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Coal Combustion Residue Impoundment
Round 9 - Dam Assessment Report

Flint Creek Power Plant

Bottom Ash Dike
SWEPCO
Gentry, Arkansas

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

Dewberry & Davis, LLC
Fairfax, Virginia

Under Contract Number: EP-09W001727
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INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The release of over five million cubic yards of coal combustion waste from the Tennessee Valley Authority's Kingston, Tennessee facility in December 2008 flooded more than 300 acres of land, damaging homes and property. In response, the U.S. EPA is assessing the stability and functionality of the coal combustion ash impoundments and other management units across the country and, as necessary, identifying any needed corrective measures.

This assessment of the stability and functionality of the Flint Creek Power Plant primary and secondary bottom ash ponds are based on a review of available documents and on the site assessment conducted by Dewberry personnel on February 15, 2011, we found the supporting technical documentation adequate (Section 1.1.3).

In summary, the Flint Creek Power Plant primary and secondary bottom ash ponds are **SATISFACTORY** for continued safe and reliable operation, with no recognized existing or potential management unit safety deficiencies.

PURPOSE AND SCOPE

The U.S. Environmental Protection Agency (EPA) is embarking on an initiative to investigate the potential for catastrophic failure of Coal Combustion Surface Impoundments (i.e., management unit) from occurring at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present), status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency. The initiative will address management units that are classified as having a Less-than-Low, Low, Significant or High Hazard Potential ranking. (For Classification, see pp. 3-8 of the 2004 Federal Guidelines for Dam Safety.)

In early 2009, the EPA sent its first wave of letters to coal-fired electric utilities seeking information on the safety of surface impoundments and similar facilities that receive liquid-borne material that store or dispose of coal combustion residue. This letter was issued under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e), to assist the Agency in assessing the structural stability and functionality of such management units, including which facilities should be visited to perform a safety assessment of the berms, dikes, and dams used in the construction of these impoundments.

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EPA requested that utility companies identify all management units including surface impoundments or similar diked or bermed management units or management units designated as landfills that receive liquid-borne material used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Utility companies provided information on the size, design, age and the amount of material placed in the units. The EPA used the information received from the utilities to determine preliminarily which management units had or potentially could have High Hazard Potential ranking.

The purpose of this report is **to evaluate the condition and potential of residue release from coal combustion residue management units.** This evaluation included a site visit. Prior to conducting the site visit, a two-person team reviewed the information submitted to EPA, reviewed any relevant publicly available information from state or federal agencies regarding the unit hazard potential classification (if any) and accepted information provided via telephone communication with the management unit owner. Also, after the field visit, additional information was received by Dewberry & Davis LLC about the Flint Creek Power Plant primary and secondary bottom ash pond that was reviewed and used in preparation of this report.

Factors considered in determining the hazard potential classification of the management unit(s) included the age and size of the impoundment, the quantity of coal combustion residuals or by-products that were stored or disposed of in these impoundments, its past operating history, and its geographic location relative to down gradient population centers and/or sensitive environmental systems.

This report presents the opinion of the assessment team as to the potential of catastrophic failure and reports on the condition of the management unit(s).

LIMITATIONS

The assessment of dam safety reported herein is based on field observations and review of readily available information provided by the owner/operator of the subject coal combustion residue management unit(s). Qualified Dewberry engineering personnel performed the field observations and review and made the assessment in conformance with the required scope of work and in accordance with reasonable and acceptable engineering practices. No other warranty, either written or implied, is made with regard to our assessment of dam safety.

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Doc 06:	Dam & Dike Inspection Report, September 16 2009
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Doc 08:	Ash Pond Dike Cross Sections FCX3-2, dated 7/10/74
Doc 09:	Secondary Ash Settling Pond Weir FCX104-1, dated 9/22/09
Doc 10:	Ash Storage Basin Control Structure FCX29-2, dated 4/7/76
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Doc 16:	Dam Inspection Check List Form Primary Bottom Ash Pond
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1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a one-day site visit on February 15, 2011, and review of technical documentation provided by SWEPCO.

1.1.1 Conclusions Regarding the Structural Soundness of the Management Unit(s)

The dike embankments and spillway appear to be structurally sound based on a review of the engineering data provided by the owner's technical staff and Dewberry engineers' observations during the site visit.

1.1.2 Conclusions Regarding the Hydrologic/Hydraulic Safety of the Management Unit(s)

Hydrologic and hydraulic analyses provided to Dewberry indicate adequate impoundment capacity to contain the 1-percent probability/Probable Maximum Precipitation design storm without overtopping the dikes.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

The supporting technical documentation is adequate. Engineering documentation reviewed is referenced in Appendix A.

1.1.4 Conclusions Regarding the Description of the Management Unit(s)

The description of the management unit provided by the owner was an accurate representation of what Dewberry observed in the field.

1.1.5 Conclusions Regarding the Field Observations

Dewberry staff was provided access to all areas in the vicinity of the management unit required to conduct a thorough field observation. The visible parts of the embankment dikes and outlet structure were observed to have no signs of overstress, significant settlement, shear failure, or other signs of instability. Embankments appear structurally sound. There are no apparent indications of unsafe conditions or conditions needing remedial action.

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

The current maintenance and methods of operation appear to be adequate for the bottom ash management unit. There was no evidence of significant embankment repairs or prior releases observed during the field inspection.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The surveillance program appears to be adequate. The original management unit dikes were not instrumented; four piezometers were installed in 2010 for monitor ground water levels. Based on the size of the dikes, the portion of the impoundment currently used to store bottom ash and storm water, the history of satisfactory performance and the current inspection program, no additional dike monitoring system is needed at this time.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

The facility is SATISFACTORY for continued safe and reliable operation. No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria.

1.2 RECOMMENDATIONS

No recommendations appear warranted at this time.

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

W. Greg Carter P.E., American Electric Power (AEP)
Ivaunna Neigler, American Electric Power (AEP)
Carl Handley, American Electric Power (AEP)
Scott Carney, American Electric Power (AEP)
William R Smith P.E., American Electric Power (AEP)
Michael McLaren P.E., Dewberry
Kyle Shepard P.E., Dewberry

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1.3.2 Acknowledgement and Signature

I acknowledge that the management unit referenced herein has been assessed on February 15, 2011.

Michael J McLaren, P.E.

Arkansas License #13067

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2.0 DESCRIPTION OF THE COAL COMBUSTION RESIDUE MANAGEMENT UNIT(S)

2.1 LOCATION AND GENERAL DESCRIPTION

The Flint Creek Power Plant is located next to Flint Creek near Gentry, Arkansas. The plant is operated by SWEPCO. The primary and secondary bottom ash ponds are adjacent to the plant and the plant cooling pond. A project location map is provided in Appendix A – Doc 1. An Aerial photograph of the impoundment is provided in Appendix A – Doc 2.

The Flint Creek Power Plant bottom ash ponds are cross valley embankments constructed of native clayey fill that impounds bottom ash and ash pond water. Construction started in 1974 and was completed in 1978.

The maximum height of the primary dike is 46.5 feet while the secondary dike maximum height is 35 feet. The primary impoundment area (referred to herein as the Primary Bottom Ash Pond) is approximately 42.8 acres and has a storage capacity of 484.1 acre-ft (See Appendix A – Doc 3). The secondary impoundment area (referred to herein as the Secondary Bottom Ash Pond) is approximately 3.7 acres and has a storage capacity of 24.3 acre-ft (See Appendix A – Doc 3). Construction began on the dike in 1974, and the plant opened for operation in 1978.

Table 2.1: Summary of Dam Dimensions and Size	
	Primary Bottom Ash Pond
Dam Height (ft)	46.5
Crest Width (ft)	12
Length (ft)	820
Side Slopes (upstream) H:V	3:1
Side Slopes (downstream) H:V	3:1
Table 2.1a: Summary of Dam Dimensions and Size	
	Secondary Bottom Ash Pond
Dam Height (ft)	35.0
Crest Width (ft)	12
Length (ft)	750
Side Slopes (upstream) H:V	3:1
Side Slopes (downstream) H:V	3:1

2.2 COAL COMBUSTION RESIDUE HANDLING

2.2.1 Fly Ash

Fly ash is removed from flue gas by electrostatic precipitators (ESPs). Fly ash is pneumatically transported from ESPs by a hydrovactor system into the fly ash silo. Some ash becomes entrained in the hydrovactor water stream and is discharged to the primary ash pond. Ash stored in the fly ash silo is disposed in the on-site landfill, or marketed.

2.2.2 Bottom Ash

Bottom ash accumulates at the bottom of the boiler before it is sluiced into the primary ash pond, approximately twice daily. As necessary, bottom ash is stockpiled in the primary ash pond, or dredged for on-site landfill disposal or use.

2.2.3 Boiler Slag

Boiler slag is managed with bottom ash during normal boiler operations. Approximately twice per year, the boiler is shut down for cleaning and residual slag is removed and disposed in the on-site landfill.

2.2.4 Flue Gas Desulfurization Sludge

The Flint Creek Power Plant does not operate a flue gas desulfurization system.

2.3 SIZE AND HAZARD CLASSIFICATION

The classification for the Primary Bottom Ash Pond, based on the height of the dam, is “intermediate” and, based on the storage capacity, is “small.” The classification for the Secondary Bottom Ash Pond, based on the height of the dam, is “small” and, based on the storage capacity, is “small” in accordance with USACE Recommended Guidelines for Safety Inspections of Dams ER 1110-2-106 criteria summarized in Table 2.3a.

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Table 2.3a: USACE ER 1110-2-106 Size Classification		
	Impoundment	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

The bottom ash ponds are not in the National Inventory of Dams; therefore these dikes do not have established hazard classifications. Dewberry conducted a qualitative hazard classification based on the 2004 Federal Guidelines for Dam Safety classification system (shown in Table 2.3b).

Table 2.3b: FEMA Federal Guidelines for Dam Safety Hazard Classification		
	Loss of Human Life	**Economic, Environmental, Lifeline Losses**
Low	None Expected	Low and generally limited to owner
Significant	None Expected	Yes
High	Probable. One or more expected	Yes (but not necessary for classification)

Loss of human life is not probable in the event of a catastrophic failure of the dikes and a failure of the dikes is expected to have a low economic and environmental impact. Therefore, Dewberry evaluated the bottom ash ponds as "**Low hazard potential**."

2.4 AMOUNT AND TYPE OF RESIDUALS CURRENTLY CONTAINED IN THE UNIT(S) AND MAXIMUM CAPACITY

The data reviewed by Dewberry did not include the volume of the residuals stored in the Primary or Secondary Bottom Ash Pond at the time of inspection. Volume information provided in Tables 2.3a and 2.3b was measured on 12/31/2008.

Table 2.3a: Maximum Capacity of Unit	
Primary Bottom Ash Pond	
Surface Area (acre)[1]	42.8
Current Storage Capacity (cubic yards)[1]	80,700
Total Storage Capacity (acre-feet)	484.1
Crest Elevation (feet)	46.5
Normal Pond Level (feet)	36.5

Table 2.3b: Maximum Capacity of Unit	
Secondary Bottom Ash Pond	
Surface Area (acre)[1]	3.7
Current Storage Capacity (cubic yards)[1]	Minimal- Ash is routinely removed for beneficial use
Total Storage Capacity (acre-feet)	24.3
Crest Elevation (feet)	35
Normal Pond Level (feet)	22

2.5 PRINCIPAL PROJECT STRUCTURES

2.5.1 Earth Embankment

The bottom ash pond is divided into two impoundments in series. The primary dam is an 820-foot long cross-valley dam. The secondary dam is a 750-foot long cross-valley dam. The dikes are earthen embankments with a crest width of 12 feet. The inside and exterior slopes are approximately 3H:1V (See Appendix A – Doc 4). The lower portions of the slopes are protected with rip rap and the upper portions are grass covered.

2.5.2 Outlet Structures

The principal spillway at the Primary Bottom Ash Pond is a concrete curb and a small weir box at a slightly lower elevation. The principal spillway at the Secondary Bottom Ash Pond is a concrete structure with a series of horizontal orifices and a weir that discharges to a new concrete spillway with a weir box that discharges into the cooling lake. The emergency spillway is a concrete curb that is approximately 2.5 feet above the weir invert and discharges to the cooling lake.

2.6 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

Critical infrastructure inventory data was not provided to Dewberry for review.

Based on the available area topographic maps, surface drainage in the area of the bottom ash ponds are to the southwest through the cooling lake. Releases from the impoundments would not impact the water level in the cooling lake significantly.

The nearest town, Watts Oklahoma, is approximately 32 miles downstream of the impoundment.

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3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

Summary of Reports on the Safety of the Management Unit

SWEPCO provided two dam inspection reports:

- Report For The Inspection Of Flint Creek Ash Pond, Golder Associates May 2009 (See Appendix A – Doc 5)
- Dam & Dike Inspection Report, SWEPCO, September 16, 2009 (See Appendix A – Doc 6)

The reports concluded that the structures appeared to be performing adequately with only minor maintenance items that need to be addressed. No conditions were observed that would affect the continued safe operation of the impoundment.

3.1 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

The dams for the Primary and Secondary Bottom Ash Ponds are not permitted.

Discharge from the impoundment is regulated by the Arkansas Department of Environmental Quality and the impoundment has been issued a National Pollutant Discharge Elimination System Permit. Permit No. AR0037842 was issued March 1, 2006 (See Appendix A – Doc 7).

3.2 SUMMARY OF SPILL/RELEASE INCIDENTS

Data reviewed by Dewberry did not indicate any spills, unpermitted releases, or other performance related problems with the dam over the last 10 years.

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4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

The Flint Creek Power Plant Bottom Ash Ponds were constructed beginning in 1974, and were completed in 1978. The original design crest was 1,155 feet (See Appendix A – Doc 8).

4.1.2 Significant Changes/Modifications in Design since Original Construction

The principal spillway for the Secondary Bottom Ash Pond was reconstructed in 2009 with a new weir box and 13-foot wide weir with a crest elevation of 1,142.5 feet. Also the emergency concrete curb spillway was raised to 1,145 feet (See Appendix A – Doc 9).

4.1.3 Significant Repairs/Rehabilitation since Original Construction

No documentation was provided to indicate any significant repair/rehabilitation has taken place since the original construction.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

The impoundment was designed and operated for bottom ash sedimentation and control. The pond receives plant process waste water, and coal combustion waste slurry. Treated (via sedimentation) process water is discharged through an overflow outlet structure.

4.2.2 Significant Changes in Operational Procedures and Original Startup

No documents were provided to indicate any operational procedures have changed.

4.2.3 Current Operational Procedures

No documents were provided to indicate any operational procedures have changed.

4.2.4 Other Notable Events since Original Startup

No additional information was provided to Dewberry addressing other notable events impacting the operation of the impoundments.

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5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Michael McLaren, P.E. and Kyle Shepard, P.E. performed a site visit on February15, 2011 with the participants listed in Section 1.3.

The site visit began at 9:00 AM. The weather was cool and overcast. Photographs were taken of conditions observed. Additional site information is provided in the Dam Inspection Checklists in Appendix B. Selected photographs are included here for ease of visual reference. All pictures were taken by Dewberry personnel during the site visit.

The overall assessment of the dam was that it was in satisfactory condition and no significant findings were noted.

5.2 PRIMARY/SECONDARY POND WEST DIKE

5.2.1 Crest

The west dike is shared by both the primary and secondary pond. The crest had no signs of depressions, tension cracks, or other indications of settlement or shear failure, and appeared to be in satisfactory condition. Figure 5.2.1-1 shows conditions of the crest on the west dike.

Figure 5.2.1-1: Photo Showing Crest, West Dike

5.2.2 Upstream/Inside Slope

There were no observed scarps, sloughs, bulging, cracks, or depressions or other indications of slope instability or signs of erosion. The lower portion of the inside slope was protected with rip rap. Figure 5.2.2-1 shows the general condition of the inside slope, west dike.

Figure 5.2.2-1: General condition of the inside slope, west dike

5.2.3 Downstream/Outside Slope and Toe

There were no observed scarps, sloughs, bulging, cracks, or depressions or other indications of slope instability or signs of erosion. The lower portion of the outside slope was protected with rip rap. Figure 5.2.3-1 shows the general condition of the outside slope of the Primary Bottom Ash Pond; the cooling pond is on the left side of the picture.

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Figure 5.2.3-1: General condition of the west dike outside slope and groin

5.2.4 Abutments and Groin Areas

There were no observed scarps, sloughs, bulging, cracks, or depressions or other indications of slope instability or signs of erosion. Figure 5.2.3-1 also shows the general condition of the groin.

5.3 INCISED PRIMARY AND SECONDARY PONDS

5.3.1 Incised

For both the primary and secondary bottom ash ponds, the north, south, and east sides are incised so no visual inspection was required.

Figure 5.3.1-1: Incised pond

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5.4 OUTLET STRUCTURES

5.4.1 Overflow Structure

As described on the drawings (see Appendix A – Doc 9, 10), the principal spillway at the secondary bottom ash pond is a concrete structure with a series of horizontal orifices. The plant has added a new weir box with a 13-foot wide weir with a crest elevation of 1,142.5 feet which discharges into the cooling lake.

The primary overflow structure was observed to be working properly, discharging flow from the bottom ash ponds. The outlet structure visually appeared to be in satisfactory condition. There were no signs of clogging of the spillway and the water exiting the outlet was flowing clear. Figure 5.4.1-1 shows the main outlet structure.

Figure 5.4.1-1. Main outlet structure

5.4.2 Outlet Conduit

The outlet weir appeared to be in good shape and operating normally with no sign of clogging and the water exiting the outlet was flowing clear. Figure 5.4.2-1 shows the water discharging from the main spillway outfall.

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Figure 5.4.2-1. Water discharging from the main spillway outfall

5.4.3 Emergency Spillway

The Emergency Spillway is a concrete curb that was recently extended up to an elevation of 1,145 feet. If overtopped, water would drain to the cooling lake via overland flow.

5.4.4 Low Level Outlet

No low level outlet is present.

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6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record and Inflow Design Flood

SWEPCO provided a hydraulic analysis report titled, "Hydraulic Analysis of Flint Creek Power Plant Ash Ponds, Freese and Nichols, Inc. January 2011" (See Appendix A – DOC 11). The report provided information on the flood of record and inflow design criteria.

6.1.2 Spillway Rating

SWEPCO provided a spillway analysis in the "Design Calculations Secondary Ash Settling Pond Weir, American Electric Power Flint Creek Power Plant, September 21, 2009" (See Appendix A – DOC 12).

6.1.3 Downstream Flood Analysis

No downstream flood analysis (breach analysis) was provided for review.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Supporting documentation reviewed by Dewberry was adequate.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

Based on the calculations provided in the hydrologic and hydraulic study (See Appendix A – Doc 11) the bottom ash ponds can retain the 1-percent design storm event. Hence dike failure by overtopping seems improbable.

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

ETTL Engineers & Consultants performed an embankment investigation in August 2010. (See Appendix A – Doc 13.)

The Stability analysis used the computer program Geostase. The program is capable of calculating the factor of safety for potential failure surfaces using different methods; the modified Bishop method was used. Conditions assessed were:

- Steady state conditions based on ground water levels measured at the time of the borings
- Seismic loading applied to steady state loading
- Static analysis under rapid drawdown conditions

7.1.2 Design Parameters and Dam Materials

Design documentation provided to Dewberry for review was the September 4, 1974 original contract, SWEPCO/ Machen Construction Company Flint Creek Power Plant Site work. (See Appendix A – Doc 14.)

7.1.3 Uplift and/or Phreatic Surface Assumptions

The ETTL Engineers & Consultants report referenced above included an embankment investigation and analysis of phreatic elevations. (See Appendix A – Doc 13.)

7.1.4 Factors of Safety and Base Stresses

The August 2010 analysis calculated Factors of Safety for the west dike of both bottom ash ponds for the three conditions. All calculated Factors of Safety met or exceeded the minimum required by the U.S. Army Corps of Engineers.

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Table 7.1.4 Factors of Safety for Flint Creek Power Plant

Loading Condition	Soil Strength	Required Safety Factor (US Army Corps of Engineers)	West Dike Computed Average Safety Factor
Steady State	Full Design Strength Parameters	1.5	1.9 (Primary) 1.6 (Secondary)
Steady State with Seismic Loading		1.2	1.3 (Primary) 1.2 (Secondary)
Rapid Drawdown Conditions			1.2 (Primary) 1.5 (Secondary)

7.1.5 Liquefaction Potential

ETTL Engineers & Consultants performed an embankment investigation in August of 2010. (See Appendix A – Doc 13). The report indicates that the foundation soil conditions do not appear to be susceptible to liquefaction.

7.1.6 Critical Geological Conditions

There was no documentation provided to Dewberry that included an evaluation of Critical Geological Conditions.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation is adequate.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Overall, the structural stability of the dam appears to be satisfactory based on the following observations:

- The crest appeared free of depressions and no significant vertical or horizontal alignment variations were observed.
- There was no indication of major scarps, sloughs or bulging along the dikes.
- Boils, sinks or uncontrolled seepage was not observed along slopes, groins or toes of the dike.
- The computed factors of safety comply with accepted criteria.

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8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

The bottom ash ponds are operated for settling and storage of bottom ash deposits. Treated coal combustion process waste water is discharged through an overflow outlet structure.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

No formal maintenance plan was supplied to Dewberry for review. During the site visit and through discussions on the dam maintenance with plant personnel, it appears that maintenance procedures are adequate. Plant personnel perform routine monthly maintenance inspections. More formal quarterly inspection reports, including required maintenance items, were provided for review (See Appendix A – DOC 15).

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

Operating procedures appear to be satisfactory.

8.3.2 Adequacy of Maintenance

Based on assessments of inspection reports and visual observations during the site visit, operation and maintenance activities appear to be adequate.

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9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

Monthly inspections are conducted by plant personnel. Inspection reports are submitted to the plant manager for review and the appropriate corrective actions are performed as required.

9.2 INSTRUMENTATION MONITORING

The Flint Creek Power Plant impoundment dikes have four piezometers to monitor ground water levels.

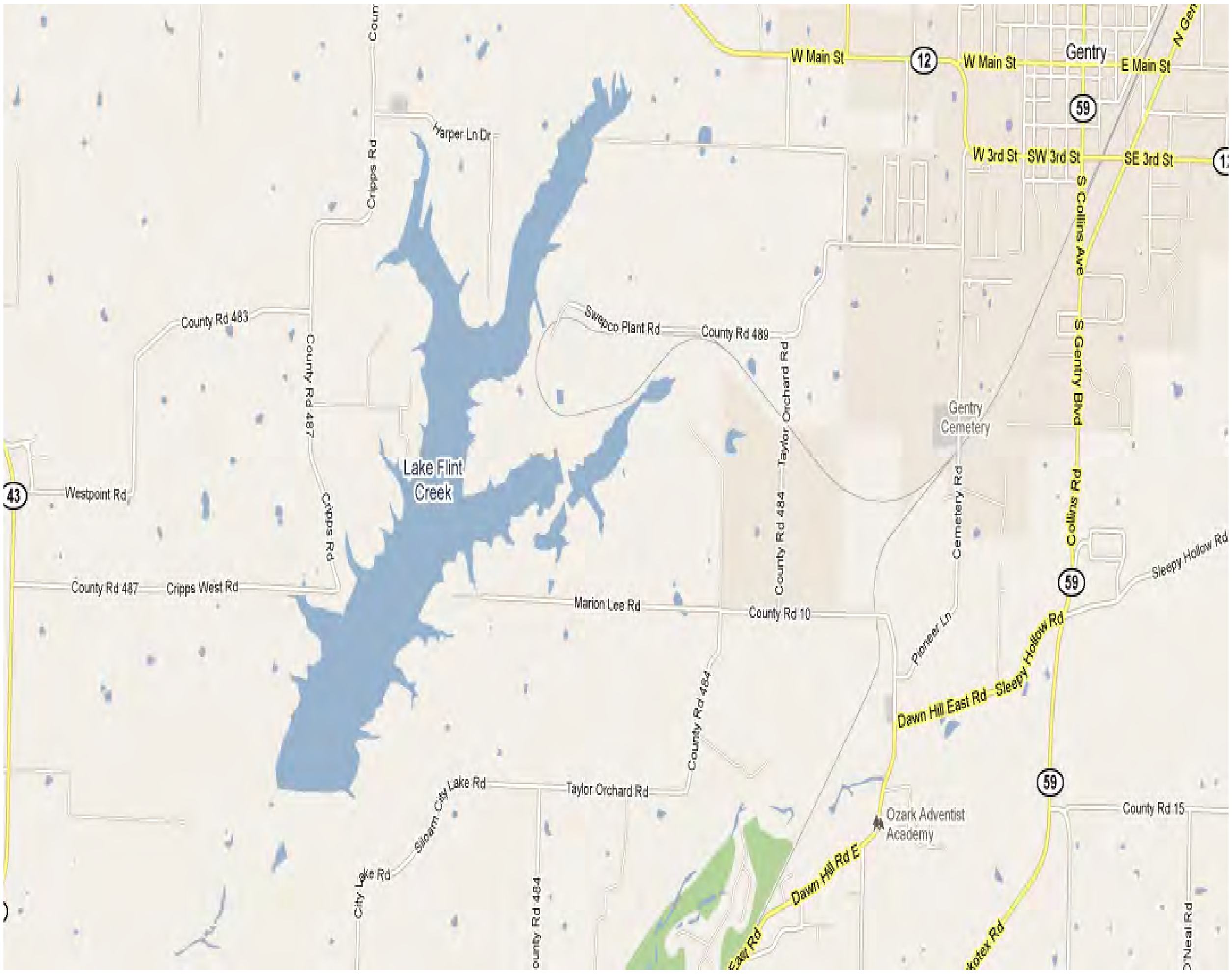
9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

Based on the data reviewed by Dewberry, including observations during the site visit, the inspection program is adequate.

9.3.2 Adequacy of Instrumentation Monitoring Program

Based on the data reviewed by Dewberry, including observations during the site visit, the inspection program is adequate.



Gentry
W Main St
12
W Main St
E Main St
59
W 3rd St
SW 3rd St
SE 3rd St
Harper Ln Dr
Cripps Rd
County Rd 483
County Rd 487
Swepco Plant Rd
County Rd 489
Taylor Orchard Rd
Gentry Cemetery
S Collins Ave
S Gentry Blvd
Collins Rd
Lake Flint Creek
43
Westpoint Rd
Cripps Rd
County Rd 484
Cemetery Rd
Sleepy Hollow Rd
County Rd 487
Cripps West Rd
Marion Lee Rd
County Rd 10
Pioneer Ln
Dawn Hill East Rd
Sleepy Hollow Rd
County Rd 484
Siloam City Lake Rd
Taylor Orchard Rd
County Rd 15
Ozark Adventist Academy
Dawn Hill Rd E
O'Neal Rd


County Rd 483
County Rd 487
Wesley Rd
Worthington Rd
Capps Rd
Swepco Rd
Lake Flint
Creek
County Rd 489
Swepco Plant
Marion Lee Rd
Marion Lee Rd
Marion Lee Rd

COMPANY

PLANT

ASH MANAGEMENT UNIT

Please provide the information requested below for each [illegible] management unit [illegible] [illegible] for the storage or disposal of residuals or by-products from the combustion of coal, [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] free liquids.

QUESTION 1

- [illegible] Hazard Rating
- [illegible] Rating
- [illegible] Rating
- No Rating Assigned

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or [illegible] [illegible] [illegible] [illegible] potential hazard [illegible] for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

QUESTION 2

- Year Commissioned
- Year(s) [illegible]

2. What year was each management unit commissioned and expanded?

QUESTION 3 - Mark all that apply

- Fly Ash
- Bottom Ash
- Boiler Slag
- Flue Gas Emission Control Residuals
- Other (Specify)

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other," please specify the other types of materials that are temporarily or permanently contained in the unit(s).

QUESTION 4

- Designed by P.E.
- Constructed under P.E. Supervision
- Inspection/monitoring under P.E. Supervision

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

QUESTION 5

- Date of Last Company Safety Assessment
- Describe Evaluator's Credentials
- Describe Post Followup Corrective Actions
- Describe Credentials of Corrective Action Implementers
- Describe Planned Followup Actions
- Date of Next Safety Assessment

5. When did the company last assess or evaluate the safety (i.e., structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

QUESTION 6

- Date of Last Regulatory Safety Inspection
- Agency Name
- Date of Planned Regulatory Safety Inspection
- Agency Name
- Copy of Most Recent Regulatory Inspection Included

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

QUESTION 7

- Safety Issues from Regulatory Inspections w/in Past Year
- Corrective Actions
- [illegible]

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and, if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

QUESTION 8

[illegible]

1

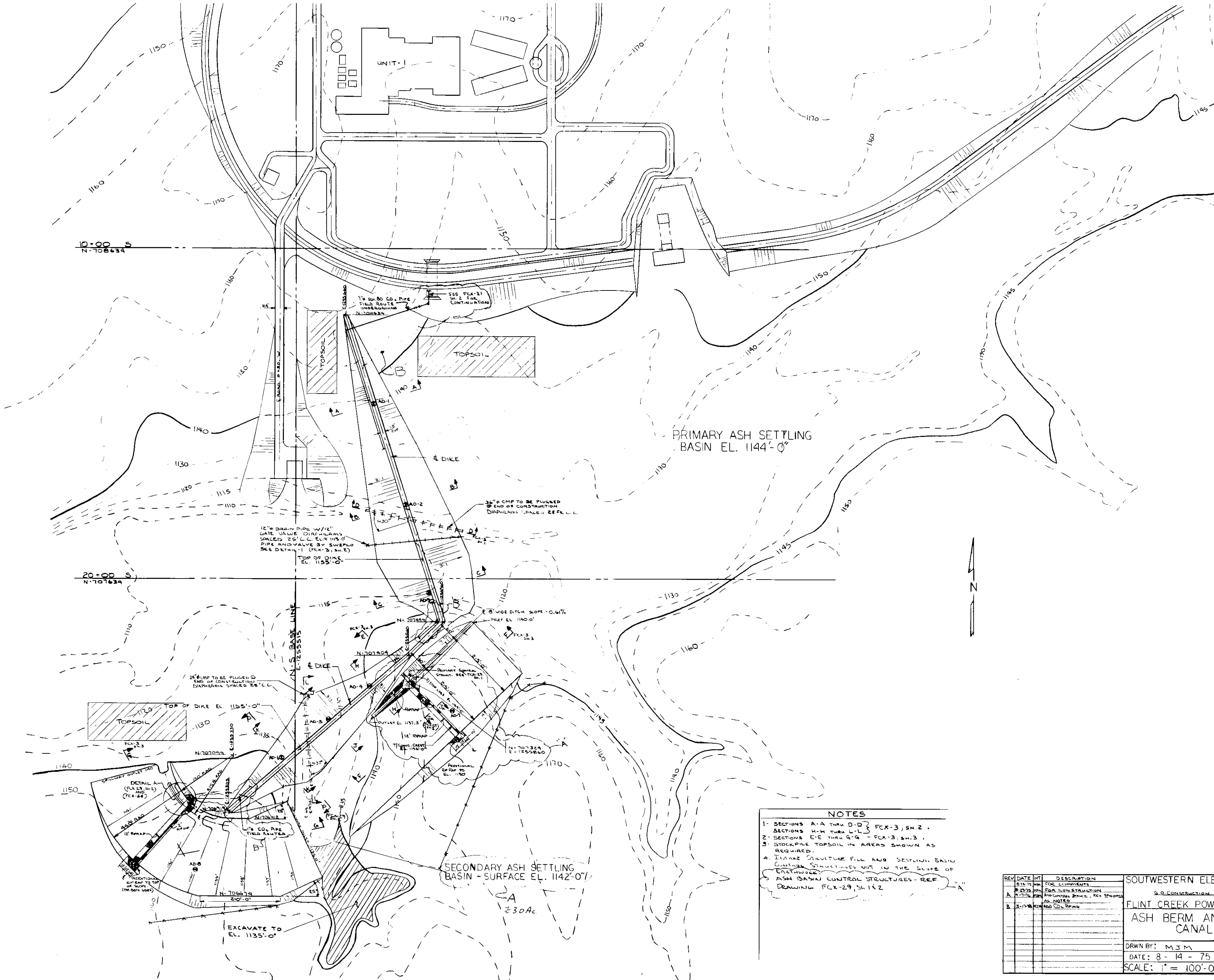
QUESTION 9

[illegible]

QUESTION 10

[illegible]

COMPANY	Southwestern Electric Power Company	Southwestern Electric Power Company
PLANT	Flint Creek	Flint Creek
ASH MANAGEMENT UNIT	Primary Bottom Ash Pond	Secondary Bottom Ash Pond
QUESTION 1		
Dam Hazard Rating		
Who Established Rating		
Basis for Rating		
No Rating Assigned	X	X
QUESTION 2		
Year Commissioned	1978	1978
Year(s) Expanded		
QUESTION 3 - Mark all that apply		
Fly Ash	Yes	Yes
Bottom Ash	Yes	Yes
Boiler Slag	Yes (with bottom ash)	
Flue Gas Emission Control Residuals		
Other (Specify)	Coal pile and landfill runoff	Coal pile and landfill runoff
QUESTION 4		
Designed by P.E.	Yes	Yes
Constructed under P.E. Supervision	Yes	Yes
Inspection/monitoring under P.E. Supervision	Yes	Yes
QUESTION 5		
Date of Last Company Safety Assessment	3/30/2009	3/30/2009
Describe Evaluator's Credentials	PE	PE
Describe Past Followup Corrective Actions	Report not yet received	Report not yet received
Describe Credentials of Corrective Action Implementers		
Describe Planned Followup Actions		
Date of Next Safety Assessment	2012 (AEP considers this facility to be Low Hazard)	2012 (AEP considers this facility to be Low Hazard)
QUESTION 6		
Date of Last Regulatory Safety Inspection	None Performed	None Performed
Agency Name		
Date of Planned Regulatory Safety Inspection		
Agency Name		
Copy of Most Recent Regulatory Inspection Included		
QUESTION 7		
Safety Issues from Regulatory Inspections w/in Past Year	N/A	N/A
Corrective Actions		
Documentation Included		
QUESTION 8		
Surface Area (acres)	42.8 acres	3.7 acres
Total Storage Capacity	484.1 acre-ft	24.3 acre-ft
Volume Currently Stored	80,700 c.y. Ash is routinely removed for beneficial use	Minimal - Ash is routinely removed for beneficial use
Date of Volume Measurement	12/31/2008	12/31/2008
Maximum Height (feet)	46.5	35
QUESTION 9		
Spills or Unpermitted Release History (10 Years)	None	None
QUESTION 10		
All Legal Owners and Operators	Southwestern Electric Power Company Arkansas Electric Cooperative Corporation	Southwestern Electric Power Company Arkansas Electric Cooperative Corporation



NOTES

1. SECTIONS A-A THRU D-D, SECTIONS H-H THRU L-L } FCX-3, SH. 2.
2. SECTIONS E-E THRU G-G - FCX-3, SH. 3.
3. STOCKPILE TOPSOIL IN AREAS SHOWN AS REQUIRED.
4. INTAKE STRUCTURE FILL AND SETTLING BASIN CONTROL STRUCTURES NOT IN THE SCOPE OF EARTHWORK.
5. ASH BASIN CONTROL STRUCTURES - REF. DRAWING FCX-29, SH 1 & 2 "A"

REV	DATE	INT	DESCRIPTION
	8-14-75	MJM	FOR COMMENTS
	8-29-75	MJM	FOR CONSTRUCTION
A	9-7-76	MJM	ADD CONTROL STRUCT., REV. SPILLWAYS AS NOTED
B	3-17-78	MJW	ADD CO_2 PIPING

SOUTWESTERN ELECTRIC POWER COMPANY

G.O. CONSTRUCTION DEPARTMENT

FLINT CREEK POWER PLANT

ASH BERM AND CONNECTING CANAL PLAN

DRWN BY: MJM
DATE: 8-14-75
SCALE: 1" = 100'-0"

FCX - 3
SH. 1 OF 3

AEPFC000148

Report

REPORT FOR THE INSPECTION OF FLINT CREEK ASH POND

ARKANSAS

Submitted To: American Electric Power

Submitted By: Golder Associates Inc.

Distribution: 3 – American Electric Power
3 – Golder Associates Inc.

Date May 2009

Project No. 09390068-10

A world of capabilities delivered locally

Golder Associates

Golder Associates Inc.
3730 Chamblee Tucker Road
Atlanta, GA USA 30341
Telephone (770) 496-1893
Fax (770) 934-9476

Golder Associates

May 1, 2009

Our Ref.: 09390068-10

American Electric Power (AEP)
1 Riverside Plaza
Columbus, OH 43215-2373

Attn: Mr. Pedro J. Amaya, P.E., Senior Engineer – Geotechnical Engineering

RE: REPORT FOR THE INSPECTION OF THE BOTTOM ASH POND AT FLINT CREEK STATION BENTON COUNTY, ARKANSAS

Dear Mr. Amaya:

Golder Associates Inc. (Golder) is pleased to submit the attached visual inspection report for the American Electric Power (AEP), Southwestern Electric Power Bottom Ash Pond at Flint Creek Station. The inspection was performed on March 30, 2009 by Mr. Michael T. Chilson and Mr. Rafael I. Ospina, P.E., under the direction of Mr. W. Randall Sullivan, P.E. Mr. William R. Smith and Mr. Gregg Carter, P.E. (plant inspection coordinator) with AEP were present during the inspection. This work was performed in accordance with our proposal dated February 23, 2009 and Service Agreement 194677X168, signed March 5, 2009.

We appreciate this opportunity to provide engineering services to AEP. Please do not hesitate to contact one of the undersigned if you have any further questions, require additional information, or would like to discuss the conclusions presented in this report.

Very truly yours,

GOLDER ASSOCIATES INC.

Rafael I. Ospina, P.E.
Principal and Senior Consultant

W. Randall Sullivan, P.E., Lic# 8575
Principal and Practice Leader

RIO/WRS/mtc/sdp

Distribution:
1 Copy – American Electric Power
3 Copies – Golder Associates Inc.

[illegible]

DAM & DIKE INSPECTION REPORT

BOTTOM ASH POND AT FLINT CREEK STATION BENTON COUNTY, AR

INSPECTION DATE March 30, 2009

PREPARED BY Michael T. Chilson DATE 5/11/09

REVIEWED BY Rafael I. Ospina, P.E. DATE 5/11/09

APPROVED BY W. Randall Sullivan, P.E. DATE 5/ /

REGISTERED PROFESSIONAL ENGINEER
★★★
No. 6575

PROFESSIONAL ENGINEER

SEAL & SIGNATURE

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1.0 INTRODUCTION

1.1 Background

American Electric Power (AEP) Service Corporation Civil Engineering administers the dam inspection and maintenance program at AEP facilities. AEP contracted with Golder Associates Inc (Golder) to complete the annual inspection of the Bottom Ash Pond at Flint Creek Station. This inspection was completed to fulfill, in part, the requirements of the Arkansas National Resources Commission's Dam Safety Program, and to provide AEP an evaluation of the facility to assist in the prioritization of maintenance activities. Golder understands that this structure has not been recently inspected. This report contains Golder's observations, photographs, conclusions and recommendations with inspection certification of AEP's Bottom Ash Pond at Flint Creek Station. A completed dam inspection checklist was submitted to AEP on April 6, 2009. A copy of the checklist is included in Appendix A.

Mr. Rafael I. Ospina, P.E., and Mr. Michael T. Chilson, of Golder, under the direction of Mr. W. Randall Sullivan, P.E., with Mr. William R. Smith, P.E., and Mr. Gregg Carter, P.E. of AEP visually inspected the dam on March 30, 2009. At the time of inspection, the temperature was in the 60's with partly cloudy skies. The severity of noted deficiencies and the adequacy of freeboard and spillway capacities were assessed based on the operation of the dam at the time of visit. No analytical assessment of the hydrologic or hydraulic performance of the dam and components was made.

The following documentation, provided by AEP, was reviewed and utilized during the preparation of this report and is included in Appendix C.

- Flint Creek Power Plant, Drawing Number FCX-3, Sheets 1 and 2 of 3, dated 1974 and 1975.
- Flint Creek, Drawing Number 1-30301-01-A, Bottom Ash Pond, Bottom Ash Storage Cell Location Plan Map, dated 2006.

1.2 General Description of Dam

See Figure 1-1 for the location of the dam, and Figure 1-2 for the plan view and aerial photograph. The Bottom Ash Pond is divided into two impoundments in series. The primary (upper) dam is 820-foot long cross-valley dam on an unnamed tributary to the Little Flint Creek. The secondary (lower) dam is a 750-foot long cross-valley dam on an adjacent first order stream. The secondary impoundment discharges directly to the Little Flint Creek Reservoir, which backs up to both the primary and secondary embankments

GENERAL INFORMATION

Dam or Reservoir:	Bottom Ash Pond at Flint Creek Station
Owner:	AEP Southwest Electric Power
Type of Dam:	Earth-Fill Structure
Date of Construction:	1978
D/S Hazard:	Not Classified

LOCATION

County:	Benton County
General Location:	Approximately 4.5 miles north of Siloam Springs, AR
Stream and Basin:	Unnamed tributary to Little Flint Creek; Flint Creek Basin

SIZE - PRIMARY DAM

Dam Crest Elevation[1]:	1,155	feet-MSL
Maximum Water Level:	Not Established	
Current Water Level[2]:	1,146	feet-MSL
Height[1]:	45	feet
Surface Area:	24	acres (at normal pool)
Reservoir Volume:	Depth and volume are unknown	

SIZE - SECONDARY DAM

Dam Crest Elevation[1]:	1,155	feet-MSL
Maximum Water Level:	Not Established	
Current Water Level[2]:	1,143	feet-MSL
Height[1]:	35	feet
Surface Area:	6	acres (at normal pool)
Reservoir Volume:	Depth and volume are unknown	

Notes: 1.) Estimated from previously references provided by AEP; 2.) Visually estimated by Golder.

2.0 SUMMARY OF VISUAL INSPECTION TERMS

The summary of the visual observations presented herein uses terms to describe the general appearance or condition of an observed item, activity or structure. Their meaning is understood as follows:

CONDITION OF DAM COMPONENT

Good: A condition or activity that is generally better or slightly better than what is minimally expected or anticipated from a design or maintenance point of view.

Fair: A condition or activity that generally meets what is minimally expected or anticipated from a design or maintenance point of view.

Poor: A condition or activity that is generally below what is minimally expected or anticipated from a design or maintenance point of view.

SEVERITY OF DEFICIENCY

Minor: A reference to an observed deficiency (e.g., erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is normal or desired, but which is not currently causing concern from a structure safety or stability point of view.

Significant: A reference to an observed deficiency (e.g. erosion, seepage, vegetation, etc.) where the current maintenance program has neglected to improve the condition. Usually these conditions have been identified in previous inspections, but have not been corrected.

Excessive: A reference to an observed deficiency (e.g., erosion, seepage, vegetation, etc.) where the current maintenance condition is above or worse than what is normal or desired, and which may have affected the ability of the observer to properly evaluate the structure or particular area being observed or which may be a concern from a structure safety or stability point of view.

3.0 VISUAL OBSERVATIONS

See Figure 3-1 for the location of structures and deficiencies itemized below.

