in 1982 to control runoff from the mining areas and as part of the N-14 East haul road (see Figure 16 for a typical cross section of the embankment). The detailed design of N14-G was submitted in Volume 21, Table C as an amendment to Permit AZ-0001. Approval was received from MSHA on 5/21/82 and from OSM on 3/25/82. Drawing No. 85426 shows the current "as-built" condition of dam site. N14-G drains a watershed of approximately 1,479 acres with a total present storage capacity of approximately 185 acre-feet. Figure 17 depicts the current stage-capacity curve. More detailed design information can be found in SHB's "Geotechnical Investigation Report" (12/30/81) submitted prior to OSM's approval.

XI. N14-H, MSHA I.D. No. 1211-AZ-09-01195-06. N14-H is a multi-zoned earth dam constructed in 1985 to control runoff from the mining area (see Figure 18 for a typical cross section of the embankment). The detailed design of N14-H was submitted to OSM on 10/7/82 in Volume 36 of Permit AZ-0001. Approval was received from MSHA on 3/9/84 and from OSM on 2/21/84. Drawing No. 85428 shows the current "as-built" condition of the dam site. N14-H drains a watershed of approximately 1,615 acres with a total present storage capacity of approximately 227 acre-feet. Figure 19 depicts the current stage-capacity curve. More detailed design information can be found in SHB's "Geotechnical Investigation Report" previously submitted to OSM.

After a review of the above information for each MSHA dam and based on prior review and approval of the structure by the appropriate regulatory agencies, PICC believes these structures are in compliance with 30 CFR 780.12. Each structure was constructed and/or modified under the supervision of a registered professional engineer.

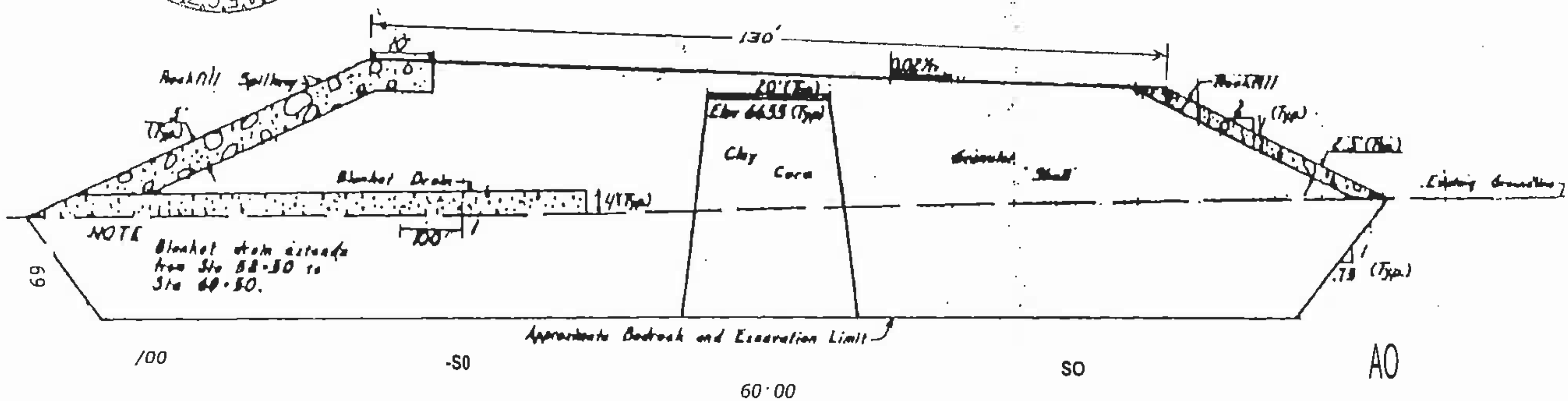



FIGURE 10

# N14-G

1211-AZ-09-01195-05 (10/01/86)

## Dam Cross-Section

## Exhibit "A"

## Date: 11-15-85

## Stage-Capacity Curve, N14-G
## Black Mesa/Kayenta Mines

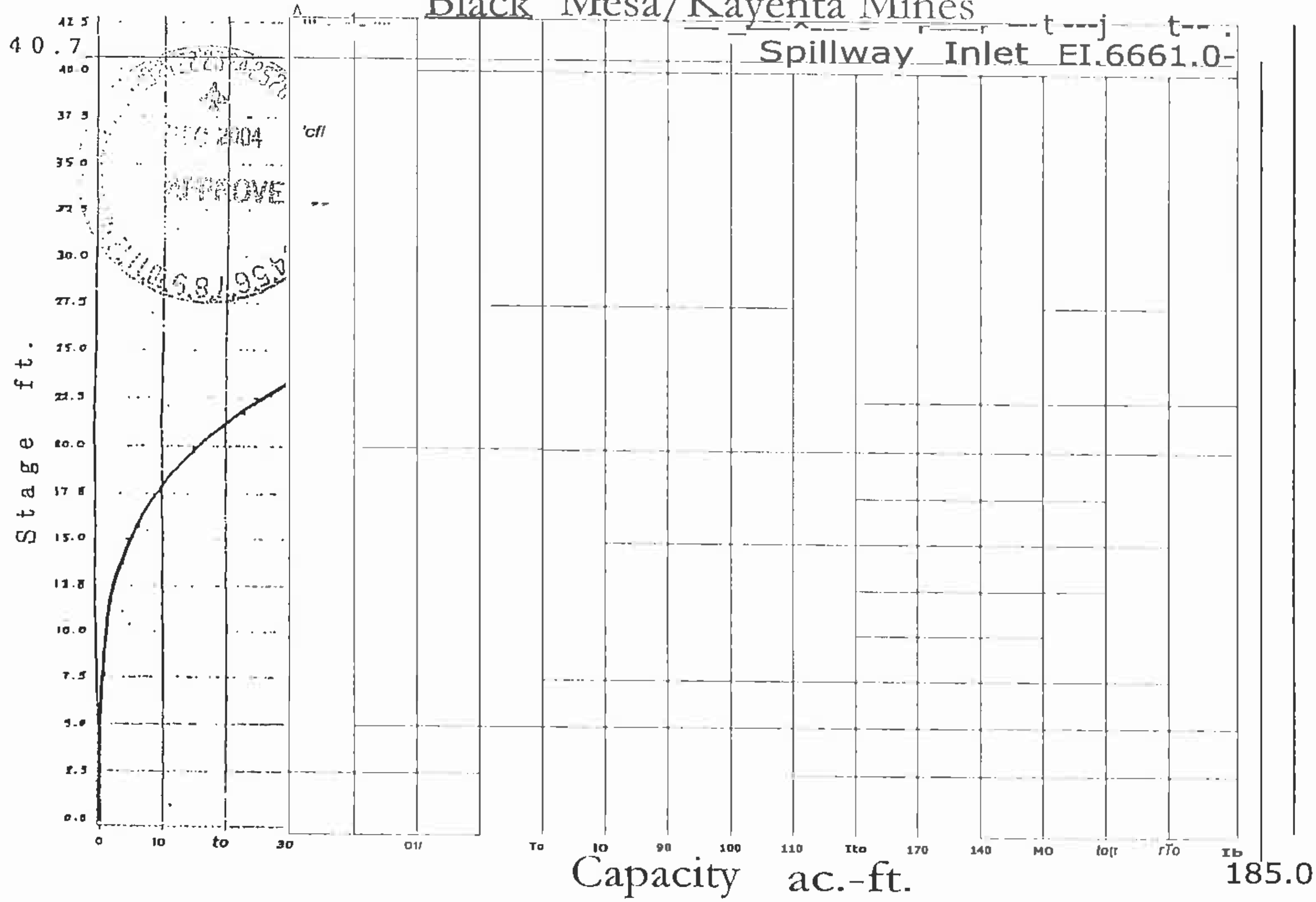



**FIGURE 17**

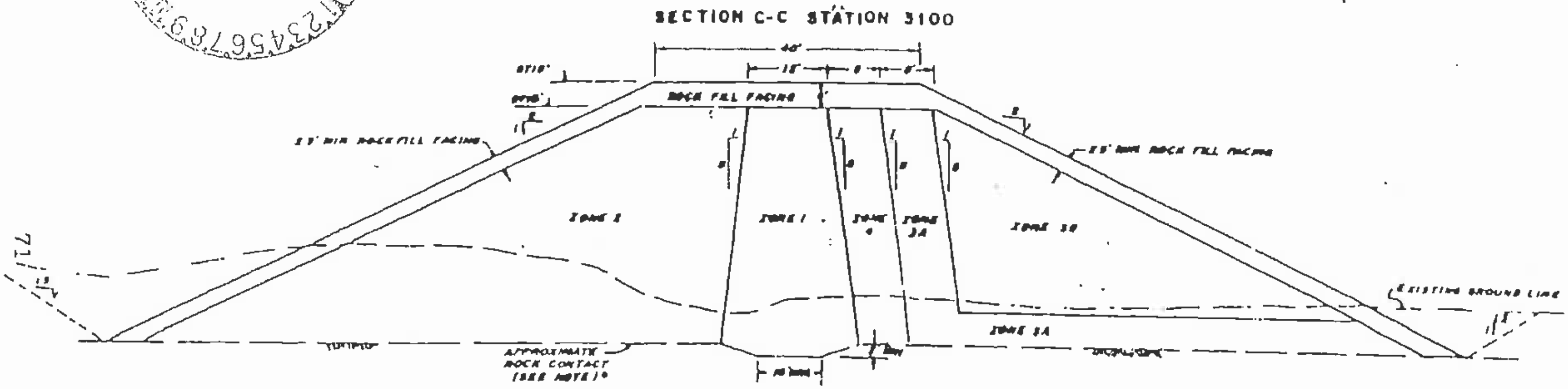



FIGURE 18

# N14-H

1211-AZ-09-01195-06 (10/01/86)

## Dam Cross-Section
## Exhibit "A"
## Date: 1 1-1 5-85



Revised 08/31/90

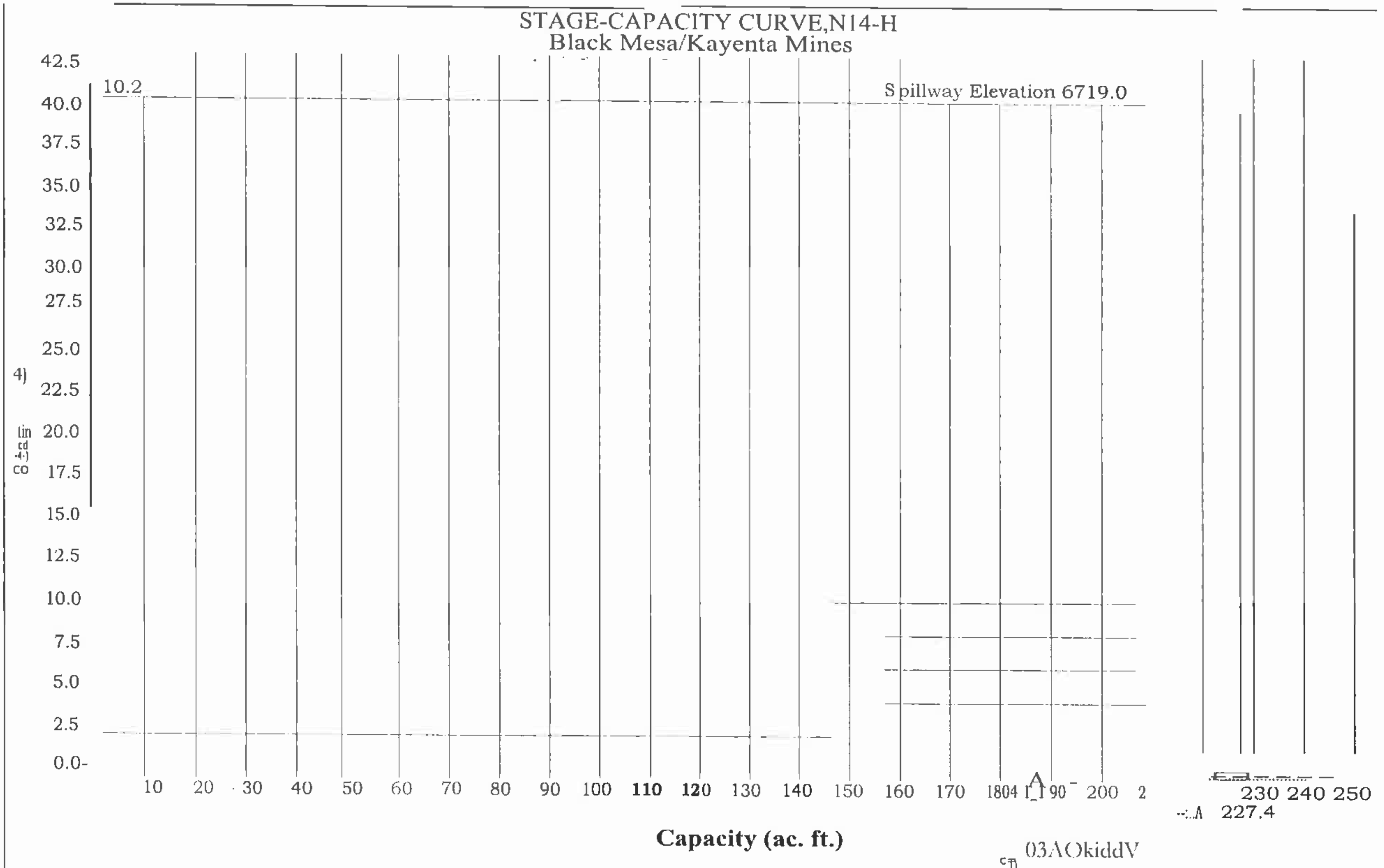

STAGE-CAPACITY CURVE,N14-H
Black Mesa/Kayenta Mines
Spillway Elevation 6719.0
10.2
227.4
42.5
40.0
37.5
35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 230 240 250
Capacity (ac. ft.)

FIGURE 19

Drawing No. 85406 compares the design runoff capacity of each existing structure with the present storage capacity and for each structure the present storage capacity is more than adequate to allow storage for the design runoff capacity, plus sediment storage. Therefore, it is safe to assume storage capacity is more than adequate.

The spillway for each structure was constructed according to the approved plan; therefore, it is safe to assume the spillways will perform as approved.

Attachment K and Drawing No 85406 indicate no remedial work is required for any of the existing MSHA-size structures. Therefore, it should be safe to assume there is no apparent structure problems, which creates a risk of harm to the environment or to the public health or safety.

Permanent Impoundments

Fifty-one total water sources that fall into three categories of impoundments for providing water for wildlife and livestock will exist or are being proposed for consideration to permanently exist at final bond release. These categories include Pre-Law internal impoundments, existing and proposed Post-Law internal impoundments, and existing and proposed water control structures (sediment ponds). All of these impoundments are shown on Drawing Nos. 85324 or 85405.

Nineteen pre-law and post-law permanent internal impoundments currently exist that are available for wildlife and livestock use as a part of the post-mining landscape. Three permanent impoundments are approved permanent internally draining ponds located in the N-2 coal resource area and are designated as N2-RA, N2-RB, and N2-RC. Sixteen impoundments existed prior to the 1982 issuance of the Interim Program Permit or are Pre-Law internal impoundments. The sixteen structures include five Post-Law structures, 31-RA.(J1-PI 4#1), J1-RB(J1-PI #2), J3-G(J3-G(PI)), N1-RA(N1-PI #3) and N8-RA(N8-PI #1), and 85 Pre-Law structures. Five Pre-Law structures are located in the J-3 coal resource area, J3-PII #1, J3-PII ##2, J3-PII #3, J3-PII #4, and J3-PII #5, and the N-1 coal reeurce area has six Pre-Law structures, N1-PII $1, N1-PII #2, N1-PII #4, N1-PII 45, N1-#6, an 1-PII #7 (see Drawing No. 85324).

The exit i'. N2-RA, N2-RB and H2-RC Post-Law internal permanent impoundments have been 1^rfisly designed and approved in the AZ-0001 permit. Individual inspection reports as well as the approved design are included in Attachment H. PWCC and Dames & Moore evaluated the current condition of each impoundment based on the new 30 CFR regulations. Included in the inspection reports are a site description; stability, hydrology and hydraulics description; stability, hydrology and hydraulics analysis; remedial compliance plans and the 1985 inspection reports.

One additional internal permanent impoundment is being proposed for consideration in this PAP (J19-RB). It will be located in the J-19 coal resource area. Water persistence work sheet calculations are provided in Attachment T. Detailed designs will be submitted in accordance with schedule provided in Table 1.

In addition to the nine Post-Law internal impoundments, PWCC is also proposing an additional thirty-one existing or proposed sediment control structures be considered as permanent impoundments (Table 9). These thirty-one impoundments include nine existing MSHA structures, 20 existing sediment control structures, and 2 proposed sediment control structures. Of the 5 Post-Law, pre-1982 internal impoundments, one existing structure, J3-G, is currently being utilized for sediment control; however, it is more applicable to consider this structure as an internal impoundment being utilized as a sediment control structure. The other four Post-Law, pre-1982 structures, J1-RA, J1-RB, N1-RA, and N6-RA, are located in the reclamation.

Being multi-purpose structures, these impoundments are utilized for sediment control during the life of the mining and reclamation operations and will then be converted to permanent structures prior to final bond release. Detailed designs will be submitted for approval in accordance with the schedule provided in Table 1 prior to construction. Designs for proposed structures, or modification of existing structures will address permanent impoundment performance standards. Water persistence worksheet calculations are provided in Attachment T. Additional reference information can be found for each structure in Table 4.

Peabod[y] Engineering Design (Permanent Impoundments). Waste and Land, Inc. (WWL), Fort Collins, Colorado to study and model pertinent hydrological parameters and analyze the structural stability of potential internal impoundments. The resultant report was submitted to OSM in April, 1982 (PAP-Appendix E, Volume 27).

The hydrologic parameters related to the permanent impoundments were analyzed by WWL *through* the use of three computer models. The first model developed precipitation statistics for the Black Mesa leasehold by analyzing a 30-year precipitation record from nearby Betatakin, Arizona. The precipitation statistics were then integrated in a Monte Carlo simulation to develop a precipitation sequence by day that retains the statistical properties of the 30-year historical record.

Table 9

Proposed Permanent Impoundments, Including Post-Law Internal Impoundments and Sediment Control Structures

| Pond ID | Condition | Drainage Area (acres) |
|---|---|---|
| J1-RA | Existing(I) | 327.7* |
| J1-RB | Existing(I) | 25.5* |
| J2-A | Existing(M) | 2661.3 |
| J3-D | Existing(S) | 318.0 |
| J3-E | Existing(5) | 251.3 |
| J3-G | Existing(I) | 241.8 |
| J7-DAM | Existing(M) | 5256.7 |
| J7-JR | Existing(M) | 3960.3 |
| J7-R | Existing(S) | 260.1 |
| J16-A | Existing(M) | 2415.0 |
| J16-G | Existing(S) | 272.0 |
| J16-L | Existing(M) | 7355.9 |
| J19-RB | Proposed(I) | 517.1* |
| J21-A | Existing(S) | 544.0 |
| J21-C | Existing(S) | 1182.0 |
| J21-I | Proposed(S) | 731.1* |
| J27-RA | Existing(S) | 45.8 |
| J27-RB | Existing(S) | 10.8 |
| J27-RC | Existing(S) | 86.8 |
| N1-RA (OSM Released 10/04) | Existing(I) | 615.6 |
| N2-RA (OSM Released 10/04) | Existing(I) | 317.0 |
| N2-RB (OSM Released 10/04) | Existing(I) | 349.8 |
| N2-RC (OSM Released 10/04) | Existing(I) | 156.2 |
| N5-A | Existing(S) | 531.1 |
| N6-L | Existing(S) | 402.6 |
| N7-D | Existing(S) | 756.0 |
| N7-E | Existing(S) | 246.9 |
| N8-RA | Existing(I) | 305.3 |
| N10-A1 | Existing(S) | 701.8 |





Revised 01/28/05

Table 9 (cont.)