3.1 Spillway Structures

The plant inflow channel to the primary impoundment, and the principal and emergency spillways at the primary and secondary impoundments were visually inspected, and are generally in fair condition.

The plant inflow channel is off set about 5 feet from the upstream toe and runs the length of the primary embankment. At the right abutment, the channel is routed through a series of 3 culverts, one of which is shown in Photograph 1. These culverts are submerged at one or both ends indicating they may be undersized. The culverts may be inset too short for the width of the roadway fill with some overhang of overburden above the inlets creating a risk of blockage in the event of a collapse of the overhang. The culverts could not be fully inspected due to submergence and lack of visibility.

The principal spillway at the primary impoundment is a concrete drop-inlet structure. The discharge conduit was submerged at the exit at the time of visit and could not be inspected. Some minor corrosion of the metal components, chipping of the concrete, and erosion at the embankment contact were observed and are shown in Photographs 2 and 3.

The emergency spillway at the primary impoundment, shown in Photographs 4 and 5, is an earth-cut channel in natural ground and was active at the time of inspection. The spillway control section was designed to have a riprap-lined weir. The riprap-lining is displaced and sporadic along the crest. Though the entire spillway could not be inspected due to unsafe access, the region of greatest flow, near the right bank, appeared stable. A significant extent of undesirable vegetation and trees was observed within the entrance and exit channels of the spillway.

The principal spillway at the secondary impoundment, shown in Photographs 6 through 8, is a concrete structure with a series of horizontal orifices and weir that discharges to an open cut channel. The concrete and metal components of the structure are in fair condition. Minor algae growth partially obstructs flow through the trashrack.

The emergency spillway at the secondary impoundment, shown in Photograph 9, is a grass-lined, earth-cut channel in natural ground. It was not active at the time of inspection. No signs of erosion were observed. A minor extent of undesirable vegetation was observed at the entrance to the spillway.

3.2 Upstream Slope

The upstream slope, depicted in Photographs 10 and 11 is generally in fair condition. Minor undesirable vegetation exists on both the primary and secondary impoundments. Minor erosion of the right upstream groin of the primary embankment was observed. The upper third of the slope on the secondary dam steepens to about 2h:1v.

3.3 Crest

The surface of the crest of the dam is hard-packed earth for vehicular access. The crests of the primary and secondary impoundments are in fair condition with significant rutting and ponding as shown in Photograph 12 and 13.

3.4 Downstream Slope

The downstream slope, depicted in Photographs 14 through 16, is in fair condition. The Little Flint Creek Reservoir backs up against the dam preventing full inspection of approximately 12 vertical feet of slope below the water surface. The riprap on the exposed slope surface above the water surface appears in good condition.

Undesirable vegetation, consisting of low brush and trees to 6 inches in diameter, was observed on the downstream slope mostly among the riprap on the primary and secondary impoundments. An active seep, with immeasurably small and dispersed flow was identified on the primary impoundment located about 3 feet above the downstream water surface, near the left abutment. No signs of sloughing or slope instability were observed, and no movement of fine soils. Three animal burrows were identified at the left groin of the primary impoundment (at the mid-dam abutment between the primary and secondary embankments), shown in Photograph 17. The burrows range in size from 6 to 18 inches in diameter, and 1 to 4 feet deep. In the same location, groin erosion from surface runoff was observed.

3.5 Monitoring Instrumentation

Two piezometers were found, one each at the crest of the primary and secondary embankments. The piezometer at the crest of the primary embankment could not be opened and was not read. The piezometer at the crest of the secondary embankment was broken at the surface and the opening was buried, as shown in Photograph 18. The opening was dug out and the piezometer was read

4.0 ASSESSMENT OF RECENT INSTRUMENTATION DATA

Figure 4-1 depicts the section view of the secondary embankment and piezometer reading. The phreatic surface within the secondary embankment appears normal. The depth to water was 21.1 feet below the top of casing, estimated at about 1,133.6 feet-msl. For comparison, the upstream water surface is about 1,143.0 feet-msl, and the downstream water surface is about 1,132.1 feet-msl. The top of dam is about 1,155.0 feet-msl.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Table 5-1 summarizes the deficiencies and recommendations for the Bottom Ash Pond at Flint Creek Station.

The dam is generally in fair condition. Throughout the majority of the upstream and downstream slopes of both the primary and secondary impoundments, significant undesirable vegetation was observed. An active seep with immeasurable trickle flow was identified near the downstream water surface of the primary impoundment. Signs of animal activity were observed at the mid-slope abutment.

To address the deficiencies identified at the Bottom Ash Pond, Golder recommends the following remedial actions.

- Reinspect the inflow channel and culverts during a period of no flow. Monitor for insufficient capacities, and sloughing of overburden at the culvert inlets.
- Regularly clear and maintain the trash rack for the principal spillway at the secondary impoundment.
- Clear the brush and woody vegetation from the emergency spillway channel at the primary impoundment. Reinspect the riprap control section of the emergency spillway for signs of erosion during a period of no flow.
- Clear the woody vegetation from the inlet area to the emergency spillway channel at the secondary impoundment.
- Regrade the crest for positive drainage towards the upstream slope.
- All vegetation should be cut and maintained less than 6 inches in height. Clear both slopes and riprap of trees and other undesirable vegetation. Seed and mulch areas without riprap to establish a grass cover.
- Backfill animal burrows with compacted fill, seed and mulch to establish grass cover.
- Monitor seepage for increased flow rates, muddy flow and embankment instabilities due to saturated soils.
- Open, inspect and read piezometer on the primary embankment. Further excavate, and repair/replace the outer casing of the piezometer on the secondary embankment.

Golder further recommends AEP update the current Emergency Action Plan (EAP) for the Little Flint Creek Dam, or develop an independent EAP to specifically address emergency situations associated with the Bottom Ash Pond at Flint Creek Station. As part of this update, AEP should evaluate the impact a failure of the Bottom Ash Pond will have on the Little Flint Creek Dam.

GOLDER ASSOCIATES INC.

Michael T. Chilson
Project Engineer

Rafael I. Ospina, P.E.
Principal and Senior Consultant

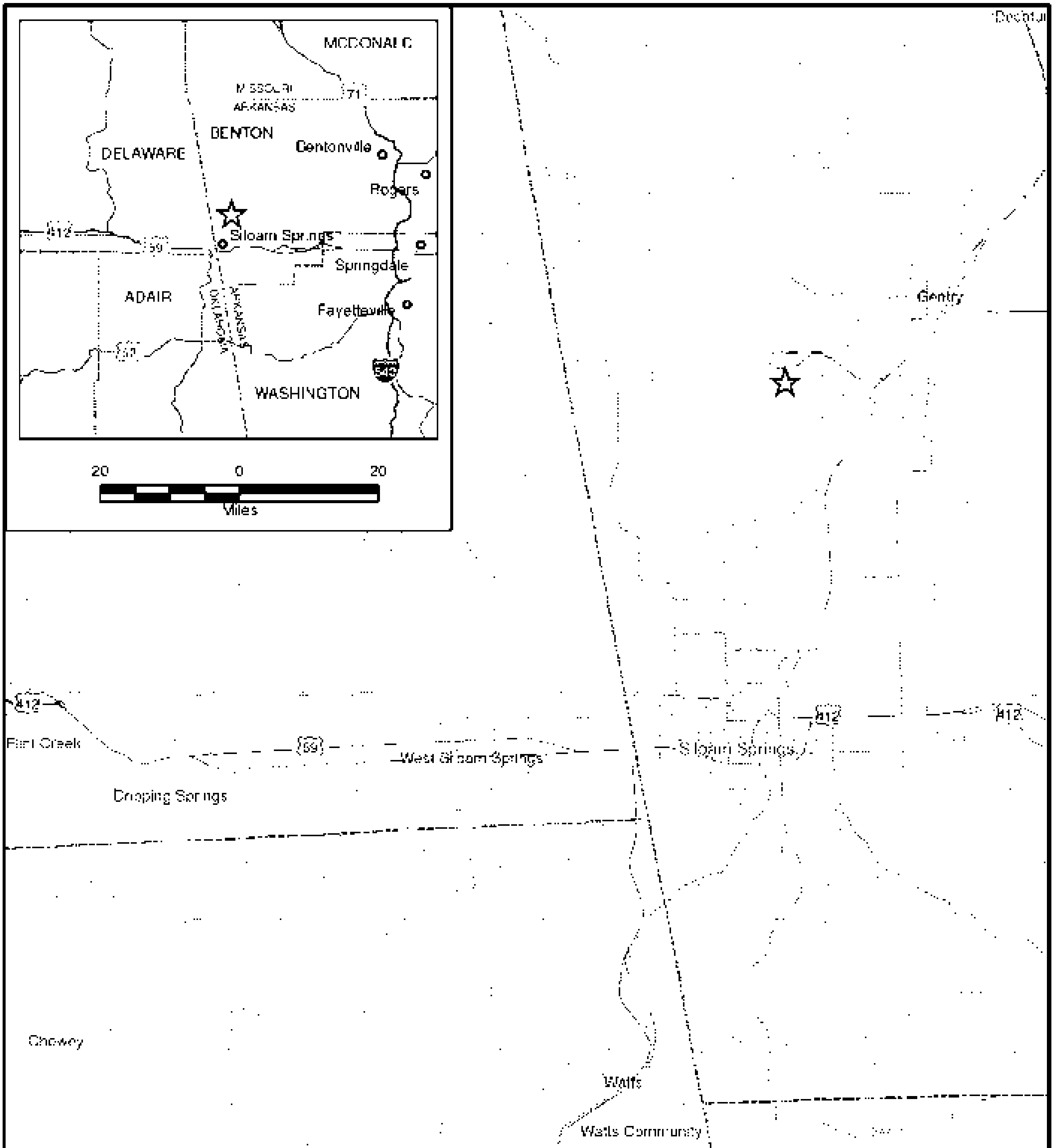
W. Randall Sullivan, P.E.
Principal and Practice Leader

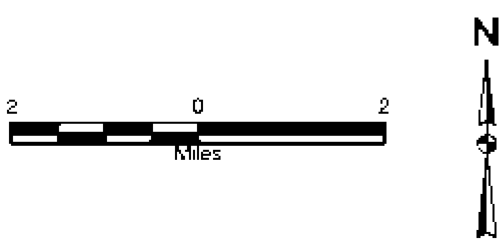
Tables

TABLE 5-1
SUMMARY OF DAM DEFICIENCIES

Component of Dam	Condition	Deficiency	Severity	Recommendation
Inflow Channel	Fair	Submerged Culverts	Minor	Reinspect culverts at time of no flow, monitor for insufficient capacity and overburden sloughing at inlets.
Principal Spillways	Fair	Corrosion/ Chipping	Minor	Monitor corrosion on the metal components and chipping of the concrete on the spillway at the primary impoundment.
		Debris in Trash Rack	Minor	Regularly clear and maintain trash rack at secondary impoundment.
Emergency Spillways	Fair	Undesirable Vegetation	Significant	Clear brush and trees from spillways, or reevaluate spillway capacities
		Limited Accessibility	Minor	Reinspect the control section of the primary spillway for riprap displacement and erosion at time of no flow.
Upstream Slope	Fair	Undesirable Vegetation	Minor	Clear brush and trees from riprap and slope. Seed and mulch to reestablish a grass cover in areas without riprap.
		Groin Erosion	Minor	The right upstream groin of the primary embankment showed some erosion from surface runoff
Crest	Fair	Rutting/Ponding	Significant	Regrade crest surface for positive drainage towards upstream slope.
Downstream Slope	Poor	Undesirable Vegetation	Minor	Clear brush and trees from riprap and slope. Seed and mulch to reestablish a grass cover in areas without riprap.
		Groin Erosion	Minor	The left downstream groin of the primary embankment showed some erosion from surface runoff
		Active Seep	Minor	Monitor seep for increased flow, muddy flow, and embankment instabilities due to saturated soils.
		Animal Activity	Minor	Backfill burrows with compacted fill, seed and mulch to establish a grass cover
Monitoring Instrumentation	Poor	Damage	Excessive	Open piezometer on the primary embankment, inspect for further damage and take reading. Further excavate the piezometer on the secondary embankment, and repair/replace the outer casing

Figures





☆ Flint Creek Ash Pond

AMERICAN ELECTRIC POWER
FLINT CREEK BOTTOM ASH POND

LOCATOR MAP

Golder Associates
Atlanta, Georgia

1-1

REFERENCES

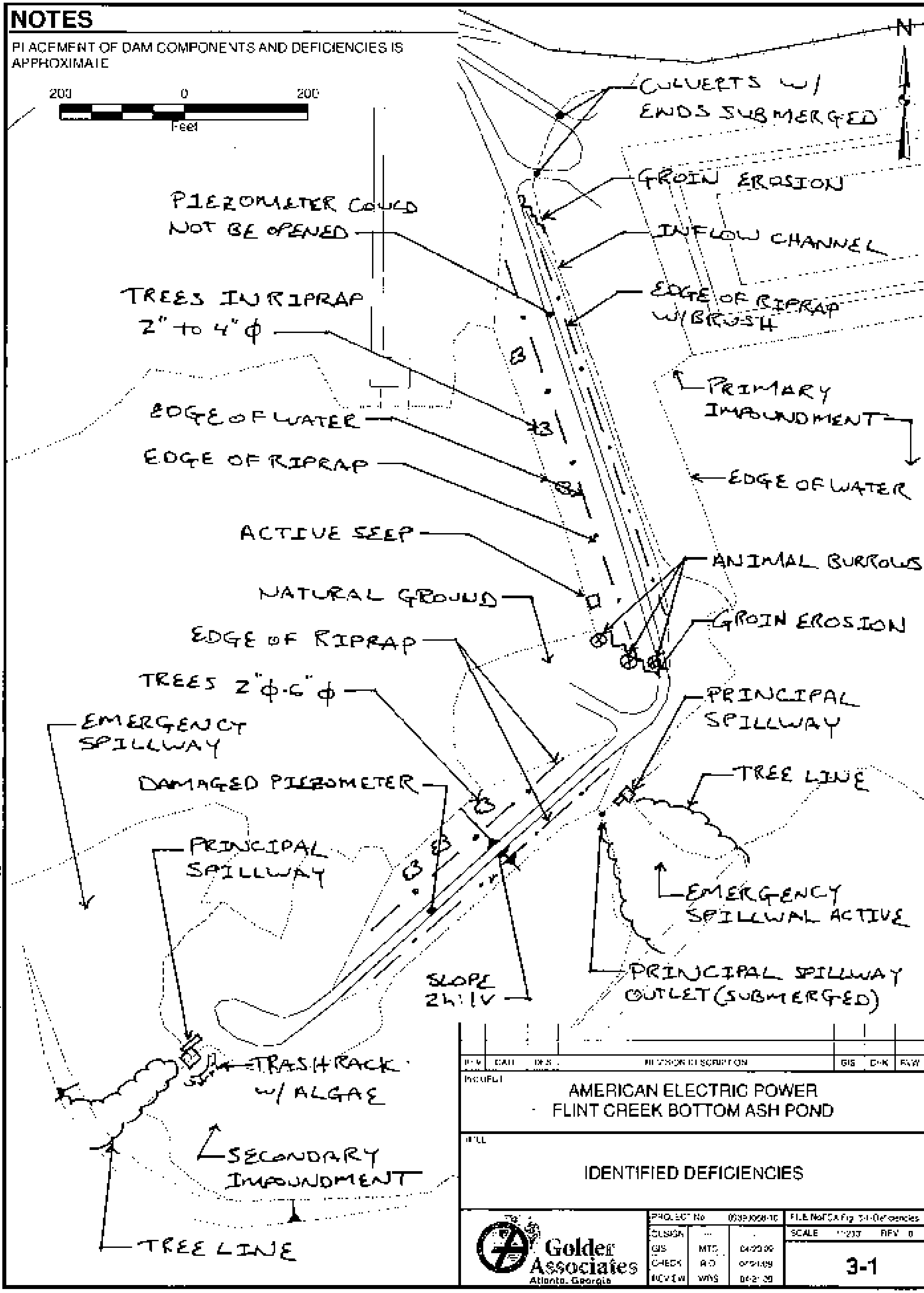
USGS 2008, USGS High Resolution State Orthoimagery for Arkansas. USGS Sioux Falls, SD

AMERICAN ELECTRIC POWER
FLINT CREEK BOTTOM ASH POND

PLAN VIEW WITH AERIAL PHOTOGRAPH

Golder Associates
Atlanta, Georgia

1-2



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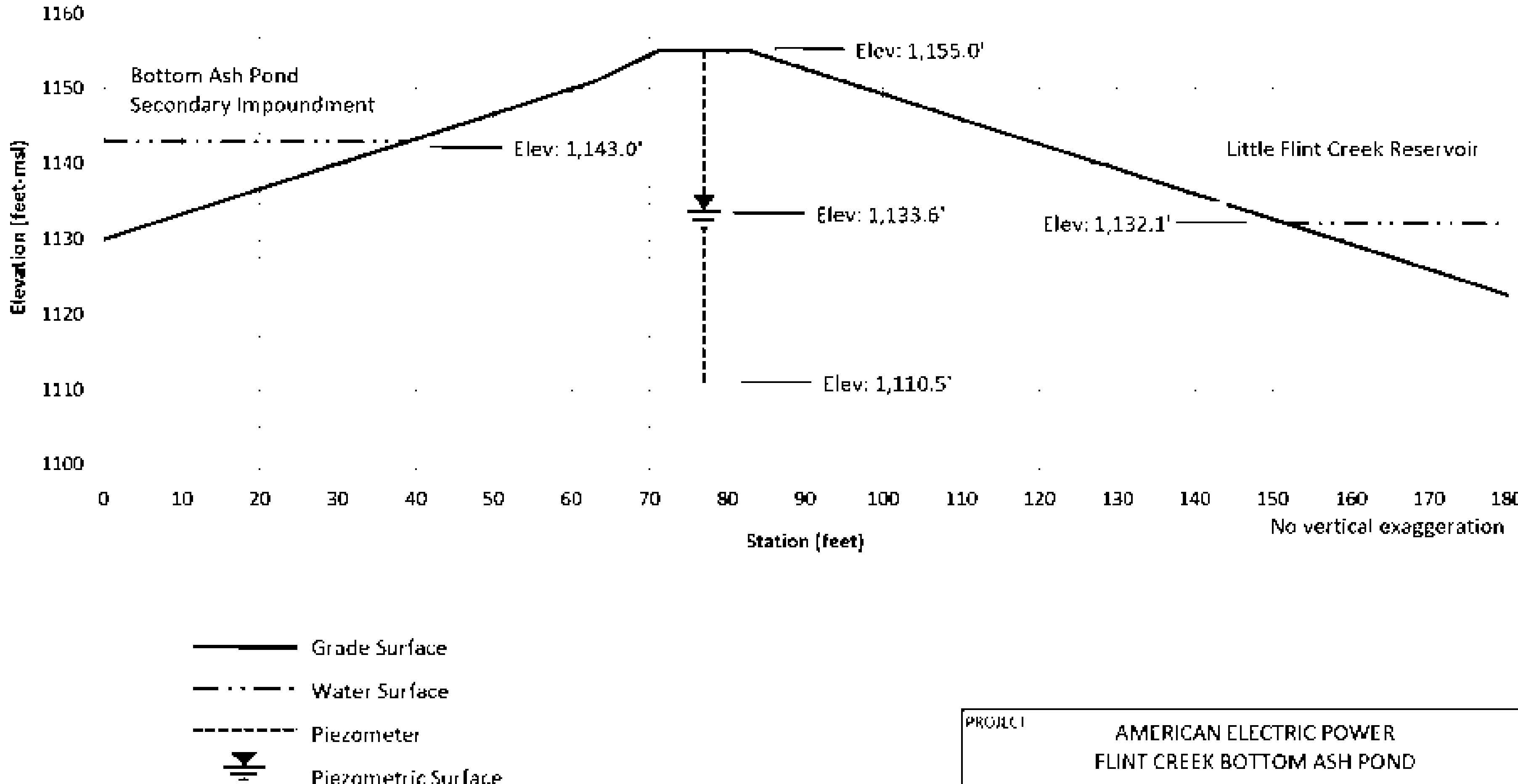


PROJECT

AMERICAN ELECTRIC POWER
FLINT CREEK BOTTOM ASH POND

TITLE

SECTION VIEW OF PIEZOMETRIC WATER SURFACE
SECONDARY IMPOUNDMENT

Golder Associates

SCALE: | REV 0

4-1

Appendix A

Inspection Checklist

Golder Associates Inc.

3730 Chamblee Tucker Road
Atlanta, GA USA 30341
Telephone (770) 496-1893
Fax (770) 934-9476

Golder Associates

April 6, 2009

Our Ref: 093-90068.10

American Electric Power Corporation
1 Riverside Plaza
Columbus, OH 43215-2373

Attention: Mr. Pedro J. Amaya, P.E., Senior Engineer – Geotechnical Engineering

RE: FLINT CREEK PLANT
2009 ANNUAL DIKE AND DAM INSPECTION
LITTLE FLINT CREEK BOTTOM ASH POND
ARKANSAS

Dear Mr. Amaya:

Golder Associates Inc. (Golder) is pleased to submit the attached Inspection Checklist Forms for the annual safety inspection of the Little Flint Creek Bottom Ash Pond performed on March 30, 2009. The inspection was performed by Mr. Mike Chilson and Rafael Ospina, P.E. under the direction of W. Randall Sullivan, P.E. Mr. W.R. Smith and W.G. Carter with AEP were present during the inspection.

The enclosed forms are to be submitted to the Arkansas Soil and Water Conservation Commission. The full report of the inspection will be submitted to you under a separate cover. The work was performed in accordance with our Proposal dated February 23, 2009 and Service Agreement 194677X168.

If you have any questions, please do not hesitate to contact us.

Very truly yours,

GOLDER ASSOCIATES INC.

Rafael I. Ospina, P.E.
Principal and Senior Consultant

W. Randall Sullivan, P.E. Arkansas #8575
Principal and Practice Leader

REGISTERED PROFESSIONAL ENGINEER
No. 8575

Attachments: Inspection Checklists

RIO/WRS/rio

cc: W.R. Smith - AEP – Engineer – Geotechnical Engineering
W.G. Carter - AEP Senior Engineer – Region 5 Plant Engineering
M. Chilson – Golder Associates Inc. – Project Engineer

N:\Clients\American Electric Power\093-90068.10 Flint Creek Station Dam Inspection\2009 Report\3.1 March 2009 Ash Pond Inspection Report\Flint Creek Ash Pond 10 Day Cover Letter 4-6-09.docx

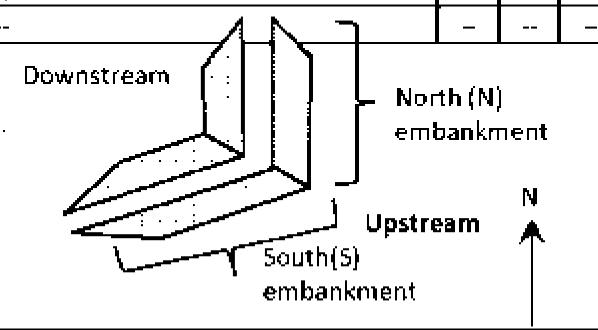
NAME OF DAM: Flint Creek Plant Bottom Ash Pond **INSPECTION DATE:** 3/30/2009

EMBANKMENT

1 of 2

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
CREST	1	SURFACE CRACK NG	None - OK	✓		
	2	CAVE IN, ANIMAL BURROW	None - OK	✓		
	3	LOW AREA(S)	see 5			✓
	4	HORIZONTAL ALIGNMENT	OK	✓		
	5	RUTS AND/OR PUDDLES	(7) on N crest; (5) on S crest			✓
	6	VEGETATION CONDITION	OK	✓		
	7	----	----	--	--	--
	8	----	----	--	--	--
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP	None - OK	✓		
	10	SLOPE PROTECTION	Some vegetation in riprap	✓		
	11	SINKHOLE, ANIMAL BURROW	Animal activity (< 2"-3" deep holes) near crest of N & S embankment connectic	✓		
	12	EMB.-ABUT. CONTACT	Groin erosion at right groin on N embankment.	✓		
	13	EROSION	None - OK	✓		
	14	VEGETATION CONDITION	Tall woody vegetation on slope and at toe.			✓
	15	SLOPE ANGLE	Upper 1/3 of S embankment increases in slope to 1.5-2.0:1 (h:v)	✓		
	16	----	----	--	--	--

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.



3) Crest with several low areas holding water. regrade for positive drainage towards upstream slope.
14) Clear woody vegetation from slopes.
10) Clear and maintain vegetation on slope and riprap.

Inspected by: Rafael Ospina, and Mike Chilson, Golder Associates Inc.
Accompanied by: Gregg Carter and Bill Smith, AEP

NAME OF DAM: Flint Creek Plant Bottom Ash Pond **INSPECTION DATE:** 3/30/2009

AREA INSPECTED	ITEM NO.	EMBANKMENT 2 of 2	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)	Wet area (3' x 3') area on N embankment, right of N & S embankment groin	✓		
	18	SEEPAGE	None - OK	✓		
	19	SLIDE, SLOUGH, SCARP	None - OK	✓		
	20	EMB.-ABUT. CONTACT	OK	✓		
	21	CAVE IN, ANIMAL BURROW	Burrows 6" - 12" ⌀, >2' deep at N & S embankment groin			✓
	22	EROSION	Minor groin erosion between N & S embankments	✓		
	23	UNUSUAL MOVEMENT	None - OK	✓		
	24	VEGETATION CONTROL	Excessive vegetation among riprap			✓
	25	MID EMBANKMENT GROIN	Excessive debris in groin	--	--	--
	26	-----	-----	--	--	--
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS	Well on S embankment broken; Could not open well on N embankment		✓	✓
	28	STAFF GAUGE AND RECORDER	NA - None observed	--	--	--
	29	WEIRS	NA - None observed	--	--	--
	30	SURVEY MONUMENTS	NA - None observed	--	--	--
	31	DRAINS	NA - None observed	--	--	--
	32	FREQUENCY OF READINGS	Frequency of readings scheduled by AEP	--	--	--
	33	LOCATION OF RECORDS	Records kept with AEP	--	--	--
	34	-----	-----	--	--	--
	35	-----	-----	--	--	--

CHECK (✓) ACTION NEEDED

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

21) Backfill and compact burrows.
25) Clear debris from groin between N & S embankments and monitor for progressive erosion.
27) Repair broken well; Open and measure well on N embankment.
24) Clear vegetation from riprap.

NAME OF DAM: Flint Creek Plant Bottom Ash Pond

INSPECTION DATE: 3/30/2009

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
		SPILLWAYS 1 of 1		**CHECK (✓) ACTION NEEDED**		
ERODIBLE CHANNEL N/A	51	SLIDE, SLOUGH, SCARP	None - OK	✓		
	52	EROSION	None - See note below	✓	✓	
	53	VEGETATION CONDITION	Excessive vegetation in channel			✓
	54	DEBRIS	Excessive vegetal debris in channel			✓
	55	APPROACH AREA	Stand of trees in approach area	✓		
	56	---	---	--	--	--
NON-ERODIBLE PRINCIPAL CHANNEL	57	SIDEWALLS	NA	--	--	--
	58	CHANNEL FLOOR	NA	--	--	--
	59	UNUSUAL MOVEMENT	NA	--	--	--
	60	APPROACH AREA	NA	--	--	--
	61	WEIR OR CONTROL	NA	--	--	--
	62	DISCHARGE AREA	NA	--	--	--
	63	DRAINS	NA	--	--	--
	64	-----	----	--	--	--
DROP INLET N/A	65	INTAKE STRUCTURE	NA	--	--	--
	66	TRASHRACK	NA	--	--	--
	67	STILLING BASIN	NA	--	--	--
	68	---	---	--	--	--
	69	----	----	--	--	--

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

52) Could not fully inspect upper channel due to limited access. Excessive debris and active discharge at time of inspection prevented safe access. Clear channel at time of no flow and reinspect for erosion.

NAME OF DAM: Flint Creek Plant Bottom Ash Pond **INSPECTION DATE:** 3/31/2009

OUTLET WORKS

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK (✓) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE	Lower and Upper structures OK - minor erosion at embankment contact	✓		
	71	TRASHRACK	Lower trash rack with excessive algae growth			✓
	72	STILLING BASIN	OK	✓		
	73	PRIMARY CLOSURE	NA	–	–	–
	74	SECONDARY CLOSURE	NA	–	–	–
	75	CONTROL MECHANISM	Weirs functional	✓		
	76	OUTLET PIPE	Could not inspect upper pipe - submerged in lower pond, no lower pipe	✓		
	77	OUTLET TOWER	NA	✓		
	78	EROSION ALONG DAM TOE	OK	✓		
	79	SEEPAGE	None - OK	✓		
	80	UNUSUAL MOVEMENT	None - OK	✓		
	81	-----	-----	–	–	–
	82	-----	-----	–	–	–
	83	-----	-----	–	–	–

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

71) Periodically clear algae from trash rack

CHAPTER 16: DAM INSPECTION AND MAINTENANCE CHECKLIST

THE EMBANKMENT

Key things to look for: Any evidence of movement, either within the dam itself, at its ends, or in the material on which it rests; and excessive surface erosion or other damage to the embankment, or excessive seepage. Is the dam overgrown with underbrush or trees?

SURFACE CRACKS

Yes No	Remarks	Maintenance Tips
☐ ☒ Are there any surface cracks?	May indicate movement within the dam.	Should be evaluated by a professional engineer.
☐ ☒ Is there any unusual movement or cracking at or beyond the toe?	Dam or its foundation may be unstable.	Should be evaluated by a professional engineer.

SURFACE EROSION

Yes No	Remarks	Maintenance Tips
☐ ☒ Is there erosion on upstream face from wave action or changes in pool level?	If severe or rapid, a serious problem.	If severe and progressive, protect upstream face with riprap or other form of wave protection.
☒ ☐ Is there erosion from runoff, either rills, gullies or bare areas? See Inspection Checklist Items 12 & 22	Erosion of any sort is a problem, as it tends to worsen with time if not corrected.	Improve grass cover; reshape embankment to improve drainage pattern.
☐ ☒ Is there erosion from traffic (people, animals, vehicles)?	Any erosion is serious, as it will get worse with time if not corrected.	Try to keep all types of traffic to a reasonable level. Keep vehicles off dam. Stabilize crest roads to prevent rutting. Prohibit recreational vehicle traffic on slopes. Keep livestock off dam. Fill in existing ruts or eroded areas and reseed.

EMBANKMENT (continued)

ANIMAL BURROWS

Yes No	Remarks	Maintenance Tips
☒ ❑ Are there any animal burrows? See Inspection Checklist Item 21	May provide passageways for water into or through the dam.	Fill burrows with earth or otherwise block entry. Try to keep woodchucks, muskrat and beaver away from the dam.

DEPRESSIONS

Yes No	Remarks	Maintenance Tips
❑ ☒ Are there depressed areas on the dam?	May have resulted from slope failures or settlement, or even piping.	If pronounced or progressive, must be evaluated by a professional engineer.

PIPING

Yes No	Remarks	Maintenance Tips
❑ ☒ Is there any evidence of piping? (This condition is evidenced by a muddy flow through the dam and/or the formation of soil deposits beyond the dam and depressions on its slopes.)	Piping is internal erosion within an embankment, or the progressive removal of soil particles adjacent to leaks through a soil mass.	Piping is always a serious condition, which can lead to failure of the dam. A piping condition must be evaluated by a professional engineer.
❑ ☒ Does the crest appear to have shifted or settled excessively? (Look for cracks in the em-bankment and associated structures. Compare alignment with plans if they are available.)	Crest movement may indicate a stability problem. However, some settlement of a new fill, such as an embankment dam, is normal.	Must be evaluated by a professional engineer.

EMBANKMENT (continued)

PIPING (continued)

Yes No	Remarks	Maintenance Tips
❑ ☒ If the upstream face is protected by riprap is it in good condition? (Riprap is a layer, facing, or protective mound of stone in random size pieces, randomly placed to prevent erosion, scour, or sloughing of an embankment or structure.)	Effectiveness is lessened if riprap has slipped out of place, has been undermined, or has become overgrown with brush. See Inspection Checklist Item 10	Restore riprap as necessary; keep free of trees and bushes.
❑ ❑ If there is riprap in discharge channels or in the plunge pool downstream, is it in good condition? N/A	Has riprap been displaced or overgrown?	Restore riprap as necessary; keep free of trees and bushes.
❑ ❑ If drainage channels at ends of embankment are protected with riprap, is it in good condition? N/A See Inspection Checklist Item 12	Drainage along abutments often causes gullying if there is no protection.	Riprap or other form of slope protection should be used as necessary.
❑ ☒ If there is riprap in miscellaneous areas (on downstream slope, on crest, etc.) is it in good repair? See Inspection Checklist Item 24		Restore as necessary.

AEPFC000190

EMBANKMENT (continued)

ALIGNMENT

Yes No	Remarks	Maintenance Tips
❑ ☒ Does the crest appear to have shifted or settled excessively? (Look for cracks in the em-bankment and associated structures. Compare alignment with plans if they are available.)	Crest movement may indicate a stability problem. However, some settlement of a new fill, such as an embankment dam, is normal.	Should be evaluated by a professional engineer.

SEEPAGE

Yes No	Remarks	Maintenance Tips
❑ ❑ If there are any drains to collect and remove, seepage, are they operating properly? N/A	Check plans for the presence of drains and search the dam to see if any others are present.	Keep drains clear of any blockages and assure proper operation.
❑ ❑ If there are foundation drain outlets, are they clear and flowing? N/A	Foundation drains serve to collect seepage passing through the dam and conduct it away from the embankment.	Open outlets to such drains if they have become covered or clogged.
☒ ❑ Are there wet spots or areas on the downstream face, at the toe, or beyond the dam? (Such spots are often indicated by a change in color or type of vegetation, such as from grass to cattails.) See Inspection Checklist Item 17	Some seepage is normal for an earth dam. Be concerned if it appears to be excessive (a lot of standing water; very soft and marshy areas; evidence of a seepage line high on the downstream face).	Observe seepage areas periodically to detect changes in the amount of moisture, new flows, or muddy flows. If the upper limit of seepage is fairly high on the downstream face, the dam may be unstable.

EMBANKMENT (continued)

SEEPAGE (continued)

❑ ☒ Are there seeps or springs with flowing water? Look closely for these at the ends of the dam, around any pipes passing through the embankment, on downstream face, at the toe of the dam and beyond, and at the base of trees on, near, or below the dam.	Flowing seeps or springs may indicate problems, and should be periodically monitored for changes in rate of flow or muddy flow. Creation of an impoundment often causes changes in the water table nearby.	Monitor seepage closely for any changes in amount, rate, extent, or clarity. Excessive or turbid seepage, or marked increases in rate of seepage, should be evaluated by a professional engineer.
❑ ☒ Is there swamp or marsh type vegetation on downstream face or beyond the dam (cattails, tall grass, etc.)?	Swamp type vegetation indicates the presence of seepage.	Cut frequently to make observation of the area easier. Such growth can hide problems.

VEGETATION

☒ ❑ Is the dam overgrown with trees and/or underbrush? See Inspection Checklist Items 14 and 24	One of the most frequent problems, and highly un-desirable. Roots may damage the embankment and allow water to pass into or through it. Trees may be uprooted in a storm and breach the dam.	Keep embankment faces free of trees and underbrush by periodic mowing. Remove existing trees and saplings, and establish and maintain a good grass cover on the dam.

EMBANKMENT (contined)

OVERTOPPING

❑ ☒ Has the dam ever been overtopped by water flowing over it?	Past overtopping may have resulted in erosion of the crest and downstream face of the dam. Overtopping indicates that the emergency spillway is probably too small.	Restore eroded areas or other damage done to the dam by overtopping. Consider enlarging the emergency spillway, lowering the normal pool level to allow more storage capacity during floods, or perhaps raising the height of the embankment to decrease the possibility of future overtopping. Consult a professional engineer.

MODIFICATIONS

❑ ☒ Has there been any modification of the embankment, such as raising the crest, changing the shape or size of the principal spillway or the emergency spillway, or changing the shape or size of the embankment?	Inappropriate or unsuitable modifications can drastically affect the safety of a dam, even one that may have originally been properly designed and constructed.	Dams that have been appreciably modified since construction should be evaluated for stability by a professional engineer.

THE PRINCIPAL SPILLWAY

Yes No	Remarks	Maintenance Tips
☒ ❑ Can water flow into the principal spillway without difficulty, as intended when constructed? See Inspection Checklist Item 71	The riser, intake structure, or channel should be free of trash or other blockage.	Install a trash rack if one is not already in place. Periodically clear trash rack of any accumulated debris.
☒ ❑ Is outlet pipe or discharge channel clear and open to allow the free passage of the principal spillway discharge?	Flows passing through the spillway should not erode or otherwise damage the dam.	Keep outlet pipe, plunge basin, and all other outlet works clear and in good repair.
☒ ❑ Is the primary spillway structure in good condition (check concrete, wood, and metal portions for damage or deterioration)?	Such dam features as the principal spillway require continued maintenance like any other structure.	Repair and maintain as appropriate to insure the continued useful life of the dam.
❑ ☒ Does the lake have a drain that can be used to lower it in an emergency?	Lowering a lake may be necessary if the dam begins to develop problems.	Check plans or search dam for emergency drain system.
❑ ❑ If there is an emergency drain, is it known to be in working condition? **Danger**: If a drain has not been used for a long time, it may be possible to open it but not close it, thus draining the lake. N/A	Drain valves and other mechanisms should receive sufficient maintenance to insure that they remain in working order.	Maintain system so that it can be used in an emergency. Normally, the pool behind an earth embankment dam should not be lowered at a rate of more than 1 inch per day.
❑❑ If there are other gates, valves, or operating equipment, are these in working condition? N/A	Such devices are vital to the effective and safe operation of the dam.	Repair and restore if necessary, and maintain in an operable condition.

THE EMERGENCY SPILLWAY

Yes No	Remarks	Maintenance Tips
☒ ☐ Can water flow into the emergency spillway without difficulty, as intended when con-structed?	To be effective, all portions of the spillway channel should be clear and unobstructed.	The approach channel should be kept free of trash, underbrush, or other blockage.
☐ ☒ Is the discharge channel clear and open to allow the free passage of the emergency spillway discharge? See Inspection Checklist [illegible]	Spillway flows must be ef-fectively conducted away from the dam.	Clear as necessary.
☒ ☐ Is the emergency spillway constructed in such a way that its flows will not erode other por-tions of the dam?	A berm is often constructed to keep spillway flows from encroaching on the embankment.	Reshape dam if necessary to take care of this problem.
☒ ☐ Is the emergency spillway in good condition overall (check for erosion within the channel, adequacy of grass cover, etc.)? See Inspection Checklist Item 52	Spillway erosion is a common problem.	Restore any erosion gullies or eroded areas. Provide channel protection (riprap, concrete, etc.) if necessary to eliminate recurring problems.

THE RESERVOIR AREA

Yes No	Remarks	Maintenance Tips
☐ ☒ Is serious wave erosion occurring along the shoreline?	Some minor erosion along a shoreline is to be expected.	Critical shoreline areas can be protected with vegetation or in some other manner.
☒ ☐ Is a lot of sediment entering the impoundment, or has this happened in the past? Bottom ash	This may occur as a result of construction or agricultural activity in the watershed.	Dredging may be required to restore the lake.

RESERVOIR AREA (continued)

❑ ☒ Does the nature of the land surrounding the lake or its use present any problems?	Intensive agricultural or development activities in the watershed may precipitate problems associated with surface runoff or other difficulties.	Problems of this nature are often complex and may be beyond the owner's direct control.
❑ ☒ Is there any evidence of landslides or instability on the slopes around the reservoir?	A large landslide into a lake can subject a dam to overtopping or other damage.	Suspected or evident problems of this type should be investigated by a professional engineer or engineering geologist.

<u>DOWNSTREAM CHANNEL</u>

Yes No	Remarks	Maintenance Tips
☒ ❑ Is the downstream channel free of obstructions, so that water in a flood will not back up against the toe of the dam?	The channel below a dam is often a neglected area.	Clear downstream channel if necessary.

<u>WATERSHED AREA</u>

Yes No	Remarks	Maintenance Tips
❑ x Have there been any major modifications or significant changes in the watershed drainage area, such as new urban developments (shopping centers, housing projects), clear cutting of woodlands, or other basic changes in land use.	Intensive agricultural or development activities in the watershed may precipitate problems associated with greater surface runoff or other difficulties.	Problems of this nature are often complex and may be beyond the owner's direct control. Appeals to existing regulations dealing with erosion prevention, pollution control, etc. may be helpful.

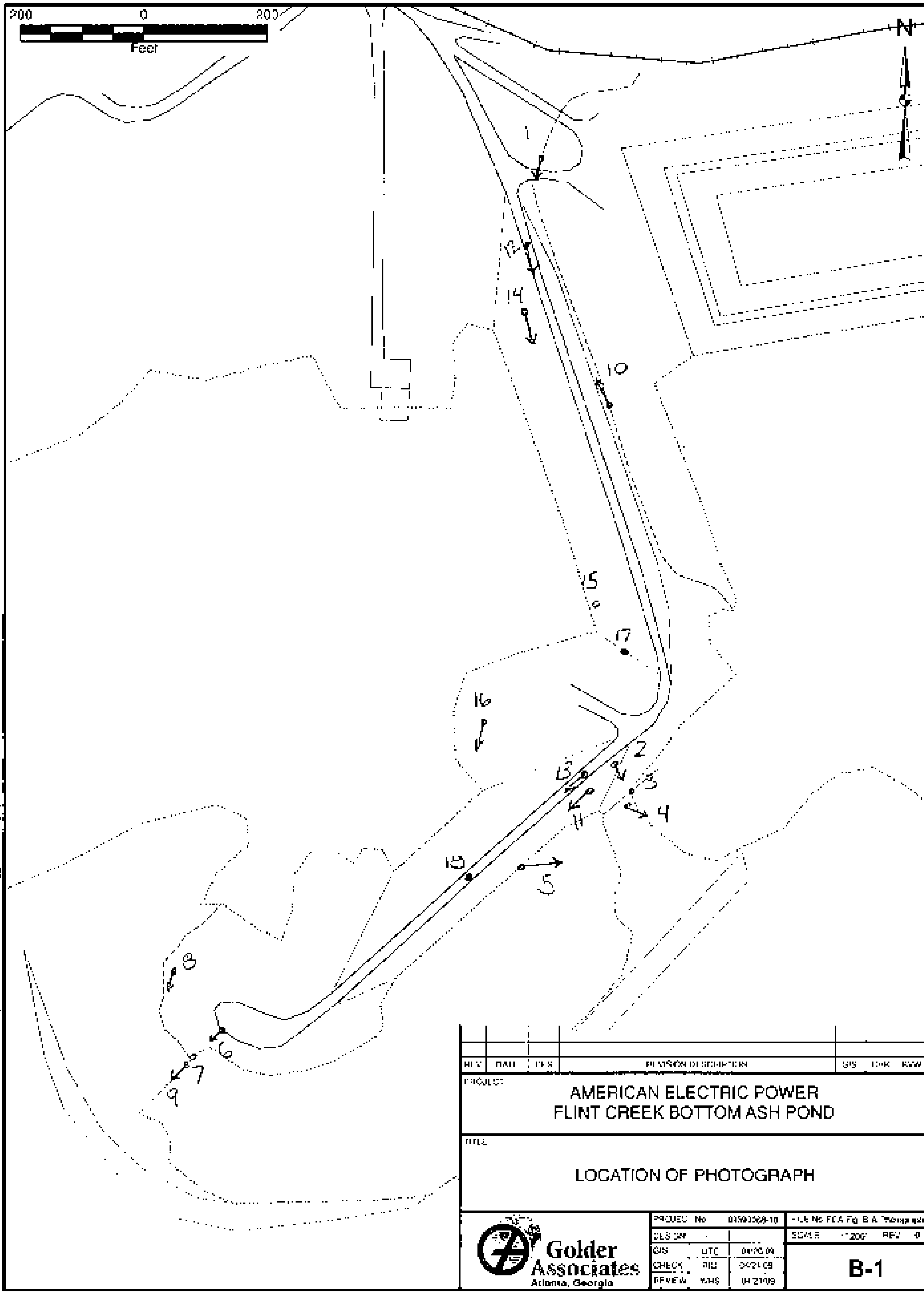
THE DOWNSTREAM AREA

Yes No	Remarks	Maintenance Tips
☐ ☐ If the dam should fail, would loss of life or extensive property damage be likely?	Consider the number of occupied homes or businesses downstream, their distance from the dam, and their distance from and elevation above the streambed. Consider also potential losses in property and disruption of facilities, i.e., roads, railroads, or utilities.	Personally inspecting the area that would be affected will be useful in determining who needs to be alerted in an emergency. Topographic maps prepared by the U.S. Geological Survey are also useful for this purpose.
☑ ☐ Do you have on file the current telephone numbers of any persons living or working in areas downstream from the dam, as well as the telephone numbers of those responsible for facilities that would be affected, such as highways or public utilities.	Prior planning for an emergency is invaluable in terms of mitigating losses. When a dam failure is imminent, it is too late to begin wondering who is located downstream and how they can be reached.	Any list of phone numbers or other information to be used in an emergency should be checked for accuracy and updated periodically to insure that the information remains current.
☑ ☐ Do you have on file the current telephone numbers of local authorities who should be informed if the dam is endangered, such as the sheriff, county administrator, or emergency services coordinator?	In an emergency certain functions, such as compelling the evacuation of an area, can be performed only by those with the legal authority to do so.	The Arkansas Soil and Water Conservation Commission and the local Emergency Services Coordinator can offer guidance for preparing an emergency warning plan, if needed. Such a plan should be filed with local authorities.