Proposed Permanent Impoundments, Including Post-Law Internal Impoundments and Sediment Control Structures

| Pond ID | Condition | Drainage Area (acres) |
|---|---|---|
| N10-D | Existing(S) | 286.9 |
| N10-G | Proposed(P) | 463.9* |
| N11-A | Existing(S) | 495.3 |
| N11-G | Existing(S) | 863.0 |
| N12-C | Existing(S) | 473.0 |
| N14-D | Existing(M) | 1636.0 |
| N14-F | Existing(M) | 376.0 |
| N14-G | Existing(M) | 1479.0 |
| N14-H | Existing(M) | 1615.0 |
| TPF-D | Existing(S) | 259.6 |
| TPF-E | Existing(S) | 258.0 |

1 - (S) Sediment Control Structure, (I) Internal Impoundment Structure, (M) MSHA Sediment Control Structure

- Not Designed

The second model calculated the runoff corresponding to the precipitation input for each day, the pond depth for each runoff event, and the change in water quality for each day. The runoff calculations employ accepted NRCS equations and a dimensionless Area Index parameter for corresponding watershed and pond areas. The water quality calculations were based on a mass balance model that incorporated evaporation (based on historical record at Many Farms), seepage, runoff water quality, and pond depth.

The third model determined the sediment yield for each precipitation event. The model utilized the Modified USLE which has been well documented in the literature. The runoff volume and peak discharge were calculated by the runoff model (second model) and the soil erodibility, slope, and conservation factors were determined from MRCS nomographs and tables.

As mentioned previously, the WWL study also addressed the structural stability aspects of the permanent impoundments. Samples of spoil material were obtained from a series of test pits in reclaimed areas on the PWCC leasehold. These samples were analyzed for particle size distribution, plasticity properties, and shear strengths. These parameters were then used in a slope stability model (BISHOP) to assess slope stabilities in the spoil material under static loading and earthquake loading conditions.

The WWL report addressed the quantity, quality, and persistence of water impounded within graded and topsoiled spoil banks, together with stability of graded spoil and impoundments. In essence, the WWL study concluded that there should be no problems concerning impoundment stability and water quality, and that persistence of water in the impoundments was dependent on drainage area and impoundment size. The WWL report and this discussion will provide the basis for the general and detailed design of all permanent impoundments. Although data requirements are slightly different when using the WWL methodology to modify existing structures to permanent impoundments, the results should be conservative.

<u>Design Criteria.</u> Based on site visits and infiltrometer tests, WWL personnel determined that the most reasonable values for the MRCS runoff curve numbers fell within the range of 80 to 75. No attempt has been made to further refine these values. In examining the minimum probability of water in the impoundments, a curve number of 75 was used so as to establish a probable lower bound. To maximize the amount of time an impoundment might contain water, the WWL study made the following recommendations:

1. The pond should be constructed so that the resultant surface area is as small as possible.
2. The pond should have side slopes as steep as permissible so that surface area does not vary greatly with depth.

   The bottom of the pond should be compacted during construction to minimize seepage through the bottom of the pond during the early years of operation.

A \2 0303?a°

Water, Waste and Land Impoundment Design Methodology. The WWL study produced the concept of an "Area Index": the ratio of the total watershed area of a theoretical impoundment to the water surface area of the same theoretical impoundment. A computer watershed model was developed to simulate characteristics of mined spoil impoundments. This model was analyzed for various runoff curve number values, and various values of the Area Index. Generated data for a theoretical impoundment include probability of water, mean depth of water, probability of dissolved solids exceeding a specified amount, together with various statistical parameters resulting from the computer simulation. As might be expected, the probability of water and the mean depth of water in a theoretical impoundment varied directly with the Area Index, i.e., the larger the watershed, the greater chance for water to exist in the impoundment and the higher the mean depth of water.

The WWL computer model is based on the assumption of watersheds of constant Area Inds::; a condition that is impossible to achieve in practice. The boundaries of the watershed can reasonably be expected to remain constant; the water surface area however, will vary with the depth of water in the impoundment. This is due to the fact that impoundment sides cannot be vertical for stability and safety reasons. Typically, the impoundment sides are on a slope of three horizontal to one vertical. Where access to water in the impoundment is desirable, slopes of five horizontal to one vertical or flatter are more desirable. As impoundment area increases with the square of the increasing sides, the variation in Area Index over the possible range of water depths becomes very substantial.

Adaptation of Water, Waste, and Land Methodology. As the WWL study established mean depths for various Area Indexes, it became possible to graph the mean depth as a function of Area Index for curve numbers of 75 and 80 (see Figure 20). In addition, the standard deviation of the mean depth was added to the mean depth and graphed as a function of the Area Index for both curve numbers. This was done to give some general idea of the upper range of depths at which water might reasonably be expected to persist. It should be noted that the reported values in inches in the WWL report were changed to feet for this graph.

Once the proposed design for an impoundment was determined, it was also possible to determine water surface area, and hence Area Indexes for various depths. Thus, each impoundment also has a depth-Area Index curve. If this curve is superimposed over the mean depth-Area Index curve for a specific curve number (Figure 21), the two curves will intersect at a unique value of mean depth and Area Index. This intersection gives a first approximation of depth and Area Index at *which* Cr impoundment q s;tend to stabilize.

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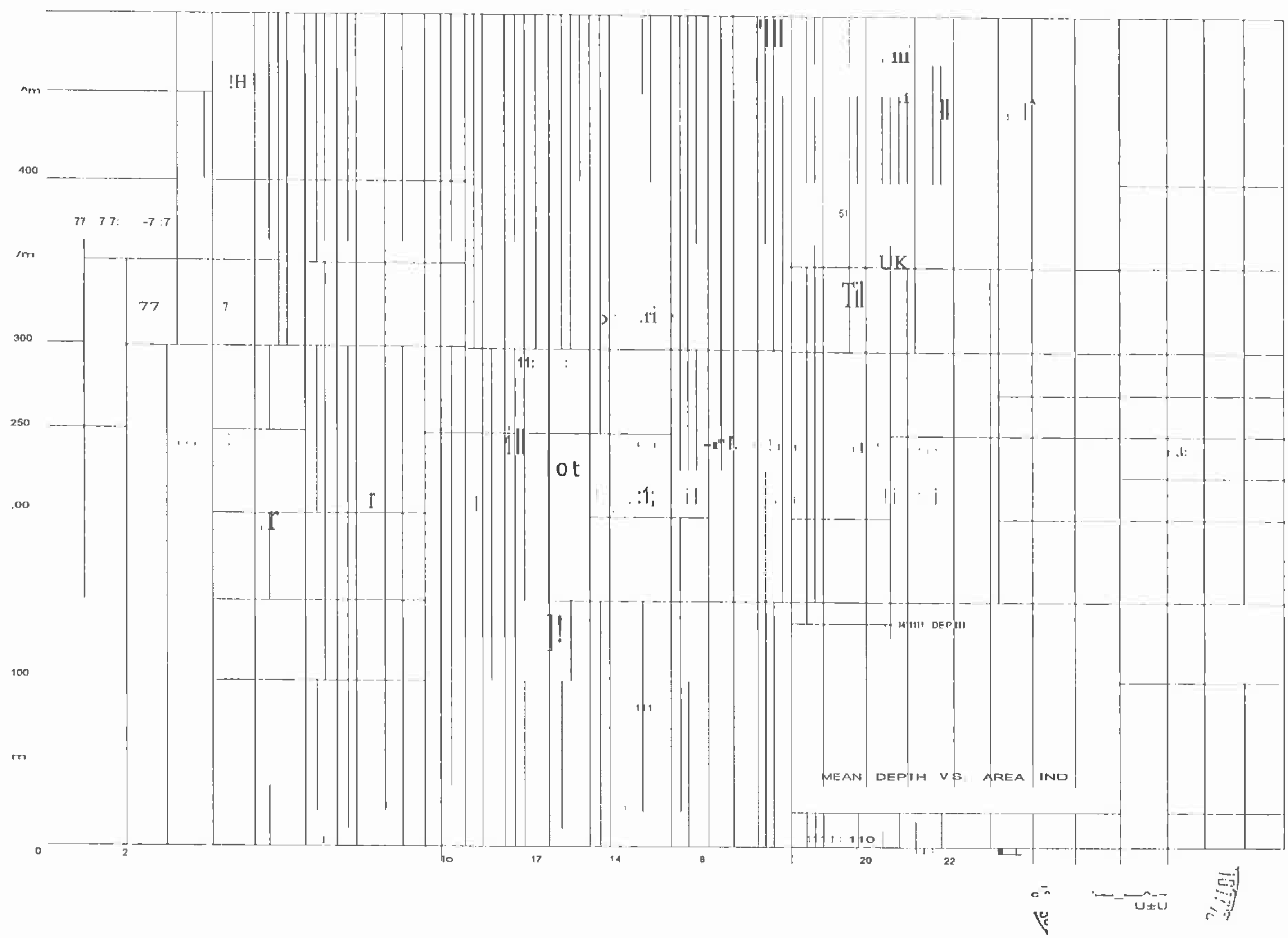

MEAN DEPTH VS AREA IND
400
300
250
100
0
2
17
14
20
22

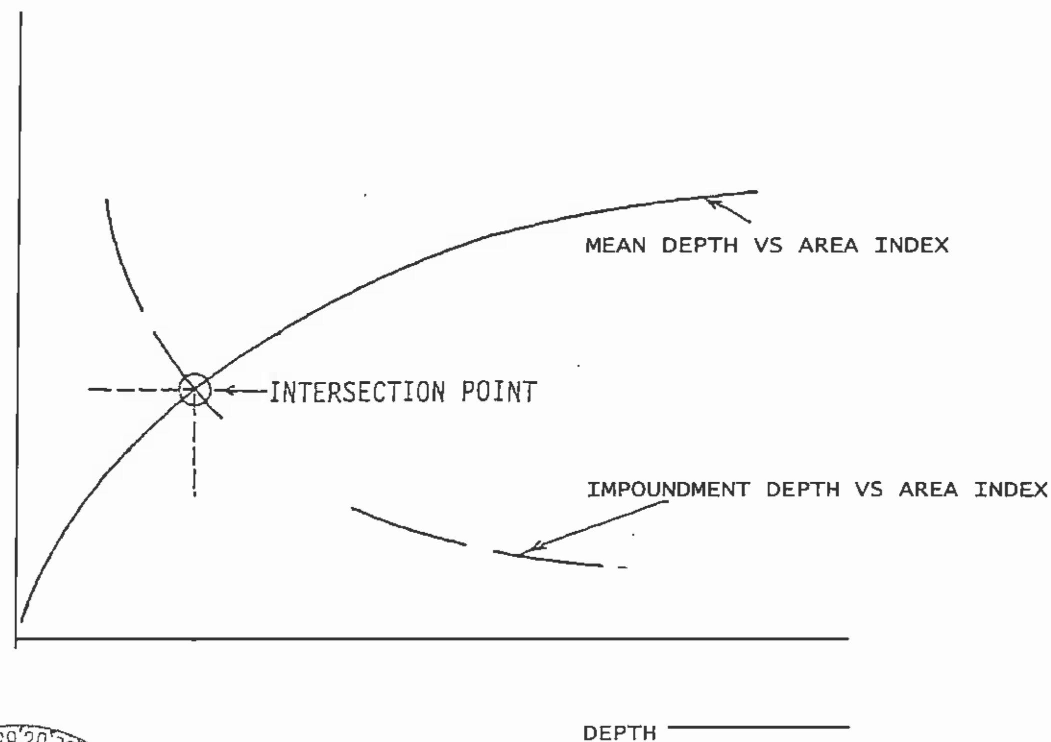





FIGURE 21 MEAN DEPTH AND AREA INDEX.

It should be noted that the "depth" term of each graph has a slightly different meaning. D'pth in the graphs of mean depths-Area Index means depth of a theoretical impoundment with vertical sides, as that was assumed in the WWL analysis. As WWL methodology does not assume gains (runoff) and losses (infiltration, evaporation) to be proportionate to depth of water, only to surface area, it can be seen that a theoretical impoundment will contain a larger volume of water than an actual impoundment at the same depth "d". The theoretical impoundment will have a bottom area equal to the surface area, while the actual impoundment will have a bottom area sometimes much less than the surface area, due to the sloping sides.

The solution to this problem requires the construction of two more graphs plotted along the same depth ordinate used in the previous two graphs. The first graph is simply the depth-capacity curve for the actual impoundment to be constructed. The second is the depth-capacity curve of an impoundment whose surface area varies with depth in the same fashion as the proposed impoundment does, but whose volume meets the criteria of the WWL study, i.e., with vertical sides and bottom area equal to surface area. Thus the volume of this theoretical impoundment is always the surface area multiplied by the depth, $A_y(y)$, where the volume of the actual impoundment is determined by the integral:

$$V \int_{y=c} Ay\, dy$$

where A is a function of y. During the design of impoundments of irregular shape, the above integral is approximated by the average end area method of determining volume.

Various parameters such as actual impoundment depth and volume must be determined. In order to do this, a series of curves are presented on a graph. This graphical method facilitates solving four equations for four unknowns when none of the equations can he easily represented by mathematical formulae.

e first set of curves is obtained from the WWL documents. For each curve number cff" utilUged, a4 eoretical mean depth and theoretical mean depth plus standard deviation-Area Index •t5urvtis plotii (see Figure 20). This basic curve set can be used for any impoundment design. !fie 1$.'e of the Eurves will he explained below.

,I A. second:.of curves is generated from data specific to the proposed impoundment. This data :'l $ water surface area, theoretical volume, Area Index, and actual volume for various rater depths. Both sets of curves are plotted on the same graph.

The basic calculations for a detailed design are as follows:

1. Determine required sediment capacity.
2. Determine maximum design water capacity.
3. Determine impoundment required capacity and depth.
4. Determine worst-case storage requirements and resulting water depth.
5. Compare actual impoundment capacity to required storage.
6. Compare actual impoundment capacity to the standard deviation depth to worst-case storage requirements.
7. Determine water persistence.

The procedure for determining mean depth and volume of water in each impoundment is as follows: (refer to Figure 22) locate the intersection of the actual depth-Area Index curve and the theoretical mean depth-Area Index curve (PT. A). Assume an actual depth approximately equal to 1.1 times the mean depth located by intersection. Determine the Area Index corresponding to this actual depth for the impoundment in question from the actual depth-Area Index curve (PT. B). For this Area Index, determine the theoretical mean depth from the theoretical mean depth-Area Index curve (PT. C). This depth assumes an impoundment with vertical sides. For this theoretical depth, determine the theoretical mean impoundment volume from the theoretical mean depth-capacity curve (PT. D). Finally, determine the actual depth required for this volume from the actual depth-capacity curve (PT. E), and compare to the initial assumed actual depth. If these two depths are not approximately equal, adjust the assumed depth and repeat the above procedure until these depths are equal.

<u>Probability Determination.</u> A general evaluation of water persistence was conducted for two proposed and one existing (J3-G) internal permanent impoundment, one proposed and eight existing MSHA sediment control structures, 6 proposed sediment control structures, and 16 existing sediment control structures. The evaluation estimated the probability that water would persist in the impoundments. Results of this evaluation are provided in Attachment T. The above previous discussions described the detailed design procedure that will be conducted when detailed designs are formulated. The discussion below describes the general evaluation procedure used to determine the persistence probability.

From the graph shown on Figure 23, assuming a MRCS runoff curve number of 75, it can be seen that an impoundment will tend to stabilize at a specific Area Index. The