6 Apr 2004

Appendix B

Photographs of Dam



PROJECT

AMERICAN ELECTRIC POWER
FLINT CREEK BOTTOM ASH POND

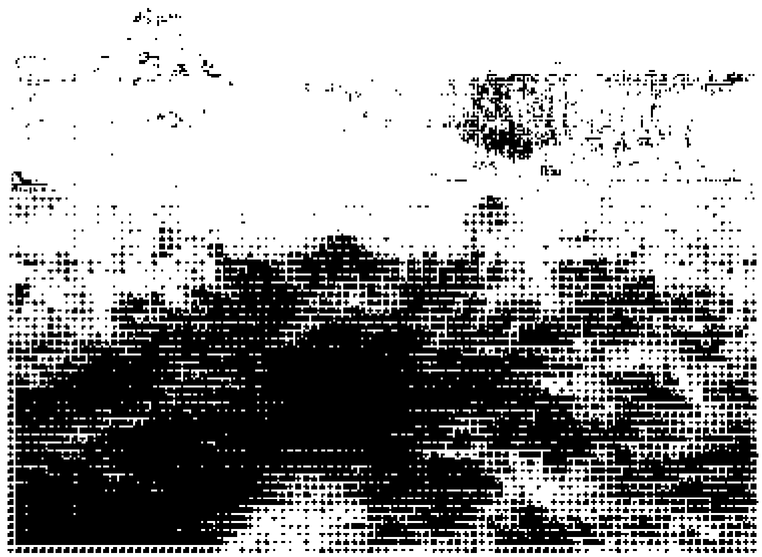
TITLE

LOCATION OF PHOTOGRAPH

Golder Associates
Atlanta, Georgia

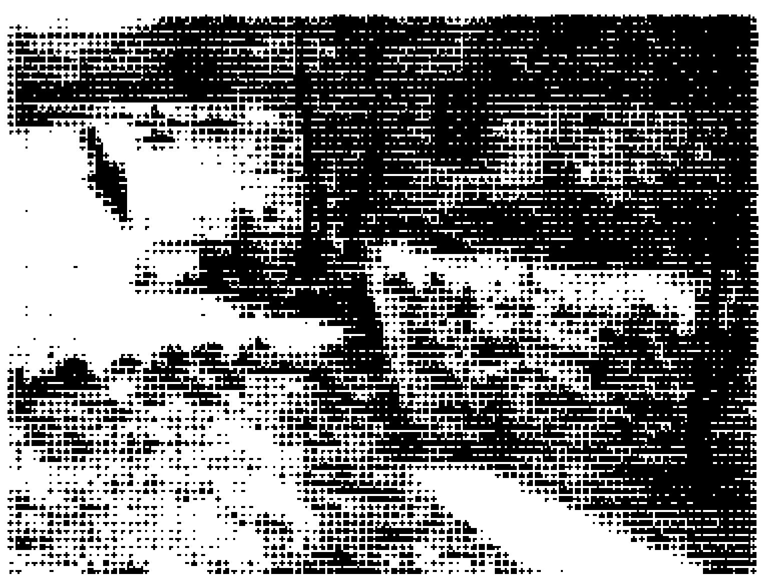
B-1

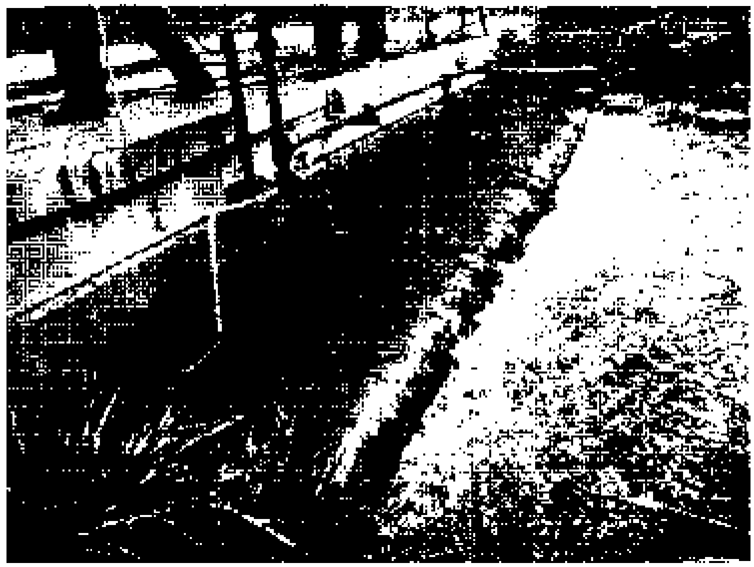
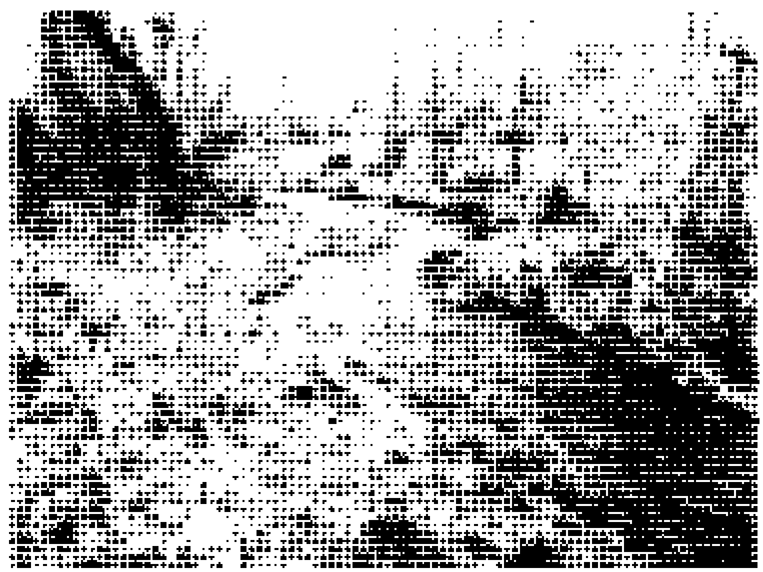
<table>
<tr><td>1.) Inflow Channel;
Fair condition

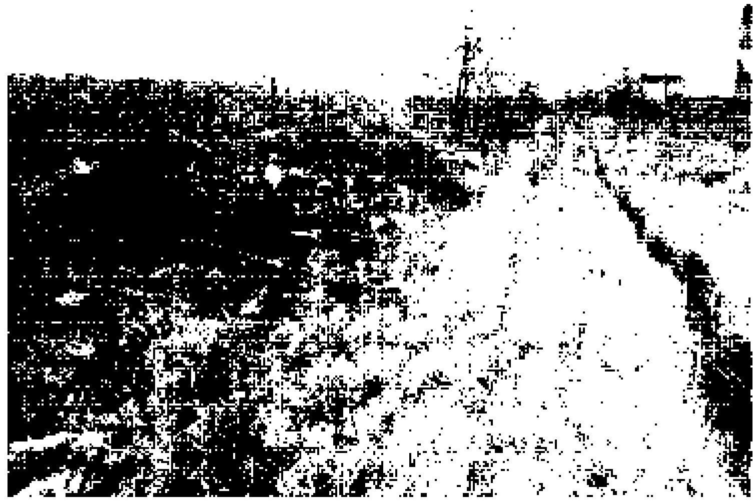
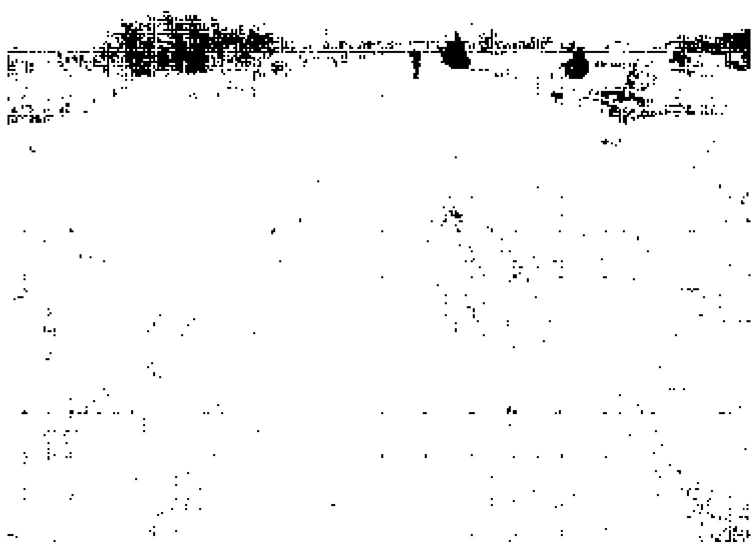
Culverts in the channel are submerged at both ends, indicating culverts may be undersized.</td><td></td></tr>
<tr><td>2.) Principal Spillway –
Primary Impoundment;
Fair condition.

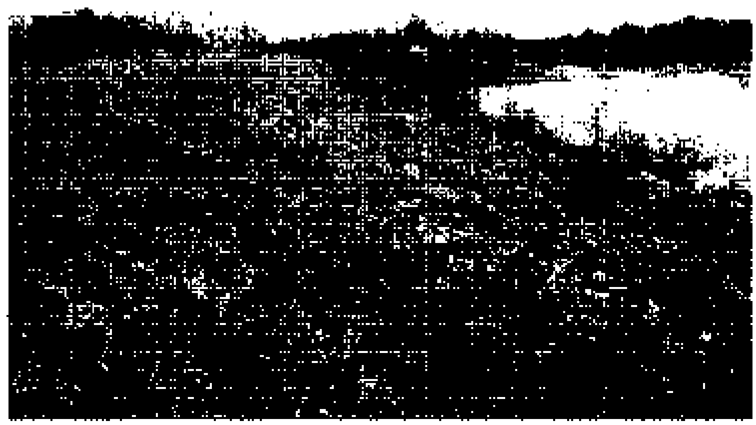
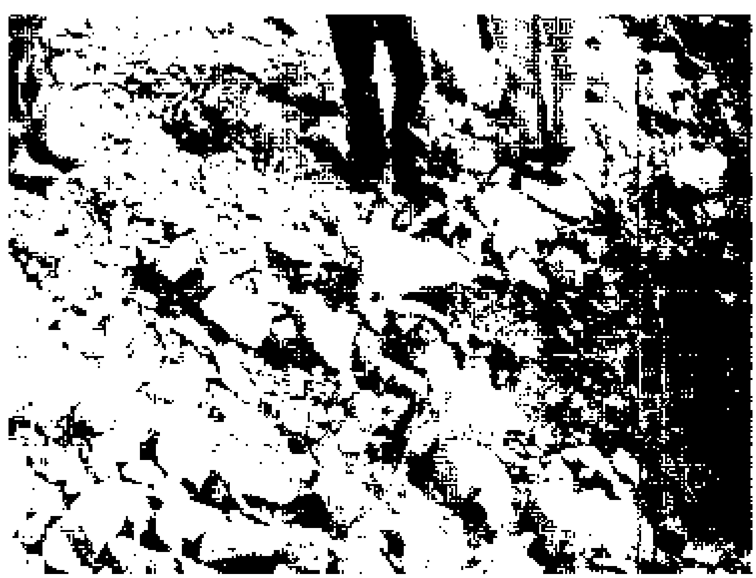
Minor erosion at embankment contact.</td><td></td></tr>
<tr><td>3.) Principal Spillway Weir
Primary Impoundment;
Fair condition.

Minor chipping of the concrete and corrosion of metal components were observed</td><td></td></tr>
</table>

4.) Emergency Spillway Control Section – Primary Impoundment: Poor condition due to significant riprap displacement. The emergency spillway was activating at the time of inspection. The riprap control section has significant displacement.	
5.) Emergency Spillway Channel – Primary Impoundment: Poor condition due to significant undesirable vegetation. Significant undesirable vegetation obstructs channel	
6.) Principal Spillway Secondary Impoundment, Fair condition. Minor algae growth partially obstructs flow through the trash rack.	

7.) Principal Spillway Weir – Secondary Impoundment. Fair condition. Concrete orifice and weir system	
8.) Principal Spillway Discharge Channel – Secondary Impoundment; Fair condition. Channel appears stable.	
9.) Emergency Spillway Secondary Impoundment. Fair condition. Minor extent of woody vegetation partially obstructs entrance.	

10.) Upstream Slope – Primary Impoundment: Fair condition. Undesirable vegetation on slope.	
11.) Upstream Slope – Secondary Impoundment. Fair condition. Undesirable vegetation on slope. Slope steepens near crest.	
12.) Crest – Primary Impoundment: Fair condition Significant rutting and ponding on surface.	

13.) Crest – Secondary Impoundment; Fair condition. Significant rutting and ponding on surface.	
14.) Downstream Slope – Primary Impoundment; Fair condition. Undesirable vegetation.	
15.) Downstream Slope Primary Impoundment; Active seepage ~3 vertical feet above downstream water surface with immeasurably small and dispersed flow.	

16.) Downstream Slope – Secondary Impoundment: Fair condition. Undesirable vegetation.	
17.) Left Groin – Primary Impoundment (at mid-dam abutment between primary and secondary embankments): Fair condition. Three animal burrows were identified on the mid-dam abutment, approximately 6 to 18 inches in diameter and 1 to 4 feet deep.	
18.) Piezometer Secondary Impoundment Poor condition. The outer casing is broken at the top and the piezometer was buried.	

Appendix C

Documentation Provided by AEP

NOTES

1- SECTIONS A-A THRU D-D / SECTIONS H-H THRU L-L } FCX-3, SH.2.
2- SECTIONS E-E THRU G-G - FCX-3, SH.3.
3- STOCKPILE TOPSOIL IN AREAS SHOWN AS REQUIRED.
4. INTAKE STRUCTURE FILL AND SETTLING BASIN CONTROL STRUCTURES NOT IN THE SCOPE OF EARTHWORK.
5 ASH BASIN CONTROL STRUCTURES - REF. DRAWING FCX-29, SH 1 & 2 "A"

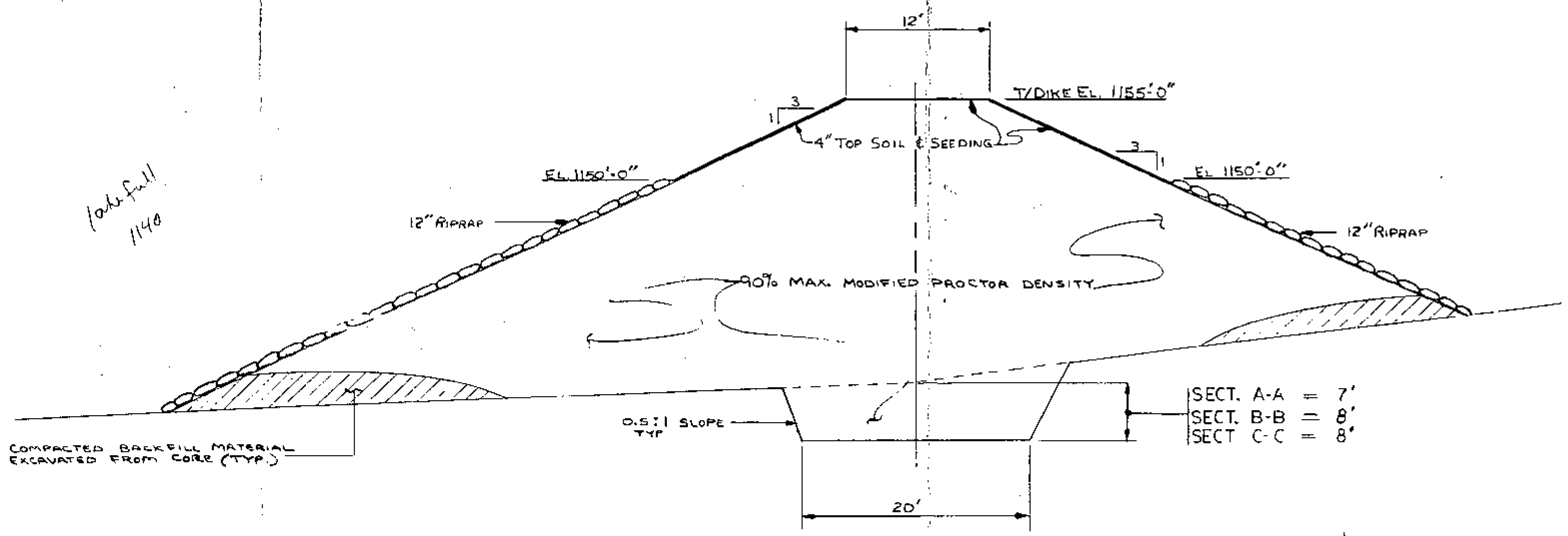
REV	DATE	INT	DESCRIPTION
	8-14-75	MJM	FOR COMMENTS.
	8-29-75	MJM	FOR CONSTRUCTION
A	4-7-76	MJM	ADD CONTROL STRUCT., REV. SPILLWAY AS NOTED.
B	3-17-78	MJM	ADD CO_2 PIPING

SOUTWESTERN ELECTRIC POWER COMPANY
G.O. CONSTRUCTION DEPARTMENT
FLINT CREEK POWER PLANT

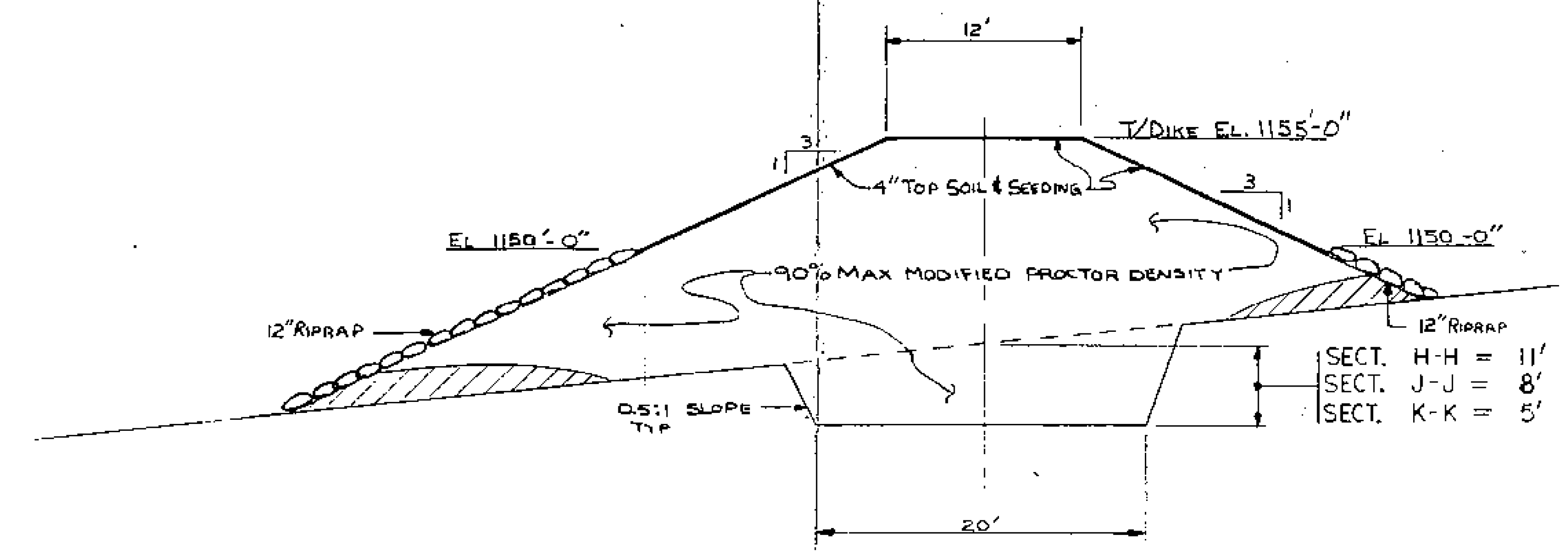
ASH BERM AND CONNECTING CANAL PLAN

DRWN BY: MJM
DATE: 8-14-75
SCALE: 1" = 100'-0"
FCX - 3
SH. 1 OF 3

Landfill
1140

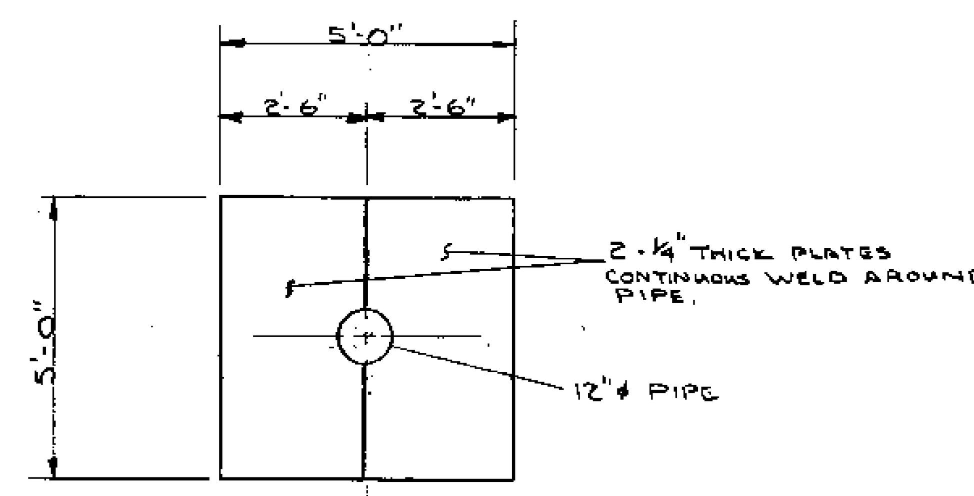


Ash Pond
1144.5/1145



SECTION "H-H" THRU "K-K"
SECONDARY ASH POND DIKE

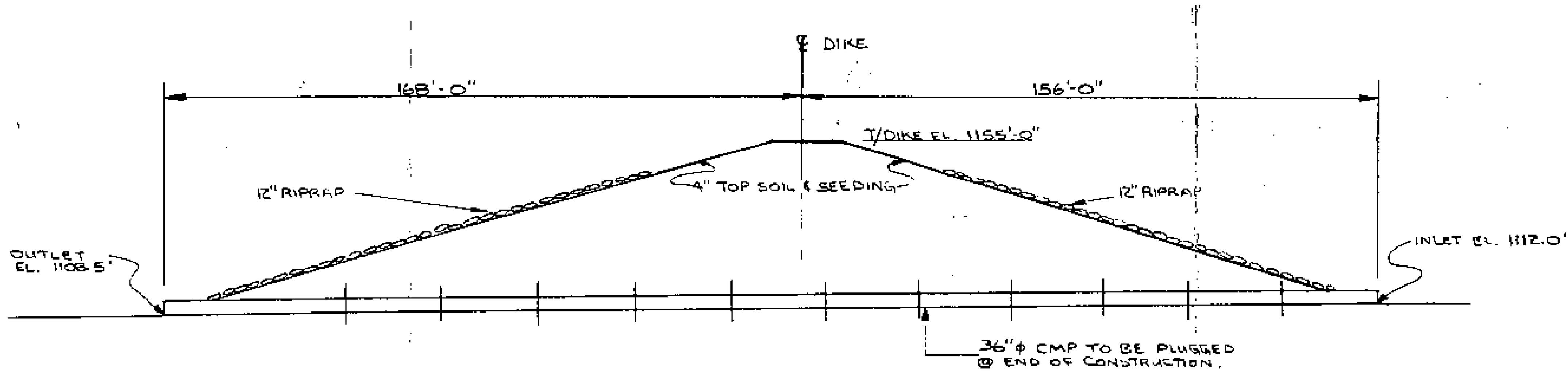
SECTION "A-A" THRU "C-C"
PRIMARY ASH POND DIKE



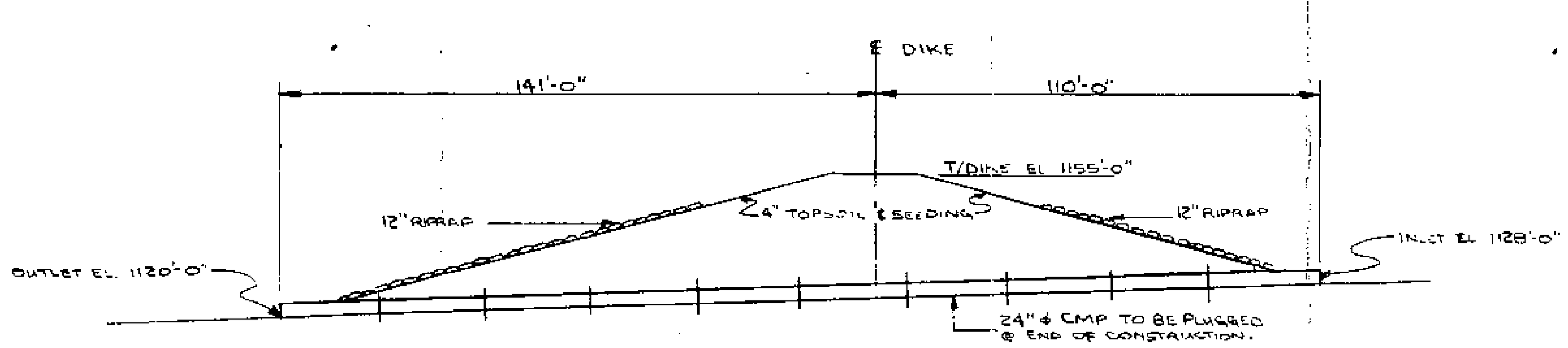
DETAIL 2
TYPICAL DIAPHRAM

NOTES

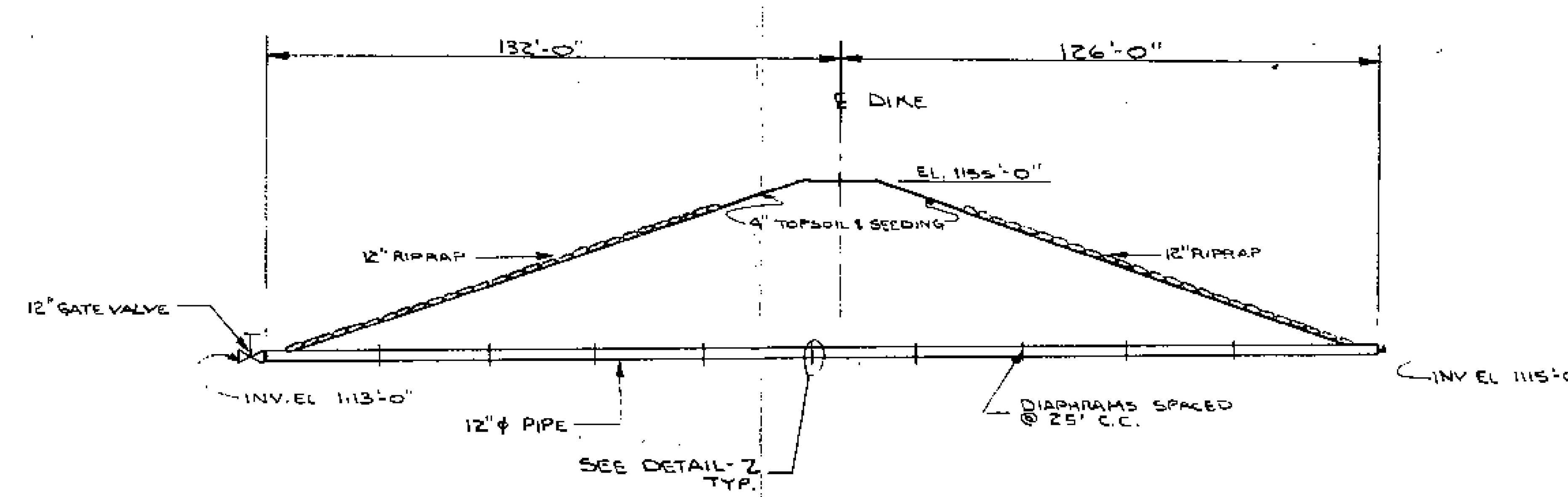
1- Contractor shall strip topsoil from dike and spillway area and stockpile as shown on FCX-3, sh. 1.
2- Excavated material from core to be used as compacted fill in toe of beam.
3- Core to be cut to design sections shown. Depth of core shall vary between sections. Upon completion of core excavation, owner's engineer shall make inspection before backfill begins.
4- Contractor shall provide drainage of ash basin area during construction. Ash basin connecting canal and spillway shall be cut to allow for drainage before backfill begins.
5- Contractor to furnish (1) - 36"Ø, and (1) - 24"Ø, 16 Ga. CMP as shown with diaphrams spaced at 25' intervals. Actual culvert invert elevations will vary due to field conditions.
6- 12"Ø pipe and 12" gate valve furnished by SWEPCO.



SECTION "D-D"
N.T.S.



SECTION "L-L"
N.T.S.



DETAIL - 1

REV	DATE	BY	SUBJECT
	7/12/74		FOR BID
	8/29/75	MJM	FOR CONSTRUCTION

ASH POND DIKE
CROSS - SECTIONS

FLINT CREEK POWER PLANT

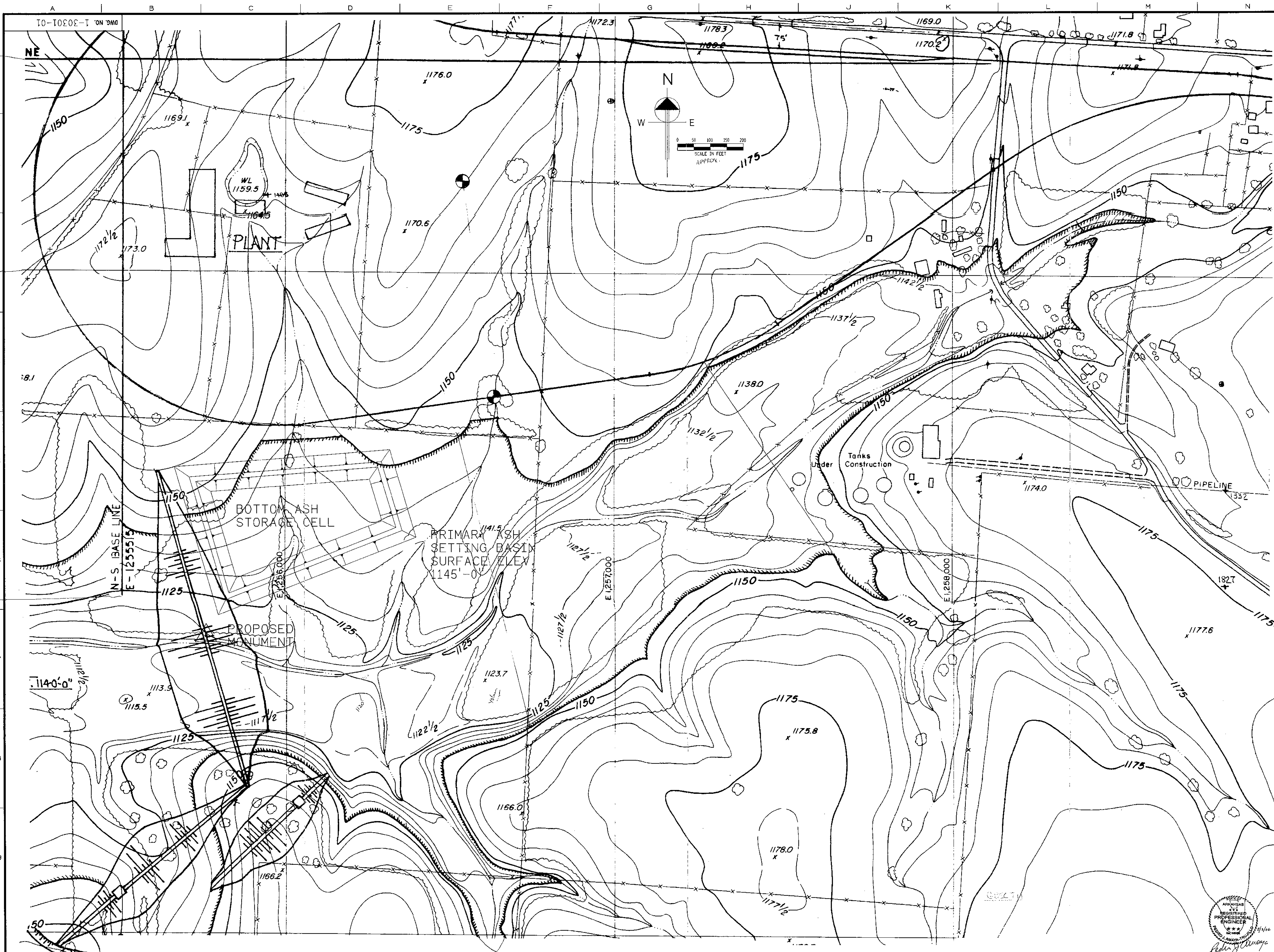
SOUTHWESTERN ELECTRIC POWER CO.
G.O. CONSTRUCTION DEPARTMENT
DIVISION

APPROVED ENGR IN CHARGE
APPROVED DIV SUPT.
APPROVED CHIEF ENGR

DRWN BY MJM
TRAC. BY
DATE: 7-10-74
SCALE: NONE
WORK ORDER
DRWG NO FCX - 3 SH. 2
SHEET

FILE

AEPFC000208



NOTES

REFERENCE DRAWINGS

1-30301-02 BOTTOM ASH STORAGE CELL

DATE	NO.	DESCRIPTION	APPD.
1/30/06	A	ISSUED FOR BID	PJA

REVISIONS

s:\str\FlintCreek\30301-01.dgn

SWEPCO

FLINT CREEK

BENTON COUNTY AR

BOTTOM ASH POND
BOTTOM ASH STORAGE CELL
LOCATION PLAN MAP

DWG. NO. 1-30301-01-A

SCALE: AS NOTED
CIVIL ENGINEERING
DR: J D HAYDEN
CH: W SMITH
ENGR:
PROJ ENGR: PJA
DATE: 02/03/06
APPROVED BY

AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE-DD-MMM-YYYY

S:\str\FlintCreek\AshPond.dgn 2/3/2006 7:06:55 AM

AEPFC000209

DAM & DIKE INSPECTION REPORT

PRIMARY & SECONDARY ASH POND DAMS AT FLINT CREEK POWER PLANT BENTON COUNTY, AR

INSPECTION DATE September 16, 2009

PREPARED BY William R. Smith, P.E. **DATE** 6/16/2010

REVIEWED BY Gary F. Zych, P.E. **DATE** 6/17/2010

APPROVED BY Pedro J. Amaya, P.E. **DATE** 6/18/2010

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
WILLIAM R. SMITH

PROFESSIONAL ENGINEER
SEAL & SIGNATURE

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INTRODUCTION

AEPSC (American Electric Power Service Corporation) Civil Engineering administers the Dam Inspection and Maintenance Program (DIMP) at AEP facilities. As part of the DIMP, staff from the geotechnical engineering section conducts dam and dike inspections annually. Mr. William R. Smith, P.E., performed the 2009 inspection of the primary and secondary ash pond dams at the Flint Creek Power Plant. This report is a summary of the inspection and an assessment of the general condition of the facility. Appendix A presents photos that were taken during the inspection. Appendix B contains completed and blank dam inspection and maintenance checklists on forms provided by the State of Arkansas. Appendix C provides design drawings of the dams and their appurtenances.

Mr. W. Greg Carter of AEP Plant Engineering, Region 5 joined Mr. Smith in the inspection. Mr. Damon Robertson, maintenance superintendent at the Flint Creek Plant, was the facility contact. The inspection was performed on September 16, 2009. Weather conditions were overcast with light winds, light rain, and temperatures in the low to mid 70's (°F).

Figure 1 provides a plan view and aerial photograph of the primary and secondary ash pond dams and appurtenances. Drawing FCX-3, Sheet 1 in Appendix C provides a plan view of the design of the dams and appurtenances. The ash ponds are divided into two impoundments in series. The primary (upper) ash pond dam is an 820-foot long cross-valley dam on an unnamed tributary to Little Flint Creek. The secondary (lower) dam is a 750-foot long cross-valley dam on an adjacent first order stream. The secondary impoundment discharges directly to the Little Flint Creek Reservoir, which is adjacent to both the primary and secondary ash pond embankments.

GENERAL INFORMATION

Dam or Reservoir:	Primary and Secondary Ash Pond Dams at Flint Creek Power Plant
Owner:	AEP Southwestern Electric Power Co.
Type of Dam:	Earth-Fill Structure

Date of Construction:	1978
D/S Hazard:	Not Classified

LOCATION

County:	Benton County
General Location:	Approximately 4.5 miles north of Siloam Springs, AR
Stream and Basin:	Unnamed tributary to Little Flint Creek; Flint Creek Basin

SIZE – PRIMARY DAM

Dam Crest Elevation[1]:	1,155	feet-MSL
Maximum Water Level:	Not Established	
Current Water Level[2]:	1,146	feet-MSL
Height[1]:	45	feet
Surface Area:	24	acres (at normal pool)
Reservoir Volume:	Depth and volume are unknown	

SIZE – SECONDARY DAM

Dam Crest Elevation[1]:	1,155	feet-MSL
Maximum Water Level:	Not Established	
Current Water Level[2]:	1,143	feet-MSL
Height[1]:	35	feet
Surface Area:	6	acres (at normal pool)
Reservoir Volume:	Depth and volume are unknown	

Notes: 1.) Estimated from AEP construction drawings; 2.) Visually estimated during inspection.

SUMMARY OF VISUAL OBSERVATIONS

The summary of the visual observations presented herein uses terms to describe the general appearance or condition of an observed item, activity or structure. Their meaning is understood as follows:

CONDITION OF DAM COMPONENT

Good: A condition or activity that is generally better or slightly better than what is minimally expected or anticipated from a design or maintenance point of view.

Fair or Satisfactory: A condition or activity that generally meets what is minimally expected or anticipated from a design or maintenance point of view.

Poor: A condition or activity that is generally below what is minimally expected or anticipated from a design or maintenance point of view.

SEVERITY OF DEFICIENCY

Minor: A reference to an observed deficiency (e.g., erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is normal or desired, but which is not currently causing concern from a structure safety or stability point of view.

Significant: A reference to an observed deficiency (e.g. erosion, seepage, vegetation, etc.) where the current maintenance program has neglected to improve the condition. Usually these conditions have been identified in previous inspections, but have not been corrected.

Excessive: A reference to an observed deficiency (e.g., erosion, seepage, vegetation, etc.) where the current maintenance condition is above or worse than what is normal or desired, and which may have affected the ability of the observer to properly evaluate the structure or particular area being observed or which may be a concern from a structure safety or stability point of view.

Spillway Structures

The principal spillway at the primary impoundment is a concrete drop-inlet structure with stop logs to control the crest elevation. Significant blockage of the inlet with tree branches and other vegetative debris was noted. Some minor corrosion of the metal components and chipping of the concrete was also observed. A view of the partially blocked inlet is shown in Photo 1. The principal spillway also had significantly high vegetation, including woody vegetation growing around it as shown in Photo 2. The plant has reportedly cleared the blockage from the spillway inlet and controlled the growth of vegetation since the time of inspection.

The emergency spillway at the primary impoundment is an incised channel in natural ground and was active at the time of inspection. The spillway was observed to be in generally fair to poor condition. This condition was primarily attributable to excessive, undesirable vegetation growth including a number of trees over 20 feet in height observed within the entrance and exit channels of the spillway as shown in Photo 3. The spillway control section was designed to have a riprap-lined weir as shown on Drawings FCX-3, Sheet 1 and FCX-29, Sheet 2. The riprap lining was observed to be displaced and sporadic along the weir. Though the entire spillway could not be inspected due to unsafe access, the region of greatest flow, near the right bank, appeared stable. The plant has reportedly cleared the vegetation from the emergency spillway and controlled further growth since the time of inspection.

The principal spillway at the secondary impoundment, shown in Photos 4 through 6, consists of a concrete outlet structure with a series of horizontal orifices and a weir that discharges to an open cut channel. The concrete and metal components of the outlet structure were observed and noted in fair condition. Significant growth of woody vegetation, including one tree over 15 feet in height was observed adjacent to the outlet structure. Minor growth of woody vegetation was observed growing just upstream of the weir. The discharge channel was in fair and stable condition. The plant has reportedly cleared the vegetation from the spillway and controlled further growth since the time of inspection.

The emergency spillway at the secondary impoundment, shown in Photos 4 and 5, is an incised channel in natural ground and was active at the time of inspection. The spillway control section was designed to have a riprap-lined weir as shown on Drawings FCX-3, Sheet 1 and FCX-29, Sheet 2. The riprap lining was observed to be displaced and sporadic along the upstream side of the weir. The downstream side had been recently excavated in preparation for reconstruction activities. No signs of erosion were observed.