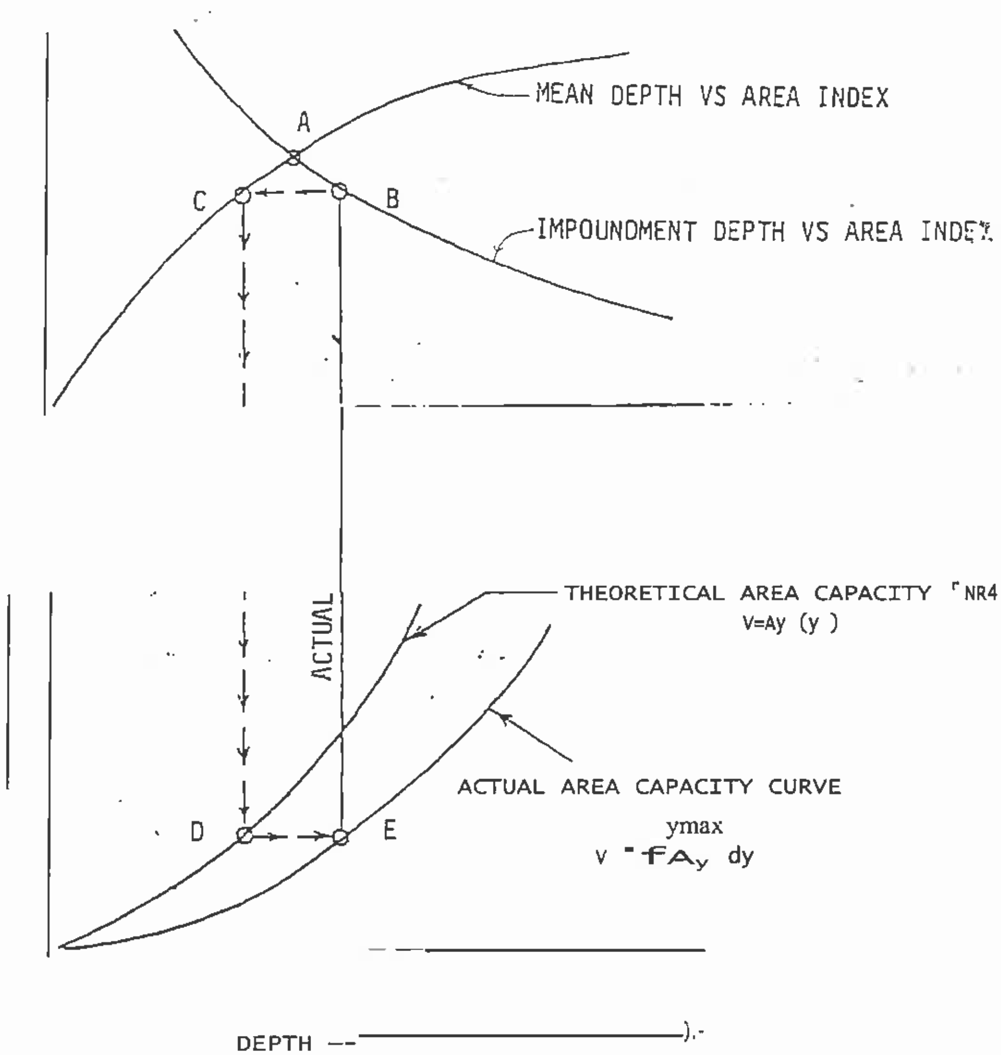
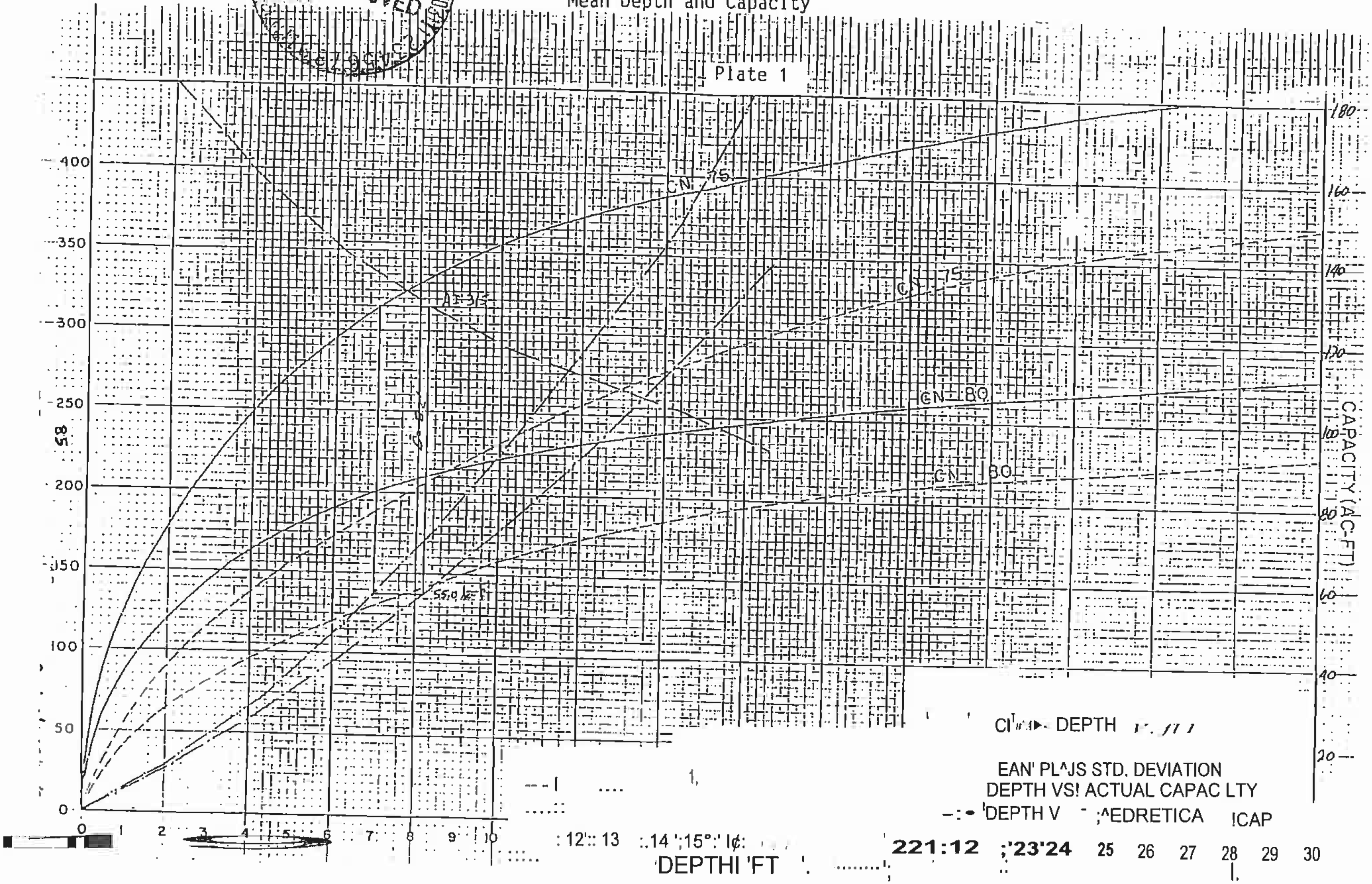



FIGURE 22 MEAN DEPTH AND VOLUME DETERMINATION

FIGURE 23.
Example Graph for Determining
Mean Depth and Capacity



corresponding annual probability of water that would exist for this Area Index is determined from annual depth/probability curves found in the WWL report such as is shown on Figure 24. The probability of water existing in the impoundment was calculated based upon an assumed minimum depth of, the greater of, 3.0 feet or a depth corresponding to a capacity of at least 2.0 ac-ft to ensure livestock and wildlife utilization. The Area Index for that minimum depth is then calculated and worst-case probability determined from the WWL study (monthly) depth/probability curves (Figure 25). The month of July is generally used because this month exhibits the lowest probabilities of depth when the area index is greater than 130. The month of June is utilized for area indexes of 130 or less.

In addition, it should be emphasized that there will be a substantial increase in Area Index for increasing impoundment depths. As depths approach zero, the Area Index for the impoundment approaches a respective upper bound. As the Area Index increases, so does the probability of water existing in the impoundment.

Drawing No. 85406 contains a list of existing and proposed permanent impoundments, locations, map numbers (Drawing 85400), construction dates, and when the remedial work, if applicable, will he completed, embankment stability category, hydrology design data, design storage capacity, and spillway information, when applicable.

Structures Reclaimed

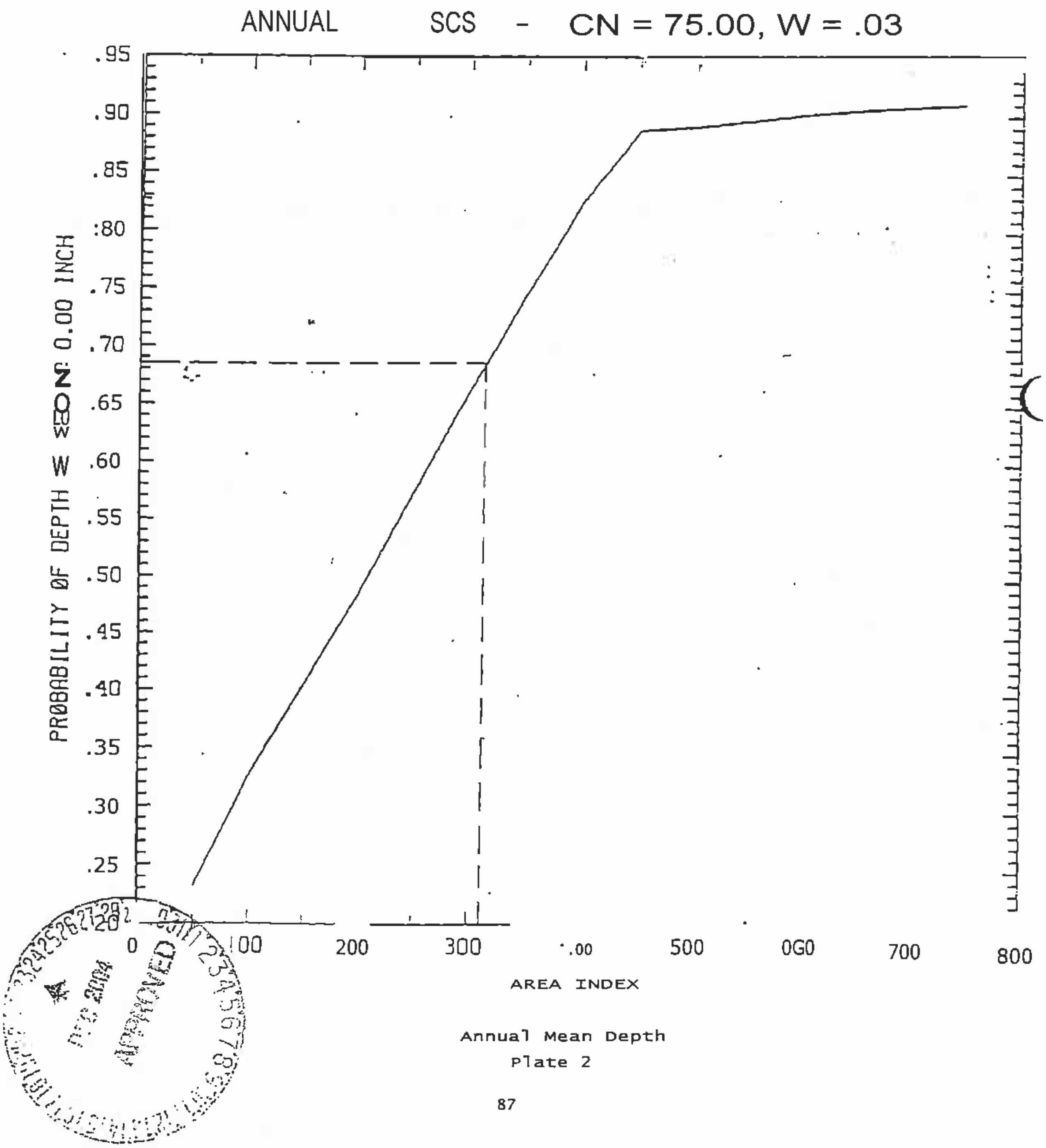
As of January 2004, seventy structures have been identified that will not be required for operational or regulatory purposes. Drawing No. 85406 contains a summary list of all ponds, locations, map numbers (Drawing 85400), and reclamation dates for these structures. The purposes of these ponds were discussed with OSM Technical Staff on August 29, 1985, and in subsequent permit revisions. These ponds are either redundant ponds where another pond downstream is designed to cover the entire watershed or they are ponds which fall in the category of 816.46(a)(2). No design or evaluation is included for these structures. These structures will be reclaimed in accordance with PWCC's approved reclamation plan and schedule.

Dam Break Analysis

As a result of the August 29, 1985 meeting with OSM's Technical Staff, Dames & Moore, and Peabody, OSM instructed Peabody to perform a Dam-Break Analysis on those temporary impoundment structures [illegible] to retain upstream from existing MSHA-size

FIGURE 24

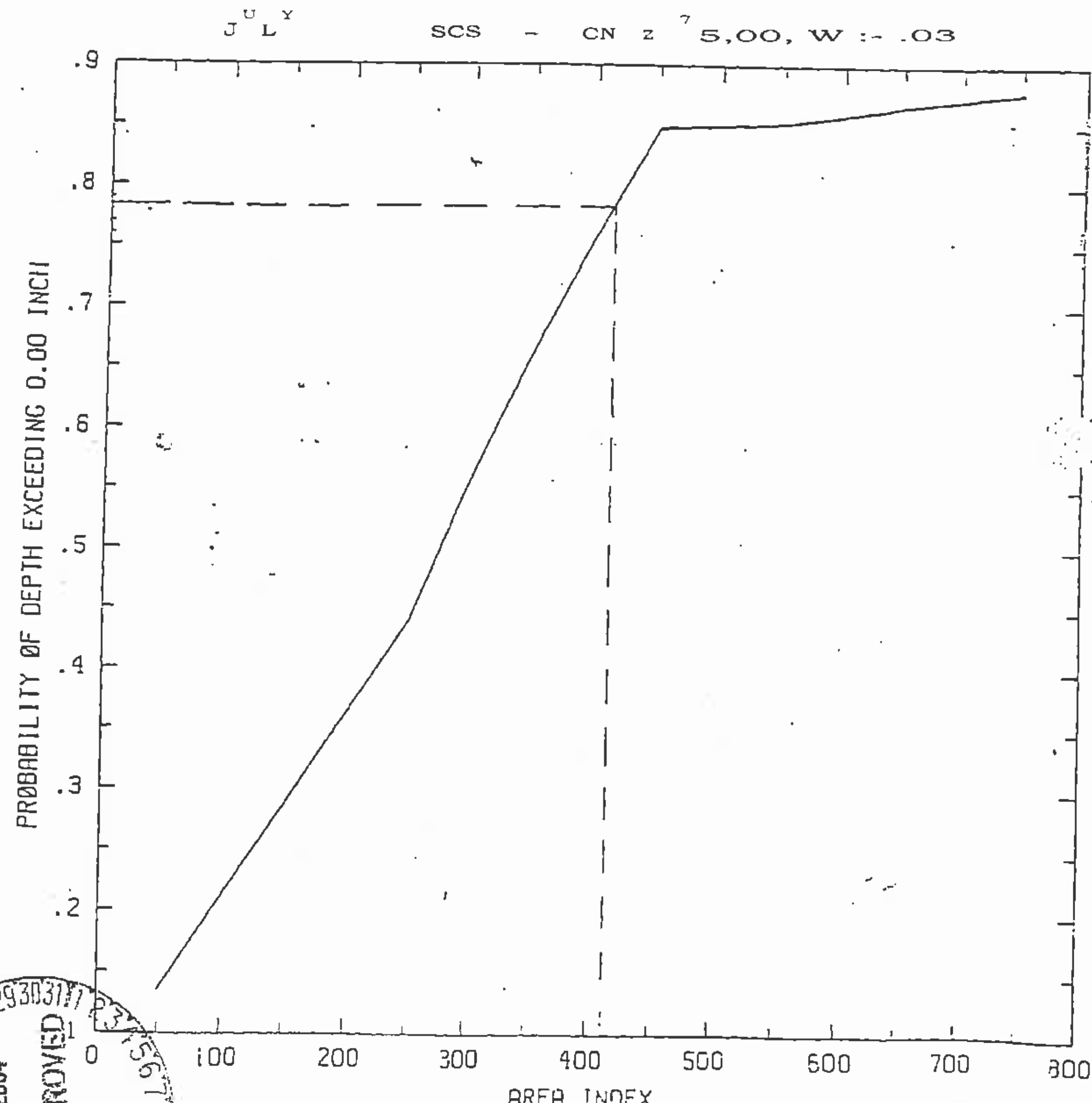
Probability vs. Annual
Mean Depth




Annual Mean Depth
Plate 2

FIGURE 25

Probability vs. Minimum Depth




Minimum Depth
Plate 3

dams. These upstream structures are redundant structures; however, Peabody desired to retain these temporary impoundments to localize the runoff around the new Kayenta Mine facilities. Based on these decisions, Peabody retained Dames & Moore to perform a Dam Break Analysis on the J28-B, J28-C, and J28-D impoundments upstream from the J16-A MSHA dam and also on the J28-G impoundments upstream from the J16-L MSHA dam. The results of Dames & Moore's report can be found in Attachment L.

The results of the evaluations indicate both MSHA dams have adequate storage and spillway capacities to safely discharge the dam-break flood waves. As noted in the report, the mechanisms hypothesized to induce breaches in the sedimentation ponds are extremely conservative and highly unlikely.

Transportation Facilities

Introduction. There are four types of roadways inside or crossing PWCC's permit area. These roadway types are primary roads, ancillary roads, non-mining related roads (i.e., public roads and private roads), and pit ramps or routes of travel which are within the mining and spoil grading areas. The location of these roadways and main ramps are found on the Jurisdictional Permit and Affected Lands Map, Drawing No. 85360. OSMRE's 30 CFR 701.5 definition of a road includes the following:

> "Road means a surface right-of-way for purposes of travel by land vehicles used in surface coal mining and reclamation operations or coal exploration. A road consists of the entire area within the right-of-way, including the roadbed, shoulders, parking and side areas, approaches, structures, ditches, and surface. The term includes access and haul roads constructed, used, reconstructed, improved, or maintained for use in surface coal mining and reclamation operations or coal exploration, including use by coal hauling vehicles to and from transfer, processing, or storage areas. The term does not include ramps and routes of travel within the immediate mining area or within spoil or coal mine waste disposal areas".

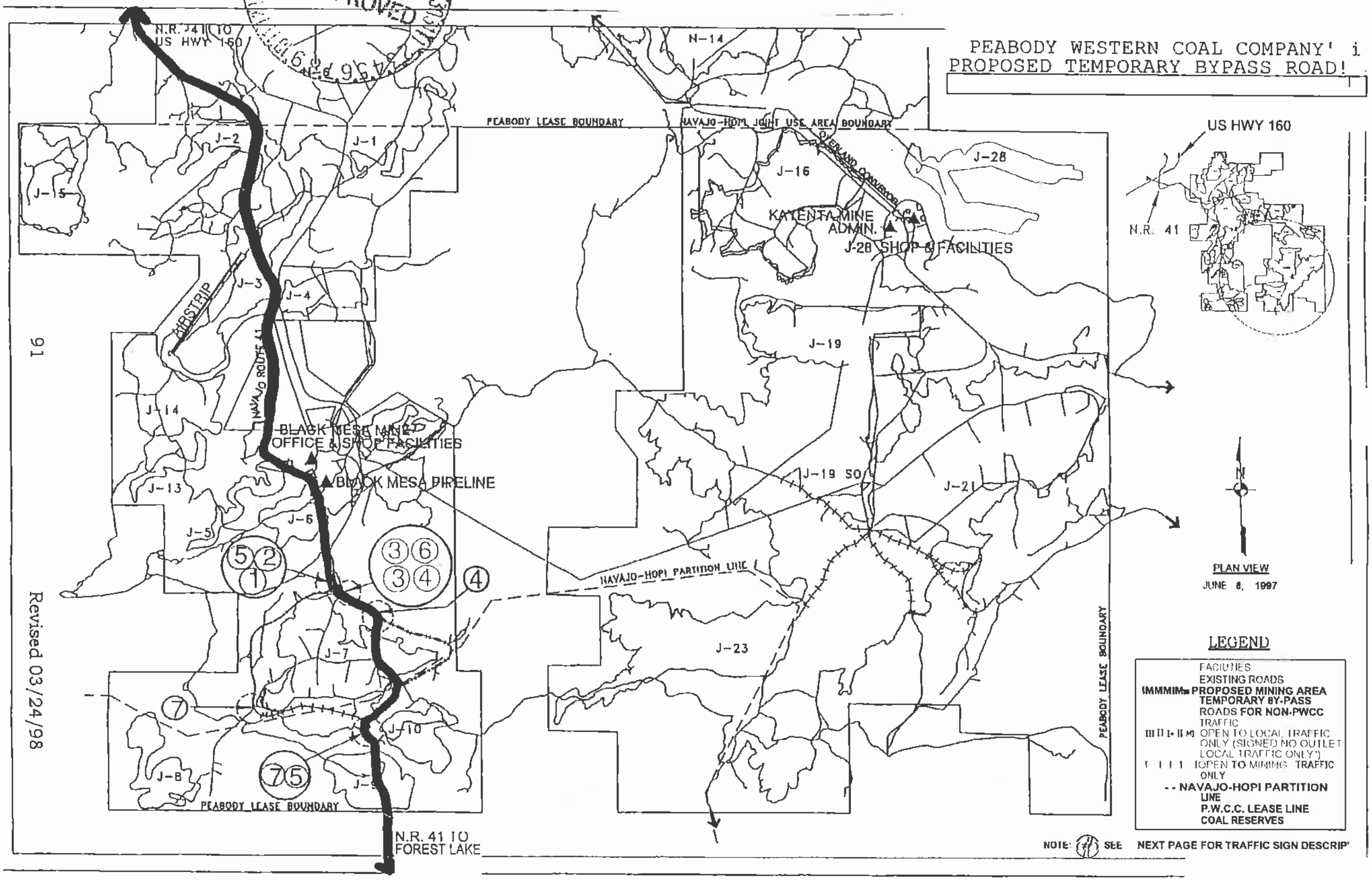
This definition for road only refers to primary and ancillary roads. OSMRE's 30 CFR 701.5 definition of spoil includes the following: spoil means overburden that has been removed during surface coal mining operations.