Upstream Slopes

The upstream slope of the primary dam was observed to be in generally fair to poor condition because of excessive undesirable vegetation including a number of trees in over 20 feet in height as shown in Photos 7 and 8. Substantial portions of the slope and groins at the primary dam were not observable because of the significantly to excessively overgrown vegetation. No observable signs of sloughing, erosion, or slope instability were noted. The upstream groins of the primary dam are depicted in Photos 7 and 9. The plant has reportedly cleared the vegetation from the slope and groins and controlled further growth since the time of inspection.

The upstream slope of the secondary dam was observed to be in generally fair condition. All of the excessive woody vegetation had been recently cut as depicted in Photo 10, but significant vegetation was observed growing through the riprap slope protection. The riprap itself appeared to be in good condition, but the condition was not observable in some areas because of dense vegetation growing through it. No observable signs of sloughing, erosion, or slope instability were noted. The upstream groins of the secondary dam, with significantly high vegetation, are shown in Photos 11 and 12. The plant has reportedly cleared the vegetation from the slope and groins and controlled further growth since the time of inspection.

Crests

The surface of the crest of the dam is hard-packed earth and used for vehicular access. The crests of the primary and secondary impoundments were noted in fair condition with no evidence of misalignment, settlement, or cracking, but with minor rutting and ponded water as shown in Photos 13 and 14. The plant has reportedly regraded the crests at both dams for positive drainage toward the upstream slopes and eliminated the rutting and ponding of water since the time of inspection.

Downstream Slopes

The downstream slope of the primary dam was noted to be in fair condition. No apparent signs of sloughing, erosion, or slope instability were observed, but substantial portions of the slope were obscured by significantly overgrown vegetation and a few areas were covered by vegetation that was excessively overgrown. Views of the slope and groins at the primary dam are shown in Photos 15 through 21. The Little Flint Creek Reservoir (also known as Lake Flint Creek) backs up against both the primary and secondary dams. This prevented inspection of approximately 21 vertical feet of slope at the primary dam that was below the water surface at the time of inspection.

The riprap on the exposed slope above the water surface was in apparently good condition, but the condition was not observable in some areas because of significantly to excessively overgrown vegetation growing through it as shown in the photos. The plant has reportedly cleared the vegetation from the slope and groins and controlled further growth since the time of inspection.

An active seep, located during a March 2009 inspection of the downstream slope of the primary dam, near the left groin and the water surface, was searched for but could not be found and was apparently dry. One group of animal burrows was identified at the left downstream groin of the primary impoundment, and is shown in Photo 20. An active in-ground beehive was noted on the downstream slope at the left quarter of the dam near the crest. Photo 21 shows the hive and its active use. Plant personnel began the application of insecticide at the hive during the inspection. The plant has reportedly backfilled the group of animal burrows and eliminated the beehive since the time of inspection.

The downstream slope of the secondary dam was noted to be in fair condition. No apparent signs of sloughing, erosion, or slope instability were observed, but some portions of the slope were obscured by significantly overgrown vegetation. Views of the slope and groins at the secondary dam are shown in Photos 22 through 25. The inundation of the dam by the Little Flint Creek Reservoir prevented inspection of approximately 10 vertical feet of slope that was below the water surface at the time of inspection.

The riprap on the exposed slope of the secondary dam above the water surface was in apparently good condition, but the condition was not observable in some areas because of significantly overgrown vegetation growing through it as shown in the photos. All of the large trees on the slope, except one evergreen, had recently been cut as demonstrated in Photos 23 and 24. These two photos were taken back-to-back at the mid slope area and together show most of the slope. The downstream groins showed no signs of erosion, but the left groin had a substantial amount of significantly overgrown vegetation growth as shown in Photo 25. The plant has reportedly cleared the vegetation from the slope and groins and controlled further growth since the time of inspection.

Monitoring Instrumentation

Three piezometers were found at the ash pond dams, two at the crest of the primary dam and one at the crest of the secondary. The piezometers at the primary dam were in fair condition. The piezometer at the crest of the secondary dam was broken at the surface and the opening was buried under a few inches of soil. The opening was dug out, as shown in Photo 26, and the piezometer was read. The plant has reportedly had the piezometer repaired since the time of inspection.

ASSESSMENT OF RECENT INSTRUMENTATION DATA

The depths to the water surface and to the bottoms of the three piezometers at the ash pond dams were measured during the inspection. The piezometer toward the right side of the primary dam had a depth to water of 22.07 ft. and a depth to bottom of 57.73 ft. The bottom was noted as soft indicating some sediment build-up at the piezometer bottom. The depth to water of the piezometer toward the left side was 22.05 ft. and the depth to bottom was 42.69

ft. The bottom in this piezometer was also soft. Using the design top elevation at the crest of 1155.0 ft., gives a water elevation of approximately 1132.9 ft. at the crest of the primary dam. This phreatic surface appears normal given that the upstream water surface was at about El. 1146.0 ft. and the downstream water surface was at El. 1132.4 ft.

The piezometer on the crest of the secondary dam had a depth to water of 21.64 ft. and a depth to bottom of 43.86 ft. The bottom was noted as soft. Using the design top elevation at the crest of 1155.0 ft., gives a water elevation of approximately 1133.4 ft. at the crest of the secondary dam. This phreatic surface within the secondary dam appears normal given that the upstream water surface was at about El. 1,143.0 ft., and the downstream water surface was at El. 1,132.4 ft.

CONCLUSIONS AND RECOMMENDATIONS

Based on our visual inspection and review of the instrumentation information available, it is concluded that the primary and secondary ash pond dams were generally in fair condition at the time of inspection with no signs of distress that would indicate possible instability, excessive settlement, misalignment, sloughing, or cracking of the dams.

A summary of our recommendations for general maintenance and continued monitoring, as well as any recommendations for remedial activities, is provided as follows:

Recommendations for General Maintenance and Monitoring Activities

- Regularly clear any blockage and maintain free flow to the principal spillway inlets at the primary and secondary dams.
- Regularly control any brush and/or woody vegetation growth at the emergency spillway channels at the primary and secondary dams.
- Maintain vegetation by cutting at least twice per year. At areas where it is not feasible to use mowing equipment, control vegetation with weed trimmers, power brush cutters, or similar equipment. General vegetation control should extend to 25 feet beyond the groins. Appendix D contains recommended guidelines on herbicide use to control the growth of brush and woody vegetation near earthen dams.

- Maintain a grass cover at areas without riprap to prevent erosion.
- Backfill any noted animal burrows with compacted fill, seed and mulch to establish grass cover on a regular basis.
- Monitor the riprap control section of the emergency spillways for signs of erosion during periods of no flow.
- The dams should be inspected by plant personnel quarterly and within 24 hours of unusual events such as seismic activity or a significant storm event with the inspection documented in accordance with AEP Circular Letter CI-M-CL-010C. For the purpose of these inspections, a "significant storm event" is defined as a storm that results in three inches or more of rainfall in 24 hours. A blank copy of inspection forms provided by the Arkansas Soil and Water Conservation Commission is provided at the end of Appendix B.

Recommendations for Remedial Activities

- None

Submitted By:

American Electric Power Service Corporation

Civil/Geotechnical Engineering

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STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
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APPENDIX I

Inspection Photographs

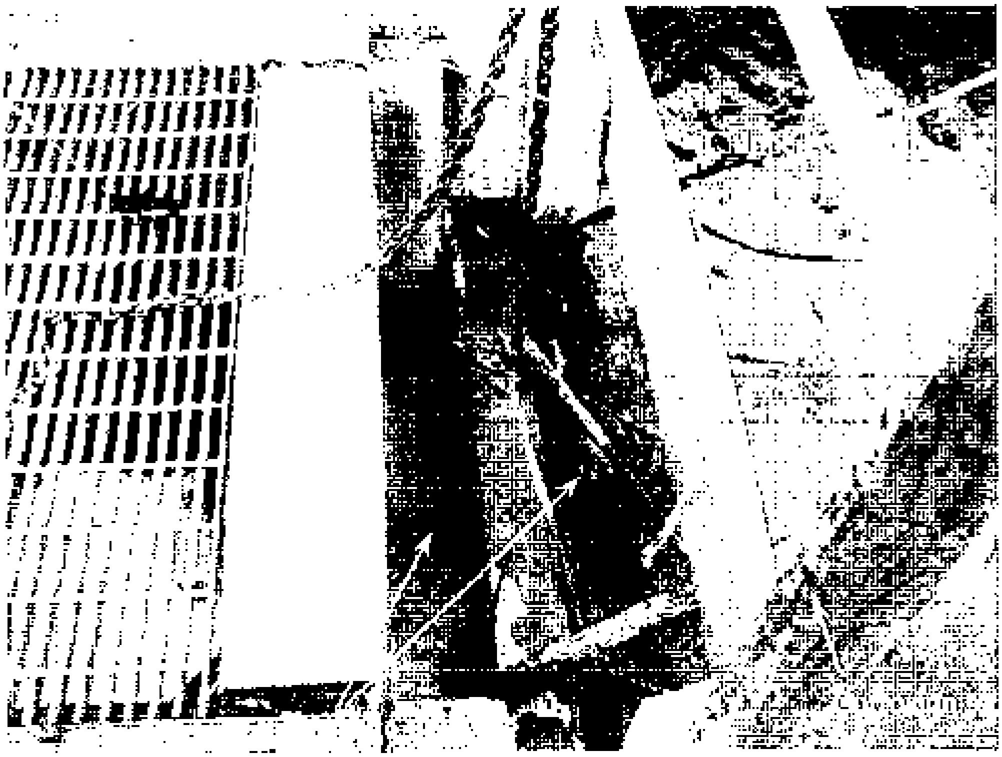


Photo 1. Primary ash pond principal spillway with significant blockage at inlet and minor corrosion of steel and chipping of concrete components.

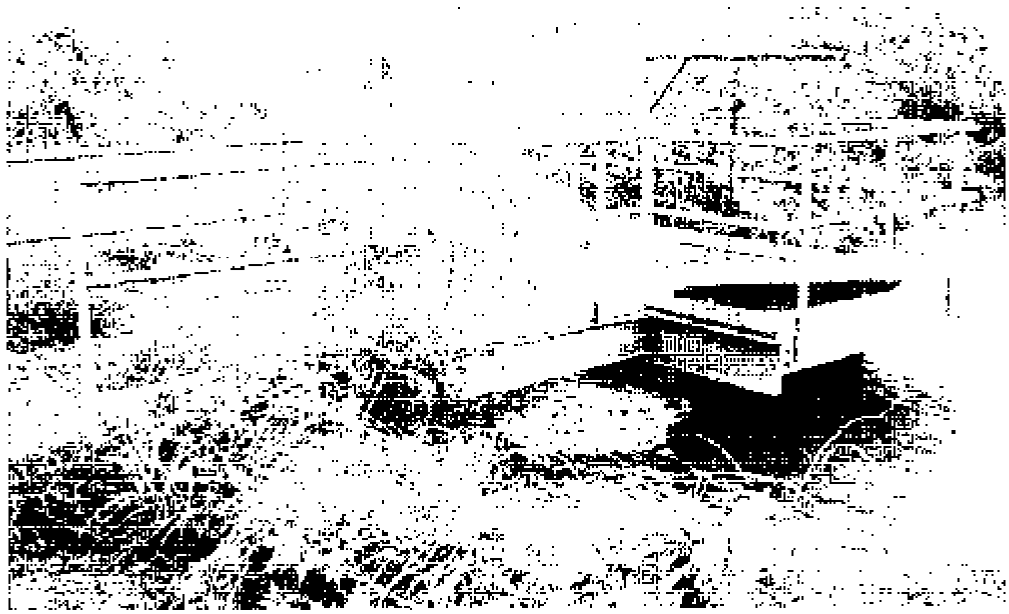


Photo 2. Primary ash pond principal spillway with significantly high and woody vegetation growing adjacent to it.

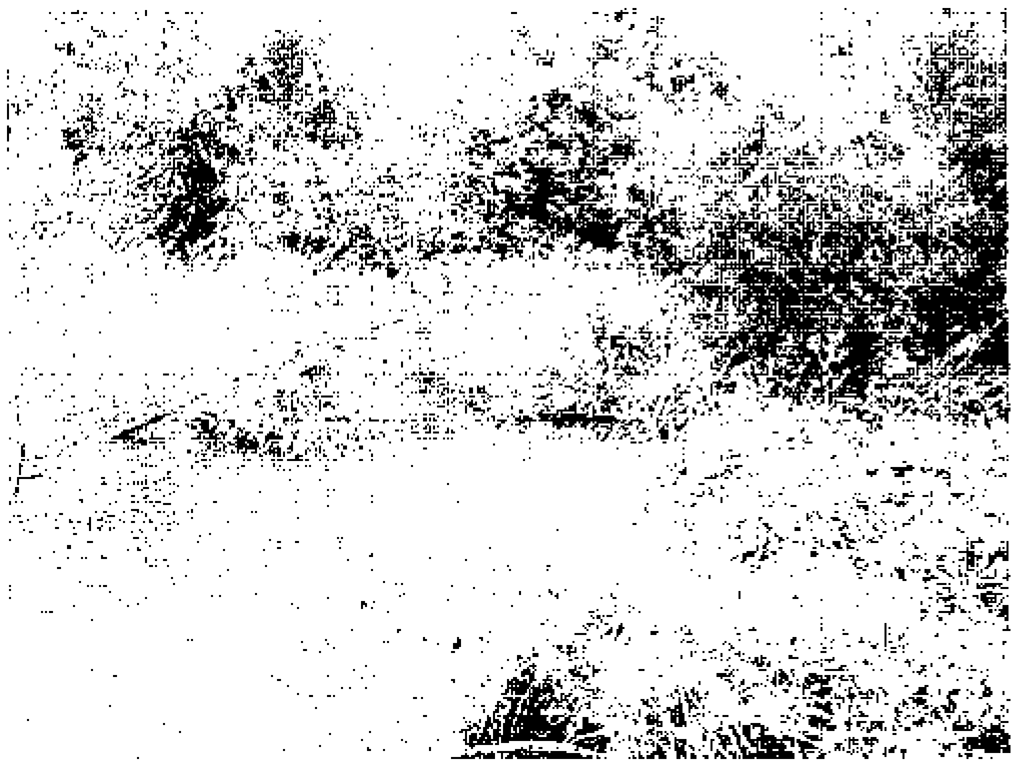


Photo 3. Primary ash pond emergency spillway, active, with excessive vegetation and riprap displaced from the weir crest.

Photo 4. Secondary ash pond principal and emergency spillways with significant vegetation at principal and recent preparation for reconstruction at emergency spillway.

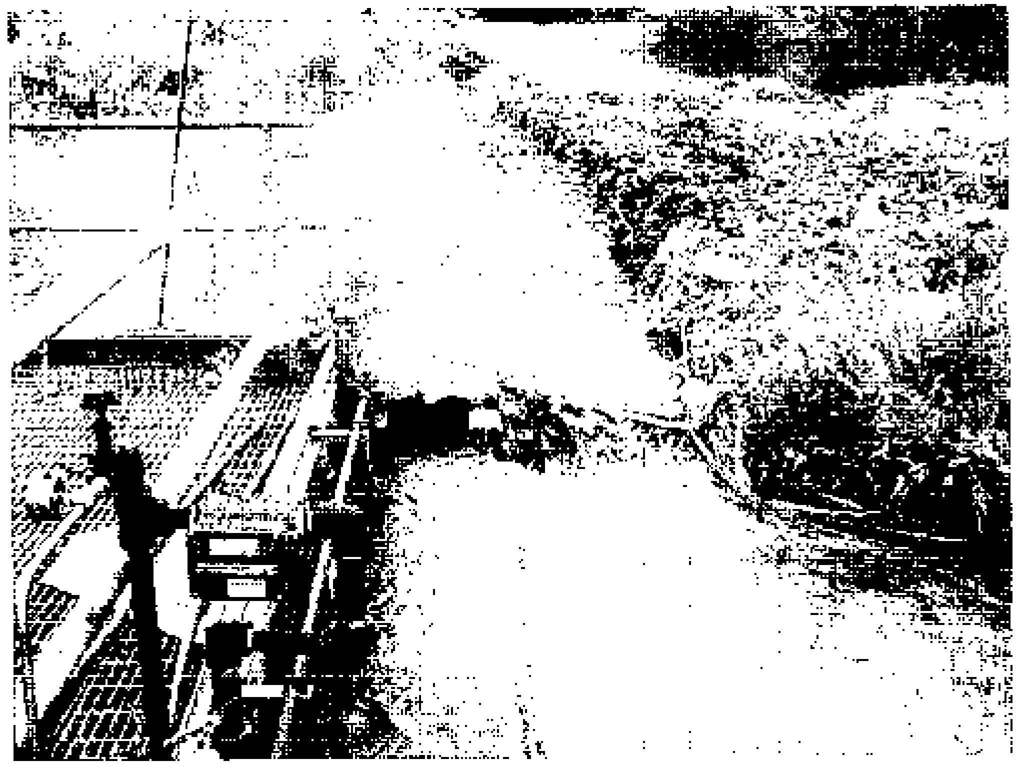


Photo 5. Secondary ash pond principal spillway weir with minor growth of woody vegetation and active emergency spillway prepared for reconstruction.

Photo 6. Secondary ash pond principal spillway discharge channel was in fair and stable condition.

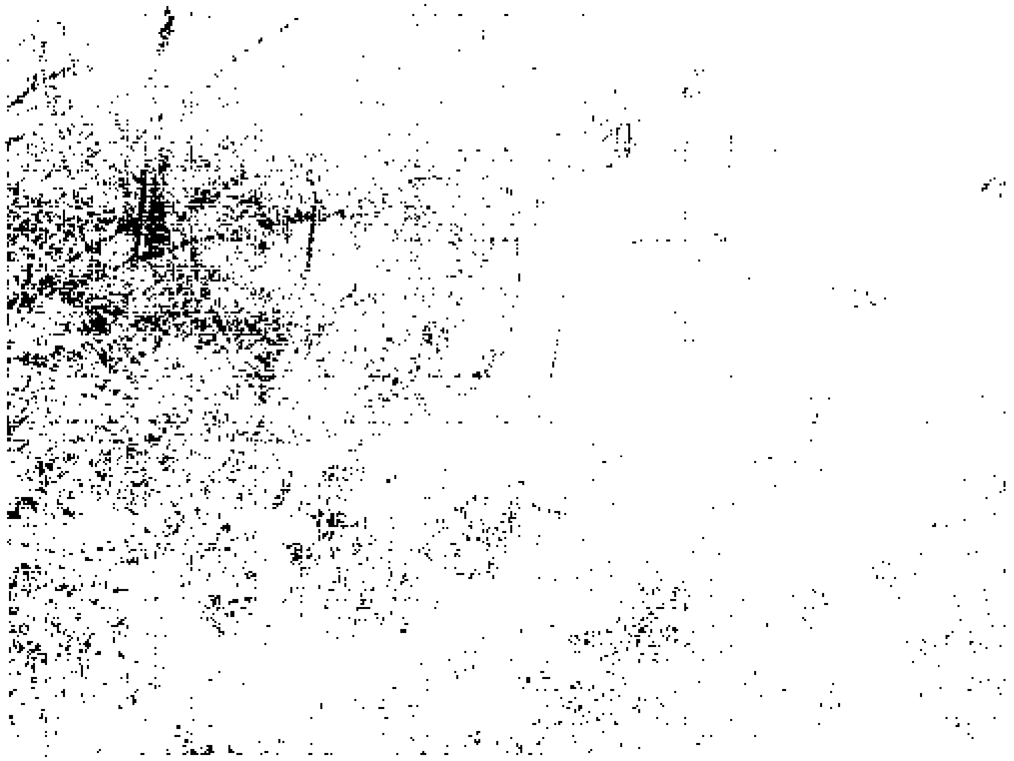


Photo 7. Upstream slope and right groin area of primary dam with excessive and undesirable vegetation.

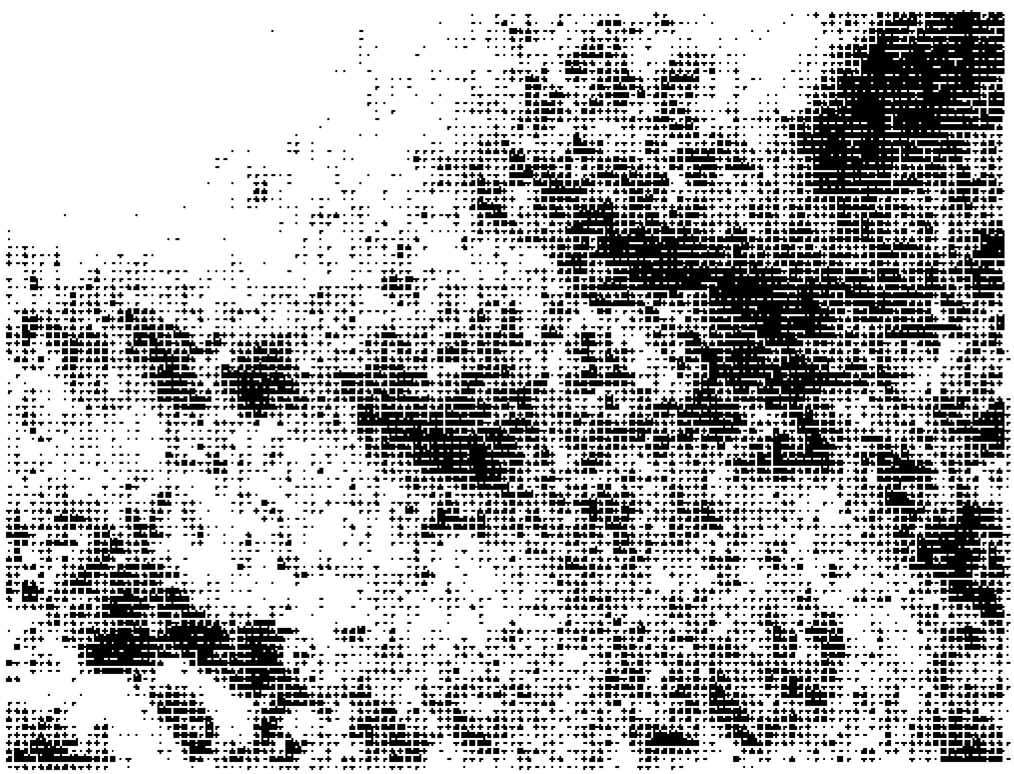


Photo 8. Upstream slope of primary dam, looking right, with excessive and undesirable vegetation.

Photo 9. Upstream left groin of primary dam with some recently cut woody vegetation and some remaining at left of photo.

Photo 10. Upstream slope of secondary dam with recently cut tree at left and significant vegetation growing through riprap.

Photo 11. Upstream right groin of secondary dam with significantly overgrown vegetation growing through riprap.

Photo 12. Upstream left groin of secondary dam with significantly overgrown vegetation.

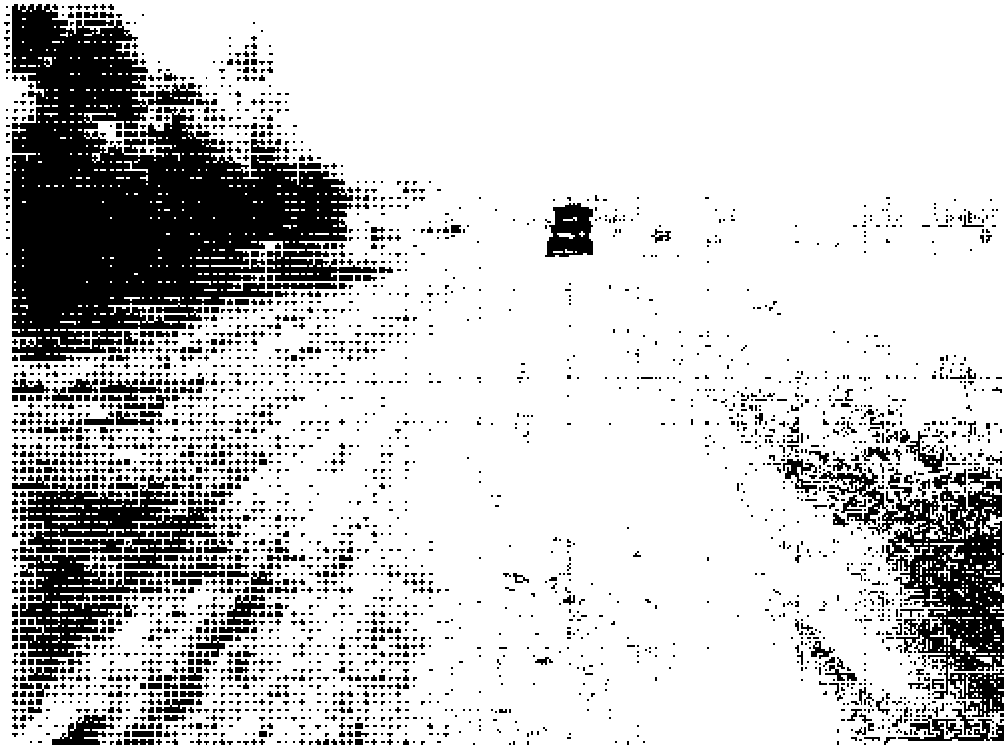


Photo 13. Crest of primary dam from near right abutment, looking left, with minor rutting and ponded water.

Photo 14. Crest of secondary dam from near left abutment, looking right, with minor rutting and ponded water.

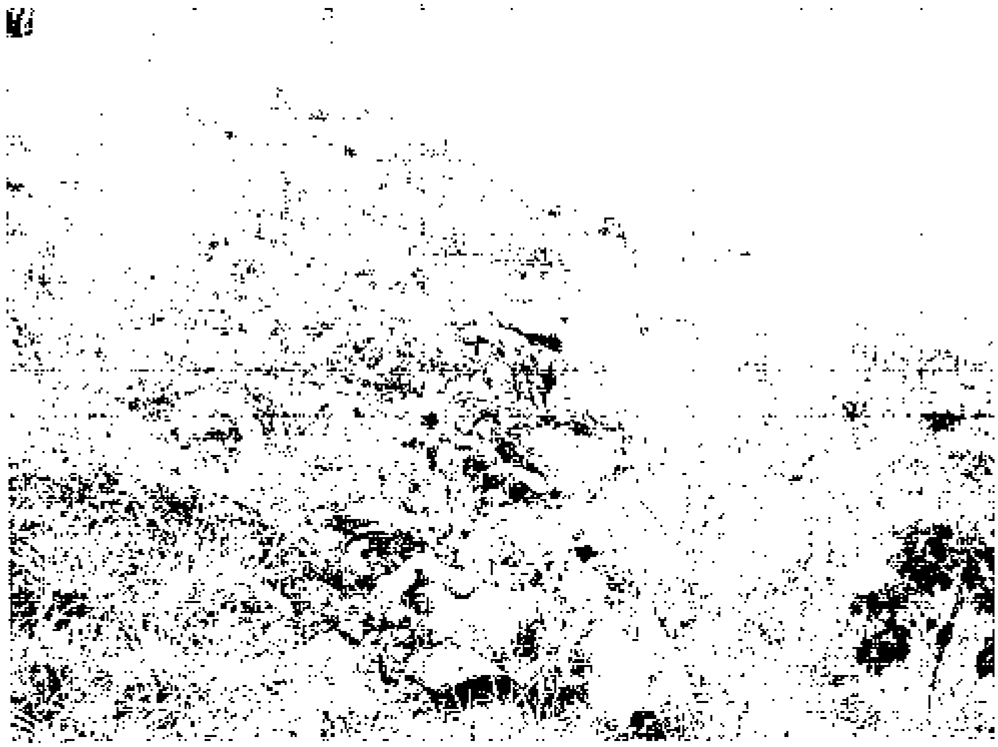


Photo 15. Downstream right groin at primary dam in fair condition with a minor amount of overgrown vegetation growing through the riprap.

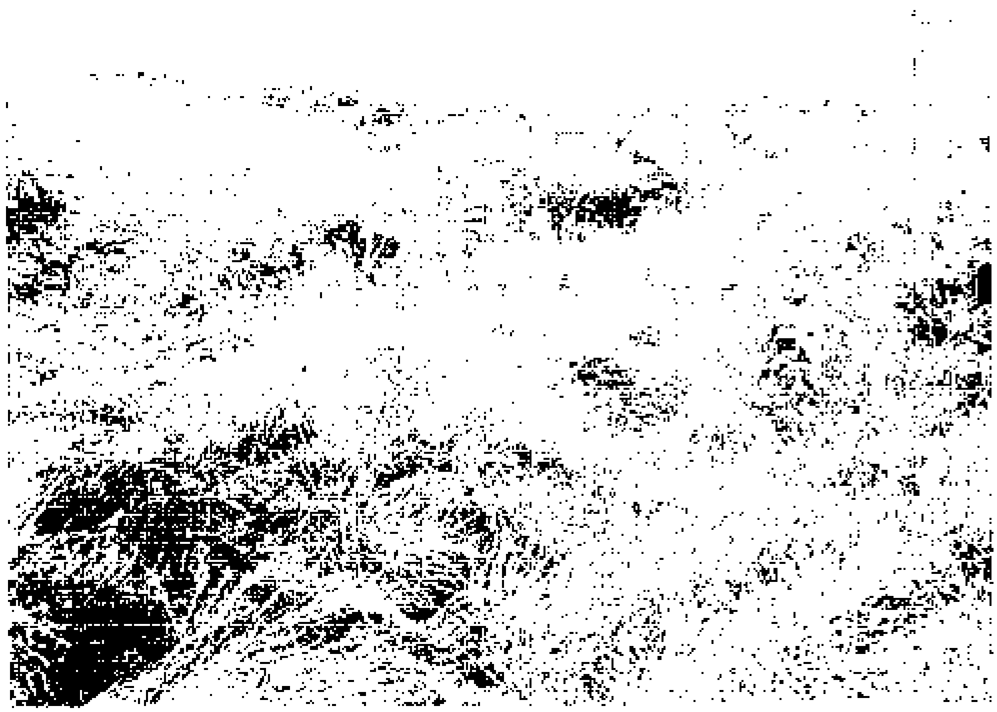


Photo 16. Downstream left groin of the primary dam with significantly to excessively overgrown vegetation growing through the riprap.

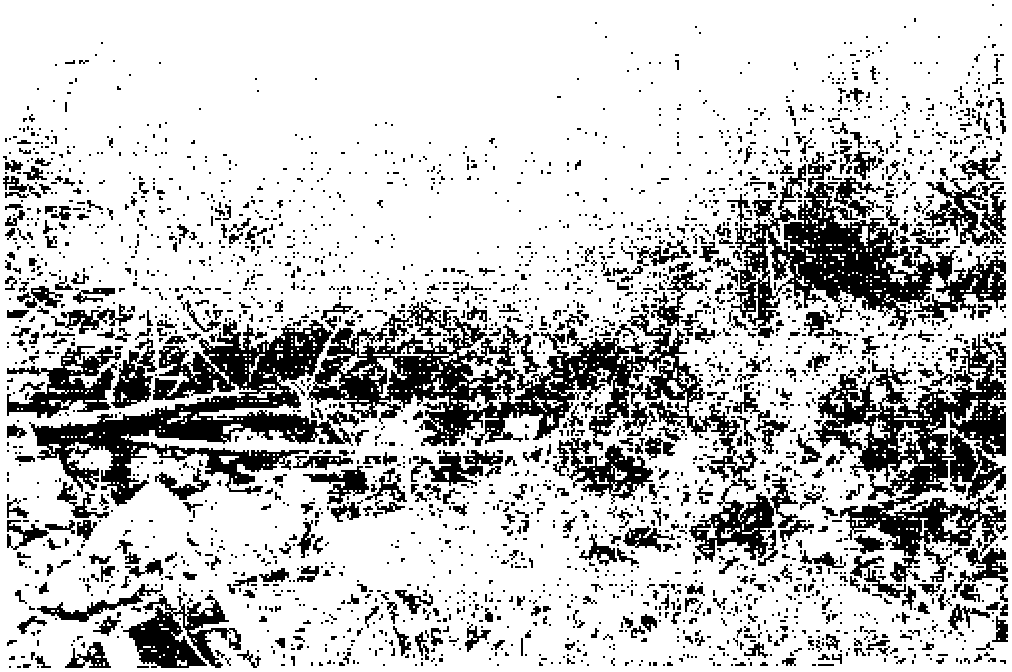


Photo 17. Downstream left groin of the primary dam, looking upstream, with significantly to excessively overgrown vegetation

Photo 18. Overview of downstream slope of primary dam in fair condition.

Photo 19. Downstream slope of primary dam with significantly overgrown vegetation and recently cut tree in foreground.

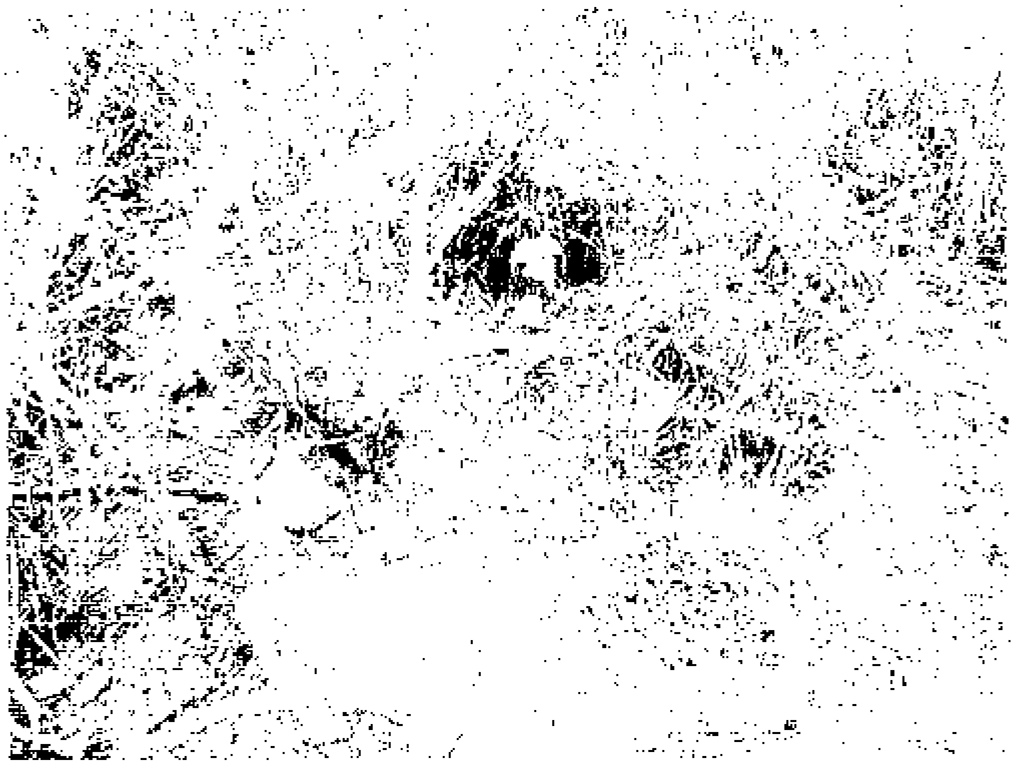


Photo 20. One group of animal burrows was observed at the downstream left groin of the primary dam.

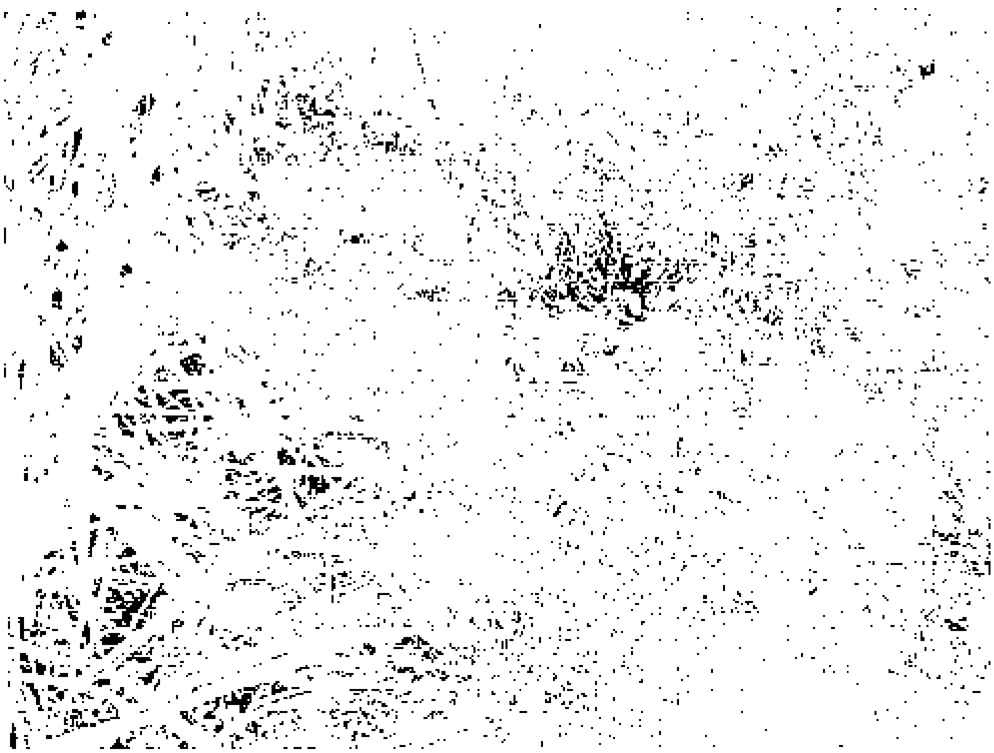


Photo 21. An active in-ground beehive was observed on the downstream slope of the primary ash pond dam.

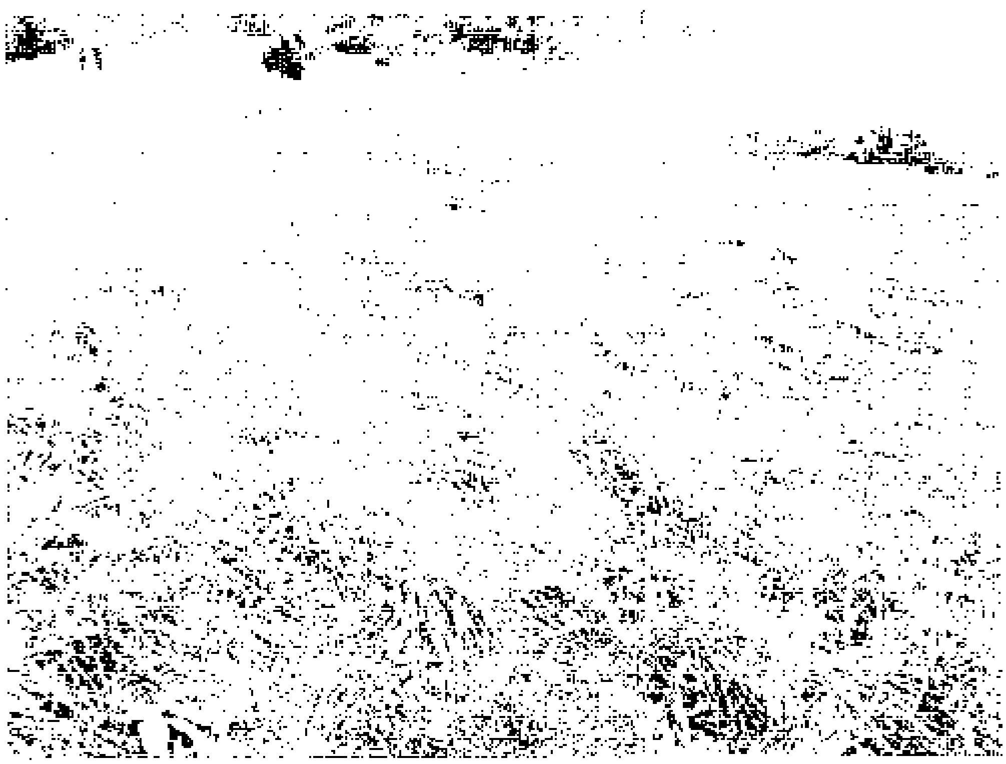


Photo 22. Downstream right groin at secondary dam with significantly overgrown vegetation.

Photo 23. Downstream slope of secondary ash pond dam, looking right, with recently cut tree in foreground and some significantly overgrown vegetation.

Photo 24. Downstream slope of secondary dam, looking left, with one large tree remaining and significantly high vegetation growing through the riprap.

Photo 25. Downstream left groin at secondary dam with significantly overgrown vegetation preventing a thorough inspection.

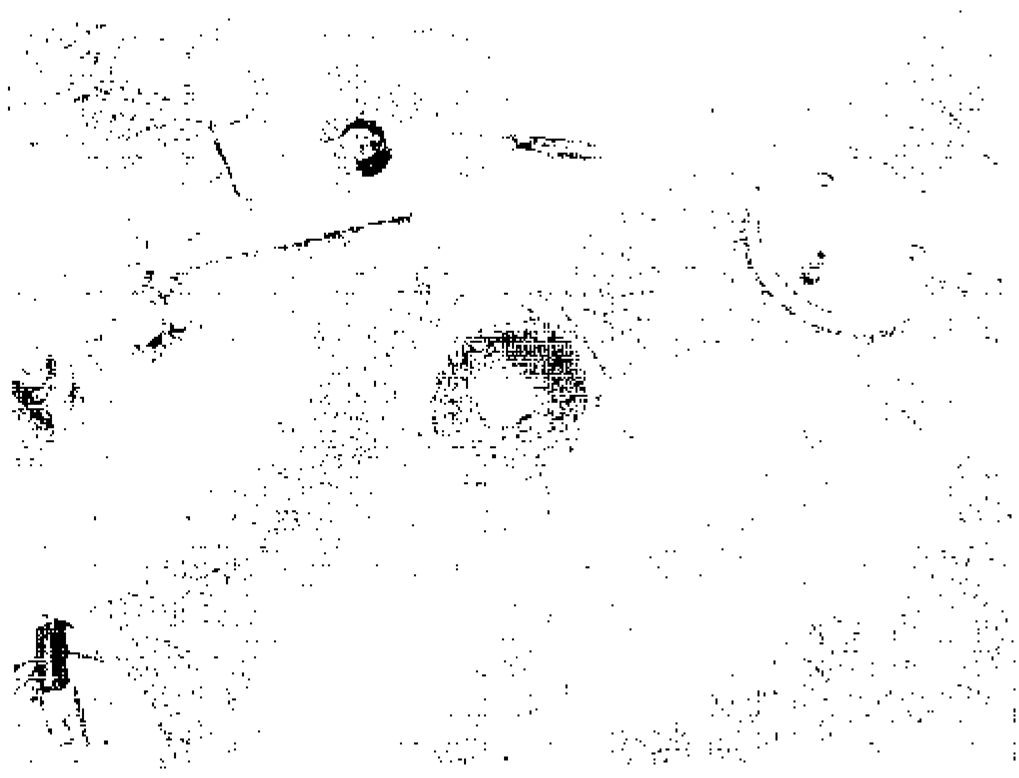


Photo 26. The piezometer at the crest of the secondary dam was buried under a few inches of soil, dug out, and read.

APPENDIX II

Arkansas Dam Inspection and Maintenance Checklist

NAME OF DAM: First Ck. Primary Bottom Ash Pond **INSPECTED BY:** WRS **INSPECTION DATE:** 9/16/2009

EMBANKMENT

1 of 2

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK (✓) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
CREST	1	SURFACE CRACKING	None observed -- OK	✓		
	2	CAVE IN, ANIMAL BURROW	Repaired shortly after inspection, per plant	✓		
	3	LOW AREA(S)	None observed -- OK	✓		
	4	HORIZONTAL ALIGNMENT	OK	✓		
	5	RUTS AND/OR PUDDLES	Repaired shortly after inspection, per plant	✓		
	6	VEGETATION CONDITION	Good	✓		
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP	None observed -- OK	✓		
	10	SLOPE PROTECTION	Continue control of vegetation growing through riprap	✓		
	11	SINKHOLE, ANIMAL BURROW	None observed -- OK	✓		
	12	EMB.-ABUT. CONTACT	Vegetation cleared shortly after inspection, per plant	✓		
	13	EROSION	None observed -- OK	✓		
	14	VEGETATION CONDITION	Fair to poor but excess controlled after inspection, per plant	✓		
	15					
	16					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond INSPECTED BY: WRS INSPECTION DATE: 3/16/2009

EMBANKMENT

AREA INSPECTED	ITEM NO.		OBSERVATIONS	CHECK (✓) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)	None observed -- OK	✓		
	18	SEEPAGE	None observed -- OK	✓		
	19	SLIDE, SLOUGH, SCARP	None observed -- OK	✓		
	20	EMB.-ABUT. CONTACT	Vegetation cleared shortly after inspection, per plant	✓		
	21	CAVE IN, ANIMAL BURROW	Burrows repaired shortly after inspection, per plant; No cave-ins observed	✓		
	22	EROSION	None observed -- OK	✓		
	23	UNUSUAL MOVEMENT	None observed -- OK	✓		
	24	VEGETATION CONTROL	Fair but excess controlled after inspection, per plant	✓		
	25					
	26					
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS	Fair	✓		
	28	STAFF GAUGE AND RECORDER	N/A			
	29	WEIRS	N/A			
	30	SURVEY MONUMENTS	N/A			
	31	DRAINS	N/A			
	32	FREQUENCY OF READINGS	Quarterly readings recommended	✓		
	33	LOCATION OF RECORDS	Forward copy to AEP Civil Engineering	✓		
	34					
	35					

ADDITIONAL COMMENTS: **REFER TO ITEM NO. IF APPLICABLE.**

N/A -- Not Applicable

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond **INSPECTED BY:** WRS **INSPECTION DATE:** 9/16/2009

SPILLWAYS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK (✓) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
ERODIBLE CHANNEL	51	SLIDE, SLOUGH, SCARP	None observed -- OK	✓		
	52	EROSION	None observed -- OK	✓		
	53	VEGETATION CONDITION	Vegetation cleared shortly after inspection, per plant	✓		
	54	DEBRIS	Debris cleared shortly after inspection, per plant	✓		
	55					
	56					
NON-ERODIBLE PRINCIPAL CHANNEL N/A	57	SIDEWALLS	N/A			
	58	CHANNEL FLOOR	N/A			
	59	UNUSUAL MOVEMENT	N/A			
	60	APPROACH AREA	N/A			
	61	WEIR OR CONTROL	N/A			
	62	DISCHARGE AREA	N/A			
	63					
	64					
DROP INLET	65	INTAKE STRUCTURE	Vegetation and debris cleared shortly after inspection, per plant	✓		
	66	TRASHRACK	N/A			
	67	STILLING BASIN	N/A			
	68					
	69					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.
N/A -- Not Applicable

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond **INSPECTED BY:** WRS **INSPECTION DATE:** 9/15/2006

OUTLET WORKS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK (✓) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE	Debris cleared shortly after inspection per plant	✓		
	71	TRASHRACK	Debris cleared shortly after inspection. per plant	✓		
	72	STILLING BASIN	N/A			
	73	PRIMARY CLOSURE	N/A			
	74	SECONDARY CLOSURE	N/A			
	75	CONTROL MECHANISM	N/A			
	76	OUTLET PIPE	Submerged by design, not inspected	✓		
	77	OUTLET TOWER	N/A			
	78	EROSION ALONG DAM TOE	None observed -- OK	✓		
	79	SEEPAGE	None observed -- OK	✓		
	80	UNUSUAL MOVEMENT	None observed -- OK	✓		
	81					
	82					
	83					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.
N/A - Not Applicable

NAME OF DAM: Flint Ck. Secondary Bottom Ash Pond **INSPECTED BY:** WRS **INSPECTION DATE:** 9/16/2009

EMBANKMENT

1 of 2

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK (✓) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
CREST	1	SURFACE CRACKING	None observed -- OK	✓		
	2	CAVE IN, ANIMAL BURROW	None observed -- OK	✓		
	3	LOW AREA(S)	None observed -- OK	✓		
	4	HORIZONTAL ALIGNMENT	OK	✓		
	5	RUTS AND/OR PUDDLES	Repaired shortly after inspection, per plant	✓		
	6	VEGETATION CONDITION	Good	✓		
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP	None observed -- OK	✓		
	10	SLOPE PROTECTION	Continue control of vegetation growing through riprap	✓		
	11	SINKHOLE, ANIMAL BURROW	None observed -- OK	✓		
	12	EMB.-ABUT. CONTACT	Vegetation cleared shortly after inspection, per plant	✓		
	13	EROSION	None observed -- OK	✓		
	14	VEGETATION CONDITION	Fair but excess controlled after inspection, per plant	✓		
	15					
	16					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Secondary Bottom Ash Pond INSPECTED BY: WRS INSPECTION DATE: 9/16/2009

EMBANKMENT

AREA INSPECTED	ITEM NO.		OBSERVATIONS	CHECK (✓) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)	None observed -- OK	✓		
	18	SEEPAGE	None observed -- OK	✓		
	19	SLIDE, SLOUGH, SCARP	None observed -- OK	✓		
	20	EMB.-ABUT. CONTACT	Vegetation cleared shortly after inspection, per plant	✓		
	21	CAVE IN, ANIMAL BURROW	None observed -- OK	✓		
	22	EROSION	None observed -- OK	✓		
	23	UNUSUAL MOVEMENT	None observed -- OK	✓		
	24	VEGETATION CONTROL	Fair but excess controlled after inspection, per plant	✓		
	25					
	26					
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS	Fair; damaged piezo. was repaired after inspection, per plant	✓		
	28	STAFF GAUGE AND RECORDER	Not observed	✓		
	29	WEIRS	Vegetation cleared shortly after inspection, per plant	✓		
	30	SURVEY MONUMENTS	N/A			
	31	DRAINS	N/A			
	32	FREQUENCY OF READINGS	Quarterly readings recommended	✓		
	33	LOCATION OF RECORDS	Forward copy to AEP Civil Engineering	✓		
	34					
	35					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.
N/A -- Not Applicable

NAME OF DAM: Flint Cr. Secondary Bottom Ash Pond **INSPECTED BY:** WRS **INSPECTION DATE:** 9/15/2009

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
		SPILLWAYS 1 of 1		CHECK (✓) ACTION NEEDED		
ERODIBLE CHANNEL	51	SLIDE, SLOUGH, SCARP	None observed -- OK	✓		
	52	EROSION	None observed -- OK	✓		
	53	VEGETATION CONDITION	Vegetation cleared shortly after inspection, per plant	✓		
	54	DEBRIS	Debris cleared shortly after inspection, per plant	✓		
	55					
	56					
NON-ERODIBLE PRINCIPAL CHANNEL N/A	57	SIDEWALLS	N/A			
	58	CHANNEL FLOOR	N/A			
	59	UNUSUAL MOVEMENT	N/A			
	60	APPROACH AREA	N/A			
	61	WEIR OR CONTROL	N/A			
	62	DISCHARGE AREA	N/A			
	63					
	64					
DROP INLET N/A	65	INTAKE STRUCTURE	N/A			
	66	TRASHRACK	N/A			
	67	STILLING BASIN	N/A			
	68					
	69					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.
N/A -- Not Applicable

NAME OF DAM: First Ck. Secondary Bottom Ash Pond **INSPECTED BY:** WRS **INSPECTION DATE:** 9/16/2009

OUTLET WORKS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE	Debris cleared shortly after inspection per plant	✔		
	71	TRASHRACK	OK	✔		
	72	STILLING BASIN	N/A			
	73	PRIMARY CLOSURE	N/A			
	74	SECONDARY CLOSURE	N/A			
	75	CONTROL MECHANISM	N/A			
	76	OUTLET PIPE	N/A			
	77	OUTLET TOWER	N/A			
	78	EROSION ALONG DAM TOE	None observed -- OK	✔		
	79	SEEPAGE	None observed -- OK	✔		
	80	UNUSUAL MOVEMENT	None observed -- OK	✔		
	81					
	82					
	83					

CHECK (✔) ACTION NEEDED

ADDITIONAL COMMENTS: **REFER TO ITEM NO. IF APPLICABLE.**

N/A -- Not Applicable

AEPFC000243

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond INSPECTED BY: INSPECTION DATE:

EMBANKMENT

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
CREST	1	SURFACE CRACKING				
	2	CAVE IN, ANIMAL BURROW				
	3	LOW AREA(S)				
	4	HORIZONTAL ALIGNMENT				
	5	RUTS AND/OR PUDDLES				
	6	VEGETATION CONDITION				
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP				
	10	SLOPE PROTECTION				
	11	SINKHOLE, ANIMAL BURROW				
	12	EMB.-ABUT. CONTACT				
	13	EROSION				
	14	VEGETATION CONDITION				
	15					
	16					

ADDITIONAL COMMENTS: **REFER TO ITEM NO. IF APPLICABLE.**

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond INSPECTED BY: INSPECTION DATE:

EMBANKMENT

2 of 2

AREA INSPECTED	ITEM NO.		OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)				
	18	SEEPAGE				
	19	SLIDE, SLOUGH, SCARP				
	20	EMB.-ABUT. CONTACT				
	21	CAVE IN, ANIMAL BURROW				
	22	EROSION				
	23	UNUSUAL MOVEMENT				
	24	VEGETATION CONTROL				
	25					
	26					
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS				
	28	STAFF GAUGE AND RECORDER				
	29	WEIRS				
	30	SURVEY MONUMENTS				
	31	DRAINS				
	32	FREQUENCY OF READINGS				
	33	LOCATION OF RECORDS				
	34					
	35					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond INSPECTED BY: INSPECTION DATE:

SPILLWAYS

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
ERODIBLE CHANNEL N/A	51	SLIDE, SLOUGH, SCARP				
	52	EROSION				
	53	VEGETATION CONDITION				
	54	DEBRIS				
	55					
	56					
NON-ERODIBLE PRINCIPAL CHANNEL	57	SIDEWALLS				
	58	CHANNEL FLOOR				
	59	UNUSUAL MOVEMENT				
	60	APPROACH AREA				
	61	WEIR OR CONTROL				
	62	DISCHARGE AREA				
	63					
	64					
DROP INLET N/A	65	INTAKE STRUCTURE				
	66	TRASHRACK				
	67	STILLING BASIN				
	68					
	69					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond INSPECTED BY: INSPECTION DATE:

OUTLET WORKS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE				
	71	TRASHRACK				
	72	STILLING BASIN				
	73	PRIMARY CLOSURE				
	74	SECONDARY CLOSURE				
	75	CONTROL MECHANISM				
	76	OUTLET PIPE				
	77	OUTLET TOWER				
	78	EROSION ALONG DAM TOE				
	79	SEEPAGE				
	80	UNUSUAL MOVEMENT				
	81					
	82					
	83					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Secondary Bottom Ash Pond INSPECTED BY: INSPECTION DATE:

EMBANKMENT

1 of 2

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
CREST	1	SURFACE CRACKING				
	2	CAVE IN, ANIMAL BURROW				
	3	LOW AREA(S)				
	4	HORIZONTAL ALIGNMENT				
	5	RUTS AND/OR PUDDLES				
	6	VEGETATION CONDITION				
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP				
	10	SLOPE PROTECTION				
	11	SINKHOLE, ANIMAL BURROW				
	12	EMB.-ABUT. CONTACT				
	13	EROSION				
	14	VEGETATION CONDITION				
	15					
	16					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Secondary Bottom Ash Pond **INSPECTED BY:** **INSPECTION DATE:**

EMBANKMENT

2 of 2

AREA INSPECTED	ITEM NO.		OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)				
	18	SEEPAGE				
	19	SLIDE, SLOUGH, SCARP				
	20	EMB.-ABUT. CONTACT				
	21	CAVE IN, ANIMAL BURROW				
	22	EROSION				
	23	UNUSUAL MOVEMENT				
	24	VEGETATION CONTROL				
	25					
	26					
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS				
	28	STAFF GAUGE AND RECORDER				
	29	WEIRS				
	30	SURVEY MONUMENTS				
	31	DRAINS				
	32	FREQUENCY OF READINGS				
	33	LOCATION OF RECORDS				
	34					
	35					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Secondary Bottom Ash Pond INSPECTED BY: INSPECTION DATE:

SPILLWAYS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
ERODIBLE CHANNEL N/A	51	SLIDE, SLOUGH, SCARP				
	52	EROSION				
	53	VEGETATION CONDITION				
	54	DEBRIS				
	55					
	56					
NON-ERODIBLE PRINCIPAL CHANNEL	57	SIDEWALLS				
	58	CHANNEL FLOOR				
	59	UNUSUAL MOVEMENT				
	60	APPROACH AREA				
	61	WEIR OR CONTROL				
	62	DISCHARGE AREA				
	63					
	64					
DROP INLET N/A	65	INTAKE STRUCTURE				
	66	TRASHRACK				
	67	STILLING BASIN				
	68					
	69					

CHECK ( ) ACTION NEEDED: MONITOR / INVESTIGATE / REPAIR

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Secondary Bottom Ash Pond INSPECTED BY: INSPECTION DATE:

OUTLET WORKS

1 of 1

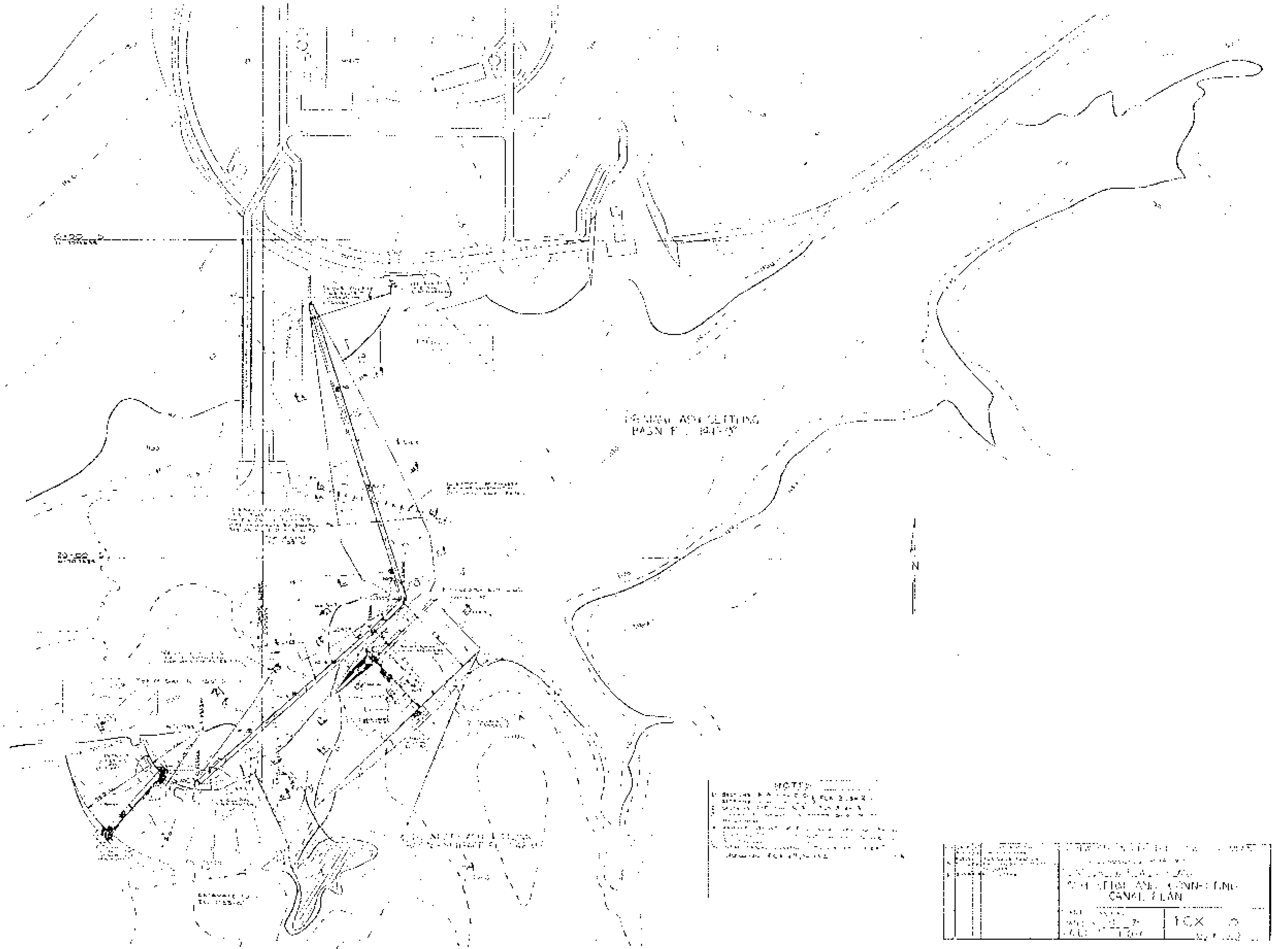
AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE				
	71	TRASHRACK				
	72	STILLING BASIN				
	73	PRIMARY CLOSURE				
	74	SECONDARY CLOSURE				
	75	CONTROL MECHANISM				
	76	OUTLET PIPE				
	77	OUTLET TOWER				
	78	EROSION ALONG DAM TOE				
	79	SEEPAGE				
	80	UNUSUAL MOVEMENT				
	81					
	82					
	83					

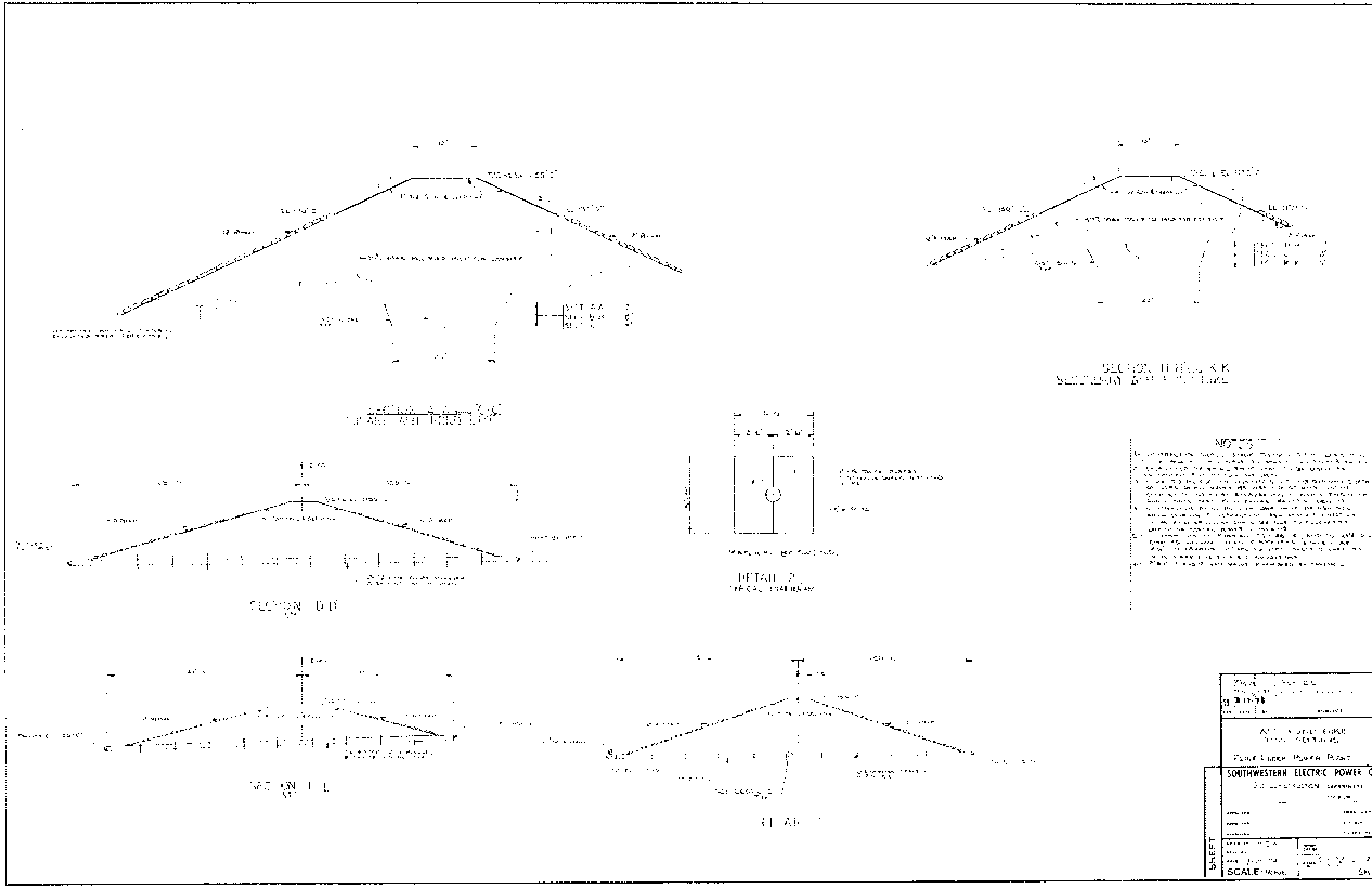
ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

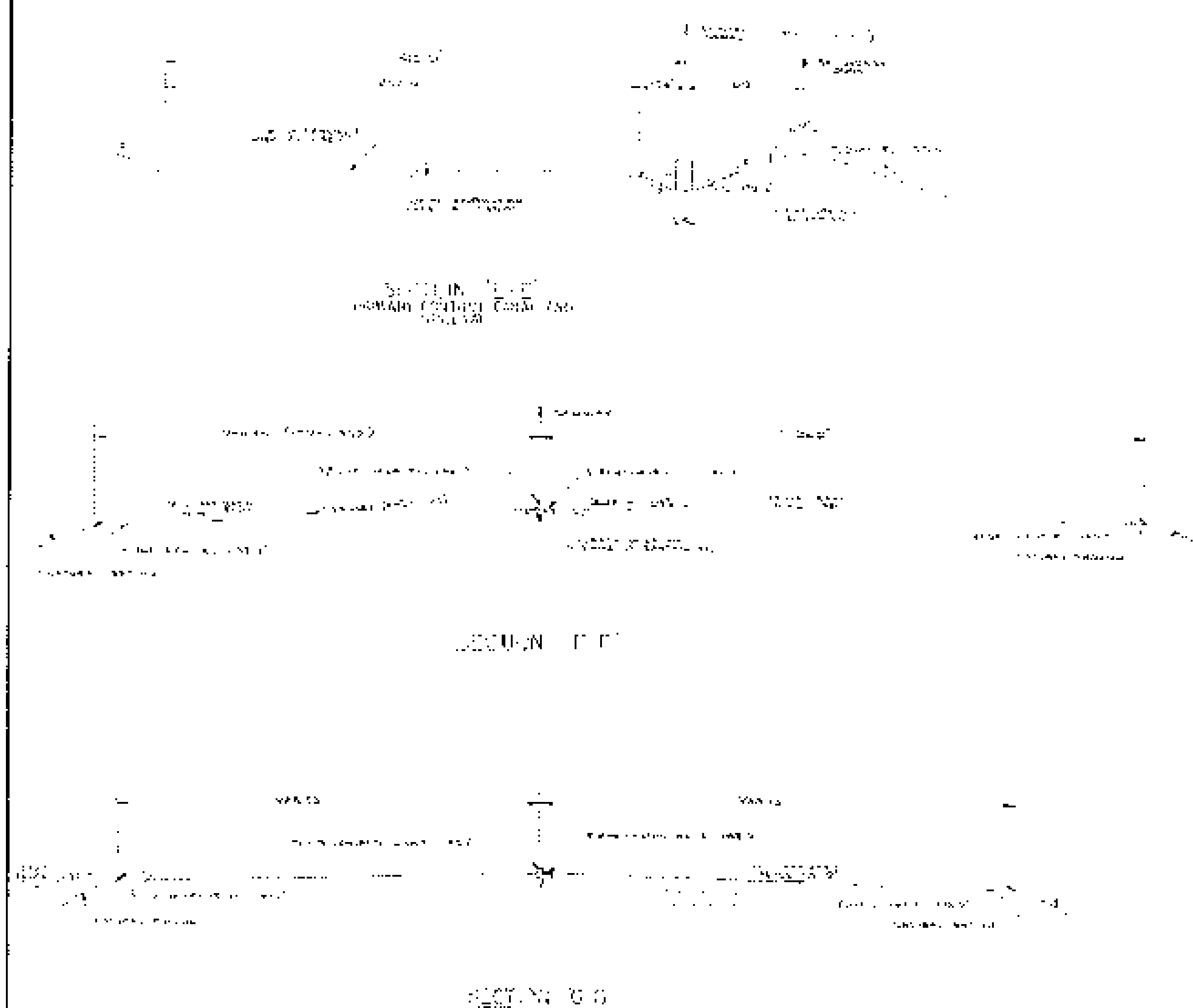
AEPFC000251

APPENDIX III

Design Drawings


NOTES
N
CANAL PLAN


SOUTHWESTERN ELECTRIC POWER CO
SHEET
SCALE



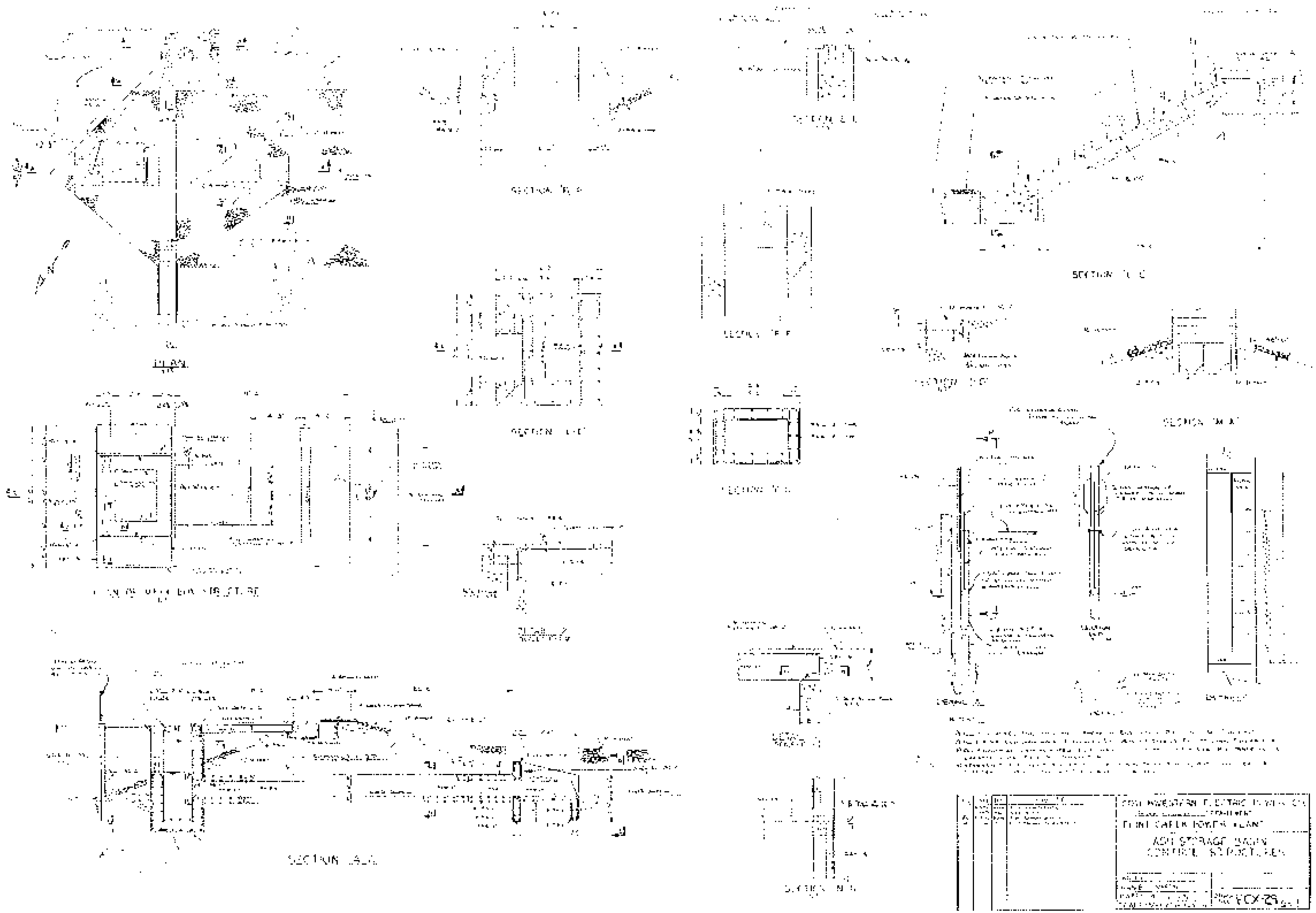
ASH POND SPILLWAY SECTIONS

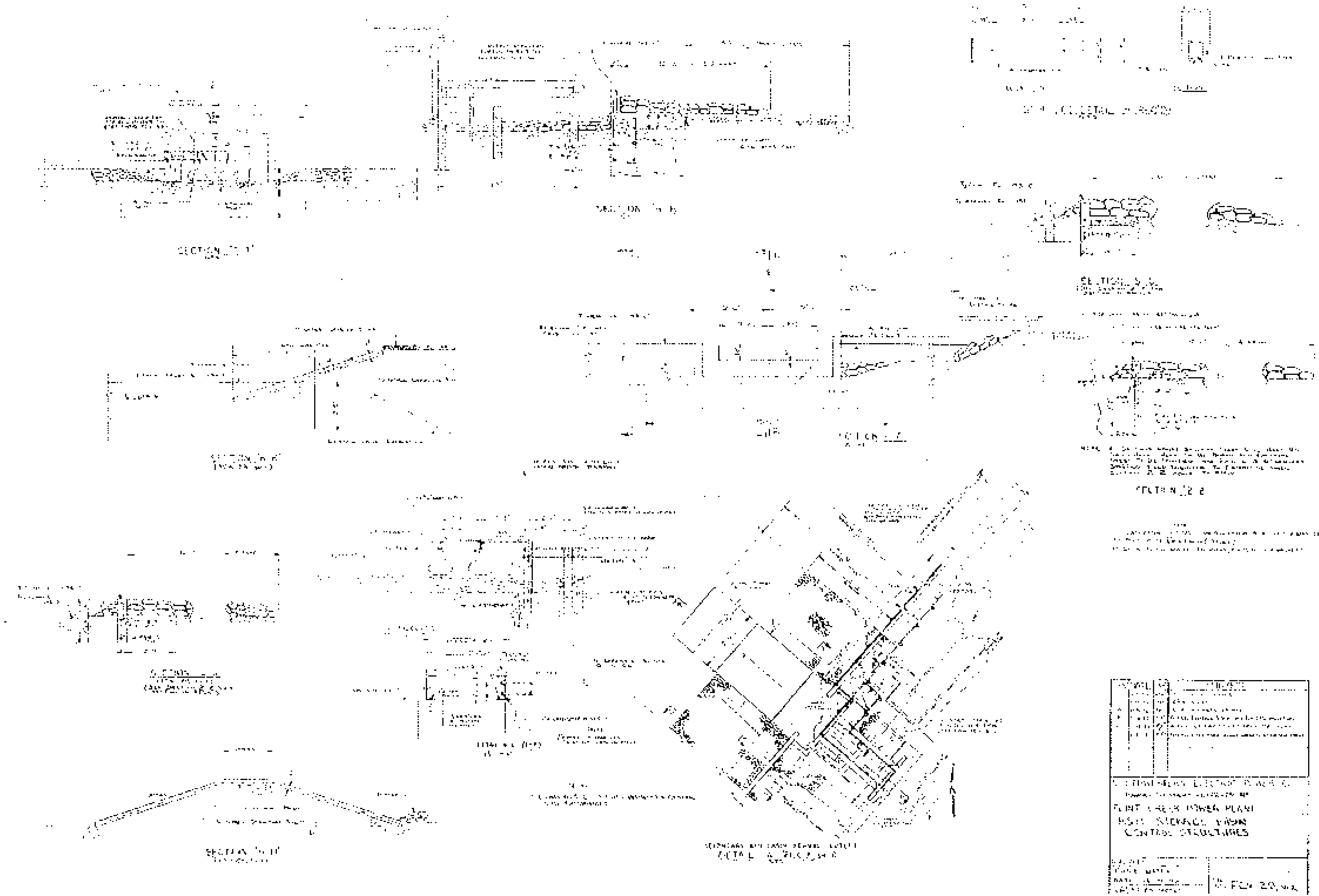
FLINT CREEK POWER PLANT

SOUTHWESTERN ELECTRIC POWER CO

SHEET

SCALE:


SECTION
PLAN
FLINT CREEK POWER PLANT
ASH STORAGE BASIN
CONTROL STRUCTURES
FCX-29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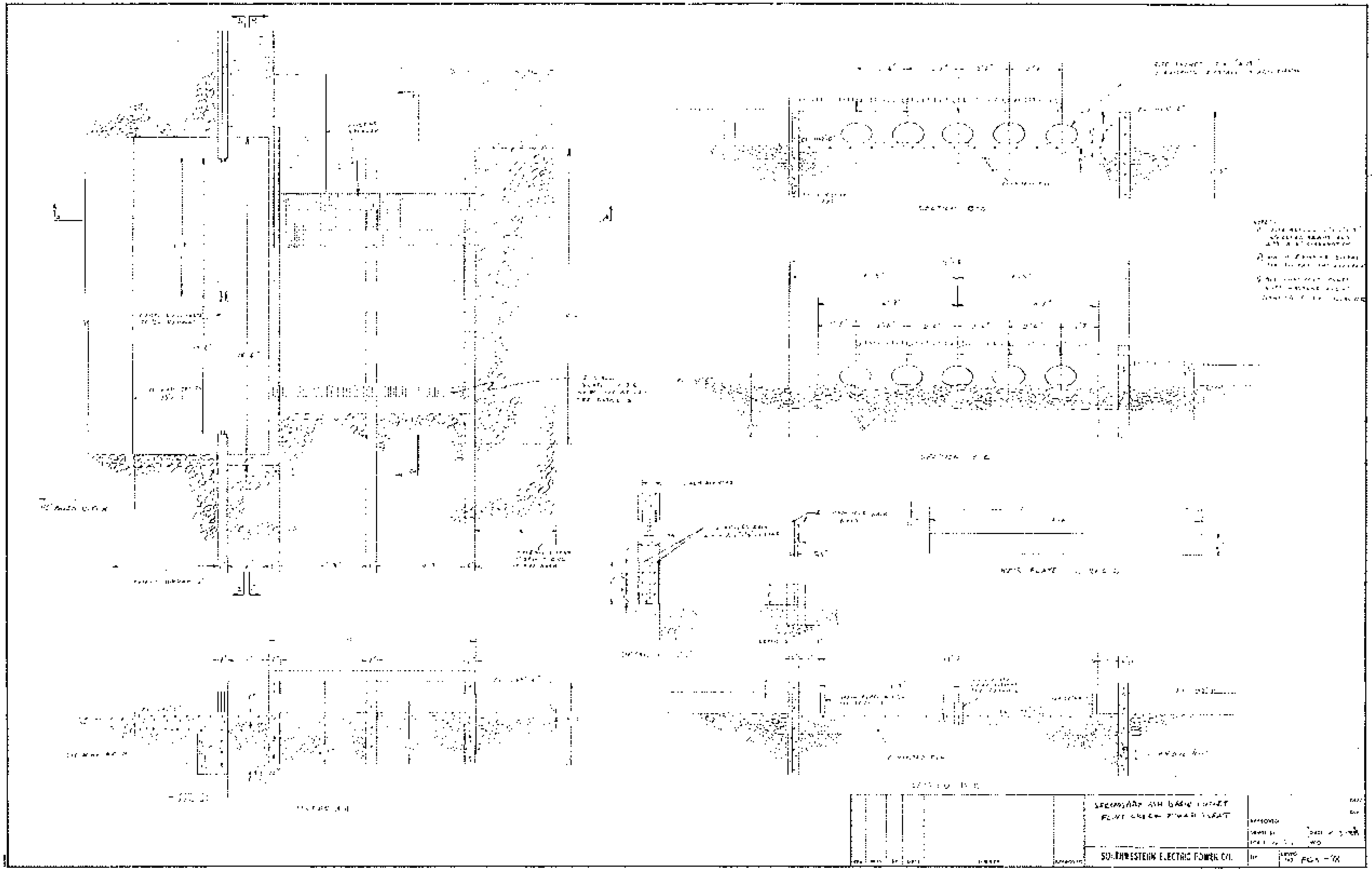
CONTROL STRUCTURES



AEPFC000258

APPENDIX IV

Guidelines for Herbicide Use on Earthen Dams

RECOMMENDATIONS ON HERBICIDE USE TO CONTROL VEGETATION ON EARTHEN DAMS

HERBICIDE APPLICATION RECOMMENDATIONS

Wind direction and speed should be monitored during application of the herbicides to minimize drift into areas of concern. Drift of herbicides into non-target areas is also dependent on the evaporation rate of the pesticide; therefore, avoid application of the herbicides during the hottest part of the day, when evaporation is highest. It is recommended that the largest droplet size consistent with adequate coverage of the herbicide be used to further reduce drift. Higher spray volumes typically reduce drift as well. The application of herbicides on the earthen dams should be delayed if rainfall is expected within 24 hours to further reduce the runoff of herbicides into the adjacent water bodies. The herbicides should be mixed and loaded into the spray units far enough away from the dam locations to ensure that potential spills won't enter the aquatic systems. When feasible, utilize individual plant treatments. The treatment of individual plants would reduce the volume of herbicide required in the control of dam vegetation which could result in lower costs associated with the vegetation management plan. In addition, adverse impacts to beneficial non-target plant species and aquatic species would be minimized due to the avoidance of exposure and the lower potential for drift and runoff. Once an earthen dam has been treated with herbicide, establish a maintenance plan to reduce the potential for future large scale herbicide applications. The establishment of a mowing and trimming schedule could be beneficial to the establishment of native grasses, forbs, and wildflowers on the earthen dams. The promotion of grasses through these methods would reduce the invasion of woody vegetation and reduce the need for additional herbicide applications. Should the use of herbicides be required in the future, applications should be made during the early successional stages so that individual plant treatments would be economically and logistically feasible.

THREATENED AND ENDANGERED SPECIES CONCERNS

According to the *Federal Insecticide, Fungicide, and Rodenticide Act*, the use of herbicides must comply with the Endangered Species Act. Although the measures proposed herein should minimize adverse impacts to fish and wildlife resources in general, special precautions should be taken to ensure that adverse impacts to rare, threatened, and endangered species are avoided.

BRUSH CONTROL HERBICIDES FOR USE ON DAMS (EXCEPT AS NOTED)

The following list of herbicides contains chemicals and formulations known to be effective in the control of vegetation typically found growing on open and previously disturbed habitats, similar to the vegetation associations expected to be growing on dams. These herbicides are also known to have low toxicity to terrestrial and aquatic organisms and are not known to leach into ground and surface waters. The implementation of the recommendations herein, during the application of the following herbicides in a manner consistent with the herbicide's label, should minimize adverse impacts to fish and wildlife resources on and around the dam. The following list of herbicides is certainly not all-inclusive as new herbicides are consistently being introduced.

2,4-D (American Brand 2,4-D, DMA 4 IVM, Weedar 64)

2,4-D (2,4-Dichlorophenoxyacetic acid) was introduced in 1946 and is the most widely used herbicide in the world. Many different manufacturers produce 2,4-D and the list of formulations above are included only to provide examples. 2,4-D is a selective herbicide that is used to control broadleaf herbaceous plants. The salt formulations of 2,4-D are relatively non-toxic to fish and wildlife species. However, the ester formulations of 2,4-D are toxic to fish. Therefore, avoid the use of the ester formulations of 2,4-D in the control of vegetation on dams. The 2,4-D salt formulations are used to control box elder (*Acer negundo*), willow (*Salix spp.*), thistle (*Cirsium* spp.), morning glory (*Ipomoea* spp.), poison ivy (*Toxicodendron radicans*), wild rose (*Rosa* spp.), Virginia creeper (*Parthenocissus quinquefolia*), ragweed (*Ambrosia* spp.), cocklebur (*Xanthium* spp.), Russian thistle (*Salsola kali*), and sunflower (*Helianthus* spp.).

Glyphosate (Accord, Aquamaster, Glypro, Pondmaster, Rodeo)

Glyphosate is a broad-spectrum, nonselective, systemic herbicide used to control grasses, broadleaf weeds, and woody plants. Because glyphosate is a broad-spectrum herbicide, care should be taken during applications to minimize adverse impacts to grasses and native vegetation important for erosion control and stabilization of earthen dams. Glyphosate is used to control dogwood (*Cornus* spp.), maple (*Acer* spp.), oak (*Quercus* spp.), giant reed (*Arundo donax*), salt cedar (*Tamarix* spp.), sweet gum (*Liquidambar styraciflua*), sycamore (*Platanus occidentalis*), willow, cocklebur, sunflower (*Helianthus* spp.), alligatorweed (*Alternanthera philoxeroides*), cattail (*Typha* spp.), blackberry (*Rubus* spp.), kudzu (*Pueraria lobata*), honeysuckle (*Lonicera* spp.), black locust (*Robinia pseudoacacia*), persimmon (*Diospyros spp.*), wild rose, Russian olive (*Elaeagnus angustifolia*), Chinese tallow (*Sapium sebiferum*), wax myrtle (*Morella cerifera*), and sumac (*Rhus* spp.).

Imazapyr (Arsenal, Chopper, Habitat, Stalker)

Imazapyr is a broad-spectrum, nonselective, systemic herbicide used to control annual and perennial grasses, broadleaf herbaceous plants, woody plants, and riparian and aquatic plants. Because imazapyr is a broad-spectrum herbicide, care should be taken during applications to minimize adverse impacts to grasses and native vegetation important for erosion control and stabilization of earthen dams. Imazapyr is used to control giant reed, ragweed, thistle, cocklebur, saltbush (*Atriplex* spp.), greenbriar (*Smilax* spp.), honeysuckle, morning glory, poison ivy, wild rose, kudzu, trumpet creeper (*Campsis radicans*), wild grape (*Vitis* spp.), ash (*Fraxinus* spp.), maple, black locust, box elder, chinaberry (*Melia azedarach*), Chinese tallow, cottonwood (*Populus deltoides*), dogwood, elm (*Ulmus* spp.), hawthorn (*Crataegus spp.*), mulberry (*Morus* spp.), oak, persimmon (*Diospyros* spp.), pine (*Pinus* spp.), privet (*Ligustrum japonicum*), Russian olive, saltcedar, sumac, sweetgum, tree-of-heaven (*Ailanthus altissima*), *Vaccinium* spp., waxmyrtle, willow, and yaupon (*Ilex vomitoria*).