The non-mining related roads definition is taken from Flannery's decision. "The affected area shall include every road that is constructed, reconstructed, improved, or maintained for access to or from, or for hauling coal or overburden to or from, surface coal mining and reclamation operations. The affected area shall also include every existing and new road that is used for the same purpose where the EFFECTS from mining are MORE than relatively minor when compared to the effects from other uses." This definition will apply to designated public roads as well as other private roads, which access living or grazing areas. This definition for the non-mining related road classification does allow for infrequent mine use on these non-mining related roads.

Public roads are roads constructed for public use when financed, maintained, and owned by the government. Public road means a road which has been designated as a public road pursuant to the laws of the jurisdiction in which it is located; which is maintained with public funds in a manner similar to other public roads of the same classification within the jurisdiction; which there is substantial (more than incidental) public use; and which meets road construction standards for other public roads of the same classification as the local jurisdiction. Governmental agencies involved with public roads on Tribal lands in the vicinity of Black Mesa include the Arizona Department of Transportation (ADOT), Bureau of Indian Affairs (BIA), and the Hopi and Navajo Tribal Transportation Departments. After discussions with the BIA and the Hopi and Navajo Transportation Departments, the only public roads within or crossing the Black Mesa complex permit area are U.S. Highway #160 and Navajo Route #41. Navajo Route #41 is an open range, collector, dirt/paved road which does not have a recorded right-of-way and limited BIA maintenance activities; however, due to its location and ability to provide north/south access south of Highway #160, it is part of the BIA's 1990 Master Road Plan and included on BIA' road inventory since at least 1979.

In order to allow the maximum recovery of coal while maintaining the general north/south traffic flow pattern on Navajo Route ((41 in the J-7 mining area during 1998 until the end of mining in the year 2005, it will be necessary to temporarily reroute traffic around the east side of the J-7 mine area and reconnect traffic to the existing Navajo Route #41 at the intersection at the south end of the J-7 Dam (see the updated Drawing No. 85210, 85360, and Figure 26 85400 for the proposed alignment). With a portion of the new alignment crossing the southeast portion of the J-7 coal reserves (approximately 0.2 miles in length) and to allow maximum coal recovery while protecting the safety of the public, it will be necessary to conduct limited mining-related surface disturbance within 100 feet of the relocated Route #41. This activity will not include any coal removal operations and will not necessitate utilization or crossing the road with mining equipment. A fence or traffic control berm will be constructed prior to mining disturbance within f Route #41 between the traffic on Navajo Route #41 and the mining disturbance acta u'i' vltc prea.em'-' mingling of traffic in this area.

FIGURE 26
PROPOSED TEMPORARY BYPASS ROAD
(J—7/Navajo Route #41)



# TRAFFIC SIGN DESCRIPTION

**(See FIGURE 26 for description)**

| SIGN LOCATION NUMBER | SIGN DESCRIPTION | |
|---|---|---|
| 1 | "LOCAL ACCESS ONLY — DEAD END" | (4'x8') |
| 2 | "PINON" | (4'x4') |
| 3 | "DANGER LOOK OUT FOR TRUCKS & MINING EQUIPMENT" | (4'x8') |
| 4 | "KAYENTA HIGHWAY 160" | (4'X4') |
| 5 | "KAYENTA HIGHWAY 160" | (4'X4') |
| 6 | "MINE ACCESS ONLY NO TRESPASSING" | (4'x4') |
| 7 | "ROAD CLOSED" | (4'x4') |
| 8 | "KAYENTA HIGHWAY 160" | (4'x4') |

## TRAFFIC **SIGN DESCRIPTION**
(CONTINUED)

| | |
|---|---|
| R11-3 | (ROAD CLOSED MILES AHEAD. LOCAL TRAFFIC ONLY) |
| W2-2 | (-I) Right & Left |
| W1-7 | (< - >) |
| R5-1 | (DO NOT ENTER) |
| WL-RB, WL-RL | (\\V//) |
| | (ROAD CLOSED AHEAD) |
| M4-10 | (DETOUR) Right & Left |
| W3-1 a | (STOP AHEAD) |
| R2-1 | (SPEED LIMIT) |
| W1-2R, W1-2L, WI-1R, W1-IL | (CURVE SIGNS) |
| N41 | (ROUTE MARKERS) |
| ...... | Type III barricade |
| RI-1 | (STOP) |
| R11-2 | (ROAD CLOSED) |
| R11-4 | (ROAD CLOSED TO THRU TRAFFIC) |
| R5-1 | (DO NOT ENTER) |
| — ILI | "(OPEN RANGE) |
| 1. | (WATCH FOR LIVESTOCK) |

In addition to the traffic signs in the "Manual on Uniform Traffic Control Devices" and shown on Figure 26, PWCC will also post signs for announcing when the relocated Navajo Route #41 will be open for traffic, large stop signs at the J-7, Ramp #3 intersection with red flashing traffic control lights in both directions, open range signs, heavy equipment crossing roadway signs, and watch for livestock signs, etc.. PWCC will provide a security vehicle with flashing red lights at this intersection for the first 30 calendar days the road is open to public traffic, which will be used as a safety warning to the public. In addition, PWCC's security will conduct a traffic count of vehicles crossing the intersection during this 30-day period. PWCC has in the past and will continue to inform and instruct all PWCC personnel on safety-related procedures and the safety procedures for the new intersection at the crossing of the J-7 haul road and Route #41. In addition, the new road alignment and associated safety rules will be posted on the appropriate bulletin boards where this information will be available for the Black Mesa Mine employees to read. Approximately 30 percent of the coal production for the Black Mesa Mine is mined and hauled from the J-7 mining area to the Black Mesa Mine Facilities area. The J-7 coal haulage and primary reclamation activities will be completed in 2005. The estimated average daily mine vehicles crossing this intersection is approximately 50 to 200 vehicles per day depending if J-7 coal haulage and overburden removal operations are occurring, the J-7 equipment maintenance and operational support activities required during the shift, and the road maintenance requirements in this segment of the road. The mine traffic estimate into and out of the J-7 mine area can be highly variable on a day-to-day basis.

In 2006, after J-7 mining and reclamation has been competed, PWCC has agreed to install stop signs on the J-7 primary road intersection. At the intersection at the south end of the J-7 Dam the flashing traffic control lights will be removed from the non-mining related traffic roadway, (see Drawing No. 85210 and Drawing No. 85400, Sheets K-10 and L-10). For safety purposes, the Peabody traffic will stop in both directions prior to proceeding through this intersection and the Navajo Route 41 traffic will have the right-of-way when crossing the intersection. Revised Figure 26, "Proposed Temporary Bypass Road (J-7/Navajo Route #41)", is the proposed alignment for non-mining related traffic. This alignment will be constructed and maintained in accordance with the

BIA Road Standards, the latest edition of the "Manual on Uniform Traffic Control Devices," and the traffic control devices recommended by OSM, BIA Branch of Roads, or shown on Figure 26. The proposed route will have a gravel surface and be similar to the existing route in width. There is no plan to pave or blacktop the temporary relocated Navajo Route 441. The BIA Chinle Agency Road Engineer will be requested by PWCC to inspect and improve this route prior to utilization by non-mining related public traffic. PWCC will provide written notification to the Tribal Governments, local police, schools, and chapters of the date that the relocated road will be open to public traffic. In conclusion, this proposed realignment of Navajo Route #41 will not require the merging of PWCC's mine traffic with the non-mining related traffic.

The J-7 west side existing Navajo Route #41 will continue to be open to local traffic; whereas, the J-7 east side route will provide the primary north/south access for public traffic traveling *through* the Peabody coal lease area. The existing Navajo Route #41 across the south side of the J-7 coal reserve will be closed to non-mining related traffic to allow mining to continue in the J-7 pit. This road will be closed on the west end at the Water Well #9 and residential access road intersection and at the east end at the wye intersection, north of Yucca Flat Wash. PWCC will establish a signed barricade with reflecting tape at both locations where the road is closed. The school bus routes will not be affected by the road relocation. School bus turnarounds will be constructed by PWCC, as required. A meeting will be held with the person in charge of school bus transportation advising him of the road relocation and safety procedures.

The temporary J-7 east side route is an existing roadway, and only a short section (approximately 0.4 miles long) of the south and east route will be reconstructed and realigned with the southeast edge of the J-7 coal recovery area (see Drawing No. 85210A). This new section will shift the road to the southeast to allow maximum J-7 coal recovery. ...on, a short section of new access road will be constructed through the J-7 reelea4. area (approximately 0.5 miles long) to connect the east route with the nor'h/soutty ection of PWCC's old J-7, Ramp 4(1 road. PWCC will install a cattle guard in the road wiMle the road crosses the Hopi/Navajo Partition fence. The proposed temporary Nav R06· 441 route will allow safe passage of traffic while maximizing J-7 coal recove,r Peabody will undertake appropriate measures to protect the general public and Traf=fic on the roadway from mine-related activities including appropriate traffic control signs, compliance with blasting regulations as described in Chapter and roadway maintenance.

Blasting signs will meet the specifications of 30 CFR 816.11. PMCC will: [illegible] ,rr.sr.cuously [illegible]lace si[illegible]ns reading "Blasting Area" along the edge of any blasting area =ha- [illegible] .._nin

100 feet of any public road right-of-way, and at the point where any other road provides access to the blasting area; and (2) At all entrances to the permit area from public roads or highways, place conspicuous signs which state "Warning! Explosives in Use," which clearly list and describe the meaning of the audible blast warning and all-clear signals that are in use, and which explain the marking of blasting areas and charged holes awaiting firing within the permit area.

Warning and all-clear signals of different character or pattern that are audible within a range of 4 mile from the point of the blast will be given. Each person within the permit area and each person who resides or regularly works within 1/2 mile of the permit area will be notified of the meaning of the signals in the blasting schedule.

Audible warning and all-clear signals are given prior to and following a blast, respectively. The warning signal consists of ten short blasts using an air horn audible for one-half mile from the point of the blast. The all-clear signals consists of one long blast from an air horn audible for 4-mile from the point of the blast. Warning and all-clear signals are explained on the blasting warning signs, the signs located at the main entrances to the mining complex, and on bulletin boards in certain buildings which the general public may frequent. The signals are also explained in the blasting schedule which is published and distributed as explained above.

Access within the blasting area will be controlled to prevent presence of livestock or unauthorized persons during blasting and until an authorized representative of PWCC has reasonable determined that (1) No unusual hazards, such a imminent slides or undetonated charges exist; and (2) Access to and travel within the blasting area can be safely resumed.

Access to the blasting area is controlled by ensuring that the blasting area is clear of all livestock or unauthorized persons, and assigning a person to block and monitor access, or barricading roads leading into the blasting area. Fluorescent orange traffic cones and plastic tape are used to identify blasting areas in which holes have been loaded, charged, of yet detonated. Boreholes are not considered charged until an electric-type conator is introduced into the detonation system or when connection to trunklines is rted. all-clear signal is given only after the area has been checked to ensure that unusual,h',zard such as slides or undetonated charges exist.

When ble.s'ting occurs in the J-7 mining area, a person will be assigned prior to the blast to monitor and temporarily bloc: access along the lion-P'rinC roads to pror.e-r t;, of the general public traveling in the area.

Peabody has or will have the appropriate Tribal Chapter, Road Agency Committee, BIA Chinle Road Engineer, and Tribal approvals prior to OSM s written findings required in 30 FR, 761.11(d)(2)(ii). In addition, after mining is completed, Peabody has committed to obtain regulatory approval to return Navajo Route #41 to approximately the original north/south route by utilizing Peabody existing J-7 Ramp #1 and haul road system to reroute traffic to Navajo Route #41. At this future time, Peabody will submit a new permit revision for appropriate regulatory approval with the proposed alignment and a request to permit these roads as permanent roads.

The BIA and the Navajo Transportation Department base their classification of private roads on the following:

a) Local roads which do not have right-of-way applications performed in accordance with 25 CFR, Part 169 and have not been designated as a public road pursuant to the laws of the Tribes are considered private roads.

b) None of these private roads are maintained with public funds in a manner similar to other public roads;

c) There is not substantial (more than incidental) public use of these roads; and

d) The Tribe or BIA does not have construction standards for these remote rural roads.

Due to the "open range" nature of the reservation, many miles of private roads on the Tribal lands have been and continue to be developed by local residents and other non-PWCC entities. The Black Mesa mining complex is different from most other mining operations in that people are living and livestock are grazed inside the permit boundary (see Drawing No. 85445, which shows the residential home sites and escrow grazing areas). Because of this difference, the road network is fluid. The private road network is similar to a road developed by a farmer, rancher, or any other landowner on their private property in any state or county. These private roads are typically two-track vehicle roads or graded dirt roads traversing across country to residential sites, residential improvement areas, grazing sites, wood gathering areas, water sources, utilities sites, ceremonial, religious, or Tribal meeting sites, etc. Therefore, because the surface area cannot be completely controlled, many of these private access roads are available for PWCC or the general public on an infrequent basis to utilize. When PWCC's vehicles are traveling on non-mining related roads, it will only be with on-highway vehicles or road maintenance equipment requested by local or regulatory entities. The mine-related traffic will be on an infrequent basis and the majority of the total traffic on the non-mining related roads will be non-mining related traffic. In addition, the primary purpose of the road will be for access by non-mining related traffic.

In addition, if these public or private roads were outside the permit area, a mining company would be allowed to use these roads on an infrequent basis to access remote environmental monitoring or surveying sites (e.g., low usage). Therefore, it stands to reason that PWCC should be allowed to use these roads on an infrequent basis inside the permit area; however, if PWCC uses a private road more frequent than once a shift, the road becomes classified as an ancillary road. This is not to imply that, because an employee drives a company vehicle on a road to get to and from work, the road is an ancillary road.

The lease arrangements between PWCC and the Tribe enable PWCC to conduct those activities necessary to the efficient operation of mining, which includes the relocation of residences and associated roads. Likewise, if the Tribe or BIA were to construct a road within the leasehold, they are required to consult with PWCC and subject their plans to the reasonable rights of PWCC under the leases to utilize the surface for mining purposes. Thus, the Tribe, which OSMRE recognizes as the governmental agency having jurisdiction over public and private roads on the leasehold, has already established a mechanism through the leases for dealing with issues relating to these roads. OSMRE is the lead regulatory agency for permitting primary and ancillary roads, and where appropriate, 30 CFR 761.12(d) will be applicable to those public roads within 100 feet of the proposed mining operations.

PWCC considers those roads within the leasehold designated as private roads, which are included in the non-mining related roads, to be like private ranch roads, and the appropriate governmental agency(s), including the Navajo and Hopi Tribes, has already agreed through the signing and renewal of the leases, that mining activity may take place near, on, through, or around such roads.

The remaining two type of OSM-defined roads (e.g., primary and ancillary roads), and ramps are utilized to facilitate mining activities. Primary and ancillary roads are defined in 30 CFR 816.150 and 701.5. The primary roads are any road which is (a) used for transporting coal or spoil and not considered a ramp which is inside the mining disturbance and spoil grading area; (b) frequently used for access or other purposes for a period in excess of six months; (c) no longer subject to frequent changes in location, are graded on-grade with the surrounding topography, and are located in areas undergoing topsoil redistribution and permanent revegetation; or (d) to be retained for an approved postmining land use.



An ancillary road is any mine road not classified as a primary road. <u>Infrequently</u> used temporary roads solely for PWCC access or other purposes, which do not include *coal or* spoil haulage and that will he in existence for an extended period of time will be considered ancillary roads. PWCC's roads used once or less each shift for the purpose of monitoring, surveying, and/or maintenance will not be frequently used roads and therefore, are classified as ancillary roads.

The ramps at the Black Mesa Complex are located within the active pit and spoil areas. These ramps are temporary routes unless they are needed to facilitate the postmining land use. In such cases, they will be permitted as a permanent primary road. The ramps in the spoil grading and mining areas are subject to frequent surface change, are graded in spoil, surface drainage from these areas are controlled by outlying siltation structures around the perimeter of each mining area, are located in areas which will undergo reclamation in accordance with the approved reclamation and surface stabilization plan, and are included with the ancillary, primary roads, and mining areas reclamation costs in the bonding calculations. Typically, if the post mining drainage channel is located where the old ramp was located, then the ramp could be graded and shaped to a reclaimed channel, this demonstration is included in the PWCC Annual "Surface Stabilization Plan" Reports and the design criteria is included in Chapter 26. If the ramp is left as a primary permanent road, then the road will be provided with adequate ditches to handle the drainage runoff. Based on the post mining land use plan, the backfilling and grading plan is flexible enough to allow PWCC to consider several options for the reclamation of ramps.

Primary and Ancillary Roads - General Requirements. Primary and ancillary roads will be located, designed, constructed, used, maintained, and reclaimed so as to:

(a) control or prevent erosion, siltation, and the air pollution attendant to erosion by vegetating, watering, using dust suppressants, or other methods in accordance with current, prudent engineering practices,

(b) control or prevent damage to fish, wildlife or their habitat, and related environmental values,

(c) control or prevent additional contribution of suspended solids to runoff outside the permit area,

(d) neither cause nor contribute to the violation of State or Federal water quality standards applicable to receiving waters,

(e) refrain from seriously altering the normal flow of water in intermittent or perennial streambeds or drainage channels,

(f) control or prevent damage to public or private property, and

(g) use non-acid or non-toxic forming substance in road surfacing.

Within stream buffer zones designated on Drawing No. 85642 and 85642A, roads utilized as mine-related road crossings, PWCC will request appropriate regulatory approval prior to construction of these crossing. In addition:

1. Use of each crossing will be limited to light vehicles (passenger vehicles), on-highway vehicles and appropriate road maintenance equipment traffic of infrequent use by PWCC.
2. No PWCC coal haulage, spoil haulage, large trucks, or large mine equipment will be using the crossings. The only exceptions to this will be any need for repairs, construction, or reclamation of the crossings, sedimentation ponds and monitoring sites. Other exceptions will need prior approval form the Office of Surface Mining Reclamation and Enforcement (OSMRE).
3. Use of the crossings will not impact the physical integrity of the stream channel.
4. No channel realignment, stream bank degradation, fill material in the stream channel and other significant changes to the physical characteristics of the streambed will occur without OSMRE approval.
5. Maintenance activities will be minimized, with only minor repairs/grading after storm events.

Within the primary and ancillary road classifications there are five sizes of roads based on use and traffic volume. There are three typical sizes of primary roads, including haul roads and mine vehicle roads, Primary Road #1, that are a minimum of 50 feet wide for two-way traffic and a minimum of 30 feet wide for one-way traffic; coal haulage, mine vehicle, and dragline deadheading roads, Primary Road #2, that are approximately 130 feet wide; and mine access roads, Primary Road #3, which are used frequently for periods longer than six months that are a minimum of 24 feet wide for two-way traffic and a minimum of 10 feet wide for one-way traffic (see Drawing No. 85430). The two types of ancillary roads are used by vehicles on a less frequent basis to gain access to mine facilities or to remote sites. These ancillary roads are constructed exclusively for PWCC's use and no local residents live at the roads' terminus. The first type is typically a two-lane road. This is a minimum of 24 feet wide, and the second type is usually a single lane road that is a minimum of a dozer blade or motor grader blade in width (see Ancillary Road #1 and #2, Lt,on:31rP2 No. 85430, respectively). The first type may require a two-lane road where an all-t,y,ather fbad is required to gain access to remote sites. The second type of ancillary road 'ra ually Yo lows the natural topography and typically has less frequent use than the first

:cation. No part of any 'rimary or ancillary road will be constructed in the channel of ar 1,rtermittent or 'erennial stream unless specifically approved by the regulatory authority (See Drawing Nos. 85210, 85360, 85400, and 85642A.). Roads will be located to minimize downstream flooding and sedimentation to the extent possible. The Jurisdictional Permit and Affected Lands Map, Drawing No 85360 shows the location of all existing and proposed ancillary and primary roads.

When ancillary roads are shown crossing an intermittent or perennial stream, the crossing will be constructed in accordance with the applicable regulations, including 816.150, and as shown on Figure 30, Drawing Nos. 85430, and 85432. Ancillary roads are utilized infrequently for access to monitoring sites, surveying sites, maintenance sites, and/or access around PWCC's active mining areas for non-PWCC and PWCC vehicles. In the arid and semi-arid southwestern United States, due to OSM's "640 acre" rule, the majority of these streams within the permit area are classified as intermittent streams and most of the washes are dry arroyos. The water quality of the runoff during precipitation events for the major washes in the permit area is heavily sediment laden.

The purpose of these at-grade-stream channel crossings are to provide adequate access across the wash during periods of low flow or no flow, and to minimize potential environmental effects by constructing a stable road crossing to accommodate the anticipated low volume of traffic and the historical stream flows.

Within stream buffer zones designated on Drawing No. 85642 and 85642A utilized as mine-related road crossings, PWCC will request appropriate regulatory approval prior to construction of these crossing. In addition:

1. Use of each crossing will be limited to light vehicles (passenger vehicles), on-highway vehicles and appropriate road maintenance equipment traffic of infrequent use by PWCC.
2. No PWCC coal haulage, spoil haulage, large trucks, or large mine equipment will be using the crossings. The only exceptions to this will be any need for repairs, construction, or reclamation of the crossings, sedimentation ponds and monitoring sites. Other exceptions will need prior approval form the Office of Surface Mining Reclamation and Enforcement (OSMRE).
3. Use of the crossings will not impact the physical integrity of the stream channel.
4. No channel realignment, stream bank degradation, fill material in the stream channel and other significant changes to the physical characteristics of the streambed will occur without OSMRE approval.
5. Maintenance activities will he minimized, with only minor repairs/grading after storm events.

Drawing No. 85432 shows the ancillary road stream crossing will be constructed utilizing gravel, rock riprap, and geotextile to stabilize the road surface and minimize pollution. As much as practicable, the ancillary road will cross the stream channel at grade and the road will start daylighting of the road grade beyond the toe of the existing natural stream's side slopes. The cross section of the stream at the road crossing will equal or be greater than the capacity of the unmodified stream channel immediately upstream and downstream from the road crossing.

During construction, a temporary silt fence or a straw bale dike will be installed downstream in the stream channel of the proposed crossing to minimize any addition of sediment to the wash. Once the crossing and ancillary road construction is completed, the adjacent disturbance area will be reclaimed to stabilize the surface. When the ancillary road and crossing are no longer required, the site will be reclaimed in accordance with the approved reclamation plan.

<u>Road Reclamation.</u> The roads on PWCC's Black Mesa leasehold can be categorized as follows:

1. Non-mining related roads which have not been built by PWCC and which may or may not have been in existence prior to the initiation of mining activities;
2. Roads built by Peabody prior to December 16, 1977; and
3. Roads built by PWCC on or after July 6, 1990 in the permanent program permit area.

All roads in categories (2) and (3) are considered temporary and will be reclaimed unless they have been approved by the regulatory authority as a part of the postmining land use plan (see Permanent Roads Map, Drawing No. 85445). All roads in category (1) are not the responsibility of PWCC and, therefore, are not addressed.

Because of the size and nature of PWCC's Black Mesa mining activities, very few of the roads in category (3) will be reclaimed until the end of mining activities on the entire leasehold (see Table 10). Exceptions would include roads in the immediate vicinity of pits and ramps, which are created in the spoil and reclaimed as the general reclamation activities progress within a specific coal resource area. Access to the various facilities and reclaimed areas necessitate retention of most roads in category (3).

Roads which: (a) were constructed by Peabody prior to December 16, 1977; (b) are no longer needed for reclamation or monitoring; and (c) are not approved by the regulatory authority as an element of a postmining land use plan will be reclaimed in the following manner:

Close the road to traffic; culverts will be removed and fill slopes will be 'u ped to establish appropriate drainage.

[illegible], the road sur[illegible]e does not consist of native materials, surfacing materials [illegible]ill be collected and properly disposed by [illegible] approved landfill [illegible]on or buried a minimum of four feet below the final revegetated surface.

3. The roadbed will be ripped, plowed, and/or scarified.
4. Cross drains, dikes, and/or water bars will be constructed to minimize erosion.
5. Revegetation will be accomplished by utilizing the seed mix specified in the reclamation plan.

Roads which: (a) were built by PWCC on or after July 6, 1990; (b) are no longer needed for operations, reclamation or monitoring; and (c) are not approved by the regulatory authority as an element of the postmining land use plan will be reclaimed in the following manner:

1. Close the road to traffic and the culverts will be removed.
2. If the road surface does not consist of native materials, surfacing materials will be collected and properly disposed of by hauling to an approved landfill location or buried a minimum of four feet below the final revegetated surface.
3. The roadbed will be ripped, plowed, and/or scarified.
4. Cut and fill slopes will be shaped to conform the site to adjacent terrain and to restore natural drainage unless a regulatory authority has approved an alternative grading plan.
5. Cross drains, dikes, and/or water bars will be constructed as necessary to minimize erosion.
6. Road surfaces and adjacent areas will be covered with topsoil.
7. The disturbed area will be revegetated in accordance with the mulching, soil amendment, and seeding provisions of the approved Mining and Reclamation Plan.

Primary Roads. Transportation of coal and spoil from outside mining and spoil grading areas to handling, sizing, shipping, or disposal areas requires construction of transportation facilities, primarily haulage roads, or conveyors. PWCC maintains an extensive network of haulage roads for material movement on the Black Mesa Complex. Designs for haulage roads constructed beyond the ramp limits shown on Drawing 85360 will be submitted for approval. The drainage plan and culvert description can be found on Drawing 85400, Sheets 1 through 26, and Chapter 6, Attachment Q.

Design and Construction. Proposed life-of-mine haulage roads are shown in the Mine Plan Map, Drawing No. 85210. Proposed five year permit term primary roads and existing primary road plans or drawings and culverts and ditch flow direction are shown on Drawing No. 55900, Sheets 1 through 26. The typical cross sections are shown on Drawing No. 85430. Primary roads constructed during the 1990-1995 permit term included the J-19 Haul Road, J-19 Deadhead/Haul Road Spur, and H-11 Facilities Plans (see Drawing Nos. 85440, 85442, and 85982). During the 2000-2005 permit term, any new primary road will be submitted to OSMRE for approval before construction in accordance with the schedule in Table 1, unless the road is a former ramp where the road's existing definition conforms with one of the four (a)-(d) criteria for primary roads in this chapter. If the Primary Road is a former ramp then only the appropriate as-built certification report will be submitted. The typical cross sections on Drawing No. 85430 and the following sections describe the typical specifications utilized for road construction.

Coal haulage is primarily dependent upon the location of the coal resource, the mine plan, and the terrain. Until adequate quality assurance drilling and coal analyses are completed, the exact location and alignment of life-of-mine coal haulage roads cannot be specified. PWCC will submit certified centerline alignment, typical cross-sections, and drainage designs for approval before construction are started. (see Drawing Nos, 85400, 85430, and Attachment 4). Once construction is completed and adequate time has occurred to collect the "as-built" data, a Registered Professional Engineer will submit a certified report indicating construction has been performed in accordance with the approved plan. In addition, certified "as-built" drawings are kept on file at the mine site and are available for inspection. Additional as-built certification information is presented in Attachment V and on Drawing 85400.

New haulage roads proposed for construction are typically designed with a minimum 50 feet driving width for two-way traffic. An additional 15 feet is added to each roadway edge to provide room for drainage ditches in cut areas and for safety berms in fill sections. Total minimum design width of such a roadway is, therefore, 80 feet (see Primary Road #1, Drawing No. 85430). Roadways utilized for movement of draglines are built with sufficient additional width to accommodate dragline passage. A total design width of 130 feet is usually adequate for this purpose (see Primary Road #2, Drawing No. 85430). Access roads used on a frequent basis and for a period longer than six months are designed with a minimum width of 24 feet for two-way traffic, unless topography restricts the width of the [illegible] two lanes of traffic to only one lane (see Primary Road #3, Drawing No. 85430).

R[illegible] tom_lqe used for dragline relocation are typically built without crowns or erelevat.i,on. This helps to eliminate lateral thrust, which can impose large stresses on [illegible] dr'aglines. After dragline movement is accomplished, regrading is performed to crown and/,or superelevate the roadway as required. Iinirnum roadway crown is 2 percent. Supeial•evation may increase the cross slope to 6 percent. The dragline sequencin[illegible] which requires deadheading the dragline between coal resource areas, is shown on ,"-cure 14 in Chapter 5. As indicated on the Primary Road ((2 tyPical cross section, ..ten _ road is ._lized for dragline deedheao_ng, this road is a part of the mine's road network and used by mine equipment to support the mining and reclamation opera t ions.

Sight distance for haulage roadways is based on a minimum design speed for light duty vehicles of 45 mph. Required sight distance for this criteria is greater than that required for coal haulage vehicles at their normal operating speeds. The more stringent sight distance requirements are considered applicable due to the use of haulage roads by light duty vehicles. Sight distance on access roads will vary based on the topography, traffic load, and other site-specific conditions.

PWCC will construct safety berms only on those portion of the roads where potential safety hazards exist and along road sections where haul road runoff may be controlled from eroding the fill slopes.

Cut and fill embankment slopes are typically 3 horizontal to 1 vertical. The primary purpose of this ratio is to facilitate equipment safely during topsoil placement and for revegetation of slopes. In some cases, steeper slopes may be required based on materials, height of embankment, and the need to minimize disturbance in steep, rolling topography. Attachment N contains the "Geotechnical Inspection Report - Haul Roads and Conveyors" which describes and analyzes the "worst case" embankment slope stability at the Black Mesa Complex.

The permanent roads on Drawing No. 85445 are proposed to be part of the postmining land use. These roads will allow access to residential home sites, grazing areas, and to the local residents customary use areas. Unless BIA and the Navajo Tribe accepts these roads into the BIA regional road system, these roads will be considered as a private road for local residents and local Tribal Chapter use.

During the reclamation process, these roads will be narrowed and the adjacent disturbed area reclaimed, such that these roads will be compatible to the postmining land use and to the volume and frequency of traffic anticipated after reclamation liability release. Similar to the non-PWCC private roads on Black Mesa, if the local residents and Chapters request these primary roads remain as part of the postmining land use, the local residents and Chapters will assume responsibility for maintenance of these roads after PWCC completes mining, reclamation, and the reclamation liability release application is approved.

After final reclamation of adjacent areas, each road will be addressed individually in PWCC s reclamation liability release application. PWCC will continue to work with the local residents, Chapters, Black Mesa Review Board, BIA, and Tribal officials to identify postmining struc (s" ChiC [illegible] easible to remain as permanent structures after mining and reclamation is ecdmet



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Each primary road will be designed, constructed or reconstructed, and maintained to have adequate drainage control using structures such as, but not limited to, ditches, cross-drains, temporary channel fords, low-water crossings, and culverts. The drainage control system will be designed to pass the peak runoff from a 10-year, 6-hour precipitation event or greater event unless otherwise specified by PWCC's engineers.

Culverts will be installed to avoid plugging or collapse and to avoid erosion at the inlets and outlets. Riprap will be installed where a culvert does not discharge upon resistant bedrock, and where the exit channel velocity exceeds 6-ft./sec. A riprap blanket, a minimum five pipe diameters long will be installed at the culvert outlet. The minimum width will be the width of the natural downstream channel. The riprap will be sized in the field by PWCC's project engineer based on the "as-built" slope of the culvert and final configuration of the exit channel slope area. The sizing shall be based on the Federal Highway Administration's HEC No. 11 "Use of Riprap for Bank Protection" or other standard methods. All pipes will have a minimum cover of 18 inches for a pipe diameter up to 48", a minimum cover of 2 ft. for pipe diameters from 54" through 72", and a minimum cover of 3 ft. for pipe diameters of 78" through 144". Culverts and drainage ditches will be maintained in a free and operating condition.

Ditches are placed on the inside of roadway cuts for drainage. A typical --ditch section would be a minimum 2 feet deep with 4:1 side slopes adjacent to the roadway and 3:1 slopes at a cut section. Ditch capacity charts for this ditch configuration are presented in Attachment M. A Manning's "n" of 0.025 is used for unlined ditches and 0.03 is utilized for lined ditches. As most road cuts are into erosion resistant material, ditches normally do not require lining.

The following is an outline of the general design procedures used in the design of culverts and roadside ditches:

1. Identify the need for a structure from the 1" 400' scale maps, Drawing No. 3031A5400, the 1"=1000' scale map Drawing Nos. 85210 and 85360, and a visit to the site.

2. Determine the size and hydrology of the watershed in question. This procedure is explained in detail in the "General Report, Geotechnic, Hydrologic, and Hydraulic Evaluation of Sedimentation Structures" by Dames & Moore, (Attachment D).

3. Perform SEDIMOT II or SEDCAD computer run to determine the peak runoff. Attachment 0 contains the typical inputs used for these SEDIMOT II calculations. SEDCAD is a PC version of SEDIMOT II and will have similar input values only a user interactive mode.

4. Using the peak flow rate from SEDIMOT II or SEDCAD[1] the depth of flow and velocity of flow for the road ditch analysis is calculated using the Manning's Equation or the charts in Attachment M. The Manning's Equation calculations are generally performed on a personal computer utilizing a program written by Dodson and Associates entitled TRAP. Attachment P contains a complete description of this program.

5. The design analysis of culverts is performed utilizing another program written by Dodson and Associates entitled PIPE. The tailwater depth and downstream velocity required for input is determined by the previously described TRAP program. Attachment P also contains a description of the PIPE program.

Basically, this program determines the capacity of the culvert using two procedures, inlet control and outlet control. The procedure resulting in the higher headwater is the value upon which culvert design is based.

Attachment Q contains an inventory of existing and proposed culverts at the Black Mesa and Kayenta Mines. The flow rates indicated on this inventory are proportional to the number of pipes in parallel flow of each site. For existing culverts with a freeboard less than 1.0 foot, the freeboard will be increased by placing additional cover on the pipe or by diverting some of the flow through another pipe. Figures 30 and 31 show typical installation of culverts. The location and watershed boundary for all of the culverts in Attachment Q can be found on Drawing No. 85400, Sheets 1 through 26. Other applicable methods include the use of charts developed by the Federal Highway Administration, new Tgf.Ep -.,shed in Hydrologic Engineering Circular HEC-5 (FHA, 1980), and Hydrologic Design Ser 3 (FHA, 1980) (see Figures 32 and 33).

Charts pul?shed in HEC-10 (FHA, 1978) (see Figure 34) are also used; however, exit elocities must then be determined by other methods. Headwater conditions are typically examined by using HEC-5 inlet control monographs. Some of the culverts are installed with !bDaa end sections; therefore, the "mitered to conform to slope" scale would be used to determine required pipe diameter or pipe capacity; however, to be conservative end allow for adequate freeboard, PICC usually uses "projecting" conditions (Figure

virtually all culverts have free outfalls, inlet control assumptions can be verified by the "Pipe Flow charts" in HDS-3 (Figure 33). If flow in the culvert has a free surface, entrance control exists, and exit velocity can be approximated by using the greater of normal or critical velocity determined by the "Pipe Flow Charts" in HDS-3.