Fosamine Ammonium (Krenite)

Fosamine ammonium is used to control brush along highway rights-of-way, railroad rights-of-way, industrial sites, storage areas, and utility and pipeline rights-of-way. It is used to control woody species such as oak, pine, sumac, sweetgum, Chinese tallow, elm, wild grape, wild rose, sycamore, and tree-of-heaven. It is also used in combination with metsulfuron methyl (Escort XP) to control eastern red cedar (*Juniperus virginiana*), tree-of-heaven, ash, elm, and maple. Fosamine ammonium is also used with imazapyr (Arsenal) to control American beautyberry (*Callicarpa americana*), baccharis (*Baccharis neglecta*), *Vaccinium* spp., waxmyrtle, box elder, black locust, dogwood, elm, maple, sassafras (*Sassafras sassafras*), and willow.

Metsulfuron Methyl (Escort XP)

Escort XP is a selective pre- and postemergence herbicide used to control broadleaf herbaceous and woody species. It has been used to control cocklebur, blackberry (*Rubus* spp.), thistle, sunflower, honeysuckle, wild rose, ash, black locust, cottonwood, eastern red cedar, elm, hackberry (*Celtis* spp.), hawthorn, mulberry, wild grape, oak, Osage orange (*Maclura pomifera*), maple, sweetgum, tree-of-heaven, *Vaccinium* spp., and willow.

Diquat (Reward)

Diquat is a non-selective contact herbicide used to control aquatic and terrestrial vegetation. Although diquat is toxic to aquatic invertebrates, it is acceptable for aquatic use because it quickly binds to soil and suspended sediments in the water. However, care should be taken while applying diquat so that direct contact with water bodies is avoided. In addition, diquat can be toxic to many grass species and other vegetation that may be beneficial in the control of dam erosion. Diquat should be applied to minimize impacts to desired, beneficial vegetation.

BRUSH CONTROL HERBICIDES TO AVOID ON DAMS

The following list of herbicides contains chemicals and formulations known to be effective in the control of upland vegetation in habitats similar to those found on earthen dams. However, because they are known to leach through the soil and accumulate in ground and surface waters or are known to be toxic to aquatic organisms, their use should be avoided in the control of dam vegetation.

Clopyralid (Reclaim, Stinger, and Transline)

Although clopyralid exhibits a low toxicity to terrestrial and aquatic organisms, it is highly mobile in the soils and can contaminate surface and ground water which may be used for irrigation and drinking purposes. Because of the proximity of dams to water, it is recommended that the use of clopyralid be avoided in the control of vegetation on dams.

Clopyralid with 2,4-D or MCPA-EHE (Curtail and Curtail M)

Curtail and Curtail M are herbicide formulations which use clopyralid as an active ingredient. Curtail contains clopyralid with 2,4-D while Curtail M contains clopyralid with MCPA-EHE. Because both formulations contain clopyralid, it is recommended that the use of Curtail and Curtail M be avoided in the control of vegetation on dams.

Glyphosate

Although glyphosate is practically non-toxic to aquatic organisms, certain surfactants added to some terrestrial formulations of glyphosate have been shown to be highly toxic to aquatic species and amphibians. Non-aquatic formulations of glyphosate (Accord SP, Accord XRT, Glyphomax, Glypro Plus, Honcho, Roundup, Touchdown) should be avoided in the control of vegetation on dams. In addition, other formulations containing glyphosate combined with 2,4-D or dicamba (Campaign, Fallowmaster, Landmaster II) should be avoided unless labeled for aquatic use.

Picloram (Tordon 22K, Tordon K)

Although picloram exhibits a low toxicity to terrestrial and aquatic organisms, it is highly mobile in the soils and can contaminate surface and ground water which may be used for irrigation and drinking purposes. Because of the proximity of dams to water, it is recommended that the use of picloram be avoided in the control of vegetation on dams.

Picloram with 2,4-D (Grazon P+D, Pathway, Tordon RTU, Tordon 101)

Because picloram is extremely mobile in the soil profile and is known to leach into surface and ground water, it is recommended that the use of Grazon P+D, Pathway, Tordon RTU, and Tordon 101 be avoided in the control of vegetation on dams.

Triclopyr (Garlon 3A, Garlon 4, Pathfinder II, Remedy)

Although triclopyr exhibits a low toxicity to terrestrial and aquatic organisms, it is highly mobile in the soils and can contaminate surface and ground water which may be used for irrigation and drinking purposes. Because of the proximity of dams to water, it is recommended that the use of triclopyr be avoided in the control of vegetation on dams.

Triclopyr with 2,4-D (Crossbow)

Crossbow is toxic to fish and drift or runoff could adversely impact fish and aquatic plants adjacent to dams. Avoid the use of Crossbow in the control of vegetation on dams.

Triclopyr with Clopyralid (Redeem R&P)

Because triclopyr and clopyralid are extremely mobile in the soil profile and are known to leach into surface and ground water, it is recommended that the use of Redeem R&P be avoided in the control of vegetation on dams.

Permit number. AR0037842

AUTHORIZATION TO DISCHARGE WASTEWATER UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM AND THE ARKANSAS WATER AND AIR POLLUTION CONTROL ACT

In accordance with the provisions of the Arkansas Water and Air Pollution Control Act (Act 472 of 1949, as amended, Ark. Code Ann. 8-4-101 et seq), and the Clean Water Act (33 U.S.C. 1251 et seq.).

American Electric Power
Southwestern Electric Power Company (SWEPCO) -Flint Creek Power Plant
21797 SWEPCO Plant Road
Gentry, AR 72734

is authorized to discharge from a facility located at approximately 3 miles southwest of Gentry, in Sections 4, 5, 8, and 18, Township 18 North, Range 33 West in Benton County, Arkansas.

Latitude: 36° 15' 22"; Longitude: 94° 31' 29"

to receiving waters named.

SWEPCO Reservoir, thence to Little Flint Creek, thence to Flint Creek in Segment 3J of the Arkansas River Basin.

The outfalls are located at the following coordinates:

Outfall 001. Latitude. 36° 14' 00"; Longitude: 94° 33' 02"
Outfall 101: Latitude: 36° 15' 03"; Longitude: 94° 31' 35"
Outfall 401: Latitude: 36° 15' 27"; Longitude: 94° 31' 32"

Discharge shall be in accordance with effluent limitations, monitoring requirements, and other conditions set forth in Parts I, II, III, and IV hereof.

The response to comments is attached to this final permit.

This permit shall become effective on March 1, 2006

This permit and the authorization to discharge shall expire at midnight, February 28, 2011

Signed this 31st day of January 2006

Martin Maner, P.E
Chief, Water Division
Arkansas Department of Environmental Quality

PART I
PERMIT REQUIREMENTS

SECTION A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS: OUTFALL 001 – SWEPCO Reservoir discharge

During the period beginning on effective date and lasting until date of expiration, the permittee is authorized to discharge from outfall serial number 001. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristics	**Discharge Limitations**				**Monitoring Requirements**	
	Mass (lbs/day, unless otherwise specified)		Concentration (mg/l, unless otherwise specified)		Frequency	Sample Type
	Monthly Avg.	Daily Max	Monthly Avg.	Daily Max		
Flow[1]	N/A	N/A	Report	Report	Continuous	Record
pH	N/A	N/A	Minimum 6.0 s.u.	Maximum 9.0 s.u.	Once/week	Grab

1 Report monthly average and daily maximum as MGD. There shall be maintained a daily average flow of at least 2 cfs (1.29 MGD) flow through spillway overflow, seepage, or pumping into Little Flint Creek.

There shall be no discharge of distinctly visible solids, scum or foam of a persistent nature, nor shall there be any formation of slime, bottom deposits or sludge banks. No visible sheen (Sheen means an iridescent appearance on the surface of the water).

Samples taken in compliance with the monitoring requirements specified above shall be taken at the Outfall 001, at the weir located at the property line in Little Flint Creek

PART I
PERMIT REQUIREMENTS

SECTION A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS: OUTFALL 101 – combined wastewater (bottom ash discharge, low volume wastewater, and storm water runoff*, including coal pile runoff, and treated municipal wastewater from the City of Gentry**)

During the period beginning on effective date and lasting until date of expiration, the permittee is authorized to discharge from outfall serial number 101. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristics	**Discharge Limitations**				**Monitoring Requirements**	
	Mass (lbs/day, unless otherwise specified)		Concentration (mg/l, unless otherwise specified)		Frequency	Sample Type
	Monthly Avg.	Daily Max	Monthly Avg.	Daily Max		
Flow[1]	N/A	N/A	Report	Report	Continuous	Record
Total Suspended Solids (TSS)	N/A	N/A	25	43	Once/week	Grab
Oil and Grease (O & G)	N/A	N/A	6	8	Once/2 months	Grab
pH	N/A	N/A	Minimum 6.0 s.u.	Maximum 9.0 s.u.	Once/week	Grab
Chronic Biomonitoring[2]	N/A	N/A	N/A	N/A	once/quarter	24-hr composite
Pimephales promelas (Chronic)[2]			7-Day Average			
Pass/Fail Lethality (7-day NOEC) TLP6C			Report (Pass=0/Fail=1)		once/quarter	24-hr composite
Pass/Fail Growth (7-day NOEC)TGP6C			Report (Pass=0/Fail=1)		once/quarter	24-hr composite
Survival (7-day NOEC) TOP6C			Report %		once/quarter	24-hr composite
Coefficient of Variation TQP6C			Report %		once/quarter	24-hr composite
Growth (7-day NOEC) TPP6C			Report %		once/quarter	24-hr composite
Ceriodaphnia dubia (Chronic)[2]			7-Day Average			
Pass/Fail Lethality (7-day NOEC) TLP3B			Report (Pass=0/Fail=1)		once/quarter	24-hr composite
Pass/Fail Production (7-day NOEC)TGP3B			Report (Pass=0/Fail=1)		once/quarter	24-hr composite
Survival (7-day NOEC) TOP3B			Report %		once/quarter	24-hr composite
Coefficient of Variation TQP3B			Report %		once/quarter	24-hr composite
Reproduction (7-day NOEC) TPP3B			Report %		once/quarter	24-hr composite

* See Condition No. 5 of Part III.

** The City of Gentry discharges treated municipal effluent, subject to the limitations of its NPDES Permit No. AR0020184, into Flint Creek Power Plant's primary ash pond. Flint Creek Power Plant bears no responsibility for the quality of the City of Gentry's effluent or for any treatment of that effluent.

1 Report monthly average and daily maximum as MGD.

2 See Condition No. 4 of Part III (Biomonitoring Requirements).

There shall be no discharge of distinctly visible solids, scum or foam of a persistent nature, nor shall there be any formation of slime, bottom deposits or sludge banks. No visible sheen (Sheen means an iridescent appearance on the surface of the water).

Samples taken in compliance with the monitoring requirements specified above shall be taken at the discharge from the secondary ash pond (final treatment unit).

PART I
PERMIT REQUIREMENTS

SECTION A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS: OUTFALL 401 – once through cooling water

During the period beginning on effective date and lasting until date of expiration, the permittee is authorized to discharge from outfall serial number 401. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristics	Discharge Limitations				Monitoring Requirements	
	Mass (lbs/day, unless otherwise specified)		Concentration (mg/l, unless otherwise specified)		Frequency	Sample Type
	Monthly Avg.	Daily Max	Monthly Avg.	Daily Max		
Flow	N/A	N/A	450 MGD	450 MGD	Continuous	Record*
Total Residual Chlorine(TRC)[1]	N/A	62.6	N/A	0.2 mg/l[2]	Once/week	Grab[3]
Temperature[4]	N/A	N/A	N/A	129.2 °F	Continuous	Record
pH	N/A	N/A	Minimum 6.0 s.u.	Maximum 9.0 s.u.	Once/week	Grab
Chronic Biomonitoring[5]	N/A	N/A	N/A	N/A	once/quarter	24-hr composite
Pimephales promelas (Chronic)[5]			7-Day Average			
Pass/Fail Lethality (7-day NOEC) TLP6C			Report (Pass=0/Fail=1)		once/quarter	24-hr composite
Pass/Fail Growth (7-day NOEC)TGP6C			Report (Pass=0/Fail=1)		once/quarter	24-hr composite
Survival (7-day NOEC) TOP6C			Report %		once/quarter	24-hr composite
Coefficient of Variation TQP6C			Report %		once/quarter	24-hr composite
Growth (7-day NOEC) TPP6C			Report %		once/quarter	24-hr composite
Ceriodaphnia dubia (Chronic)[5]			7-Day Average			
Pass/Fail Lethality (7-day NOEC) TLP3B			Report (Pass=0/Fail=1)		once/quarter	24-hr composite
Pass/Fail Production (7-day NOEC)TGP3B			Report (Pass=0/Fail=1)		once/quarter	24-hr composite
Survival (7-day NOEC) TOP3B			Report %		once/quarter	24-hr composite
Coefficient of Variation TQP3B			Report %		once/quarter	24-hr composite
Reproduction (7-day NOEC) TPP3B			Report %		once/quarter	24-hr composite

* Flow measurements may be calculated using pump records.

1 See Condition No. 7 of Part III. Total Residual Chlorine shall not be discharged from any single generating unit for more than 2 hours per day.
2 Instantaneous Maximum.
3 Sample must be representative of periods of chlorination.
4 Temperature may be measured at the condenser discharge. Daily maximum temperature shall be the highest daily flow-weighted temperature calculated for the month.
5 See Condition No. 4 of Part III (Biomonitoring Requirements).

There shall be no discharge of distinctly visible solids, scum or foam of a persistent nature, nor shall there be any formation of slime, bottom deposits or sludge banks. No visible sheen (Sheen means an iridescent appearance on the surface of the water).

Samples taken in compliance with the monitoring requirements specified above shall be taken at Outfall 401, prior to discharge to SWEPCO Reservoir.

SECTION B. SCHEDULE OF COMPLIANCE

The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

Compliance is required on the effective date of the permit.

The permittee shall comply with the Cooling Water Intake regulations found in Title 40 Code of Federal Regulations Part 125, Subpart J. These regulations include, but are not limited to the following provisions:

a. The permittee shall submit two copies of the Proposal for Information Collection to the NPDES Branch of the Water Division prior to the start of information collection activities, and,
b. The permittee shall submit two copies of the completed Comprehensive Demonstration Study to the NPDES Branch of the Water Division prior to January 7, 2008 (or on or before the federal deadline that the EPA may reestablish for complying with the requirements of 40 CFR 125, Subpart J). The permittee shall meet all other applicable requirements of this regulation.

PART II
STANDARD CONDITIONS

SECTION A – GENERAL CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the federal Clean Water Act and the Arkansas Water and Air Pollution Control Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. **Any values reported in the required Discharge Monitoring Report which are in excess of an effluent limitation specified in Part I shall constitute evidence of violation of such effluent limitation and of this permit.**

2. Penalties for Violations of Permit Conditions

The Arkansas Water and Air Pollution Control Act provides that any person who violates any provisions of a permit issued under the Act shall be guilty of a misdemeanor and upon conviction thereof shall be subject to imprisonment for not more than one (1) year, or a fine of not more than ten thousand dollars ($10,000) or by both such fine and imprisonment for each day of such violation. Any person who violates any provision of a permit issued under the Act may also be subject to civil penalty in such amount as the court shall find appropriate, not to exceed ten thousand dollars ($10,000) for each day of such violation. The fact that any such violation may constitute a misdemeanor shall not be a bar to the maintenance of such civil action.

3. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to the following:

a. Violation of any terms or conditions of this permit; or
b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or
c. A change in any conditions that requires either a temporary or permanent reduction or elimination of the authorized discharge; or
d. A determination that the permitted activity endangers human health or the environment and can only be regulated to acceptable levels by permit modification or termination.
e. Failure of the permittee to comply with the provisions of APCEC Regulation No. 9 (Permit fees) as required by condition II A.10 herein.

The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

4. Toxic Pollutants

Notwithstanding Part II. A.3., if any toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is promulgated under Regulation No. 2, as amended, (regulation establishing water quality standards for surface waters of the State of Arkansas) or Section 307(a) of the Clean Water Act for a toxic pollutant which is present in the discharge and that standard or prohibition is more stringent than any limitations on the pollutant in this permit, this permit shall be modified or revoked and reissued to conform to the toxic effluent standards or prohibition and the permittee so notified.

The permittee shall comply with effluent standards, narrative criteria, or prohibitions established under Regulation No. 2 (Arkansas Water Quality Standards), as amended, or Section 307 (a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

5. Civil and Criminal Liability

Except as provided in permit conditions on “Bypassing” (Part II.B.4.a.), and “Upsets” (Part II.B.5.b), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance. Any false or materially misleading representation or concealment of information required to be reported by the provisions of this permit or applicable state and federal statues or regulations which defeats the regulatory purposes of the permit may subject the permittee to criminal enforcement pursuant to the Arkansas Water and Air Pollution Control Act (Act 472 of 1949, as amended).

6. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Clean Water Act.

7. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Clean Water Act.

8. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

9. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provisions of this permit to any circumstance is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

10. Permit Fees

The permittee shall comply with all applicable permit fee requirements for wastewater discharge permits as described in APCEC Regulation No. 9 (Regulation for the Fee System for Environmental Permits). Failure to promptly remit all required fees shall be grounds for the Director to initiate action to terminate this permit under the provisions of 40 CFR 122.64 and 124.5 (d), as adopted in APCEC Regulation No. 6 and the provisions of APCEC Regulation No. 8.

SECTION B – OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

a. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

b. The permittee shall provide an adequate operating staff which is duly qualified to carryout operation, maintenance and testing functions required to insure compliance with the conditions of this permit.

2. Need to Halt or Reduce not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. Upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power for the treatment facility is reduced, is lost, or alternate power supply fails.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment, or the water receiving the discharge.

4. Bypass of Treatment Facilities

a. **Bypass not exceeding limitation.**

The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Part II.B 4.b.and 4 c.

b. **Notice**

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.
(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in part II.D.6 (24-hour notice).

c. **Prohibition of bypass**

(1) Bypass is prohibited and the Director may take enforcement action against a permittee for bypass, unless:
   (a) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
   (b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if the permittee could have installed adequate backup equipment to prevent a bypass which occurred during normal or preventive maintenance; and
   (c) The permittee submitted notices as required by Part II.B.4.b.
(2) The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in Part II.B.4.c(1).

5. **Upset Conditions**

a. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of Part II.B.5.b of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

b. Conditions necessary for demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
   (1) An upset occurred and that the permittee can identify the specific cause(s) of the upset.
   (2) The permitted facility was at the time being properly operated.
   (3) The permittee submitted notice of the upset as required by Part II.D.6.: and
   (4) The permittee complied with any remedial measures required by Part II.B.3.

c. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

6. **Removed Substances**

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering the waters of the State. Written approval must be obtained from the ADEQ for land application only.

7. **Power Failure**

The permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated or inadequately treated wastes during electrical power failure either by means of alternate power sources, standby generators, or retention of inadequately treated effluent.

SECTION C - MONITORING AND RECORDS

1. **Representative Sampling**

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge during the entire monitoring period. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points shall not be changed without notification to and the approval of the Director. Intermittent discharges shall be monitored.

2. **Flow Measurement**

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to insure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than +/- 10% from true discharge rates throughout the range of expected discharge volumes and shall be installed at the monitoring point of the discharge.

3. **Monitoring Procedures**

Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit. The permittee shall calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals frequent enough to insure accuracy of measurements and shall insure that both calibration and maintenance activities will be conducted. An adequate analytical quality control program, including the analysis of sufficient standards, spikes, and duplicate samples to insure the accuracy of all required analytical results shall be maintained by the permittee or designated commercial laboratory. At a minimum, spikes and duplicate samples are to be analyzed on 10% of the samples.

4. **Penalties for Tampering**

The Arkansas Water and Air Pollution Control Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under the Act shall be guilty of a misdemeanor and upon conviction thereof shall be subject to imprisonment for not more than one (1) year or a fine of not more than ten thousand dollars ($10,000) or by both such fine and imprisonment.

5. **Reporting of Monitoring Results**

Monitoring results must be reported on a Discharge Monitoring Report (DMR) form (EPA No. 3320-1). Permittees are required to use preprinted DMR forms provided by ADEQ, unless specific written authorization to use other reporting forms is obtained from ADEQ. Monitoring results obtained during the previous calendar month shall be summarized and reported on a DMR form postmarked no later than the 25th day of the month, following the completed reporting period to begin on the effective date of the permit. Duplicate copies of DMR's signed and certified as required by Part II.d.11 and all other reports required by Part II.D. (Reporting Requirements), shall be submitted to the Director at the following address:

NPDES Enforcement Section
Water Division
Arkansas Department of Environmental Quality
8001 National Drive
P.O. Box 8913
Little Rock, AR 72219-8913

If permittee uses outside laboratory facilities for sampling and/or analysis, the name and address of the contract laboratory shall be included on the DMR.

6. **Additional Monitoring by the Permittee**

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated on the DMR.

7. **Retention of Records**

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

8. **Record Contents**

Records and monitoring information shall include:

a. The date, exact place, time and methods of sampling or measurements, and preservatives used, if any;
b. The individuals(s) who performed the sampling or measurements;
c. The date(s) and time analyses were performed;
d. The individual(s) who performed the analyses;
e. The analytical techniques or methods used; and
f. The measurements and results of such analyses.

9. **Inspection and Entry**

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and
d. Sample, inspect or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

SECTION D – REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall give notice and provide plans and specification to the Director for review and approval prior to any planned physical alterations or additions to the permitted facility. Notice is required only when:

For Industrial Dischargers

a. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR Part122.29(b).
b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under 40 CRF Part 122.42 (a)(1).

For POTW Dischargers:

Any change in the facility discharge (including the introduction of any new source or significant discharge or significant changes in the quantity or quality of existing discharges of pollutants) must be reported to the permitting authority. In no case are any new connections, increased flows, or significant changes in influent quality permitted that cause violation of the effluent limitations specified herein.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers

The permit is nontransferable to any person except after notice to the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Act.

4. Monitoring Reports

Monitoring results shall be reported at the intervals and in the form specified in Part II.C.5. (Reporting). **Discharge Monitoring Reports must be submitted <u>even</u> when <u>no</u> discharge occurs during the reporting period.**

5. Compliance Schedule

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than

14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

6. **Twenty-four Hour Report**

a. The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain the following information:
(1) a description of the noncompliance and its cause;
(2) the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and
(3) steps taken or planned to reduce, eliminate and prevent reoccurrence of the noncompliance.

b. The following shall be included as information which must be reported within 24 hours:
(1) Any unanticipated bypass which exceeds any effluent limitation in the permit;
(2) Any upset which exceeds any effluent limitation in the permit and
(3) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Director in Part I of the permit to be reported within 24 hours.

c. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

7. **Other Noncompliance**

The permittee shall report all instances of noncompliance not reported under Part II.D.4,5 and 6, at the time monitoring reports are submitted. The reports shall contain the information listed at Part II.D.6.

8. **Changes in Discharge of Toxic Substances for Industrial Dischargers**

The permittee shall notify the Director as soon as he/she knows or has reason to believe:

a. That any activity has occurred or will occur which would result in the discharge, in a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the "notification levels" described in 40 CFR Part 122.42(a)(1).

b. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit if that discharge will exceed the highest of the "notification levels" described in 40 CFR Part 122.42(a)(2).

9. **Duty to Provide Information**

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit. Information shall be submitted in the form, manner and time frame requested by the Director.

10. **Duty to reapply**

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The complete application shall be submitted at least 180 days before the expiration date of this permit. The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date. Continuation of expiring permits shall be governed by regulations promulgated in APCEC Regulation No. 6.

11. **Signatory Requirements**

All applications, reports or information submitted to the Director shall be signed and certified

a. All permit applications shall be signed as follows:
  (1) For a corporation: by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:
    (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation: or
    (ii) The manager of one or more manufacturing, production, or operation facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
  (2) For a partnership or sole proprietorship: by a general partner or proprietor, respectively; or
  (3) For a municipality, State, Federal, or other public agency; by either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes:
    (i) The chief executive officer of the agency, or
    (ii) A senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

b. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person.

A person is a duly authorized representative only if:
  (1) The authorization is made in writing by a person described above.
  (2) The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant

manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and

(3) The written authorization is submitted to the Director.

c. Certification. Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

12. **Availability of Reports**

Except for data determined to be confidential under 40 CFR Part 2 and Regulation 6, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department of Environmental Quality. As required by the Regulations, the name and address of any permit applicant or permittee, permit applications, permits and effluent data shall not be considered confidential.

13. **Penalties for Falsification of Reports**

The Arkansas Air and Water Pollution Control Act provides that any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained under this permit shall be subject to civil penalties specified in Part II.A.2. and/or criminal penalties under the authority of the Arkansas Water and Air Pollution Control Act (Act 472 of 1949, as amended).

PART III
OTHER CONDITIONS

1. The operator of this wastewater treatment facility shall be Industrial licensed by the State of Arkansas in accordance with Act 1103 of 1991, Act 556 of 1993, Act 211 of 1971, and Regulation No. 3, as amended.

2. In accordance with 40 CFR Parts 122.62 (a) (2) and 124.5, this permit may be reopened for modification or revocation and/or reissuance to require additional monitoring and/or effluent limitations when new information is received that actual or potential exceedance of State water quality criteria and/or narrative criteria are determined to be the result of the permittee's discharge (s) to water body, or a Total Maximum Daily Load (TMDL) is established or revised for the water body that were not available at the time of permit issuance that would have justified the application of different permit conditions at the time of permit issuance.

3. Other Specified Monitoring Requirements

   The permittee may use alternative appropriate monitoring methods and analytical instruments other than as specified in Part I Section A of the permit without a major permit modification under the following conditions:
   - The monitoring and analytical instruments are consistent with accepted scientific practices;
   - The requests shall be submitted in writing to the NPDES Section of the Water Division of the ADEQ for use of the alternate method or instrument.
   - The method and/or instrument is in compliance with 40 CFR 136; and
   - All associated devices are installed, calibrated and maintained to insure the accuracy of the measurements and are consistent with accepted capability of that type of device. The calibration and maintenance shall be performed as part of the permittee's laboratory Quality Control/Quality Assurance program.

Upon written approval of the alternative monitoring method and/or analytical instruments, these methods or instruments must be consistently utilized throughout the monitoring period. ADEQ must be notified in writing and the permittee must receive written approval from ADEQ, if the permittee decides to return to the original permit monitoring requirements.

4. **<u>WHOLE EFFLUENT TOXICITY TESTING (7-DAY CHRONIC NOEC FRESHWATER)</u>**

   1. SCOPE AND METHODOLOGY

      a. The permittee shall test the effluent for toxicity in accordance with the provisions in this section.

      APPLICABLE TO FINAL OUTFALL: **101**

CRITICAL DILUTION (%):	**17%**
EFFLUENT DILUTION SERIES (%):	**7%, 10%,13%,17%, 23%**
COMPOSITE SAMPLE TYPE:	Defined at PART I
TEST SPECIES/METHODS:	40 CFR Part 136
APPLICABLE TO FINAL OUTFALL:	**401**
CRITICAL DILUTION (%):	**40%**
EFFLUENT DILUTION SERIES (%):	**17%, 23%,30%, 40%, 54%**
COMPOSITE SAMPLE TYPE:	Defined at PART I
TEST SPECIES/METHODS:	40 CFR Part 136

Ceriodaphnia dubia chronic static renewal survival and reproduction test, Method 1002.0, EPA/600/4-91/002 or the most recent update thereof. This test should be terminated when 60% of the surviving females in the control produce three broods or at the end of eight days, whichever comes first.

Pimephales promelas (fathead minnow) chronic static renewal 7-day larval survival and growth test, Method 1000.0, EPA/600/4-91/002, or the most recent update thereof. A minimum of five (5) replicates with eight (8) organisms per replicate must be used in the control and in each effluent dilution of this test.

b. The NOEC (No Observed Effect Concentration) is defined as the greatest effluent dilution at and below which lethality that is statistically different from the control (0% effluent) at the 95% confidence level does not occur. Chronic lethal test failure is defined as a demonstration of a statistically significant lethal effect at test completion to a test species at or below the critical dilution.

c. This permit may be reopened to require whole effluent toxicity limits, chemical specific effluent limits, additional testing, and/or other appropriate actions to address toxicity.

d. Test failure is defined as a demonstration of statistically significant sub-lethal or lethal effects to a test species at or below the effluent critical dilution.

2. PERSISTENT LETHALITY. The requirements of this subsection apply only when a toxicity test demonstrates significant lethal effects at or below the critical dilution. Significant lethal effects are herein defined as a statistically significant difference at the 95% confidence level between the survival of the appropriate test organism in a specified effluent dilution and the control (0% effluent).

   a. Part I Testing Frequency Other Than Monthly

      i. The permittee shall conduct a total of two (2) additional tests for any species that demonstrates significant lethal effects at or below the critical dilution. The two additional tests shall be conducted monthly during the next two consecutive months. The permittee shall not substitute either of the two additional tests in lieu of routine toxicity testing. The full report shall be prepared for each test required by this section in accordance with procedures outlined in Item 4 of this section and submitted with the period discharge monitoring report (DMR) to the permitting authority for review.

      ii. If one or both of the two additional tests demonstrates significant lethal effects at or below the critical dilution, the permittee shall initiate Toxicity Reduction Evaluation (TRE) requirements as specified in Item 5 of this section. The permittee shall notify ADEQ in writing within 5 days of the failure of any retest, and the TRE initiation date will be the test completion date of the first failed retest. A TRE may be also be required due to a demonstration of persistent significant sub-lethal effects or intermittent lethal effects at or below the critical dilution, or for failure to perform the required retests.

      iii. If one or both of the two additional tests demonstrates significant lethal effects at or below the critical dilution, the permittee shall henceforth increase the frequency of testing for this species to once per quarter for the life of the permit.

      iv. The provisions of Item 2.a are suspended upon submittal of the TRE Action Plan.

   b. Part I Testing Frequency of Monthly

The permittee shall initiate the Toxicity Reduction Evaluation (TRE) requirements as specified in Item 5 of this section when any two of three consecutive monthly toxicity tests exhibit significant lethal effects at or below the critical dilution. A TRE may be also be required due to a demonstration of persistent significant sub-lethal effects or intermittent lethal effects at or below the critical dilution, or for failure to perform the required retests.

3. <u>REQUIRED TOXICITY TESTING CONDITIONS</u>

a. <u>Test Acceptance</u>

The permittee shall repeat a test, including the control and all effluent dilutions, if the procedures and quality assurance requirements defined in the test methods or in this permit are not satisfied, including the following additional criteria:

i. The toxicity test control (0% effluent) must have survival equal to or greater than 80%.

ii. The mean number of <u>Ceriodaphnia</u> <u>dubia</u> neonates produced per surviving female in the control (0% effluent) must be 15 or more.

iii. 60% of the surviving control females must produce three broods.

iv. The mean dry weight of surviving fathead minnow larvae at the end of the 7 days in the control (0% effluent) must be 0.25 mg per larva or greater.

v. The percent coefficient of variation between replicates shall be 40% or less in the control (0% effluent) for: the young of surviving females in the <u>Ceriodaphnia</u> <u>dubia</u> reproduction test; the growth and survival endpoints of the fathead minnow test.

vi. The percent coefficient of variation between replicates shall be 40% or less in the critical dilution, <u>unless</u> significant lethal or nonlethal effects are exhibited for: the young of surviving females in the <u>Ceriodaphnia</u> <u>dubia</u> reproduction test; the growth and survival endpoints of the fathead minnow test.

Test failure may not be construed or reported as invalid due to a coefficient of variation value of greater than 40%. A repeat test shall be conducted within the required reporting period of any test determined to be invalid.

b. Statistical Interpretation

i. For the Ceriodaphnia dubia survival test, the statistical analyses used to determine if there is a significant difference between the control and the critical dilution shall be Fisher's Exact Test as described in EPA/600/4-91/002 or the most recent update thereof.

ii. For the Ceriodaphnia dubia reproduction test and the fathead minnow larval survival and growth test, the statistical analyses used to determine if there is a significant difference between the control and the critical dilution shall be in accordance with the methods for determining the No Observed Effect Concentration (NOEC) as described in EPA/600/4-91/002 or the most recent update thereof.

iii. If the conditions of Test Acceptability are met in Item 3.a above and the percent survival of the test organism is equal to or greater than 80% in the critical dilution concentration and all lower dilution concentrations, the test shall be considered to be a passing test, and the permittee shall report an NOEC of not less than the critical dilution for the DMR reporting requirements found in Item 4 below.

c. Dilution Water

i. Dilution water used in the toxicity tests will be receiving water collected as close to the point of discharge as possible but unaffected by the discharge. The permittee shall substitute synthetic dilution water of similar pH, hardness, and alkalinity to the closest downstream perennial water for;

(A) toxicity tests conducted on effluent discharges to receiving water classified as intermittent streams; and

(B) toxicity tests conducted on effluent discharges where no receiving water is available due to zero flow conditions.

ii. If the receiving water is unsatisfactory as a result of instream toxicity (fails to fulfill the test acceptance criteria of Item 3.a), the permittee may substitute synthetic dilution water for the receiving water in all subsequent tests provided the unacceptable receiving water test met the following stipulations:

(A) a synthetic dilution water control which fulfills the test acceptance requirements of Item 3.a was run concurrently with the receiving water control;

(B) the test indicating receiving water toxicity has been carried out to completion (i.e., 7 days);

(C) the permittee includes all test results indicating receiving water toxicity with the full report and information required by Item 4 below; and

(D) the synthetic dilution water shall have a pH, hardness, and alkalinity similar to that of the receiving water or closest downstream perennial water not adversely affected by the discharge, provided the magnitude of these parameters will not cause toxicity in the synthetic dilution water.

d. Samples and Composites

i. The permittee shall collect a minimum of three flow-weighted composite samples from the outfall(s) listed at Item 1.a above.

ii. The permittee shall collect second and third composite samples for use during 24-hour renewals of each dilution concentration for each test. The permittee must collect the composite samples such that the effluent samples are representative of any periodic episode of chlorination, biocide usage or other potentially toxic substance discharged on an intermittent basis.

iii. The permittee must collect the composite samples so that the maximum holding time for any effluent sample shall not exceed 72 hours. The permittee must have initiated the toxicity test within 36 hours after the collection of the last portion of the first composite sample. Samples shall be chilled to 4 degrees Centigrade during collection, shipping, and/or storage.

iv. If the flow from the outfall(s) being tested ceases during the collection of effluent samples, the requirements for the minimum number of effluent samples, the minimum number of effluent portions and the sample holding time are waived during that sampling period. However, the permittee must collect an effluent composite sample volume during the period of discharge that is sufficient to complete the required toxicity tests with daily renewal of effluent. When possible, the effluent samples used for the toxicity tests shall be collected on separate days if the discharge occurs over multiple days. The effluent composite sample collection duration and the static renewal protocol associated with the abbreviated sample collection must be documented in the full report required in Item 4 of this section.

v. MULTIPLE OUTFALLS: If the provisions of this section are applicable to multiple outfalls, the permittee shall combine the composite effluent samples in proportion to the average flow from the outfalls listed in Item 1.a above for the day the sample was collected. The permittee shall perform the toxicity test on the flow-weighted composite of the outfall samples.

vi. The permittee shall not allow the sample to be dechlorinated at the laboratory. At the time of sample collection the permittee shall measure the TRC of the effluent. The measured concentration of TRC for each sample shall be included in the lab report submitted by the permittee.

4. REPORTING

a. The permittee shall prepare a full report of the results of all tests conducted pursuant to this section in accordance with the Report Preparation Section of EPA/600/4-91/002, or the most current publication, for every valid or invalid toxicity test initiated whether carried to completion or not. The permittee shall retain each full report pursuant to the provisions of PART II.C.7 of this permit. The permittee shall submit full reports upon the specific request of the Department. For any test which fails, is considered invalid or which is terminated early for any reason, the full report must be submitted for review.

b. A valid test for each species must be reported on the DMR during each reporting period specified in PART I of this permit unless the permittee is performing a TRE which may increase the frequency of testing and reporting. Only ONE set of biomonitoring data for each species is to be recorded on the DMR for each reporting period. The data submitted should reflect the LOWEST survival results for each species during the reporting period. All invalid tests, repeat tests (for invalid tests), and retests (for tests previously failed) performed during the reporting period must be attached to the DMR for ADEQ review.

c. The permittee shall submit the results of each valid toxicity test on a DMR for that reporting period in accordance with PART II.D.4 of this permit, as follows below. Submit retest information clearly marked as such with the following DMR. Only results of valid tests are to be reported on the DMR.

i. Pimephales promelas (fathead minnow)

(A) If the No Observed Effect Concentration (NOEC) for survival is less than the critical dilution, enter a "1"; otherwise, enter a "0" for Parameter No. TLP6C.

(B) If the No Observed Effect Concentration (NOEC) for growth is less than the critical dilution, enter a "1"; otherwise, enter a "0" for Parameter No. TGP6C.

(C) Report the NOEC value for survival, Parameter No. TOP6C.

(D) Report the highest (critical dilution or control) Coefficient of Variation, Parameter No. TQP6C.

(E) Report the NOEC value for growth, Parameter No. TPP6C.

ii. Ceriodaphnia dubia

(A) If the NOEC for survival is less than the critical dilution, enter a "1"; otherwise, enter a "0" for Parameter No. TLP3B.

(B) If the No Observed Effect Concentration (NOEC) for reproduction is less than the critical dilution, enter a "1"; otherwise, enter a "0" for Parameter No. TGP3B.

(B) Report the NOEC value for survival, Parameter No. TOP3B.

(C) Report the higher (critical dilution or control) Coefficient of Variation, Parameter No. TQP3B.

(E) Report the NOEC value for reproduction, Parameter No. TPP3B.

5. Monitoring Frequency Reduction

a. The permittee may apply for a testing frequency reduction upon the successful completion of the first four consecutive quarters of testing for one or both test species, with no lethal or sub-lethal effects demonstrated at or below the critical dilution without a major modification. If granted, the monitoring frequency for that test species may be reduced to not less than once per year for the less sensitive species (usually the fathead minnow) and not less than twice per year for the more sensitive test species (usually the Ceriodaphnia dubia).

b. CERTIFICATION - The permittee must certify in writing that no test failures have occurred and that all tests meet all test acceptability criteria in item 3.a. above. In addition the permittee must provide a list with each test performed including test initiation date, species, NOECs for lethal and sub-lethal effects and the maximum coefficient of variation for the controls. Upon review and acceptance of this information the Department will issue a letter of confirmation of the monitoring frequency reduction. A copy of the letter will be forwarded to the Permit Compliance System section to update the permit reporting requirements.

c. SUB-LETHAL FAILURES - If, during the first four quarters of testing, sub-lethal effects are demonstrated to a test species, two monthly retests are required. In addition, quarterly testing is required for that species until the effluent passes both the lethal and sub-lethal test endpoints for the affected species for four consecutive quarters. Monthly retesting is not required if the permittee is performing a TRE.

d. SURVIVAL FAILURES - If any test fails the survival endpoint at any time during the life of this permit, two monthly retests are required and the monitoring frequency for the affected test species shall be increased to once per quarter until the permit is re-issued. Monthly retesting is not required if the permittee is performing a TRE.

e. This monitoring frequency reduction applies only until the expiration date of this permit, at which time the monitoring frequency for both test species reverts to once per quarter until the permit is re-issued.

6. TOXICITY REDUCTION EVALUATION (TRE)

a. Within ninety (90) days of confirming lethality in the retests, the permittee shall submit a Toxicity Reduction Evaluation (TRE) Action Plan and Schedule for conducting a TRE. The TRE Action Plan shall specify the approach and methodology to be used in performing the TRE. A Toxicity Reduction Evaluation is an investigation intended to determine those actions necessary to achieve compliance with water quality-based effluent limits by reducing an effluent's toxicity to an acceptable level. A TRE is defined as a step-wise process which combines toxicity testing and analyses of the physical and chemical characteristics of a toxic effluent to identify the constituents causing effluent toxicity and/or treatment methods which will reduce the effluent toxicity. The TRE Action Plan shall lead to the successful elimination of effluent toxicity at the critical dilution and include the following:

i. Specific Activities. The plan shall detail the specific approach the permittee intends to utilize in conducting the TRE. The approach may include toxicity characterizations, identifications and confirmation activities, source evaluation, treatability studies, or alternative approaches. When the permittee conducts Toxicity Characterization Procedures the permittee shall perform multiple characterizations and follow the procedures specified in the documents "Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures" (EPA-600/6-91/003) and "Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I" (EPA-600/6-91/005F), or alternate procedures. When the permittee conducts Toxicity Identification Evaluations and Confirmations, the permittee shall perform multiple identifications and follow the methods specified in the documents "Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/080) and "Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/081), as appropriate.

The documents referenced above may be obtained through the National Technical Information Service (NTIS) by phone at (800) 553-6847, or by writing:

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

ii. Sampling Plan (e.g., locations, methods, holding times, chain of custody, preservation, etc.). The effluent sample volume collected for all tests shall be adequate to perform the toxicity test, toxicity characterization, identification and confirmation procedures, and conduct chemical specific analyses when a probable toxicant has been identified;

Where the permittee has identified or suspects specific pollutant(s) and/or source(s) of effluent toxicity, the permittee shall conduct, concurrent with toxicity testing, chemical specific analyses for the identified and/or suspected pollutant(s) and/or source(s) of effluent toxicity. Where lethality was demonstrated within 48 hours of test initiation, each composite sample shall be analyzed independently.

Otherwise the permittee may substitute a composite sample, comprised of equal portions of the individual composite samples, for the chemical specific analysis;

iii. Quality Assurance Plan (e.g., QA/QC implementation, corrective actions, etc.); and

iv. Project Organization (e.g., project staff, project manager, consulting services, etc.).

b. The permittee shall initiate the TRE Action Plan within thirty (30) days of plan and schedule submittal. The permittee shall assume all risks for failure to achieve the required toxicity reduction.

c. The permittee shall submit a quarterly TRE Activities Report, with the Discharge Monitoring Report in the months of January, April, July and October, containing information on toxicity reduction evaluation activities including:

i. any data and/or substantiating documentation which identifies the pollutant(s) and/or source(s) of effluent toxicity;

ii. any studies/evaluations and results on the treatability of the facility's effluent toxicity; and

iii. any data which identifies effluent toxicity control mechanisms that will reduce effluent toxicity to the level necessary to meet no significant lethality at the critical dilution.

d. The permittee shall submit a Final Report on Toxicity Reduction Evaluation Activities no later than twenty-eight (28) months from confirming lethality in the retests, which provides information pertaining to the specific control mechanism selected that will, when implemented, result in reduction of effluent toxicity to no significant lethality at the critical dilution. The report will also provide a specific corrective action schedule for implementing the selected control mechanism.

Quarterly testing during the TRE is a minimum monitoring requirement. EPA recommends that permittees required to perform a TRE not rely on quarterly testing alone to ensure success in the TRE, and that additional screening tests be performed to capture toxic samples for identification of toxicants. Failure to identify the specific chemical compound causing toxicity test failure will normally result in a permit limit for whole effluent toxicity limits per federal regulations at 40 CFR 122.44(d)(1)(v).