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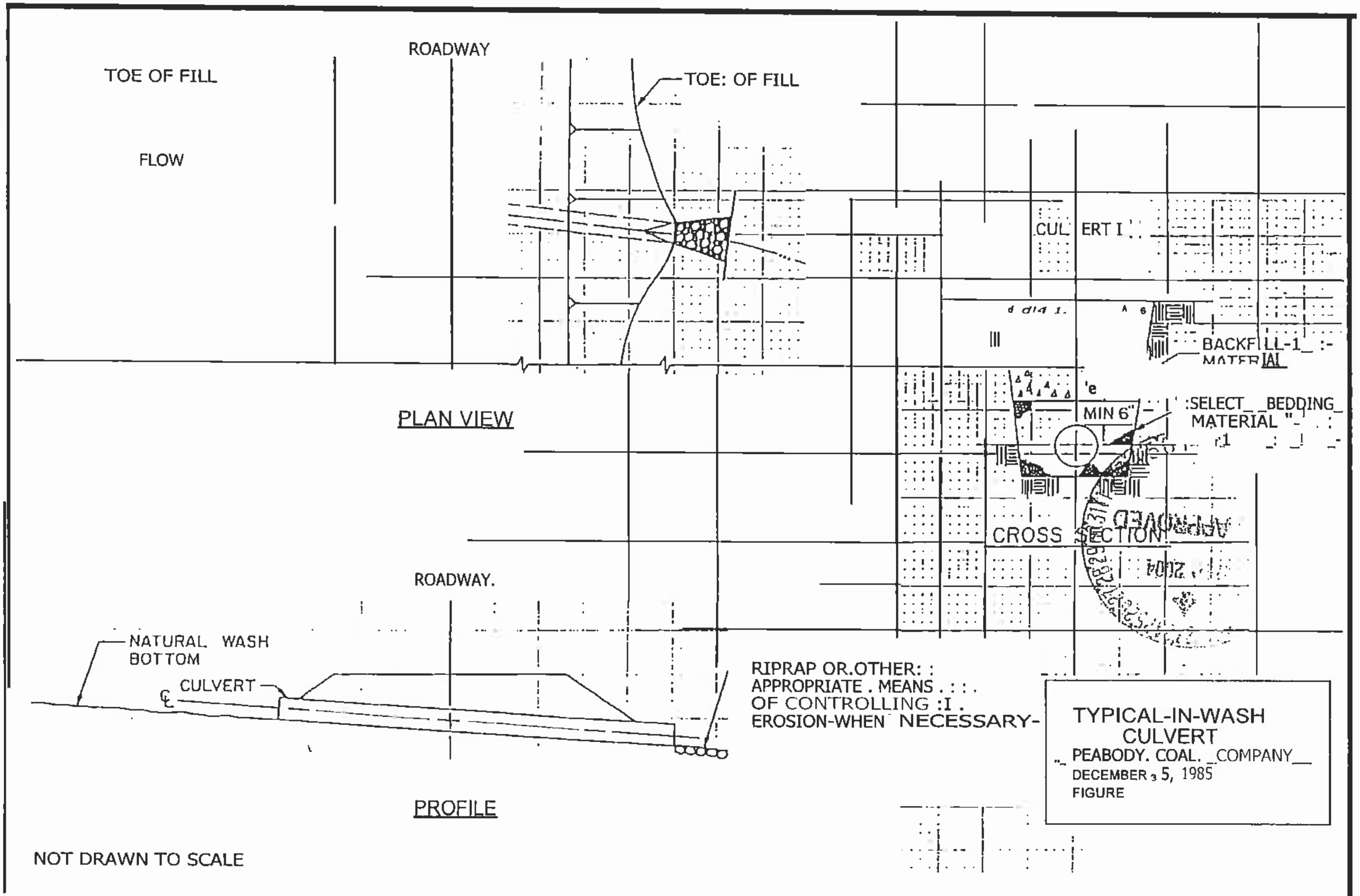
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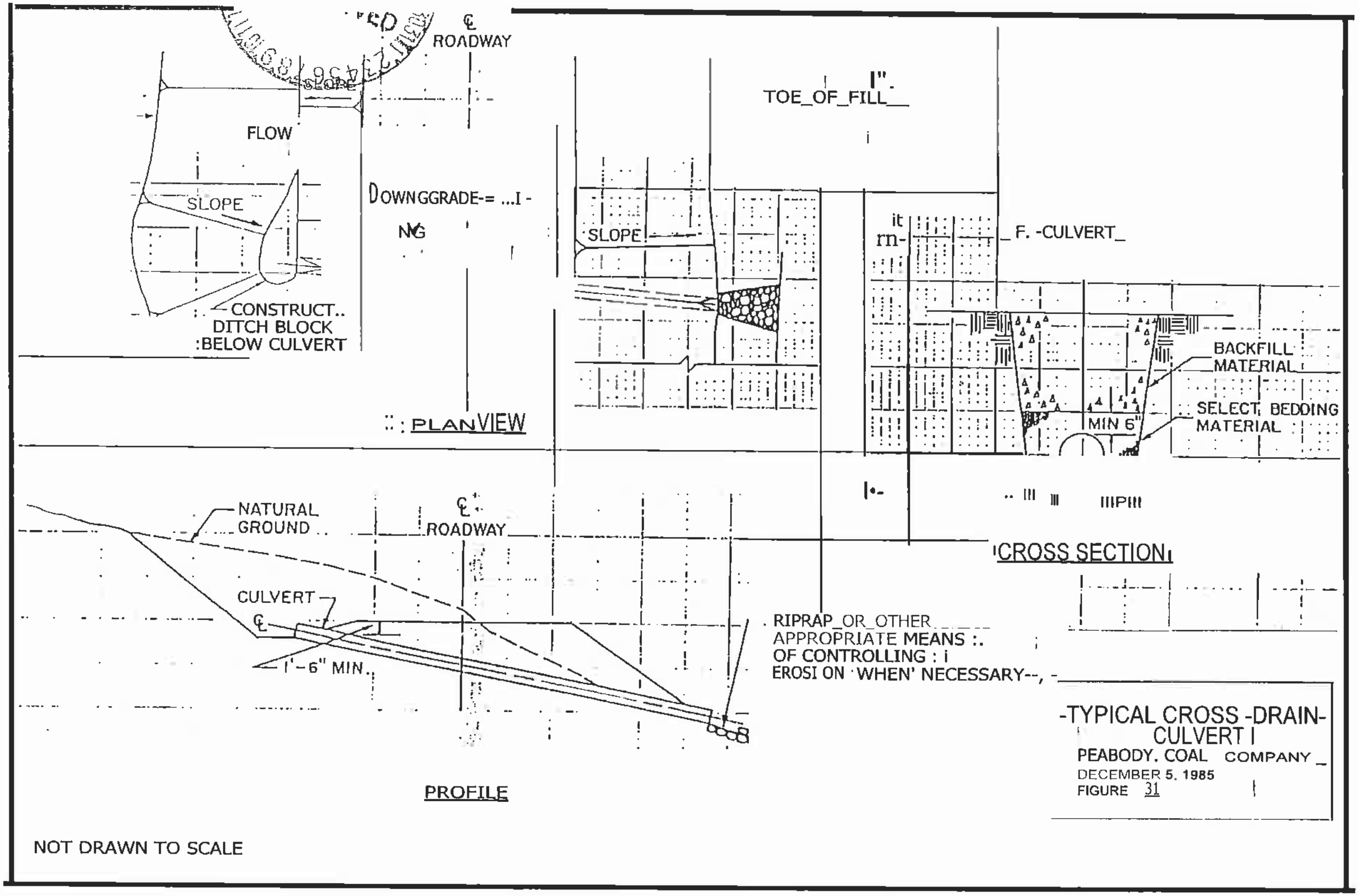
PEABODY. COAL. COMPANY
DECEMBER 5, 1985
FIGURE
NOT DRAWN TO SCALE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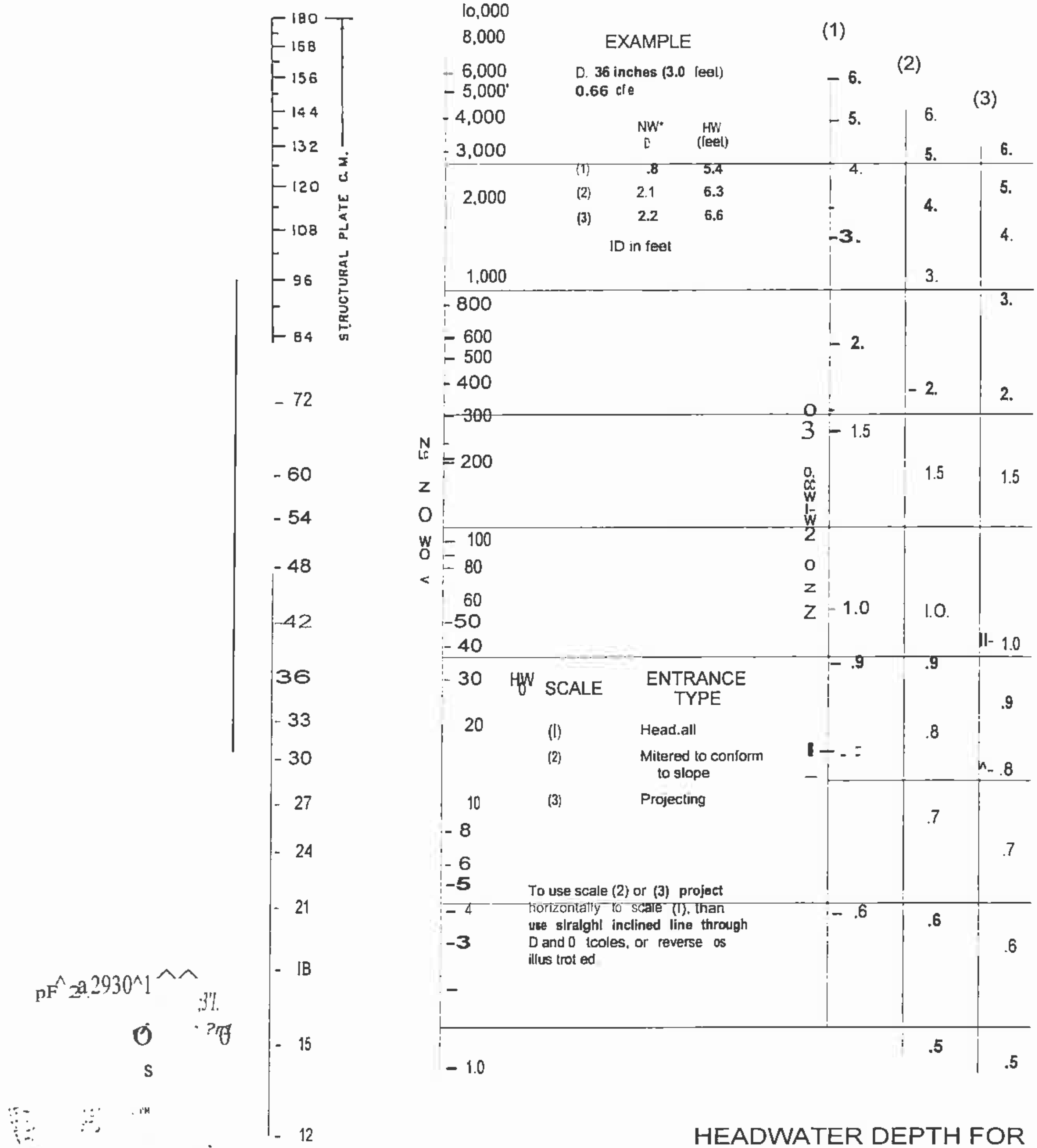
-TYPICAL CROSS -DRAIN-
CULVERT
PEABODY. COAL COMPANY
DECEMBER 5, 1985
FIGURE 31



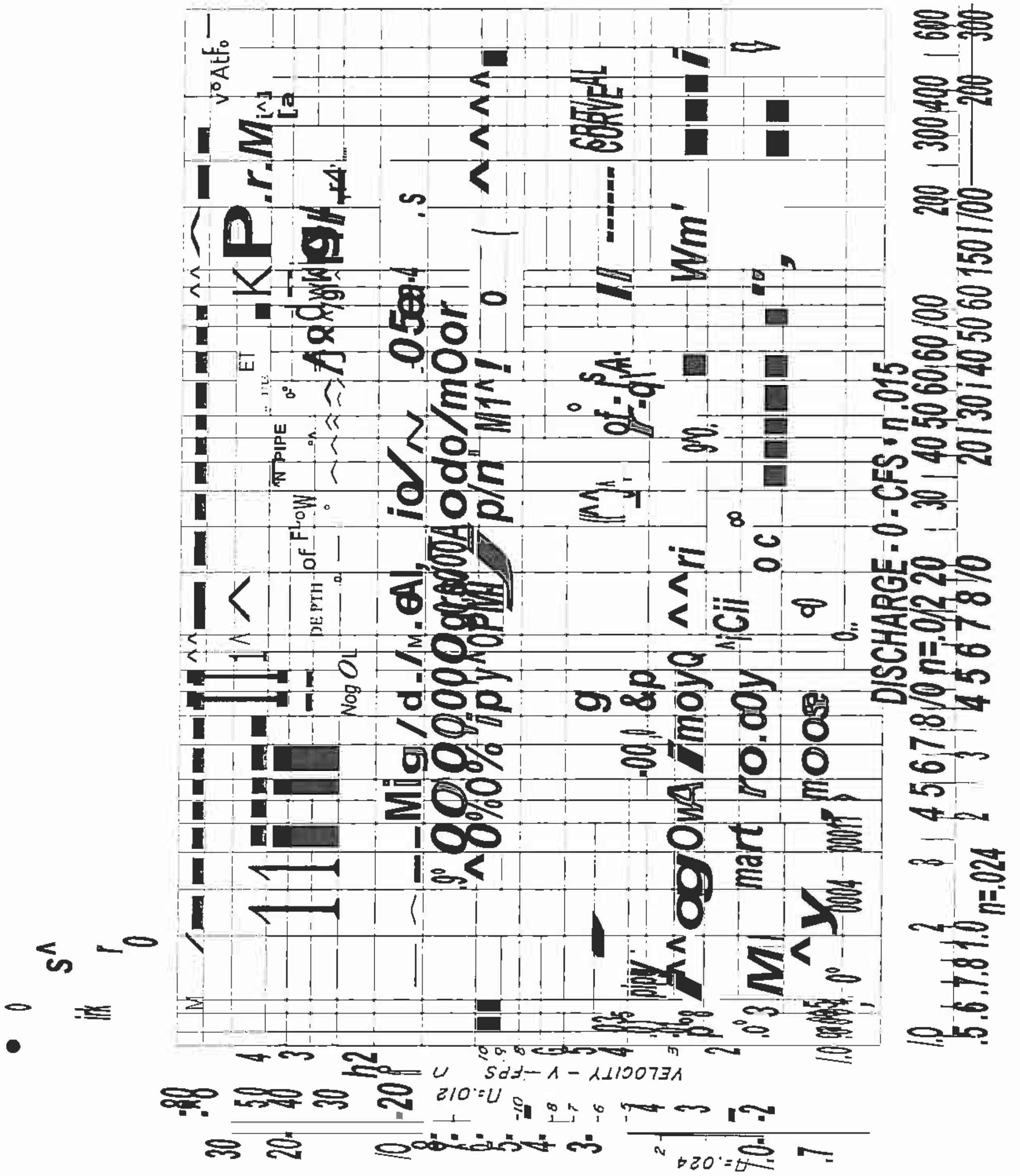

BUREAU OF PUBLIC ROADS JAN. 1963

(See HEC-5 For Further Information)

HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL

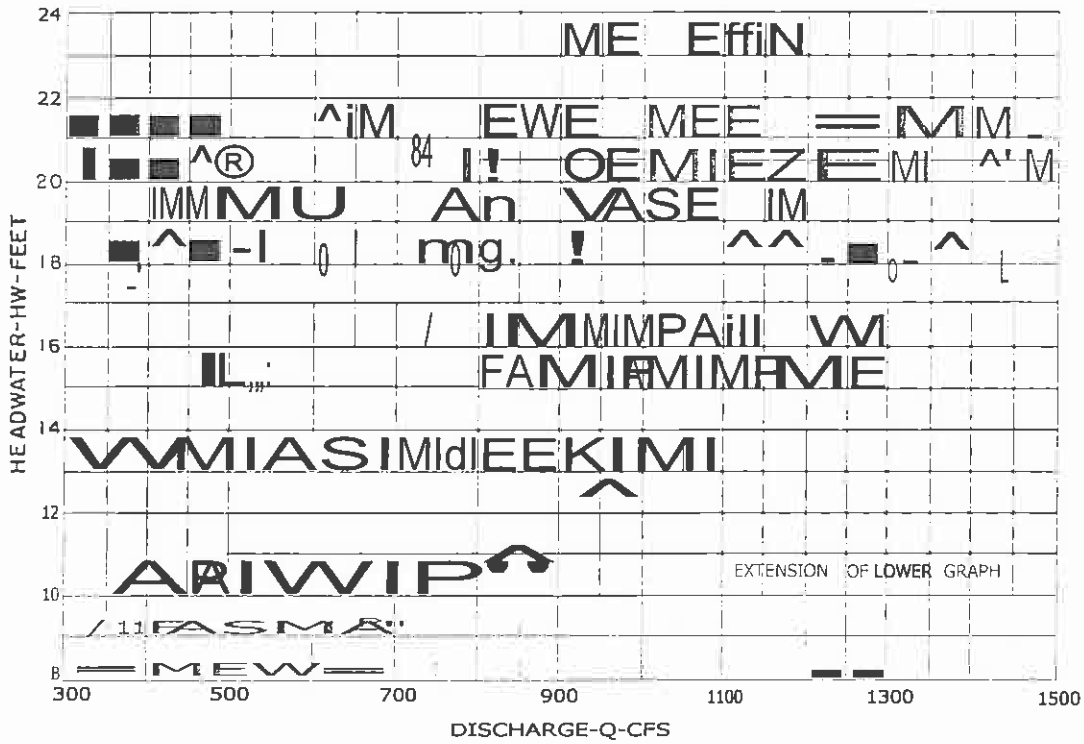
(From HEC-5)

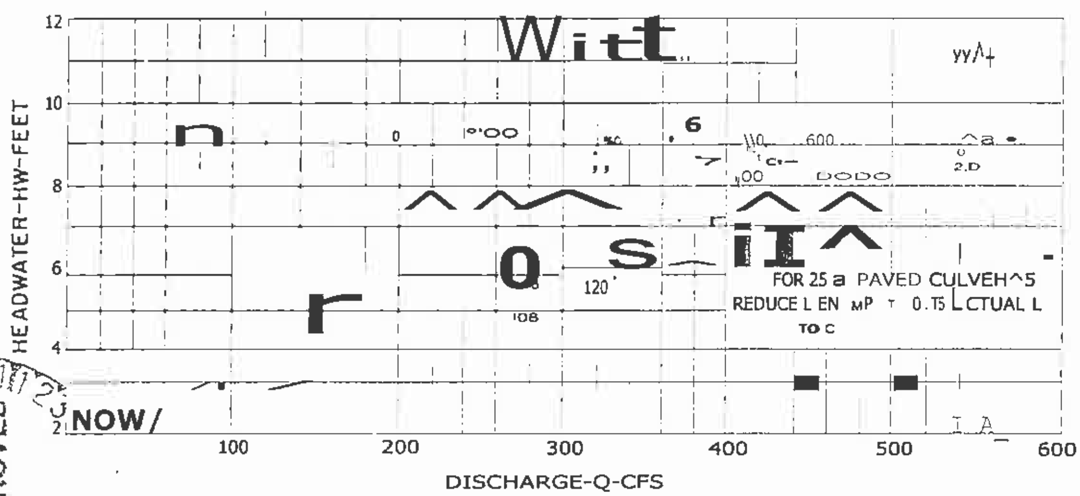
FIGURE 32




PIPE FLOW CHART
36-INCH DIAMETER

CHART 24






EXAMPLE,:

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L.=.120 FT , SD, 00083

T--SELEC 84' UNPAVED
H N : 8 B FT

(See HEC-10 For Additional Charts)

BUREAU OF PUBLIC ROADS JAN 1963

CULVERT CAPACITY
STANDARD
CIRCULAR CORR. METAL PIPE
HEADWALL ENTRANCE
72" TO 12011 Q
(From HEC-10)

FIGURE 34

Based on the anticipated volume of traffic and the weight and speed of vehicles using the roadways, a minimum of 6 to 12 inches of crushed rock, scoria, or native bedrock material is placed on the road surface. PWCC will continue to inspect and regularly maintain all mine-related roads. Maintenance will include, but may not be limited to, repairs to the road surface, blading, filling potholes, and adding replacement surfacing material. It will also include revegetation, brush removal, and minor reconstruction of road segments as necessary. PWCC also periodically applies water containing commercial additives to enhance the effectiveness of this dust control method.

During the fall of 1985, Dames & Moore's engineers performed a geotechnical stability inspection of all primary roads and the overland conveyor beltline for the Black Mesa and Kayenta Mines (Attachment Id). The purpose of Dames & Moore's inspection was to observe the existing conditions of the cuts and fills along the haul road and conveyor beltline alignments and to evaluate the stability of the roads and conveyor beltline embankments against the performance standards set forth in 30 CFR Parts 780 and 816. Dames & Moore's report included a "worst case" evaluation of the steepest and highest embankment slopes encountered during the inspection. Table 7-1 in Dames & Moore's report lists the locations where remedial work is recommended. Also, in Table 7-1 is the recommended remedial treatment for each problem. Most of the remedial treatment has already been implemented. The remaining remedial work will be implemented according to Table 23. Remedial treatments will include, but may not be limited to, the installation of riprapped channels, the periodic cleaning of culverts, the buttressing or reinforcing of slopes, the use of alternative sediment control measures to reduce erosion, and other remedial measures based on site by site evaluations.

Support Facilities

... disturbance for facilities at the mine site will be contained within the disturbance Area delineated on Drawing No. 85360. A discussion of the facilities use and maintenance is discussed in this chapter. Support facilities include but are not limited to the following types of facilities: primary and ancillary roads, mine buildings, offices and shops, bath houses, ANFO storage silos and cap magazines, coal loading facilities, coal crushing and sizing facilities, coal storage areas, equipment storage areas, water treatment and water storage facilities, sedimentation ponds, water diversions, sheds constructed on permanent foundation and greater than 100 square feet in size, utilities, permanent fuel storage and tank farms, and railroad and surface conveyor systems. The location of the facilities can be found on Drawing Nos. 85210 and '85400 with the major facility sites located on Drawing Nos. 85462 through 85482.

As stated in OSM's March 10; 1995 permit revision request, OSM does not, however, mean to imply that prior approval must be sought for every minute detail of routine mining operations. To do so would be exceedingly burdensome to both PMCC and OSM and would not result in any benefit to either party or the environment. Therefore, OSM has determined that certain other support facilities and items of a temporary nature may be placed within the approved disturbance area without prior OSM approval. Examples of this type of temporary support facilities shall include, but not be limited to the following: mulch storage area, irrigation line either in service on reclamation areas or the temporary yarding of irrigation pipe to be put into or being removed from service, skid mounted fuel and water tanks, small skid mounted sheds and storage bins, fire, first aid and portable toilet stations located in active working areas, small structures less than or equal to 100 square feet in size, and portable dragline power substations or transformers and trailing cable lines.

Support facilities will be located, maintained, and used in a manner that:

1) Prevents or controls erosion and siltation, water pollution, and damage to public or private property; and
2) To the extent possible using the best technology currently available:
   (i) Minimizes damage to fish, wildlife, and related environmental values; and
   (ii) Minimizes additional contributions of suspended solids to streamflow or runoff outside the permit area. Any such contributions shall not be in excess of limitations of State or Federal law.

'303 / port facilities, in addition to those identified in the March 1, 1995 permit renewal plicate , will be approved by OSM prior to construction regardless of their location. C'a
ly intenarle, of all facilities and reclamation of the temporary facilities will be in

Access along the Kayenta overland conveyor is necessary for service and maintenance activities. As the conveyor crosses washes, so must service and maintenance roads in some cases. The purpose of these fords is to provide adequate access across washes during periods of low flow, and to minimize potential environmental effects by designing a stable structure to accommodate the anticipated traffic and stream flows. A crossing of Yellow Water Canyon is planned and described below.

The need for a crossing of Yellow Water Canyon stems from a need to have complete access to the Kayenta Overland Conveyor for the purposes of service and maintenance. The present access to the Kayenta Overland Conveyor north of Yellow Water Canyon is inadequate during periods of low flow. Light-duty service and maintenance equipment such as pick-ups, cranes, small loaders, and forklifts are currently required to travel as much as six additional miles in order to gain access to the north side of Yellow Water Canyon.

The design selected for the Yellow Water Canyon crossing is a concrete ford based on an Arizona Department of Transportation Standard Drawing. The design dimensions provided for a length of 230 feet, a width of 14 feet (single lane), and a thickness of 8 inches. The design also provides for upstream and downstream cutoff walls of two feet and four feet, respectively, to prevent under cutting of the ford during periods of high flow. The downstream cutoff wall will include the installation of three-inch weep holes to pass any subsurface flow that might be encountered. The concrete used in the construction of this ford will be provided by PWCC and will have a required strength of 3,000 psi in 28 days.

The hydraulics of this design are based on a maximum flow of approximately 2,000 cfs recorded at environmental monitoring Site 15. Site 15 is a Parshall Flume located in Yellow Water Canyon approximately 3,000 feet upstream of the proposed crossing site. Using the Dodson and Associates trapezoidal channel analysis program and a flow of 2,000 cfs, 0.7 feet of freeboard would be available as a safety factor. The total available flow depth of four feet would result in a flow in excess of 3,200 cfs.

During construction, silt fence will be installed in Yellow Water Canyon downstream of the proposed crossing to minimize any addition of silt to the wash. Maintenance will generally consist of removal of debris and silt that may accumulate as the result of flow activity across the ford. Reclamation will be performed when the crossing is no longer needed for service and maintenance of the Kayenta Overland Conveyor. This reclamation will consist of removal and disposal of the concrete and returning the wash to the approximate original contours that existed prior to construction of the crossing.

PWCC will request approval from the appropriate regulatory agency prior to constructing mine-related crossings within stream buffer zones as shown on Drawing No. 85642 and 85642A. Drawing No. 85432 shows the ancillary road stream crossings and Drawing Nos. 85210, 85360, 85400, 85494, and 85496 show the Primary Road and Utility stream crossing locations. The above drawings include the N-9 Road crossing of Yellow Water Canyon Wash, the N-9 Powerline crossing of Yellow Water Canyon Wash, the ancillary road crossing at the southwest corner of N-9 area with a 60 inch diameter low flow culvert crossing, (see Figure 34a), and the N-11 Extension North Road crossing of the Coal Mine Diversion. The cross section of the stream at the crossing will equal or be greater than the capacity of the unmodified stream channel immediately upstream and downstream from the crossing.

During construction, a temporary silt fence or a straw bale dike will be installed downstream in the stream channel of the proposed crossing to minimize any addition of sediment to the wash. Once the crossing is completed, the adjacent disturbance area will be reclaimed to stabilize the surface. When the crossings are no longer required, the site will be reclaimed in accordance with the approved reclamation plan.

In addition, sediment control methods may include, but not be limited to, the following:

1. Disturbing the smallest practicable area at any one time during the construction and reclamation operation;
2. Stabilizing graded material to promote a reduction in the rate and volume of runoff;
3. Retaining sediment within disturbed areas;
4. Diverting runoff away from disturbance areas including stockpiles, backslopes, and material storage;
5. Diverting runoff through disturbed areas using stabilized earth channels, culverts, or pipes so as to prevent, to the extent possible, additional contributions of sediment to streamflow or to runoff outside the permit area;
6. Using BMP's, straw dikes, silt fences, small V-ditches, riprap, mulches, check dams, ripping, contour furrowing, vegetative sediment filters, small depressions, sediment traps, and other measures that will reduce overland flow velocity, reduce runoff volume, or trap sediment; and
7. Treating traffic areas with water or dust suppressant to reduce the potential for wind and water erosion.

Crossings will be located, designed, constructed, used, maintained, and reclaimed so as to: (a) control or prevent erosion, siltation, and the air pollution attendant to erosion by vegetating, watering, using dust suppressants, or other methods in accordance with current, prudent engineering practices,

(b) control or prevent damage to fish, wildlife or their habitat, and related environmental values,

(c) control or prevent additional contribution of suspended solids to runoff outside the permit area,

(d) neither cause nor contribute to the violation of State or Federal water quality standards applicable to receiving waters,

(e) refrain from seriously altering the normal flow of water in intermittent or perennial streambeds or drainage channels,

(h) control or prevent damage to public or private property, and

(i) use non-acid or non-toxic forming substance in crossing surfacing.

Figures 30 and 31 show typical installation of culverts. Following is typical culvert installation specifications:

(1) Except as directed by the Owner or as indicated on the Drawings, pipe culverts shall be installed by starting at the outlet end.

(2) Construction of new or reconstruction of existing drainage structures shall conform to the details shown on the Drawings, and at the location and elevations as indicated. Work related to connections into the existing drainage system shall be considered under this item and performed as specified.

(3) Excavation, bedding, and backfill for pipe culvert installation shall be in accordance with these Documents.

(4) All pipe culverts shall be set to the specified grade and alignments as shown on the Drawings. Pipe segments shall be jointed by sealing, banding, bolting, or thermal welding in accordance with the manufacturer's recommendations and standard practices.

(5) The lower segment of the pipe culvert shall be in contact with the shaped foundation throughout it's full length and shall be placed with circumferential laps or seams at the side and by lapping the circumferential seams on the inside in the direction of flow.

(6) Upon completion, each structure shall be cleaned of any accumulations of silt, debris, or foreign matter and shall be kept clear of such accumulation.

(7) For multiple pipe barrel installations the minimum permissible spacing are as follows:

(8) DIA.
Up to 24 inches - 12 inches of spacing
24 inches to 72 inches - one-half of the diameter of the pipe
Over 72 inches - 36 inches of spacing

(9) No backfilling will be done around any pipe culvert until they have been inspected and the backfilling authorized by the Owner. No filling or backfilling against foundations, walls, and footings shall be done until concrete forms have been removed and concrete has properly cured, and waterproofing has been applied, if applicable.

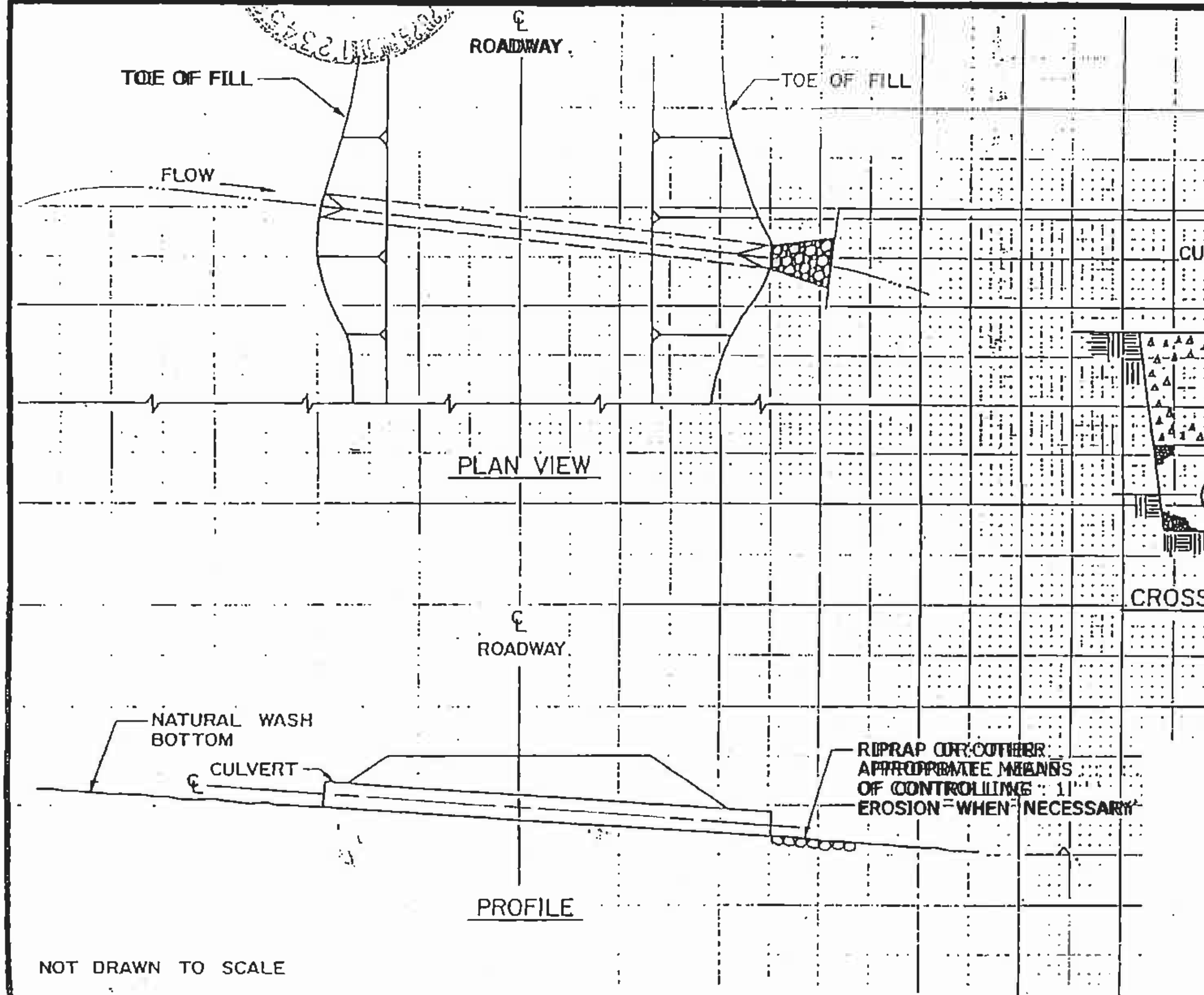
(10) Backfill shall be placed and hand-tamped in twelve inch (12in.) lifts (loose depth) under the haunches of the pipe culvert. Backfill will be placed evenly on both sides of the pipe culvert. Above the haunch of the pipe culvert, the material may be compacted using a motorized compactor or pneumatic tamper.

(11) Mechanical tampers or approved compactors shall be used to compact all backfill and embankment for not less than four feet (9 FT) on each side of a culvert. Heavy compaction equipment shall not be operated in this area or over the pipe culvert until it is covered, to the greater depth of two feet (2 FT) or one-quarter (1/4) the span of the pipe culvert, with compacted fill. The backfill shall be placed in twelve inch (12 in.) lifts (loos•dti). For multiple-span pipe culverts, the span shall be assumed to be the longest ndi!va!4n pan.

(12) Lightweight dozers and graders may be operated over pipe culverts having two foot (2 FT) of compacted cover, but heavy earth moving equipment shall require a minimum of three feet (3 FT) of cover.

(13) Backfill will be compacted in the above noted manner for a horizontal distance of at least one (1) pipe culvert diameter from the edge of the pipe culvert along each side of the culvert or to the wall of the trench, and for a vertical distance of twelve inches (12 IN) or one-eighth (1/8) the diameter above the crown, whichever is greater.

(14) Care shall be taken to preserve the lateral integrity of pipe culverts during backfill operations. Backfill operations shall be carried on uniformly on both sides of pipe culverts.




**TYPICAL LOW WATER CROSSING WITH A LOW FLOW CULVERT**

**PEABODY WESTERN COAL COMPANY**
**OCTOBER 4, 2005**
**FIGURE 34a**

Coal Handling Facilities

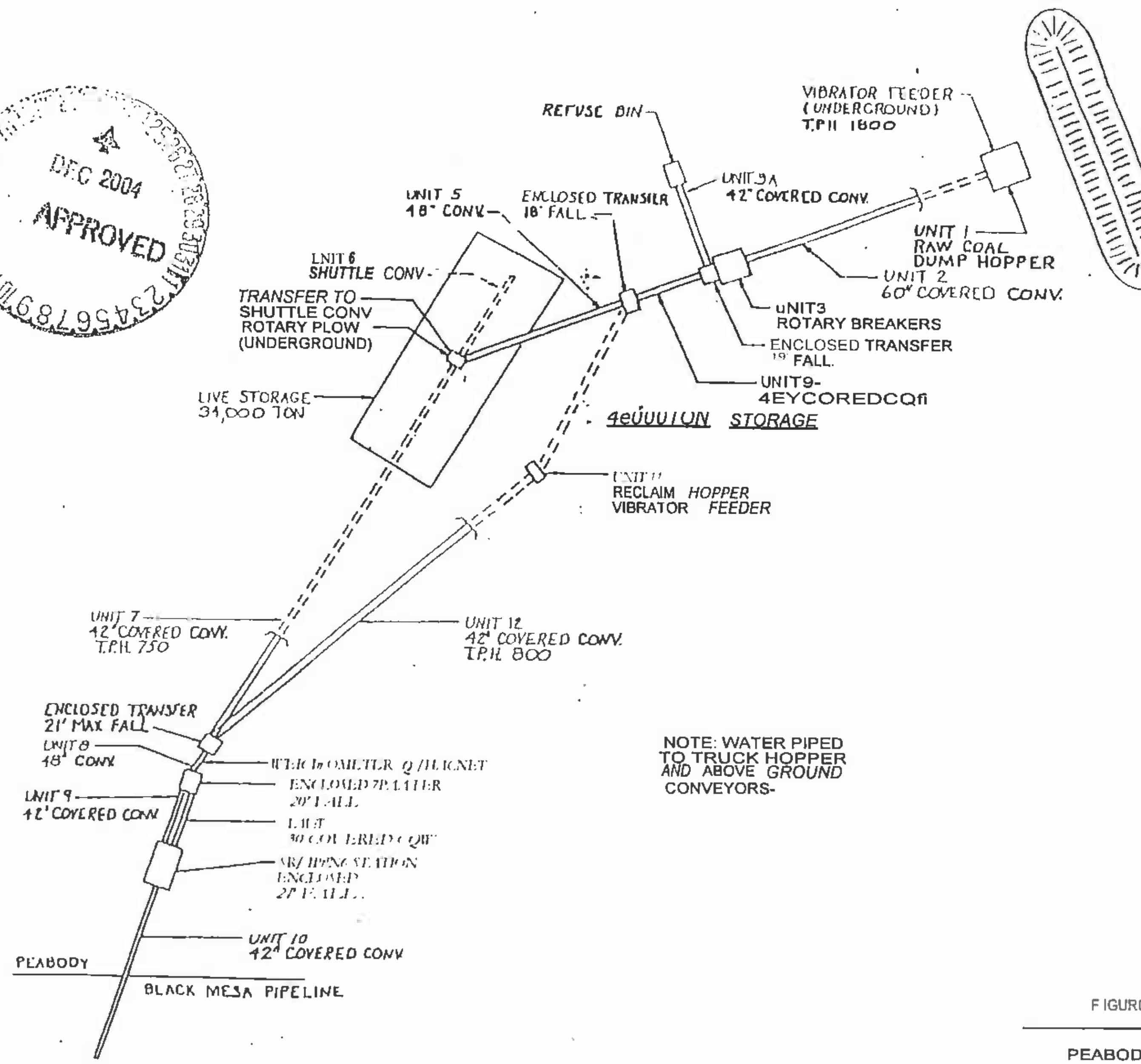
The coal produced at the mining operation is conveyed to power generating plants via conveyor and rail or slurry pipeline. Coal handling facilities at each mine physically prepare the coal prior to transportation to the power plants. All coal handling facilities are located within the proposed permit area and can be seen on Drawings 85210, 85400, 85480, and 85482.

The Black Mesa Mine produces coal destined for the Mohave Generating Station in Nevada near Bullhead City, Arizona. A schematic of the Black Mesa coal handling facilities is shown on Figure 35. Coal from this mine is processed through rotary breakers and transported via a 48-inch conveyor to either a live or dead storage area. The coal is withdrawn from either storage area via vibrator feeder or rotary plow and transported by a 42-inch conveyor to storage bunkers at the Black Mesa Pipeline Company: The coal is conveyed from the bunkers *through* a processing plant, which produces 1/8 inch, or less, diameter material to be mixed with water for preparation of a coal slurry. The slurry is transported 273 miles via Black Mesa Pipeline Company's pipeline to the Mohave Station.

Coal produced at the Kayenta Mine is destined via Salt River Project's Black Mesa and Lake Powell railroad spur for the Navajo Generating Station at Page, Arizona. Figure 36 shows a schematic of the primary coal handling facilities at Kayenta Mine.

Coal hauled to the Kayenta coal handling facility is dumped into a 2,000-ton or a 300-ton capacity dump hopper using bottom-dump and/or end-dump haulage trucks. The open-top hoppers are spanned by four beam-supported runways with one side of the hoppers open to receive coal that, when necessary, is placed on the ground during peak loading or breakdowns and shutdowns. This coal will later be pushed into the hopper using rubber-tired or track-type dozers.

Coal is fed from the bottom of the 2,000-ton dump hopper by two reciprocating plate feeders onto two 72" run-of-mine belts with one feeder for each belt. Each conveyor has a normal rate of coal transfer equal to 1,300 tons per hour. The maximum rate of 2,000 tons per hour will be utilized when only one unit is operational. Coal is fed from the bottom of the 300-ton dump hopper by a reciprocating plate feeder onto a 60-inch run-of-mine belt. The three run-of-mine conveyors are totally covered on the windward side and halfw covered on the leeward side. This will leave an opening for belt idler lubrication/'_haT inspection, and general maintenance.