5. Storm Water Pollution Plans.

   Storm water runoff commingling with other process wastewater discharged from Outfall 101 shall be managed in accordance with the Best Management Practices (BMPs) in the form of a pollution prevention plan (SWPPP) required by the Arkansas Industrial General Storm Water Permit ARR000000 to control the quality of storm water discharges associated with industrial activity based on 40 CFR 122.44(k).

6. There shall be no discharge of polychlorinated biphenyl transformer fluid.

7. The term "Total Residual Chlorine" means the value obtained using amperometric method for total residual chlorine described in 40 CFR Part 136.

   Total Residual Chlorine may not be discharged from any unit for more than two hours per day in any one day unless the discharger demonstrates to the permitting authority that discharge for more than two hours is required for macroinvertebrate control.

8. The term "low volume waste sources" means, taken collectively as if from one source, wastewater from all sources except those for which specific limitations are otherwise established. Low volume sources include, but are not limited to : wastewater from wet scrubber air pollution control systems, ion exchange water treatment system, water treatment evaporator blowdown, laboratory and sampling wastes, boiler blowdown, floor drains, cooling tower basin cleaning wastes, and recirculating house service water systems. Sanitary and air conditioning wastes are not included.

9. The term "bottom ash" means the ash that drops out of the furnace gas steam in the furnace and in the economizer sections. Economizer ash is included when it is collected with bottom ash.

10. The term "coal pile runoff" means the rainfall from or through any coal storage pile.

11. The term "once through cooling water" means water passed through the main cooling condensers in one or two passes for the purpose of removing waste heat.

12. The permittee shall comply with the Cooling Water Intake regulations found in Title 40 Code of Federal Regulations Part 125, Subpart J. These regulations include, but are not limited to the following provisions:

    c. The permittee shall submit two copies of the Proposal for Information Collection to the NPDES Branch of the Water Division prior to the start of information collection activities, and,
    d. The permittee shall submit two copies of the completed Comprehensive Demonstration Study to the NPDES Branch of the Water Division prior to January 7, 2008 (or on or before the federal deadline that the EPA may reestablish for complying with the requirements of 40 CFR 125, Subpart J). The permittee shall meet all other applicable requirements of this regulation.

PART IV
DEFINITIONS

All definitions contained in Section 502 of the Clean Water Act shall apply to this permit and are incorporated herein by reference. Additional definitions of words or phrases used in this permit are as follows:

1. **"Act"** means the Clean Water Act, Public Law 95-217 (33.U.S.C. 1251 et seq.) as amended.
2. **"Administrator"** means the Administrator of the U.S. Environmental Protection Agency.
3. **"Applicable effluent standards and limitations"** means all State and Federal effluent standards and limitations to which a discharge is subject under the Act, including, but not limited to, effluent limitations, standards of performance, toxic effluent standards and prohibitions, and pretreatment standards.
4. **"Applicable water quality standards"** means all water quality standards to which a discharge is subject under the federal Clean Water Act and which has been (a) approved or permitted to remain in effect by the Administrator following submission to the Administrator pursuant to Section 303 (a) of the Act, or (b) promulgated by the Director pursuant to Section 303(b) or 303(c) of the Act, and standards promulgated under regulation No. 2, as amended, (regulation establishing water quality standards for surface waters of the State of Arkansas.)
5. **"Bypass"** means the intentional diversion of waste streams from any portion of a treatment facility.
6. **"Daily Discharge"** means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling.

Mass Calculations: For pollutants with limitations expressed in terms of mass, the "daily discharge" is calculated as the total mass of pollutant discharged over the sampling day.

Concentration Calculations: For pollutants with limitations expressed in other units of measurement, determination of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the "daily discharge" determination of concentration shall be the arithmetic average (weighted by flow value) of all the samples collected during that sampling day by using the following formula: where C= daily concentration, F=daily flow and n=number of daily samples; daily average discharge

$$\frac{C_1F_1 + C_2F_2 + \cdots + C_nF_n}{F_1 + F_2 + \cdots + F_n}$$

7. **Monthly average**: means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month. For Fecal Coliform Bacteria (FCB) report the monthly average see 30-day average below.
8. **"Daily Maximum"** discharge limitation means the highest allowable "daily discharge" during the calendar month. The 7-day average for fecal coliform bacteria is the geometric mean of the values of all effluent samples collected during the calendar week in colonies/100 ml.
9. **"Department"** means the Arkansas Department of Environmental Quality (**ADEQ**).

10. **"Director"** means the Administrator of the U.S. Environmental Protection Agency and/or the Director of the Arkansas Department of Environmental Quality.
11. **"Grab sample"** means an individual sample collected in less than 15 minutes in conjunction with an instantaneous flow measurement.
12. **"Industrial User"** means a nondomestic discharger, as identified in 40 CFR 403, introducing pollutants to a publicly-owned treatment works.
13. **"National Pollutant Discharge Elimination System"** means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318 and 405 of the Clean Water Act.
14. **"POTW"** means a Publicly Owned Treatment Works.
15. **"Severe property damage"** means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in products.
16. **"APCEC"** means the Arkansas Pollution Control and Ecology Commission.
17. **"Sewage sludge"** means the solids, residues, and precipitate separated from or created in sewage by the unit processes a publicly-owned treatment works. Sewage as used in this definition means any wastes, including wastes from humans, households, commercial establishments, industries, and storm water runoff that are discharged to or otherwise enter a publicly-owned treatment works.
18. **"7-day average"** discharge limitation, other than for fecal coliform bacteria, is the highest allowable arithmetic means of the values for all effluent samples collected during the calendar week. The 7-day average for fecal coliform bacteria is the geometric mean of the values of all effluent samples collected during the calendar week in colonies/100 ml. The DMR should report the highest 7-day average obtained during the calendar month. For reporting purposes, the 7-day average values should be reported as occurring in the month in which the Saturday of the calendar week falls in.
19. **"30-day average"**, other than for fecal coliform bacteria, is the arithmetic mean of the daily values for all effluent samples collected during a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month. The 30-day average for fecal coliform bacteria is the geometric mean of the values for all effluent samples collected during a calendar month.
For Fecal Coliform Bacteria (FCB) report the monthly average as a 30-day geometric mean in colonies per 100 ml.
20. **"24-hour composite sample"** consists of a minimum of 12 effluent portions collected at equal time intervals over the 24-hour period and combined proportional to flow or a sample collected at frequent intervals proportional to flow over the 24-hour period.
21. **"12-hour composite sample"** consists of 12 effluent portions, collected no closer together than one hour and composited according to flow. The daily sampling intervals shall include the highest flow periods.
22. **"6-hour composite sample"** consists of six effluent portions collected no closer together than one hour(with the first portion collected no earlier than 10:00 a.m.) and composited according to flow.

23. **"3-hour composite sample"** consists of three effluent portions collected no closer together than one hour(with the first portion collected no earlier than 10:00 a.m.) and composited according to flow.
24. **"Treatment works"** means any devices and systems used in storage, treatment, recycling, and reclamation of municipal sewage and industrial wastes, of a liquid nature to implement section 201 of the Act, or necessary to recycle reuse water at the most economic cost over the estimated life of the works, including intercepting sewers, sewage collection systems, pumping, power and other equipment, and alterations thereof; elements essential to provide a reliable recycled supply such as standby treatment units and clear well facilities, and any works, including site acquisition of the land that will be an integral part of the treatment process or is used for ultimate disposal of residues resulting from such treatment.
25. **"Upset"** means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. Any upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, lack or preventive maintenance, or careless of improper operations.
26. **"For Fecal Coliform Bacteria"**, a sample consists of one effluent grab portion collected during a 24-hour period at peak loads. For Fecal Coliform Bacteria (FCB) report the monthly average as a 30-day geometric mean in colonies per 100 ml.
27. **"Dissolved oxygen limit"**, shall be defined as follows:
a. When limited in the permit as a monthly average minimum, shall mean the lowest acceptable monthly average value, determined by averaging all samples taken during the calendar month;
b. When limited in the permit as an instantaneous minimum value, shall mean that no value measured during the reporting period may fall below the stated value.
28. **The term "MGD"** shall mean million gallons per day.
29. **The term "mg/l "**shall mean milligrams per liter or parts per million (ppm).
30. **The term "µg/l"** shall mean micrograms per liter or parts per billion (ppb).
31. **The term "cfs"** shall mean cubic feet per second.
32. **The term "ppm"** shall mean part per million.
33. **The term "s.u."** shall mean standard units.
34**. Monitoring and Reporting:**
When a permit becomes effective, monitoring requirements are of the immediate period of the permit effective date. Where the monitoring requirement for an effluent characteristic is Monthly or more frequently, the Discharge Monitoring Report shall be submitted by the 25th of the month following the sampling. Where the monitoring requirement for an effluent characteristic is Quarterly, Semi-Annual, Annual, or Yearly, the Discharge Monitoring report shall be submitted by the 25th of the month following the monitoring period end date.
35. **Instantaneous maximum** value, shall mean that no value measured during the reporting period may be above the stated value.

MONTHLY:
is defined as a calendar month or any portion of a calendar month for monitoring requirement frequency of once/month or more frequently.

QUARTERLY:
(1) is defined as a fixed calendar quarter or any part of the fixed calendar quarter for a non-seasonal effluent characteristic with a measurement frequency of once/quarter. Fixed calendar quarters are: January through March, April through June, July through September, and October through December; or
(2) is defined as a fixed three month period (or any part of the fixed three month period) of or dependent upon the seasons specified in the permit for a seasonal effluent characteristic with a monitoring requirement frequency of once/quarter that does not coincide with the fixed calendar quarter. Seasonal calendar quarters are May through July, August through October, November through January, and February through April.

SEMI-ANNUAL:
is defined as the fixed time periods January through June, and July through December (or any portion thereof) for an effluent characteristic with a measurement frequency of once/6 months or twice/year.

ANNUAL or YEARLY:
is defined as a fixed calendar year or any portion of the fixed calendar year for an effluent characteristic or parameter with a measurement frequency of once/year. A calendar year is January through December, or any portion thereof.

Final Fact Sheet

For renewal of final NPDES Permit Number AR0037842 to discharge to Waters of the State

1. PERMITTING AUTHORITY.

The issuing office is:

Arkansas Department of Environmental Quality
8001 National Drive
Post Office Box 8913
Little Rock, Arkansas 72219-8913

2. APPLICANT.

The applicant is:

American Electric Power
Southwestern Electric Power Company (SWEPCO) - Flint Creek Power Plant
21797 SWEPCO Plant Road
Gentry, AR 72734

3. PREPARED BY.

The permit was prepared by:

Marysia Jastrzebski, P.E.
NPDES Branch, Water Division

4. DATE PREPARED.

The permit was prepared on January 26, 2006.

5. PREVIOUS PERMIT ACTIVITY.

Effective Date:	December 1, 2000
Modification Date:	N/A
Expiration Date	November 30, 2005

The permittee submitted a permit renewal application on 04/29/2005. It is proposed that the current NPDES permit be reissued for a 5-year term in accordance with regulations promulgated at 40 CFR Part 122.46(a).

6. RECEIVING STREAM SEGMENT AND DISCHARGE LOCATION.

The outfalls are located at the following coordinates:

Outfall 001: Latitude: 36° 14' 00", Longitude: 94° 33' 02"
Outfall 101: Latitude: 36° 15' 03", Longitude: 94° 31' 35"
Outfall 401: Latitude: 36° 15' 27", Longitude: 94° 31' 32"

The receiving waters named:

SWEPCO Reservoir, thence to Little Flint Creek, thence to Flint Creek in Segment 3J of the Arkansas River Basin. The receiving stream is a Water of the State classified for primary contact recreation, raw water source for public, industrial, and agricultural water supplies, propagation of desirable species of fish and other aquatic life, and other compatible uses.

7 303(d) List and Endangered Species Considerations

A. 303(d) List

The receiving stream is not listed on the 303(d) list. Therefore no permit action is needed.

B. Endangered Species:

No comments were received from the U.S. Fish and Wildlife Service (USF&WS)

8 OUTFALL AND TREATMENT PROCESS DESCRIPTION.

The following is a description of the facility described in the application:

Average Flow:

Outfall 001: varies from 1.7 MGD to 9.0 MGD (based on the last two years DMR data)
Outfall 101: 9.83 MGD, based on the highest monthly average flow during the last two years.
Outfall 401: 406.08 MGD, based on the highest monthly average flow during the last two years.

Type of treatment:

Outfall 001: none
Outfall 101: settling and neutralization
Outfall 401: chlorination

Discharge Description:

Outfall 001: discharge from the SWEPCO Reservoir
Outfall 101: bottom ash discharge, low volume wastewater, and storm water runoff, including coal pile runoff, treated municipal wastewater from the City of Gentry. The City of Gentry operates under NPDES permit No. AR0020184.
Outfall 401: once through cooling water

9. **APPLICANT ACTIVITY.**

Under the standard industrial classification (SIC) code 4911, the applicant's activity is the operation of a steam electric power generating plant.

10 **SEWAGE SLUDGE PRACTICES.**

There is no sewage sludge generated in this facility.

11 **PERMIT CONDITIONS.**

The Arkansas Department of Environmental Quality has made a tentative determination to issue a permit for the discharge described in the application. Permit requirements are based on NPDES regulations (40 CFR Parts 122, 124, and Subchapter N) and regulations promulgated pursuant to the Arkansas Water and Air Pollution Control Act (Act 472 of 1949, as amended, Ark. Code Ann. 8-4-101 et. seq.).

a. **Final Effluent Limitations**

i. **Conventional and/or Toxic Pollutants**

OUTFALL 001 – SWEPCO Reservoir discharge

Effluent Characteristics	**Discharge Limitations**				**Monitoring Requirements**	
	Mass (lbs/day, unless otherwise specified)		Concentration (mg/l, unless otherwise specified)		Frequency	Sample Type
	Monthly Avg.	Daily Max	Monthly Avg.	Daily Max		
Flow (mgd)	N/A	N/A	Report	Report	Continuous	Record
pH	N/A	N/A	Minimum 6.0 s.u.	Maximum 9.0 s.u.	Once/week	Grab

AEPFC000395

OUTFALL 101 – combined wastewater (bottom ash discharge, low volume wastewater, and storm water runoff, including coal pile runoff, and treated municipal wastewater from the City of Gentry)

Effluent Characteristics	**Discharge Limitations**				**Monitoring Requirements**	
	Mass (lbs/day, unless otherwise specified)		Concentration (mg/l, unless otherwise specified)		Frequency	Sample Type
	Monthly Avg.	Daily Max	Monthly Avg.	Daily Max		
Flow (mgd)	N/A	N/A	Report	Report	Continuous	Record
Total Suspended Solids (TSS)	N/A	N/A	25	43	Once/week	Grab
Oil and Grease (O & G)	N/A	N/A	6	8	Once/ 2 months	Grab
pH	N/A	N/A	Minimum 6.0 s.u.	Maximum 9.0 s.u.	Once/week	Grab
Chronic Biomonitoring	N/A	N/A	See Page 16 Below		once/quarter	24-hr composite

OUTFALL 401 – once through cooling water

Effluent Characteristics	**Discharge Limitations**				**Monitoring Requirements**	
	Mass (lbs/day, unless otherwise specified)		Concentration (mg/l, unless otherwise specified)		Frequency	Sample Type
	Monthly Avg	Daily Max	Monthly Avg.	Daily Max		
Flow (mgd)	N/A	N/A	450 MGD	450 MGD	Continuous	Record
Total Residual Chlorine(TRC)	N/A	62.6	N/A	0.2 mg/l (Inst. Max)	Once/week	Grab
Temperature	N/A	N/A	N/A	129.2 °F	Continuous	Record
pH	N/A	N/A	Minimum 6.0 s.u.	Maximum 9.0 s.u.	Once/week	Grab
Chronic Biomonitoring	N/A	N/A	See Page 16 Below		once/quarter	24-hr composite

2. **Solids, Foam, and Free Oil:** There shall be no discharge of distinctly visible solids, scum or foam of a persistent nature, nor shall there be any formation of slime, bottom deposits or sludge banks. No visible sheen (Sheen means an iridescent appearance on the surface of the water).

AEPFC000396

12. **BASIS FOR PERMIT CONDITIONS**.

The following is an explanation of the derivation of the conditions of the final permit and the reasons for them or, in the case of notices of intent to deny or terminate, reasons suggesting the tentative decisions as required under 40 CFR 124.7 (48 FR 1413, April 1, 1983).

A. **Technology-Based versus Water Quality-Based Effluent Limitations and Conditions**

Following regulations promulgated at 40 CFR Part 122.44 (1) (2) (ii), the final permit limits are based on either technology-based effluent limits pursuant to 40 CFR Part 122.44 (a) or on State water quality standards and requirements pursuant to 40 CFR Part 122.44 (d), whichever are more stringent.

B. **Technology-Based Effluent Limitations and/or Conditions**

Regulations promulgated at 40 CFR Part 122.44 (a) require technology-based effluent limitations to be placed in NPDES permits based on effluent limitations guidelines where applicable, on Best Professional Judgment (BPJ) in the absence of guidelines, or on a combination of the two.

(1) **General Comments**

Regulations promulgated at 40 CFR Part 122.44 (a) require technology-based effluent limitations to be placed in NPDES permits based on effluent limitations guidelines where applicable, on Best Professional Judgment (BPJ) in the absence of guidelines, or on a combination of the two.

(2) **Applicable Effluent Limitations Guidelines**

Outfall 001:

The final permit does not establish any technology-based effluent limitations.

Outfall 101:

Discharges from facilities of this type are covered by the Federal effluent limitations guidelines promulgated under 40 CFR Part 423 of the Steam Electric Power Generating Point Source Category.

The technology based effluent limitations for Total Suspended Solids and Oil and Grease have been based on the current NPDES permit and 40 CFR Part 122.44(a)(l). They are consistent with 40 CFR Part 423.12(b)(3) and 40 CFR Part 423.12(b)(4).

These limits were originally established in 1989 and included in the NPDES permit No. AR0037842, which was effective on November 1, 1989. They have been continued in all permits renewed since that time based on anti-backsliding regulations contained in 40

CFR122.44(l)(1). The following various wastestreams are subject to co-treatment in the ash ponds: low volume waste (hydrovactor wastewater, demineralizer water, boiler blowdown, etc.), coal pile runoff, bottom ash transport wastewater, and stormwater. Some of these wastestreams are categorical wastestreams regulated under the Steam Electric Power Generating Point Source Category, some are unregulated streams contributing solids and/or oil and grease, and some are just dilution streams. Therefore, flow - weighted concentrations or mass limitations must be included in the permit to ensure that the permit is consistent with 40 CFR 423.12(b)(12). The effluent limitations for TSS and O&G for the discharge from the co-treatment facility (ash pond) were determined in accordance with 40 CFR 423.12(b)(3), 423(b)(4), and 423.12(b)(9) requirements and EPA's "Guidance for NPDES Permits Issued to Steam Electric Power Plants", dated August 2, 1985. The detailed calculation can be found in the Fact Sheet associated with the NPDES Permit No. AR0037842 which became effective on November 1, 1989.

Outfall 401:

The technology based effluent limitations for Total Residual Chlorine have been based on the current NPDES permit and 40 CFR Part 122.44(a)(l). They are consistent with 40 CFR Part 423.13(b)(1).

Additionally, on July 9, 2004, EPA published its final regulations prescribing how "existing large volume power plants" should comply with Section 316(b) of the Clean Water Act. This rule became effective on September 7, 2004. For most large volume existing power plants (flow $\geq$ 50 MGD), this rule requires detailed studies and other information to establish what intake structure technology or other measures will be used to comply with Section 316(b). Ordinarily this material is to be submitted with the facility's next application for renewal of its NPDES permit. However, for permits that expire less than four years after the rule was published (i. e. before July 7, 2008), the operator may have up to three-and-a-half years to submit the required information, as long as it is submitted "as expeditiously as practicable". This permit will include a special condition which requires the permittee to submit all the information as required by 40 CFR 125.95 by January 7, 2008.

(3) **Process wastewater (Outfalls 101 and 401)**

The present technology-based limits and monitoring requirements are continued based on the previous NPDES permit, 40 CFR Part 423 and 40 CFR Part 122.44(a)(l).

Outfall 401-once through cooling water

There shall be no discharge of **polychlorinated biphenyls** transformer fluid (consistent with 40 CFR 432.12(b)(2).

Total residual chlorine may not be discharged from any single generating unit for more than two hours per day unless the discharger demonstrates to the permitting authority that discharge for more than two hours is required for macroinvertebrate control. Simultaneous multi-unit chlorination is permitted.

Technology-based mass loading limits for chlorine have been calculated based on the present technology-based concentration limits and the maximum allowable flow of 450 MGD. These limitations are continued from the previous permit.

(4) **Stormwater runoff**

Storm water runoff commingling with other process wastewater discharged from Outfall 101 shall be managed in accordance with the Best Management Practices (BMPs) in the form of a pollution prevention plan (SWPPP) required by the Arkansas Industrial General Storm Water Permit ARR000000 to control the quality of storm water discharges associated with industrial activity based on 40 CFR 122.44(k).

C. State Water Quality Numerical Standards Based Limitations

(1) Conventional and Non-Conventional Pollutants

Outfalls 001, 101, and 401:

The effluent limitations for pH are based on the current permit and 40 CFR Part 122.44(l). They are consistent with Chapter 5, Section 2.504 of Regulation No. 2 as amended.

Sulfates(Outfall 101):

A requirement for monitoring and reporting of Sulfates is deleted. A review of the DMR indicates that there is no potential of violations of the Arkansas Water Quality Standards for Sulfates.

Temperature (Outfall 401):

The effluent limitation for Temperature are based on the current permit and 40 CFR Part 122.44(a)(l). They are consistent with the Specific Standards for SWEPCO Reservoir as contained in Regulation No. 2 as amended.

D. Toxics Pollutants-Priority Pollutant Scan (PPS)

Arkansas Water Quality Standards:

(1) General Comments

Effluent limitations and/or conditions established in the final permit are in compliance with the Arkansas Water Quality Standards and the applicable Water Quality Management Plan.

(2) Post Third Round Policy and Strategy

Section 101 of the Clean Water Act (CWA) states that "...it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited..." To insure that the CWA's prohibitions on toxic discharges are met, EPA has issued a "Policy for the Development of Water Quality-Based Permit Limitations by Toxic Pollutants"(49 FR 9016-9019, 3/9/84). In support of the national policy, Region 6 adopted the "Policy for post Third Round NPDES Permitting" and the "Post Third Round NPDES Permit Implementation Strategy" on October 1, 1992. The Regional policy and strategy are designed to insure that no source will be allowed to discharge any wastewater which (1) results in instream aquatic toxicity; (2) causes a violation of an applicable narrative or numerical State water quality standard resulting in non-conformance with the provisions of 40 CFR Part 122.44(d); (3) results in the endangerment of a drinking water supply; or (4) results in aquatic bioaccumulation which threatens human health.

(3) **Implementation**

The State of Arkansas is currently implementing EPA's Post Third-Round Policy in conformance with the EPA Regional strategy. The 5-year NPDES permits contain technology-based effluent limitations reflecting the best controls available. Where these technology-based permit limits do not protect water quality or the designated uses, or where there are no applicable technology-based limits, additional water quality-based effluent limitations and/or conditions are included in the NPDES permits. State narrative and numerical water quality standards from the Regulation No. 2 are used in conjunction with EPA criteria and other available toxicity information to determine the adequacy of technology-based permit limits and the need for additional water quality-based controls.

(4) **Priority Pollutant Scan**

In accordance with the regional policy ADEQ has reviewed and evaluated the effluent in evaluating the potential toxicity of each analyzed pollutant:

a. The results were evaluated and compared to EPA's Minimum Quantification Levels (MQLs) to determine the potential presence of a respective toxic pollutant. Those pollutants which are greater than or equal to the MQLs are determined to be reasonably present in the effluent and an evaluation of their potential toxicity is necessary.

b. Those pollutants with one datum shown as "non-detect" (ND), providing the level of detection is equal to or lower than MQL are determined to be not potentially present in the effluent and eliminated from further evaluation.

c. Those pollutants with a detectable value even if below the MQL are determined to be reasonably present in the effluent and an evaluation of their potential toxicity is necessary.

d. For those pollutants with multiple data values and all values are determined to be non-detect, therefore no further evaluation is necessary. However, where data set includes some detectable concentrations and some values as ND, one-half of the detection level is used for those values below the level of detection to calculate the geometric mean of the data set.

The concentration of each pollutant after mixing with the receiving stream was compared to the applicable water quality standards as established in the Arkansas Water Quality Standards, Reg. No. 2 and with the aquatic toxicity, human health, and drinking water criteria obtained from the "Quality Criteria for Water, 1986 (Gold Book)". The following expression was used to calculate the pollutant instream waste concentration (IWC):

$IWC = ((C_e \text{ X } Q_e) + (C_b \text{ X } Q_b))/ (Q_e + Q_b)$

Where:

IWC = instream concentration of pollutant after mixing with receiving stream (• g/l)
C_e = pollutant concentration in effluent (• g/l)
Q_e = effluent flow of facility (cfs)
C_b = background concentration of pollutant in receiving stream (• g/l)
Q_b = background flow of receiving stream (cfs)

The following values were used in the IWC calculations:

C_e = varies with pollutant. A single value from the Priority Pollutant Screen (PPS) submitted by the permittee as part of the NPDES permit application or the geometric mean of a group of data points(less than 20 data points) is multiplied by a factor of 2.13. This factor is based on EPA's Region VI procedure (See attachment IV of Continuing Planning Process(CPP)) to extrapolate limited data sets to better evaluate the potential toxicity for higher effluent concentrations to exceed water quality standards. This procedure employs a statistical approach which yields an estimate of a selected upper percentile value (the 95th percentile) of an effluent data set which would be expected to exceed 95% of effluent concentrations in a discharge. If 20 or more data points during the last two years are available, do not multiply by 2.13, but instead use the maximum reported values.

Q_e = Outfall 101: 9.83 MGD, based on the highest monthly average flow during the last two years.

Outfall 401: 406.08 MGD, based on the highest monthly average flow during the last two years.

C_b = 0 µg/l

Q_b = (See below):

e. Aquatic Toxicity

Chronic Toxicity: Flow = 0 cfs, for comparison with chronic aquatic toxicity. This flow is 67 percent of the 7-day, 10-year low-flow (7Q10) for the receiving stream. In the absence of information regarding the 7Q10 of SWEPCO Reservoir, 7Q10 of zero cfs is used to assure that no violations of the metals will occur under the most conservative assumptions.

Acute Toxicity: Flow = 0 cfs, for comparison with acute aquatic toxicity. This flow is 33 percent of the 7Q10 for the receiving stream.

f. Bioaccumulation

Flow = 4 cfs, for comparison with bioaccumulation criteria. This flow is the based on the CPP.

g. Drinking Water

Flow = 0 cfs, for comparison with drinking water criteria. In the absence of information regarding the 7Q10 of SWEPCO Reservoir, 7Q10 of zero cfs is used to assure that no violations of the metals will occur under the most conservative assumptions.

The following values were used to determine limits for the pollutants:

Hardness = 148 mg/l, based on attachment VI of CPP.

pH = 7.54 s.u., based on compliance data from Arkansas Water Quality Inventory Report305(b), Water Quality Data Base System, utilizing ADEQ accumulated data for Station ARK0004A.

(5) **Water Quality Standards for Metals and Cyanide**

Standards for Chromium (VI), Mercury, Selenium, and Cyanide are expressed as a function of the pollutant's water-effect ratio (WER), while standards for cadmium, chromium (III), copper, lead, nickel, silver, and zinc are expressed as a function of the pollutant's water-effect ratio, and as a function of hardness.

The **Water-effect ratio** (WER) is assigned a value of 1.0 unless scientifically defensible study clearly demonstrates that a value less than 1.0 is necessary or a value greater than 1.0 is sufficient to fully protect the designated uses of the receiving stream from the toxic effects of the pollutant.

The WER approach compares bioavailability and toxicity of a specific pollutant in receiving water and in laboratory test water. It involves running toxicity tests for at least two species, measuring LC50 for the pollutant using the local receiving water collected from the site where the criterion is being implemented, and laboratory toxicity testing water made comparable to the site water in terms of chemical hardness. The ratio between site water and lab water LC50 is used to adjust the national acute and chronic criteria to site specific values.

(6) Conversion of Dissolved Metals Criteria for Aquatic Life to Total Recoverable Metal

Metals criteria established in Regulation No. 2 for aquatic life protection are based on dissolved metals concentrations and hardness values (See Page 6 of **Attachment 1**). However, Federal Regulations cited at 40 CFR 122.45(c) require that effluent limitations for metals in NPDES permits be expressed as total recoverable (See Pages 1 and 6 of **Attachment 1**). Therefore a dissolved to the total recoverable metal conversion must be implemented. This involves determining a linear partition coefficient for the metal of concern and using this coefficient to determine the fraction of metal dissolved, so that the dissolved metal ambient criteria may be translated to a total effluent limit. The formula for converting dissolved metals to total recoverable metals for streams and Reservoirs are provided in **Attachment 2** and Region 6 Implementation Guidance for Arkansas Water Quality Standards promulgated at 40 CFR 131.36.

(7) Comparison of the submitted information with the water quality standards and criteria

The following pollutants were determined to be present in the effluent as reported by the permittee.

Pollutant		Concentration Reported, µg/l	MQL, µg/l
Outfall 001:	Zinc	3.6*	10
	Phenols	10**	5
Outfall 101:	Copper	12**	10
	Phenols	10**	5
Outfall 401:	Copper	19**	10
	Phenols	10**	5

* The following set of data points have been considered: 21µg/l (application), < 4 µg/l (August 5, 2005), < 4 µg/l (August 12, 2005), < 4 µg/l (August 19, 2005). Geometric mean has been calculated in accordance with the Continuing Planning Process (page D-30 of Appendix D).

$(21 X 2 X 2 X 2)^{1/4}$ 3.6 µg/l

** Based on the application.

However, ADEQ has determined from the information submitted by the permittee that no water quality standards or Gold Book criteria are exceeded. Therefore no permit action is necessary to maintain these standards or criteria (See **Attachment 1**.)

Oklahoma Water Quality Standards Evaluation

Both Outfalls 101 and 401 discharge to SWEPCO Reservoir which is an impoundment of Little Flint Creek. SWEPCO Reservoir is a water of the State of Arkansas. This Reservoir was to have a surface area of approximately 530 acres with an average depth of 34.5 ft. The reservoir's total volume is 18,300 ac-ft. It's drainage area consist of 10,500 acres in the Little Flint watershed. There has never been a discharge over the reservoir's uncontrolled concrete spillway structure. However, in 1984, a collection system was installed near the toe of the dam to accumulate water which had seeped from the reservoir and pump it back into the reservoir. A daily average release of at least 2 cfs (1.29 mgd) flow through spillway, overflow, seepage, or pumping into Little Flint Creek (Outfall 001) is required in the permit.

In addition to tremendous dilution that takes place in SWEPCO Reservoir, the discharge travels approximately 2 miles to reach Oklahoma's state line where further dilution takes place.

A. **Effluent Analysis Summary for Aquatic Life Protection**

Outfall 001(Little Flint Creek):

Pollutant	Ce, µg/l	Ce * 2.13, µg/l	IWC, µg/l	WQ Acute+, µg/l	WQ Chronic+, µg/l
Zinc	3.6	7.67	7.67	123.48	111.85

C_e Effluent concentration based on Priority Pollutant Scan (PPS)

C_e X 2.13 – Reasonable potential factor. (Referred to as C_{95} in ODEQ's CPP)

Instream Waste Concentration (IWC). IWC (Referred to as C in ODEQ's CPP) is determined by first calculating the dilution capacity of the receiving stream, Q*. The value of Q* will determine which of three equations is to be used to calculate C, the concentration on the mixing zone boundary. (Following equations were taken from Part III of Chapter 2, page 114 in ODEQ's CPP)

Q* = Qe/Qu = 13.9/1 = 13.9
at Qe = maximum flow at Outfall 101 = 9 MGD = 13.9 cfs (Outfall 001)

Qu = 7Q2 of receiving stream = assume 0 cfs, since 7Q2 not available

Since Q* is greater than 0.3333, the following equation from ODEQ's CPP will be used to determine the concentration on the mixing zone:

$C = C_{95}$

+ Based on Oklahoma Water Resource Board (OWRB) proposed 1994 and revised on 1995 numerical criteria. Oklahoma water quality standards (OWQS) for the numerical chronic and acute criteria for toxic substances-Fish and Wildlife Propagation (OAC 785:45-5-12(e)(6)(G), amended 1997. All hardness dependent criteria were calculated using a hardness value of 106.55 mg/l $CaCo_3$ for Segment No. 121700, as taken from Oklahoma's Continuing Planning Process (CPP)2000

As seen in the above table, the calculated IWC does not exceed any Oklahoma Water Quality Standards. Therefore, no permit limits are necessary for aquatic life protection.

Phenols have been reported as < 10 µg/l. According to the Oklahoma's CPP, MQL of 10 µg/l has been established for method 625. Therefore, it is assumed that there are no Phenols in the effluent at Outfall 001

Outfalls 101 and 401:

The only parameter determined to be in the effluent discharged to SWEPCO Reservoir was Copper. It is the Best Engineering Judgment of the permit writer that the evaluation of the potential of this parameter to exceed Oklahoma's Water Quality Standards is not necessary, since this parameter is not shown to be present downstream from these Outfalls in Little Flint Creek (Outfall 001)

B. **Effluent Analysis Summary for Human Health Protection**

Pollutant	Ce, µg/l	Ce * 2.13, µg/l	IWC, µg/l	Human Health Standard+, µg/l
Zinc	3.6	7.67	7.67	*

* Oklahoma does not have any numerical criteria for this parameter.

C_e Effluent concentration based on Priority Pollutant Scan (PPS)

C_e X 2.13 = Reasonable potential factor.

IWC is computed using a mass balance model for complete mixing between the effluent and the receiving water. The equation is as follows:

IWC * (Qe + Qlta) = Qe * (Ce * 2.13) + Qlta * Cu

Cu = background concentration, assumed to be zero.

Qe = maximum average discharge flow = 13.9 cfs (Outfall 001)

Qlta = long term average flow = 4 cfs

+ Based on Oklahoma Water Resource Board (OWRB) proposed 1994 and revised on 1995 numerical criteria (OAC 785:45-5-12(e)(8)(B)).

For the substances for which Oklahoma does not have numerical criteria, ADEQ has determined that these substances do not demonstrate reasonable potential under Arkansas criteria. Therefore, no permit action is necessary to protect human health.

13. **Final Limitations**

The following effluent limitations or "report" requirements were placed in the permit based on the more stringent of the technology-based, water quality-based or previous NPDES permit limitations:

Outfall 001:

Parameter	Water Quality-Based		Technology-Based		Previous NPDES Permit		Final Permit	
	Monthly Avg mg/l	Daily Max mg/l	Monthly Avg mg/l	Daily Max mg/l	Monthly Avg mg/l	Daily Max. mg/l	Monthly Avg. mg/l	Daily Max mg/l
pH	6.0-9.0 s.u.		N/A		6-9s.u.		6.0-9.0 s.u.	

Outfall 101:

Parameter	Water Quality-Based		Technology-Based		Previous NPDES Permit		Final Permit	
	Monthly Avg. mg/l	Daily Max. mg/l	Monthly Avg. mg/l	Daily Max. mg/l	Monthly Avg. mg/l	Daily Max. mg/l	Monthly Avg. mg/l	Daily Max. mg/l
TSS	N/A	N/A	25	43	25	43	25	43
O & G	10	15	6	8	6	8	6	8
pH	6.0-9.0 s.u.		6.0 -9.0 s.u.		6-9s.u.		6.0-9.0 s.u.	

Outfall 401:

Parameter	Water Quality-Based		Technology-Based		Previous NPDES Permit		Final Permit	
	Monthly Avg. mg/l	Daily Max. mg/l	Monthly Avg. mg/l	Daily Max. mg/l	Monthly Avg. mg/l	Daily Max. mg/l	Monthly Avg. mg/l	Daily Max. mg/l
TRC	N/A	N/A	N/A	0.2*	N/A	0.2*	N/A	0.2*
Temperature	N/A	129.2°F	N/A	N/A	N/A	129.2°F	N/A	129.2°F
pH	6.0-9.0 s.u.		6.0 -9.0 s.u		6-9s.u.		6.0-9.0 s.u.	

* Instantaneous Maximum

14 **Biomonitoring**

Section 101(a)(3) of the Clean Water Act states that "......it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited." In addition, ADEQ is required under 40 CFR Part 122.44(d)(1), adopted by reference in Regulation 6, to include conditions as necessary to achieve water quality standards as established under Section 303 of the Clean Water Act. Arkansas has established a narrative criteria which states "toxic materials shall not be present in receiving waters in such quantities as to be toxic to human, animal, plant or aquatic life or to interfere with the normal propagation, growth and survival of aquatic biota."

Whole effluent biomonitoring is the most direct measure of potential toxicity which incorporates the effects of synergism of effluent components and receiving stream water quality characteristics. It is the national policy of EPA to use bioassays as a measure of toxicity to allow evaluation of the effects of a discharge upon a receiving water (49 Federal Register 9016-9019, March 9, 1984). EPA Region 6 and the State of Arkansas are now implementing the Post Third Round Policy and Strategy established on September 9, 1992. Biomonitoring of the effluent is thereby required as a condition of this permit to assess potential toxicity. The biomonitoring procedures stipulated as a condition of this permit are as follows:

TOXICITY TESTS	FREQUENCY
Chronic Biomonitoring	Once/quarter

Requirements for measurement frequency are based on appendix D of CPP.

Since 7Q10 is less than 100 cfs (ft^3/sec) and dilution ratio is less than 100:1, chronic biomonitoring requirements will be included in the permit.

The Critical Dilution (CD) of 17% (Outfall 101) is continued from the previous permit based on the submitted mixing zone study conducted by FTN Associates. The Critical Dilution (CD) of 40% (Outfall 401) is also continued from the previous permit.

Toxicity tests shall be performed in accordance with protocols described in "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms", EPA/600/4-91/002, July 1994. A minimum of five effluent dilutions in addition to an appropriate control (0%) are to be used in the toxicity tests. These additional effluent concentrations for the Outfall 101 are **7%, 10%, 13%, 17%, and 23%** and for the Outfall 401 are **17%, 23%, 30%, 40%, and 54%** (See **Attachment I** of CPP). The low-flow effluent concentration (critical dilution) is defined as **17%** effluent for the Outfall 101 and **40%** effluent for the Outfall 401. The requirement for chronic biomonitoring tests is based on the magnitude of the facility's discharge with respect to receiving stream flow. The stipulated test species, *Ceriodaphnia dubia* and the Fathead Minnow (*Pimephales promelas*) are indigenous to the geographic area of the facility; the use of these is consistent with the requirements of the State water quality standards. The biomonitoring frequency has been established to provide data representative of the toxic potential of the facility's discharge, in accordance with the regulations promulgated at 40 CFR Part 122.48.

Results of all dilutions as well as the associated chemical monitoring of pH, temperature, hardness, dissolved oxygen conductivity, and alkalinity shall be reported according to EPA/600/4-91/002, July 1994 and shall be submitted as an attachment to the Discharge Monitoring Report (DMR).

This permit may be reopened to require further biomonitoring studies, Toxicity Reduction Evaluation (TRE) and/or effluent limits if biomonitoring data submitted to the Department shows toxicity in the permittee's discharge. Modification or revocation of this permit is subject to the provisions of 40 CFR 122.62, as adopted by reference in ADEQ Regulation No. 6. Increased or intensified toxicity testing may also be required in accordance with Section 308 of the Clean Water Act and Section 8-4-201 of the Arkansas Water and Air Pollution Control Act (Act 472 of 1949, as amended).

<u>Administrative Records</u>

The following information summarized toxicity test submitted by the permittee during the term of the current permit at outfalls **101** and **401**(See **Attachment 4**.)

15. **Sample Type and Sampling Frequency**

Regulations promulgated at 40 CFR 122.44(i) (l) require permit to establish monitoring requirements which assure compliance with permit limitations.

Requirements for sample type and sampling frequency have been based on the current NPDES permit.

16. **Changes from the previously issued permit**

a. The name of the permittee has been corrected.
b. The coordinates of the facility and all Outfalls have been corrected.
c. A detailed description of facility location has been corrected (Sections).
d. A requirement for monitoring and reporting for Sulfates has been deleted.
e. The effluent limitations for pH have been changed from 6-9 s.u to 6.0-9.0 s.u
f. The internal Outfall 301 has been eliminated.
g. Part II, Part III, and Part IV have been revised.
h Reporting requirements for biomonitoring at Outfalls 101 and 401 have changed(Part IA)
i Requirements for compliance with 40 CFR Part 125 Subpart J have been added to Part III

17. **SCHEDULE OF COMPLIANCE.**

Compliance with final effluent limitations is required by the following schedule:

Compliance is required on the effective date of the permit

The permittee shall comply with the Cooling Water Intake regulations found in Title 40 Code of Federal Regulations Part 125, Subpart J. These regulations include, but are not limited to the following provisions:

a The permittee shall submit two copies of the Proposal for Information Collection to the NPDES Branch of the Water Division prior to the start of information collection activities, and,

b. The permittee shall submit two copies of the completed Comprehensive Demonstration Study to the NPDES Branch of the Water Division prior to January 7, 2008 (or on or before the federal deadline that the EPA may reestablish for complying with the requirements of 40 CFR 125, Subpart J). The permittee shall meet all other applicable requirements of this regulation

18. **MONITORING AND REPORTING.**

The applicant is at all times required to monitor the discharge on a regular basis, and report the results monthly. The monitoring results will be available to the public.

19. **SOURCES.**

The following sources were used to draft the final permit:

A. NPDES application No. AR0037842 received 04/29/2005.
B. Arkansas Water Quality Management Plan (WQMP).
C Regulation No 2
D. Regulation No 6.
E. 40 CFRs 122, 125, 423.

F. NPDES permit file AR0037842.
G. Discharge Monitoring Reports (DMRs).
H. "Identification and Classification of Perennial Streams of Arkansas", Arkansas Geological Commission.
I. Continuing Planning Process (CPP).
J. Technical Support Document For Water Quality-based Toxic Control.
K. Region 6 Implementation Guidance for Arkansas Water Quality Standards promulgated at 40 CFR 131.36.
L. E-mail dated November 2, 2005 from Clem to Jastrzebski.
M. E-mail dated August 31, 2005 from Steward to Jastrzebski
N. Site visit on July 21, 2005
O. Letters dated June 9, 2005, July 25, 2005, July 27, 2005, August 2, 2005, from David C Bouchard to Jastrzebski.
P. Oklahoma Department of Environmental Quality Continuing Planning Process, 2002 Edition.
Q. Oklahoma's Water Quality Standards.
R. Letter dated December 22, 2005, from Russell W. Draves, Manager, AEP Water and Ecological Resource Services, to ADEQ.
S. E-mail dated January 10, 2005, from David C. Bouchard, DVM, MPH AEP Water and Ecological Resource Services, to Jastrzebski.