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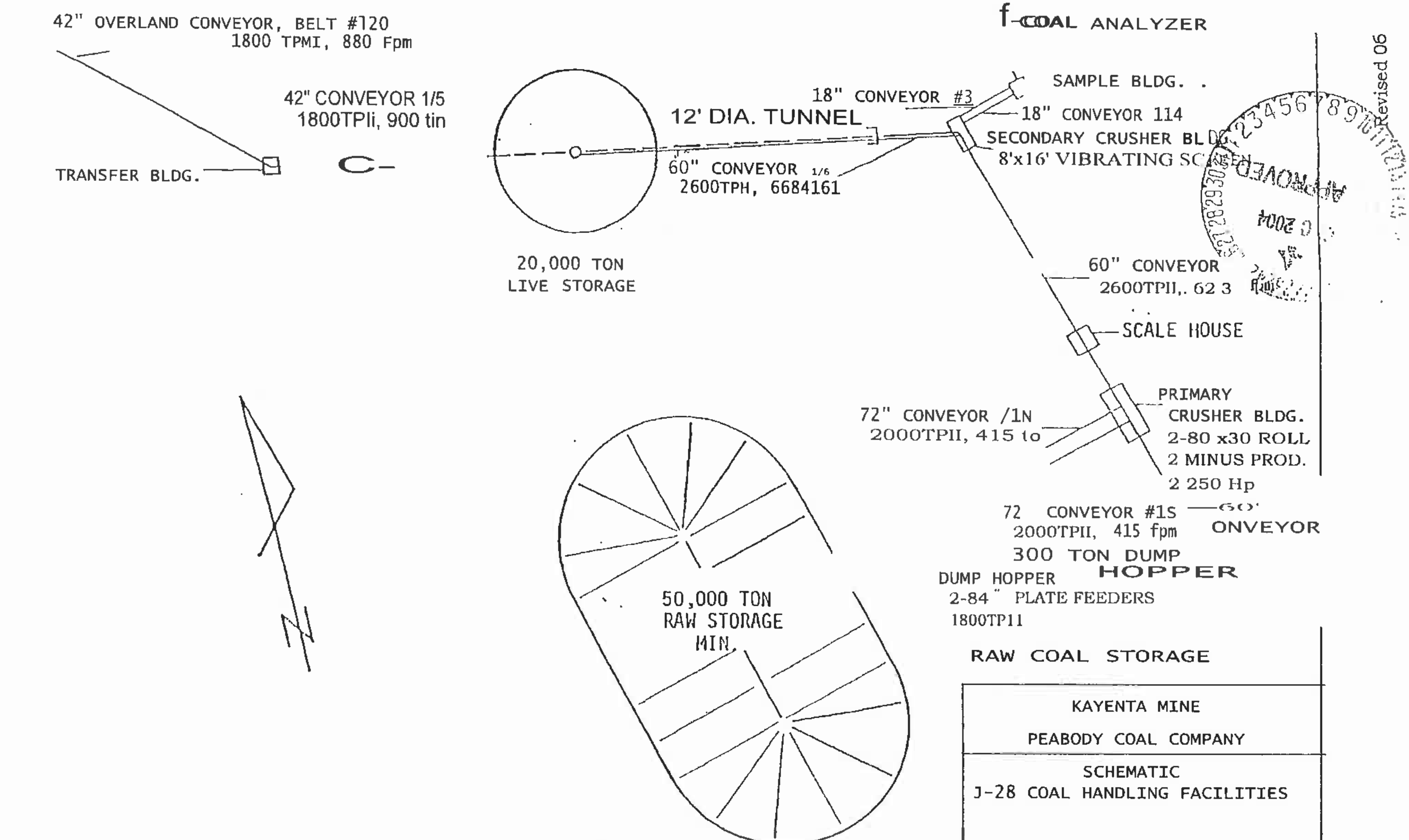
PEABODY COAL COMPANY
BLACK MESA MINE

SCHEMATIC
COAL HAIILA.INO FACILITY

Revised 12/01/88




| KAYENTA MINE | |
|---|---|
| PEABODY COAL COMPANY | |
| SCHEMATIC<br>J-28 COAL HANDLING FACILITIES | |
| NO SCALE | DATE: "0 3/9 0 |

FIGURE 36

Each 72-inch belt and 60-inch belt discharges coal into totally enclosed chute work at the primary crusher building. The coal is gravity fed into one of two 80" x 30" roll-type crushers which reduce the size of the run-of-mine product to 2" maximum. The crushed coal is gravity fed from the crushers through totally enclosed chute work onto a 60" screen feed belt having a maximum rate of coal transfer equal to 2,600 tons per hour. This belt, which carries coal through a scale house, is totally covered on the windward side and covered halfway down the leeward side for the entire 500-foot length. The belt discharges into totally enclosed chute work at the secondary crusher building.

The first function of the secondary crusher building is taking a sample, or cut of coal, which will be conveyed away from the main flow of coal by means of an 18" covered sample feed conveyor to a totally enclosed sampler building where secondary and tertiary sampling and crushing is performed, and to a coal analyzer tower where the coal quality is checked. All reject from sampling and sample crushing is conveyed back to the secondary crusher building on a parallel 18" covered return sample belt and discharged along the main flow of coal onto a stockpile belt.

The second function is screening of coal fed from the primary crushers and scalping of any coal that exceeds 2" in size. All coal that passes the screen will fall through totally enclosed chute work onto a 42" stockpile bypass belt or a 60" stockpile feed belt.

Oversized coal, which does not pass through the screens, will fall into totally enclosed chute work that feeds a secondary crusher, which recrushes the oversized coal and discharges through a bin onto the stockpile bypass or feed belt. Beneath the bin is a feeder belt which may be used to discharge coal onto the bypass belt. When the feeder belt is stopped or running at a reduced rate, the bin above the feeder will fill and discharge onto the 60" stockpile feed belt. The feed belt beneath the bin is variable speed, thus the rate of feed can vary on both belts. The bypass belt can be varied from 0 to 2,600 tons per hour while the rate of feed of the stockpile feed belt can be simultaneously varied from 800 to 2,600 tons per hour.

The 60" stockpile feed belt conveys coal at a rate of 800 to 2, 600 tons per hour for a horizontal distance of 584 feet. This belt is totally covered on the windward side and covered halfway down on the leeward side. Coal from this belt is fed into totally enclosed chute work atop a covered conical structure which discharges into a 20,000-ton capacity live storage [illegible] pile is totally enclosed with sheeting. When the pile is at capacity, approximately 63 percent is retained below grade and 37 percent of the pile is above grade. Coal is withdrawn from the bottom of live storage as needed. The 42" stockpile bypass belt originates within the same transfer as does the 60" stockpile feed belt. This bypass belt, depending upon the bin feeder belt setting, can carry 0 to 1,800 tons per hour and will convey coal a horizontal distance of 1,050 feet. This belt is a zero grade belt that travels underneath the 20,000-ton live storage stockpile, through a 12-foot diameter tunnel and discharges into totally enclosed chute work at a transfer structure. Where this conveyor is exposed, either going or coming from the live storage tunnel, it is completely covered on the windward side and covered halfway down the leeward side. Coal is reclaimed from the live storage onto this belt at a rate of 0 to 1,800 tons per hour through the use of a reciprocating plate feeder located within the tunnel underneath the live storage pile. A combination of direct run (bypass) stockpile drawdown and/or blending can be accomplished by matching the variable speed feeder belt and bypass belt to deliver a total rate of 1,800 tons per hour to the overland conveyor system.

The direction of the coal flow from the bypass conveyor is turned 31° within totally enclosed chute work at a transfer and discharged through totally enclosed chute work at a transfer structure onto the first leg, conveyor 20, of the overland conveyor extension.

Coal is transferred from the J-28 coal handling facility to the N-7/8 facilities (Figure 37) via an overland conveyor consisting of six segments or "legs". The first leg, conveyor 20, of the 42" 1,800-ton per hour overland conveyor will cover a horizontal distance of 8,890 feet. The second, third, fourth, fifth, and sixth legs, conveyors 21 through 25, of the overland conveyor, are 6,973 feet, 6,715 feet, 6,623 feet, 7,418 feet, and 13,922 feet, respectively. The total horizontal length of the overland conveyor between the two facilities is approximately ten miles.

In 1995 when the N-14 mine area was mined out, the N-14 facilities were dismantled and relocated to the N-11 truck dump/facilities area (see Drawing No. 85482). Construction began in 1994. The N-11 coal handling facilities consists of a 300,000-ton coal stockpile, a 500-ton truck dump hopper, 72-inch R.O.M. conveyor, primary and secondary crusher buildings, sampling system, and transfer conveyors, as well as a coal lab building and truck ready line area. The total conveyor length is approximately 1,480 feet. The drainage from the material storage area on the west side of the Kayenta Nine Road is channeled to ng sedimentation Pond N1-C. The drainage from the truck dump and

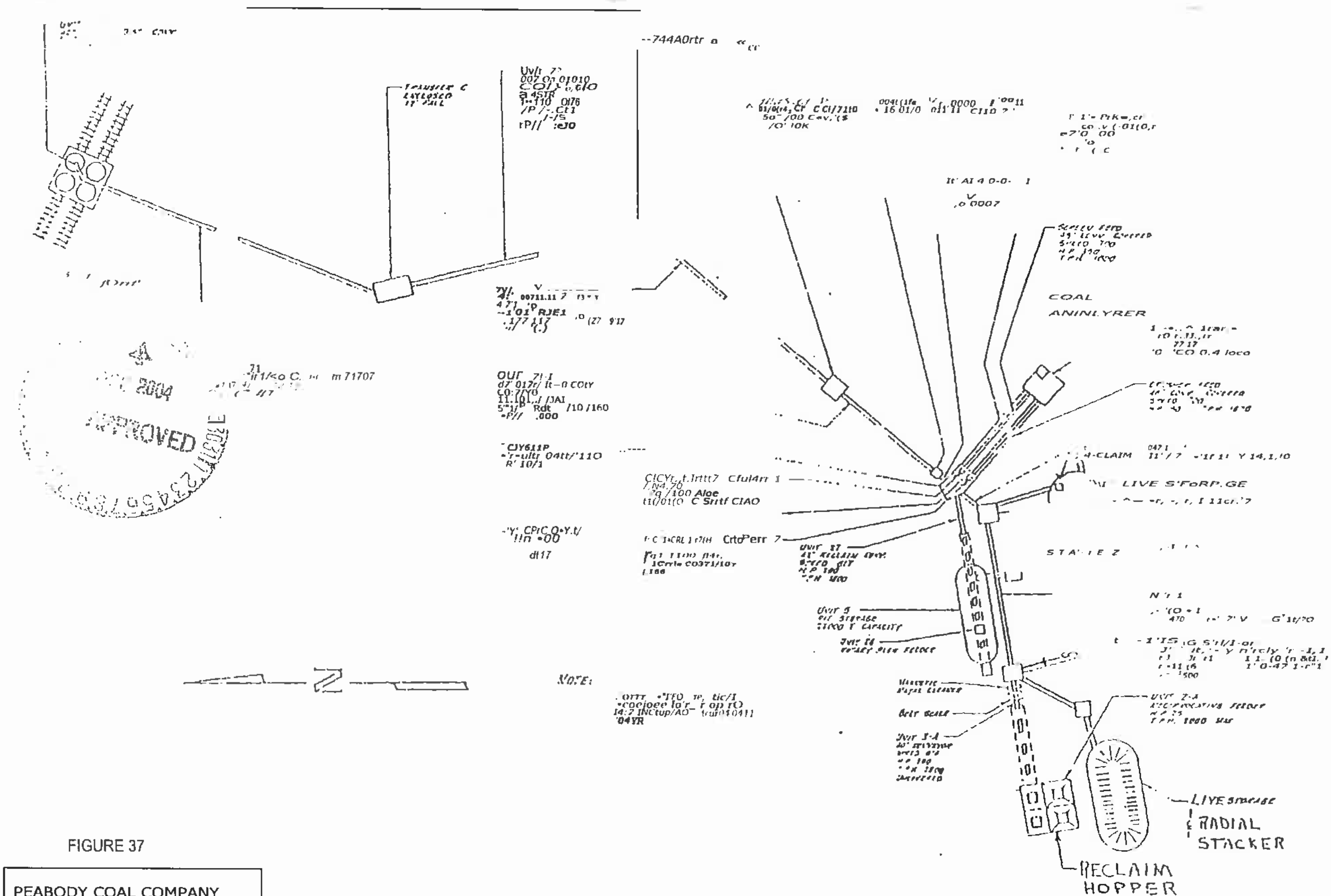



FIGURE 37

PEABODY COAL COMPANY
KAYENTA MINE

SCHEMATIC
'MAL HANDLING FACILITY

4/9c

coal stockpile area on the east side of the Kayenta Mine Road will drain into the existing sedimentation Pond N10-D (see Attachment U for calculations). The disturbance to Coal Mine Wash will be minimal.

The N-7/8 facilities consist of coal storage, conveying, and coal quality analyzer facilities similar to the J-28 facilities. Coal can be blended and/or stored at the facility prior to transfer to the rail loadout facility via a 5.8-mile overland conveyor. The coal analyzers provide continuous coal quality information and assist in coal blending operations.

Airport Facilities

In February 1986, PWCC submitted the general design and construction plans for new airport facilities. The old airport is located in the N-6 mining area. The new airport is located in the reclaimed J-3 area (see Drawing Nos. 85210 and 85462). The new airport location was chosen primarily on aviational considerations, topography, minimal disturbance to previously undisturbed areas, location relative to mine offices, and future mining activities.

The new airport facilities include an approximately 7,500-foot long by a 75-foot wide paved runway and a small airplane tie-down, taxiway, and storage building area.

The new airport facilities have been designed, constructed, and maintained to comply with all applicable local and Federal regulations. Sediment and runoff control are provided by the existing J3-A, J3-F, and J3-G sedimentation ponds. The locations of these structures are shown on Drawing No. 85405. The watershed boundaries are delineated on Drawing No. 85400, Sheet K-9. The detailed inspection and design report for each impoundment structure can be found in Attachment H.

The N-6 airport facilities area will be reclaimed as part of the N-6 mine area. The new airport facilities will be considered a temporary facility unless approved as a component of the postmining land use plan. The airport facilities will be reclaimed in the year 2011, if it is no longer required to support mining operations. Reclamation will be in accordance with the approved reclamation plan.

Solid Waste Disposal

PWCC operated a solid waste landfill at the J-3 coal resource area until it was closed in 1997. The J-3 Landfill Closure reclamation plan was submitted to the regulatory authority in 1998 and subsequently approved. The reclamation plan permit revision is located in AZ-0001 Permit, Volume 54c, Item 31, J-3 Solid Waste Landfill Closure Permit Revision. PWCC has contracted with a solid waste vendor to haul the solid waste off-site to a regulated landfill. PWCC is also working with the EPA and the Tribe on a final J-3 solid waste closure plan. A Solid Waste (Non-Coal) Disposal Plan for the landfill is contained in Appendix C, Volume 12. The plan addresses the kinds of non-coal wastes that were disposed of at the site, the methods used to prevent leachate or surface runoff from degrading surface or ground water, fire prevention, landfill operations, and reclamation. Non-coal wastes shall not be placed within eight feet of any coal outcrop or coal storage area.

No hazardous chemical wastes, radioactive materials, hazardous sludges and liquids, or any other type of hazardous waste will be disposed of within the permit area. All hazardous materials as defined by the Resource Conservation and Recovery Act (RCRA) will be disposed off-site in accordance with applicable Federal and State regulations. Rinse water that is the result of washing blasting agent residue off explosive trucks will be disposed of in active mine pits in a manner such that ground water quality is not degraded and revegetation efforts are not hindered. Currently these active pits are at the J-7, J-19, J-21, N-6, N-11, and N-11 Extension coal resource areas. As resource areas are reclaimed and mining progresses, an additional active pit may be developed at the N-10 coal resource area. Disposal sites within the active mine pit will be above the ground water table, and away from ponded water. The rinsing will occur on benches in the pit that will be blasted. Residue will therefore be mixed with the shot overburden, coal, or parting material. Chapter 22, Minesoil Reconstruction (Volume 11) describes the procedures used to determine the thickness of suitable plant growth material to be placed on top of the graded spoil. As a worst case, four feet will be placed. To prevent a public hazard, the pits are secured by a combination of fencing, security personnel patrolling the mine site, or mine personnel inspecting the active pit area during work shifts.

During the excavation and removal of the Kayenta and Black Mesa Mine underground storage tanks, PWCC's contractor encountered petroleum contaminated soil. One of the more common types of treatment or remediation methods for petroleum contaminated soil is on-site bioremediation or landfarming. The location of the J-16 and N-6 landfarms were selected in areas approved by Region IX USEPA and Navajo EPA (see Drawing 85210). These two sites are in previously permitted mining disturbance areas. This material is being landfarmed in accordance with USEPA and NEPA requirements. When the remediation process has been completed and USEPA has approved the final closure reports, PWCC will dispose of the material in the adjacent mining area and reclaim the sites in accordance with the approved reclamation plan. Bioremediation of the material is expected to be completed prior to or to coincide with the reclamation of the adjacent J-16 and N-6 pit areas.

Facility Construction Schedule

As a result of reviewing all the existing and proposed structures needed for the five-year permit term for the Black Mesa and Kayenta Mines, PWCC has developed Drawing No. 85406 and Table 10, Facility Construction Schedule Summary, for all construction after January 2005. A list of all major facilities is included in Chapter 24, Bonding, Attachment 24-4. All Construction and remedial schedules for siltation structures and impoundments are shown on Drawing No. 85406.

In accordance with 30 CFR, 780.12(a)(3), all pre-existing structures constructed prior to 12-16-1977 are shown in AZ-0001 Permit, Volume 8, Drawing No. 406. "Existing structure" means a structure or facility used in connection with or to facilitate surface coal mining and reclamation operations for which construction begins prior to the approval or implementation of the 12-16-1977 Federal Program. Construction was begun and completed on the structures shown on Drawing No. 406 after construction started on the mines in the late 1960's and early 1970's. For all other existing or reclaimed structures not shown on Drawing No. 406, construction was begun and completed after 12-16-1977.

On Drawing No. 85406 and Table 10, the remedial and new construction work was prioritized based on site specific information, potential future mine-related disturbance in the watershed, projected coal sales, and minimizing the risk of harm to the environment or to the public health and safety. The construction schedule is PWCC's best estimate at this time. Future events may require alterations in the schedule (i.e., delayed permit approval, mining projess; etc.

TABLE 10

BLACK MESA/KAYENTA MINE

FACILITY CONSTRUCTION SCHEDULE SUMMARY

| STRUCTURE IDENTIFICATION | PERMIT CATEGORY | PROPOSED ACTIVITY |
|---|---|---|
| | <u>2005 Calendar Year</u> | |
| N6/N11 North Deadhead/ Haul Road and Conveyor Crossing | Primary Haul Road | New Road Construction |
| N9 Deadhead and Haul Road | Primary Haul Road | New Road Construction |
| | <u>2006 Calendar Year</u> | |
| BM/Moenkopi CMP | Existing Haul Road | Remedial Construction Work |
| | <u>2010 Calendar Year</u> | |
| N99/N11 North Haul Road | Primary Haul Road | New Road Construction |
| N99/N11 South Haul Road | Primary Haul Road | New Road Construction |
| | **<u>2013 Permit Year</u>**<br><u>(July 2013-July 2014)</u> | |
| All temporary primary roads not required for reclamation maintenance and monitoring. | Primary Road | Primary Road Reclamation |
| Narrow and reclaim the non-permanent portion of permanent primary roads. | Primary Road | Primary Road Reclamation |
| | <u>2017 Permit Year</u><br><u>(July 2017-July 2018)</u> | |
| N-11 Haul Road Spurs | Primary Haul Road | Primary Road Reclamation |
| | <u>2022 Permit Year</u><br><u>(July 2022-2023)</u> | |
| J-19 Haul Road | Primary Haul Road . | Primary Road Reclamation |
| J-19 Deadhead/Haul Road Spur | Primary Haul Road | Primary Road Reclamation |
| J-19 West Haul Road | Primary Haul Road | Primary Road Reclamation |
| Reclaim all remaining temporary primary roads. | Primary Road | Primary Road Reclamation |

APPROVED

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