Attachment I

[PPS]

Attachment 2

Linear Partition Coefficients for Priority Metals in Streams and Reservoirs*

METAL	STREAMS		RESERVOIRS	
	Kpo	a	Kpo	a
Arsenic	0.48×10^6	-0.73	0.48×10^6	-0.73
Cadmium	4.00×10^6	-1.13	3.52×10^6	-0.92
Chromium**	3.36×10^6	-0.93	2.17×10^6	-0.27
Copper	1.04×10^6	-0.74	2.85×10^6	-0.9
Lead***	2.80×10^6	-0.8	2.04×10^6	-0.53
Mercury	2.90×10^6	-1.14	1.97×10^6	-1.17
Nickel	0.49×10^6	-0.57	2.21×10^6	-0.76
Silver****	2.40×10^6	-1.03	2.40×10^6	-1.03
Zinc	1.25×10^6	-0.7	3.34×10^6	-0.68

$Kp = Kpo \times TSS^a$

Kp = Linear Partition Coefficient
TSS = Total Suspended Solids (mg/l)-(See **Attachment 3**)
Kpo = found from table
a = found from table

$C/Ct = 1/(1 + (Kp \times TSS \times 10^{-6}))$ C/Ct = Fraction of Metal Dissolved

* Delos, C. G., W. L. Richardson, J. V. DePinto, R. B., Ambrose, P. W. Rogers, K. Rygwelski, J. P. St. John, W. J. Shaughnessey, T. A. Faha, W. N. Christie, Technical Guidance for Performing Waste Load Allocations, Book II: Streams and Rivers, Chapter 3:Toxic Substances, for the U. S. Environmental Protection Agency (EPA-440/4-84-022).

** Linear partition coefficient shall not apply to the Chromium VI numerical criterion. The approved analytical method for Chromium VI measures only the dissolved form. Therefore permit limits for Chromium VI shall be expressed in the dissolved form. See 40 CFR 122.45(c)(3).

*** Reference page 18 of EPA memo dated March 3, 1992, from Margaret J. Stasikowski(WH-586) to Water management Division Directors, Region I-IX.

**** Texas Environmental Advisory Council, 1994

Attachment 3

TOTAL SUSPENDED SOLIDS(15th PERCENTILE) BY RECEIVING STREAM AND ECOREGION

For direct discharges to the Arkansas, Red, Ouachita, White, and St. Francis Rivers use the following mean values.

TSS(15th percentile)		
Receiving Stream	TSS	Unit
Arkansas River:		
Ft. Smith to Dardanelle Dam	12.0	mg/l
Dardanelle Dam to Terry L&D	10.5	mg/l
Terry L&D to L&D #5	8.3	mg/l
L&D #5 to Mouth	9.0	mg/l
Red River	33	mg/l
Ouachita River:		
above Caddo River	2.0	mg/l
below Caddo River	5.5	mg/l
White River:		
above Beaver Reservoir	2.5	mg/l
Bull Shoals to Black River	3.3	mg/l
Black River to Mouth	18.5	mg/l
St. Francis River	18	mg/l

For all other discharges use the following ecoregion TSS:

TSS (15th percentile)		
Ecoregion	TSS	Unit
Ouachita	2	mg/l
Gulf Coastal	5.5	mg/l
Delta	8	mg/l
Ozark Highlands	2.5	mg/l
Boston Mountains	1.3	mg/l
Arkansas River Valley	3	mg/l

ADEQ

ARKANSAS
Department of Environmental Quality

RESPONSE TO COMMENTS
FINAL PERMIT DECISION

This is our response to comments received on the subject draft permit in accordance with regulations promulgated at 40 CFR Part 124.17.

Permit No. :	AR0037842
Applicant :	American Electric Power Southwestern Electric Power Company-Flint Creek Power Plant
Prepared by :	Marysia Jastrzebski, P. E.
Permit Action :	Final permit decision and response to comments received on the draft permit publicly noticed on December 09, 2005
Date Prepared	January 10, 2006

The following comments have been received on the draft permit.

Letter from Russell W. Draves, Manager, AEP Water and Ecological Resource Services to ADEQ dated December 22, 2005

I. Response to issues raised

ISSUE #1

"**Cover Letter, Public Notice,** Page 1 of the **Fact Sheet,** and Page 1 of the **Draft Permit**: Address – the underlined parts in the following indicate the corrected address:

Southwestern Electric Power Company – Flint Creek Power Plant"

RESPONSE #1

The Department agrees. The requested corrections have been made.

ISSUE #2

"**Page 2, Fact Sheet, 6. Receiving Stream Segment ...:**
The line leading into the list of outfalls should say:

"The outfalls is are located at the following coordinates:""

RESPONSE #2

The Department agrees The requested correction has been made.

ISSUE #3

"Page 2, Fact Sheet, 7. Parentheses:
Parentheses are used in the Act to designate the paragraph.

" 7. 303(d) List and Endangered Species Considerations," and:
"A. 303(d) List," and:
"The receiving stream is not listed on the 303(d) list."

RESPONSE #3

The Department agrees The requested revision has been made

ISSUE #4

"Page[s] 5 and 16, Fact Sheet, Temperature – (Inst. Max):
The reference to (Inst. Max) is inadvertently applied to temperature. It was intended only for total residual chlorine. (Daily Max) should appear in the temperature box on page 5 with 129.2°F instead of (Inst. Max). See Page 3 of Part 1A where Daily Maximum Temperature is footnoted as it should have been, i.e., "...Daily maximum temperature shall be the highest flow-weighted [average] temperature calculated for the month."

RESPONSE #4

The Department agrees. The requested revision has been made without the word "average".

ISSUE #5

"Page 6, Fact Sheet, TSS and O&G:
The Fact Sheet states that these parameters have been based on the current NPDES permit and 40 CFR 122.44(1) – should this be 40 CFR 122.44(a)(1)?
(This (a), if it belongs, is also missing on Page 8 of the Fact Sheet).

Though the draft and current permits do have the same limits, could we ask that the Fact Sheet briefly address why these limits are different than the categorical limits found in 40 CFR 423.12(b)(3) and 40 CFR 423(b)(4)?

The permit limits for total residual chlorine are the same as the CFR categorical limits. This is why it is unclear to us how this difference between the permit and the CFR concentrations for TSS and O&G were derived."

RESPONSE #5

The Department agrees The final Fact Sheet [Section 12.B(2) on Pages 5 and 6] has been revised to briefly address this issue.

ISSUE #6

"Page 12, Fact Sheet, (7) Comparison…:
At the request of the permit writer, zinc [Zn] was retested for three consecutive weeks at Outfall 001 to establish whether or not the elevated Zn concentration reported in the first analysis was representative These analyses consistently demonstrated concentrations below the MQL (<4 µg/L). This should be mentioned in the Fact Sheet instead of 21 µg/L or at least along with it."

RESPONSE #6

The Department agrees The additional three data points have been considered and Zinc concentrations have been recalculated Paragraph 7 of Section 12 D. and pages 12 & 13 (Oklahoma's Water Quality Standards Evaluation) have been revised.

ISSUE #7

"Page 13, Fact Sheet – Mid-paragraph:
"However, in 1980, a collection system…"
should say:

"However, in 198<u>4</u>, a collection system…"

RESPONSE #7

The Department agrees. The requested correction has been made on Page 12.

ISSUE #8

"Page 16, Fact Sheet:
An asterisk appears in the Daily Maximum Temperature box of the Water Quality-Based. Previous NPDES Permit and Draft Permit columns and refers to Instantaneous Maximum. This condition should be removed from temperature as it belongs only with total residual chlorine."

RESPONSE #8

The Department agrees. The requested correction has been made on Page 15.

ISSUE #9

"Cover Letter
The line leading into the list of outfalls should say:

"The outfalls ~~is~~ are located at the following coordinates:"

RESPONSE #9

The Department agrees. The requested correction has been made to the cover page of the final permit.

ISSUE #10

"**Page 2 of Part IA, Outfall 101:**
The Gentry POTW discharge is included in the list of Outfall 101 wastewaters. We believe that its presence should be included as a footnote on this page rather than with the waste streams actually generated by the plant. It should also be noted that the power plant is not responsible for the quantity or the quality of the POTW waste stream. Please consider this footnote:

"The City of Gentry discharges treated municipal effluent, subject to the limitations of its NPDES Permit No. AR0020184, into Flint Creek Power Plant's primary ash pond. Flint Creek Power Plant bears no responsibility for the quality of the City of Gentry's effluent or for any treatment of that effluent."

RESPONSE #10

The Department agrees. The requested footnote has been added on Page 2 of Part IA.

ISSUE #11

"**Page 2 of Part IA, Outfall 101, Chronic Biomonitoring:**
There are five code lines beneath each test species. These same codes appear in the biomonitoring section, Pages 8 and 9 of Part III, with items (E) and (F) in reversed positions.

For consistency, these lists should be in the same order in both sections of the permit.

RESPONSE #11

The Department agrees. Pages 8 of Part III have been revised.

ISSUE #12

"**Page 2 of Part IA, Outfall 101, Sampling Point:**
We believe it would be clearer, especially to an inspector who is not as familiar with the plant and plant site, to make the following change regarding the sampling point:

"Samples taken in compliance with the monitoring requirements specified above shall be taken at the discharge from the ~~final treatment unit~~ secondary ash pond.
or,
"Samples taken in compliance with the monitoring requirements specified above shall be taken at the discharge from the ~~final treatment unit~~ secondary ash pond (the final treatment unit)."

RESPONSE #12

The Department agrees. Page 2 of Part IA has been revised.

ISSUE #13

"**Page 3 of Permit Part IA, Outfall 401, Temperature:**
The temperature parameter requires the Daily Maximum Average Temperature to be reported, and does so on this page. The Instantaneous Maximum does not appear here, as it did in the Fact Sheet, which is correct. A definition of 'Instantaneous Maximum' in Part IV, Definitions would also be helpful."

RESPONSE #13

The Department concurs in regard to calculation of temperature. A definition has been included on page 3 of Part IA "Daily maximum temperature shall be the highest daily flow-weighted temperature calculated for the month" is sufficient. Additionally, a definition of "Instantaneous Maximum" has been added in Part IV of the permit.

ISSUE #14

"**Page 3 of Permit Part IA: Temperature – Footnote 4.**
In the second sentence of this footnote 'daily' and 'average' have been omitted.
It should read:

"Daily maximum temperature shall be the highest **daily** flow-weighted **average** temperature calculated for the month."

RESPONSE #14

The Department agrees. Page 3 of Part IA has been revised to add the above language without the word "average".

ISSUE #15

"**Page 3 of Permit Part IA: Chronic Biomonitoring:**
There are five code lines beneath each test species. These same codes appear in the biomonitoring section, Pages 8 and 9 of Part III, with items (E) and (F) in reversed positions.

RESPONSE #15

The Department agrees. Page 8 of Part III has been revised.

ISSUE #16

Page 3 of Part II, 8. Property Rights:
There is a repeated phrase:

"The issuance of this permit does not convey any property rights of any sort, or any ~~property rights of any sort,~~ or any exclusive...."

RESPONSE #16

The Department agrees. Part II. 8 has been corrected

ISSUE #17

"**Page 4 of Part II, 5. Upset Conditions: second line on the page should say:**

"...noncompliance with such technology based permit...."

RESPONSE #17

The Department agrees. Part II. 5. a. has been corrected

ISSUE #18

"**Page 8 of Part II, 1. Planned Changes, For Industrial Dischargers, b. First line of the paragraph:**

"The ~~alternation~~ alteration or addition could significantly change the nature or increase the ~~quality~~ quantity of ...."

RESPONSE #18

The Department agrees. Page 8 of Part II. D. 1.b has been corrected.

ISSUE #19

"**Page 3 of Part III, 2, Persistent Lethality:**
There simply needs to be a space between 'LETHALITY' and 'The.'

RESPONSE #19

The Department agrees. Page 3 of Part III. 2. has been corrected.

ISSUE #20

"**Page 8 of Part III, 4. c.:**
"The permittee shall submit the results of each valid toxicity test on a DMR...."

RESPONSE #20

The Department agrees. Part III. 4.c. has been corrected.

ISSUE #21

"**Page 8-9 of Part III, 4. REPORTING, c. i. and ii.:**
This is the code order that is arranged differently than the on the outfall pages"

RESPONSE #21

The Department agrees. Part III. 4 c has been corrected.

ISSUE #22

"**Page 13 of Part III, 5. Storm Water Pollution Plans:**
We believe the following revision would shorten and sharpen this paragraph without changing its meaning.

Storm Wwater Pollution Plans, 5.:
Storm water runoff commingling with other process wastewater discharged from Outfall 101 shall be managed in accordance with the Best ~~Managmenet~~ Management Practices (BMPs) in the form of a pollution prevention plan (SWPPP) required by the Arkansas Industrial General Storm Water Permit ARR000000 to control the quality of storm water discharges associated with industrial activity ~~that are authorized under~~ [40 CFR 122.44(k)]. ~~when the Permitting Authority finds numerical effluent limitations to be infeasible to carry out the purposes of the Clean Water Act."~~

RESPONSE #22

The Department agrees. Part III. 5 has been revised.

AEPFC000421

ISSUE #23

"**Page 13 of Part III, 6. PCB;**
There shall be no discharge of polychlorinated biphenyl transformer fluid."

RESPONSE #23

The Department agrees. Part III. 6 has been corrected.

ISSUE #24

"**Page 13 of Part III, 7. Total Residual Chlorine:**
On Page 1 of Part III, Condition 3. Other Specified Monitoring Requirements, it states that, with ADEQ approval, alternative monitoring methods may be used other than those specified in Part I Section A. At Part I Section A it refers to Page 13 of Part III, Other Condition 7, which gives the specifics related to total residual chlorine. To connect these three references we suggest inserting the following paragraph as the second paragraph of Condition 7., on Page 13 of Part III:

"The permittee may use alternative appropriate monitoring methods and analytical instruments other than as specified in Part I Section A of the permit without a major permit modification by complying with the procedure found on Page 1 of Part III, Condition 3. Other Specified Monitoring Requirements."

RESPONSE #24

The Department agrees. This language is already included in Condition #3 of Part III.

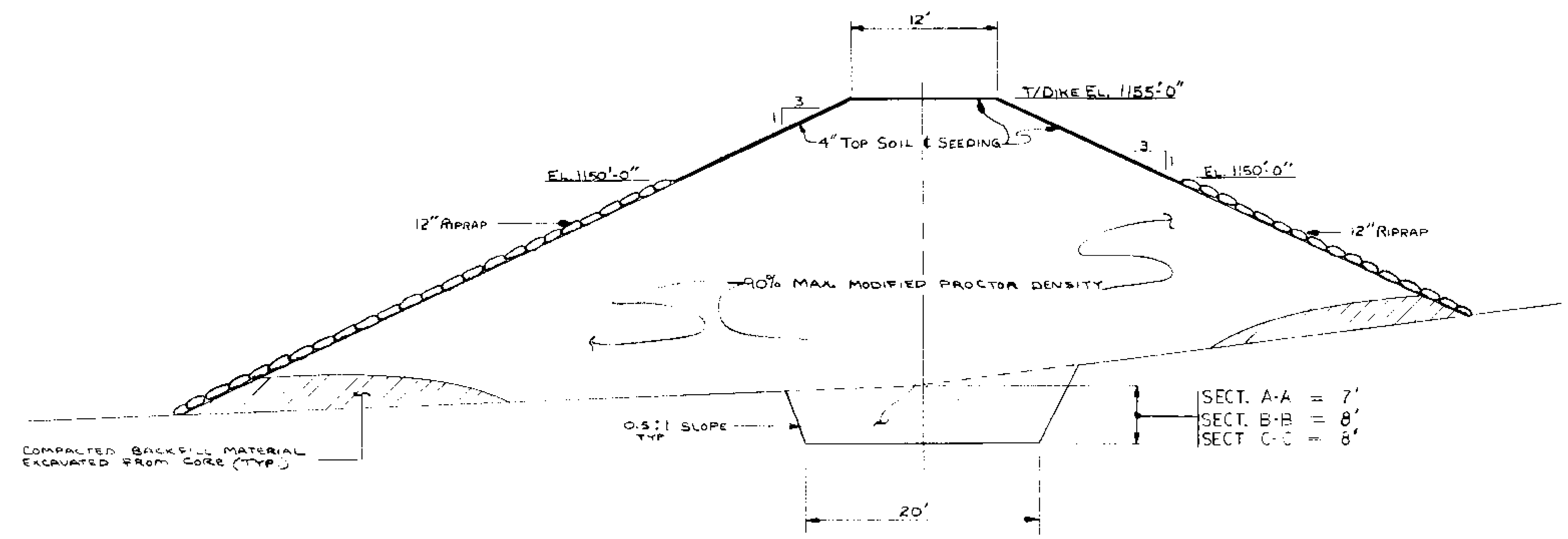
ISSUE #25

"**Page 14 of Part III, 12. b.:**
The current federal deadline for submitting the study required by 40 CFR 125(j) [316(b)] is given as the deadline in this draft permit. As this deadline may be changed, we think the following qualification should be included in Paragraph b. of this condition:

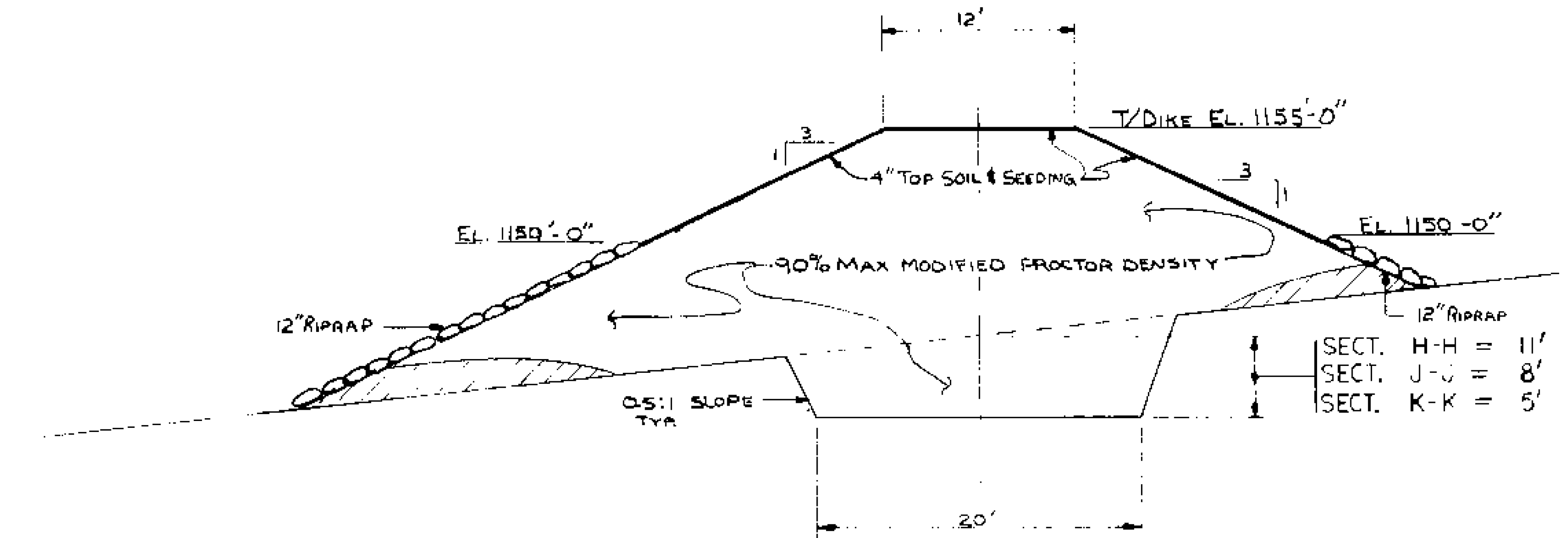
"The permittee shall submit two copies of the completed Comprehensive Demonstration Study to the Enforcement Section of NPDES Branch of the Water Division prior to January 7, 2008 (or on or before the federal deadline that the EPA may reestablish for complying with the requirements of 40 CFR 125, Subpart J)."

RESPONSE #26

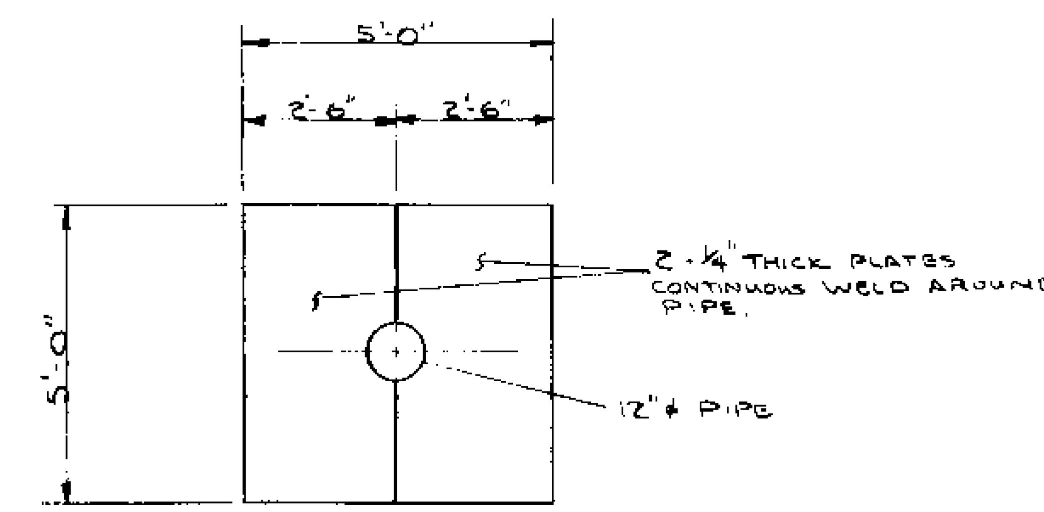
The Department agrees. The requested language has been added to Condition 12. b. of Part III and to Page 1 of Part 1B. Schedule of Compliance.



SECTION "A-A" THRU "C-C"
PRIMARY ASH POND DIKE



SECTION "H-H" THRU "K-K"
SECONDARY ASH POND DIKE

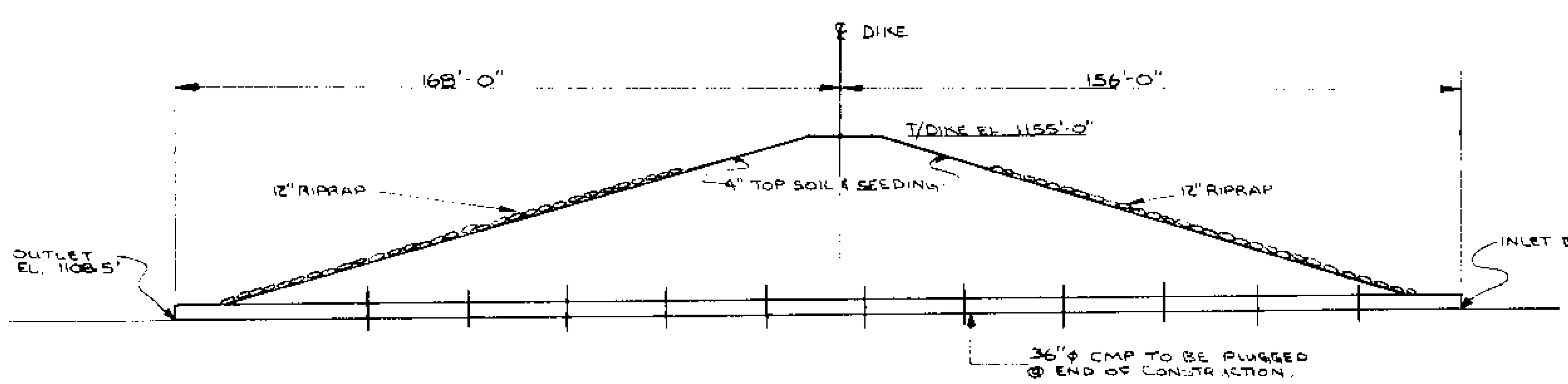


MATERIAL BY SWEPCO.

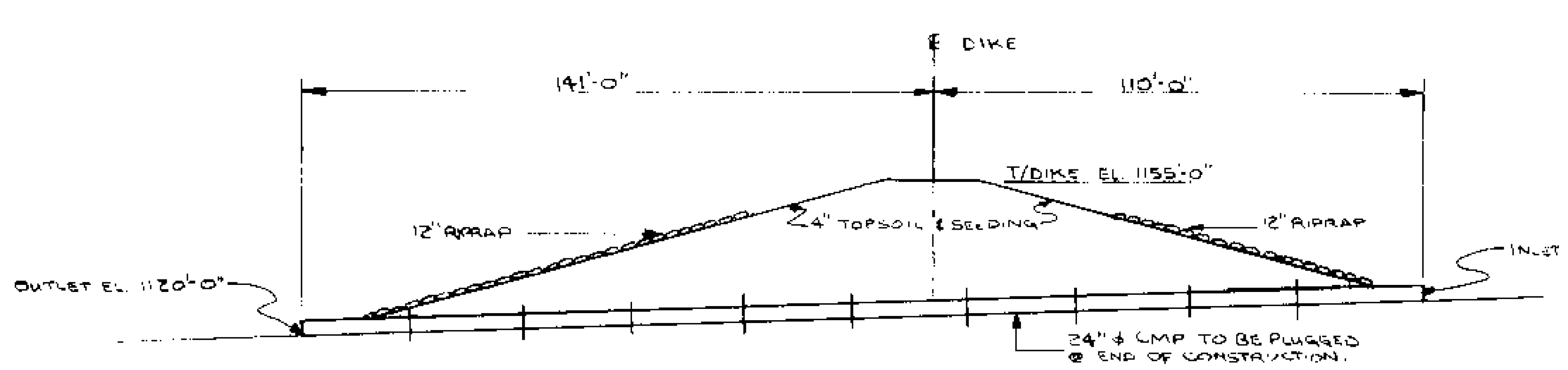
DETAIL 2
TYPICAL DIAPHRAM

NOTES

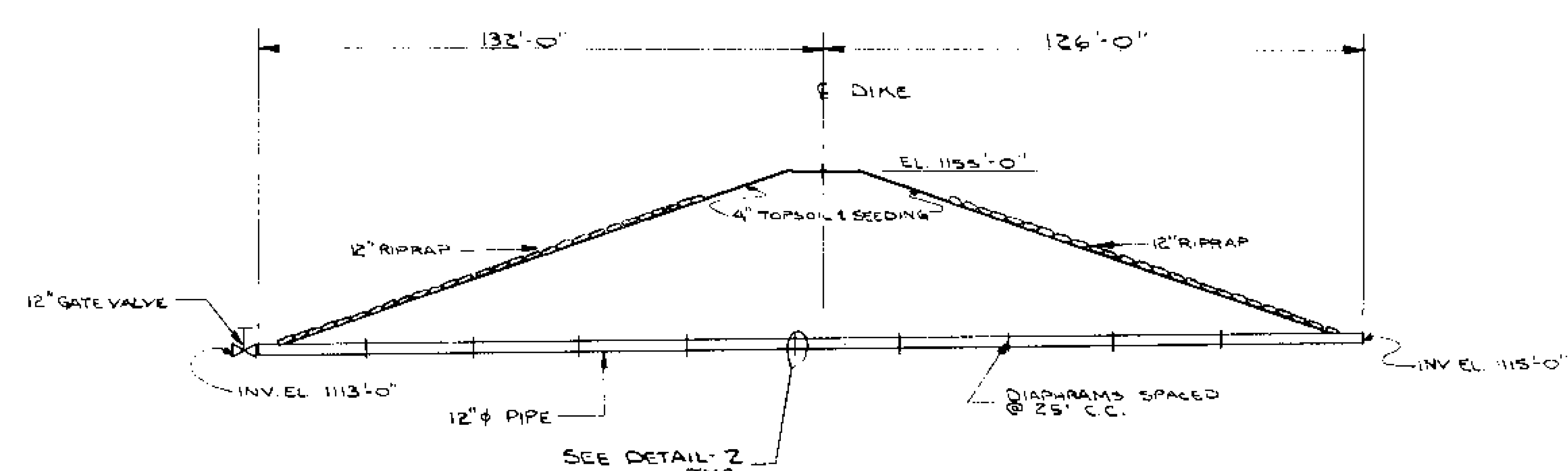
1- CONTRACTOR SHALL STRIP TOPSOIL FROM DIKE AND SPILLWAY AREA AND STOCKPILE AS SHOWN ON FCX-3, SH. 1.
2- EXCAVATED MATERIAL FROM CORE TO BE USED AS COMPACTED FILL IN TOE OF BERM.
3- CORE TO BE CUT TO DESIGN SECTIONS SHOWN. DEPTH OF CORE SHALL VARY BETWEEN SECTIONS. UPON COMPLETION OF CORE EXCAVATION, OWNER'S ENGINEER SHALL MAKE INSPECTION BEFORE BACKFILL BEGINS.
4- CONTRACTOR SHALL PROVIDE DRAINAGE OF ASH BASIN AREA DURING CONSTRUCTION. ASH BASIN CONNECTING CANAL AND SPILLWAY SHALL BE CUT TO ALLOW FOR DRAINAGE BEFORE BACKFILL BEGINS.
5- CONTRACTOR TO FURNISH (1) - 36" ϕ, AND (1) - 24" ϕ, 16 GA. CMP AS SHOWN WITH DIAPHRAMS SPACED AT 25' INTERVALS. ACTUAL CULVERT INVERT ELEVATIONS WILL VARY DUE TO FIELD CONDITIONS.
6- 12" ϕ PIPE AND 12" GATE VALVE FURNISHED BY SWEPCO.



SECTION "D-D"
N.T.S.



SECTION "L-L"
N.T.S.



DETAIL - 1

REV	DATE	BY	SUBJECT
	7/12/74		FOR BID
	7/24/75	MJM	FOR CONSTRUCTION
B	3-17-78		

ASH POND DIKE
CROSS - SECTIONS

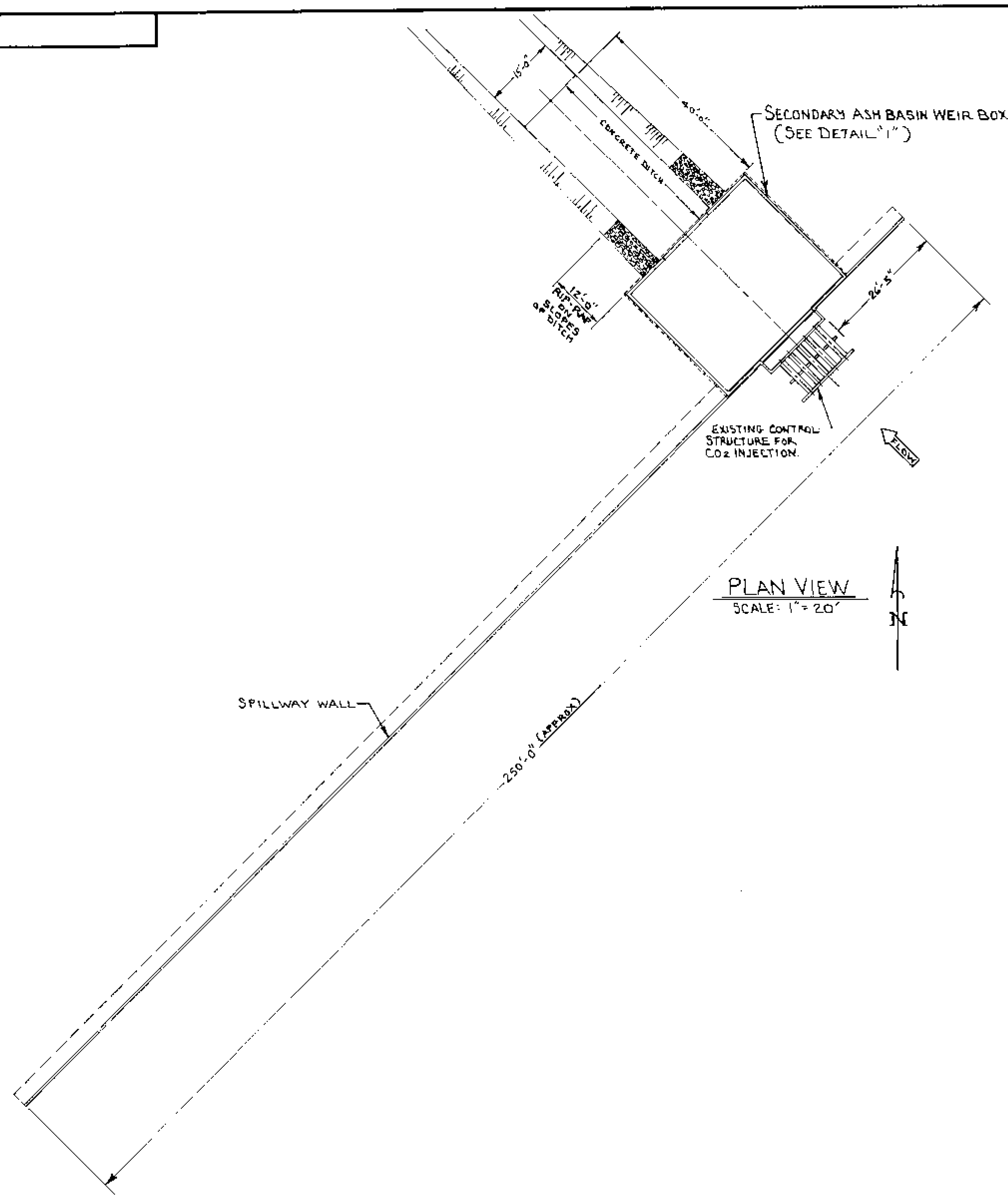
FLINT CREEK POWER PLANT

SOUTHWESTERN ELECTRIC POWER CO.
G.O. CONSTRUCTION DEPARTMENT
DIVISION

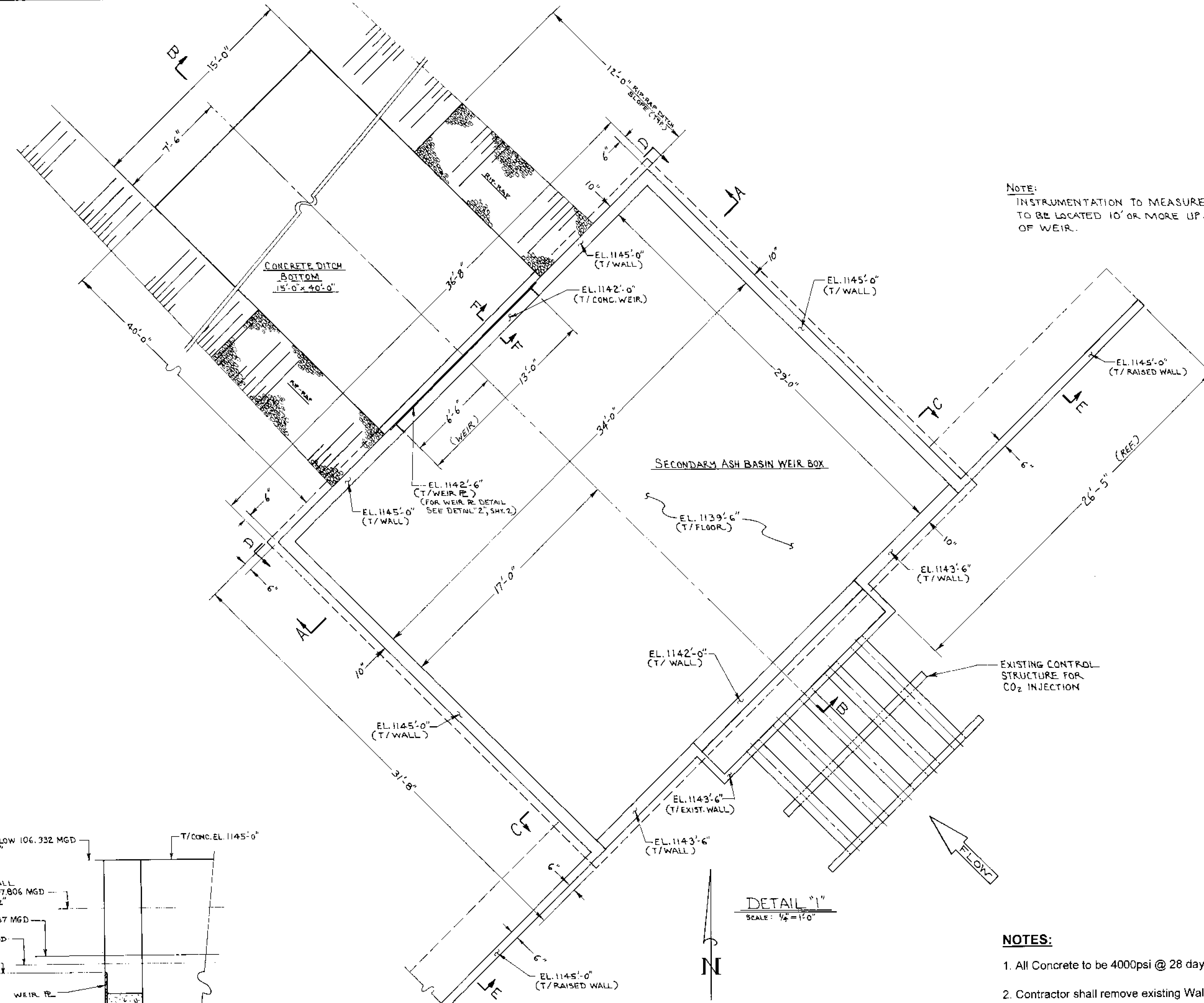
APPROVED ____ ENGR. IN CHARGE
APPROVED ____ DIV. SUPT.
APPROVED ____ CHIEF ENGR.

DRWN. BY MJM
TRAC. BY
DATE: 7-10-74
SCALE: NONE
WORK ORDER
DRWG NO. FCX - 3 SH. 2
SHEET

AEPFC000149



PLAN VIEW
SCALE: 1" = 20'



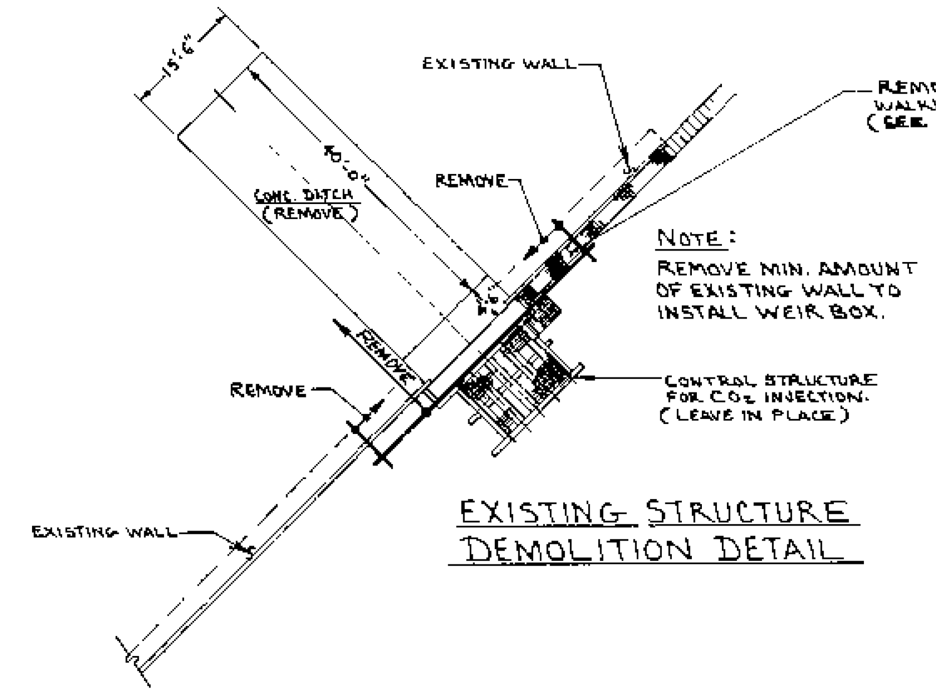
NOTE:
INSTRUMENTATION TO MEASURE HEAD TO BE LOCATED 10' OR MORE UPSTREAM OF WEIR.

DETAIL "1"
SCALE: 1/4" = 1'-0"

NOTES:

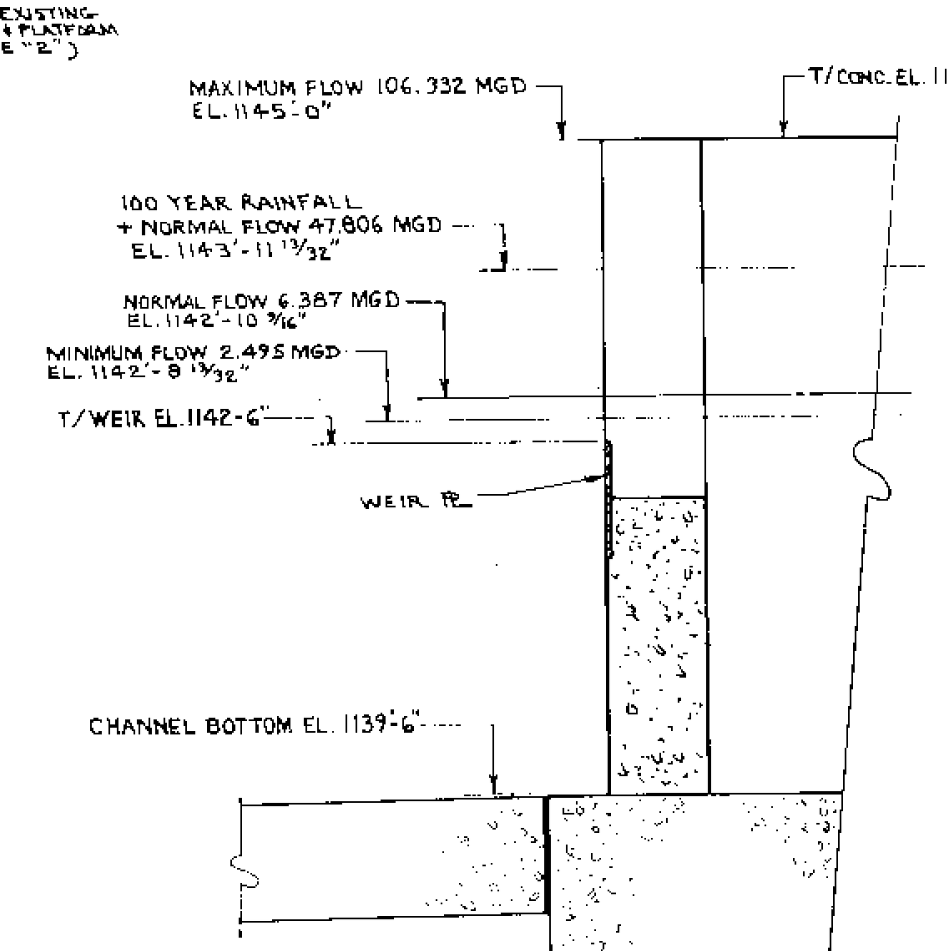
1. All Concrete to be 4000psi @ 28 days.

2. Contractor shall remove existing Walkway and Platform for installation of Weir Box.
Contractor shall re-install the Walkway and Platform after installation of Weir Box is complete.



NOTE:
REMOVE MIN. AMOUNT OF EXISTING WALL TO INSTALL WEIR BOX.

EXISTING STRUCTURE DEMOLITION DETAIL



WEIR FLOW CAPABILITY

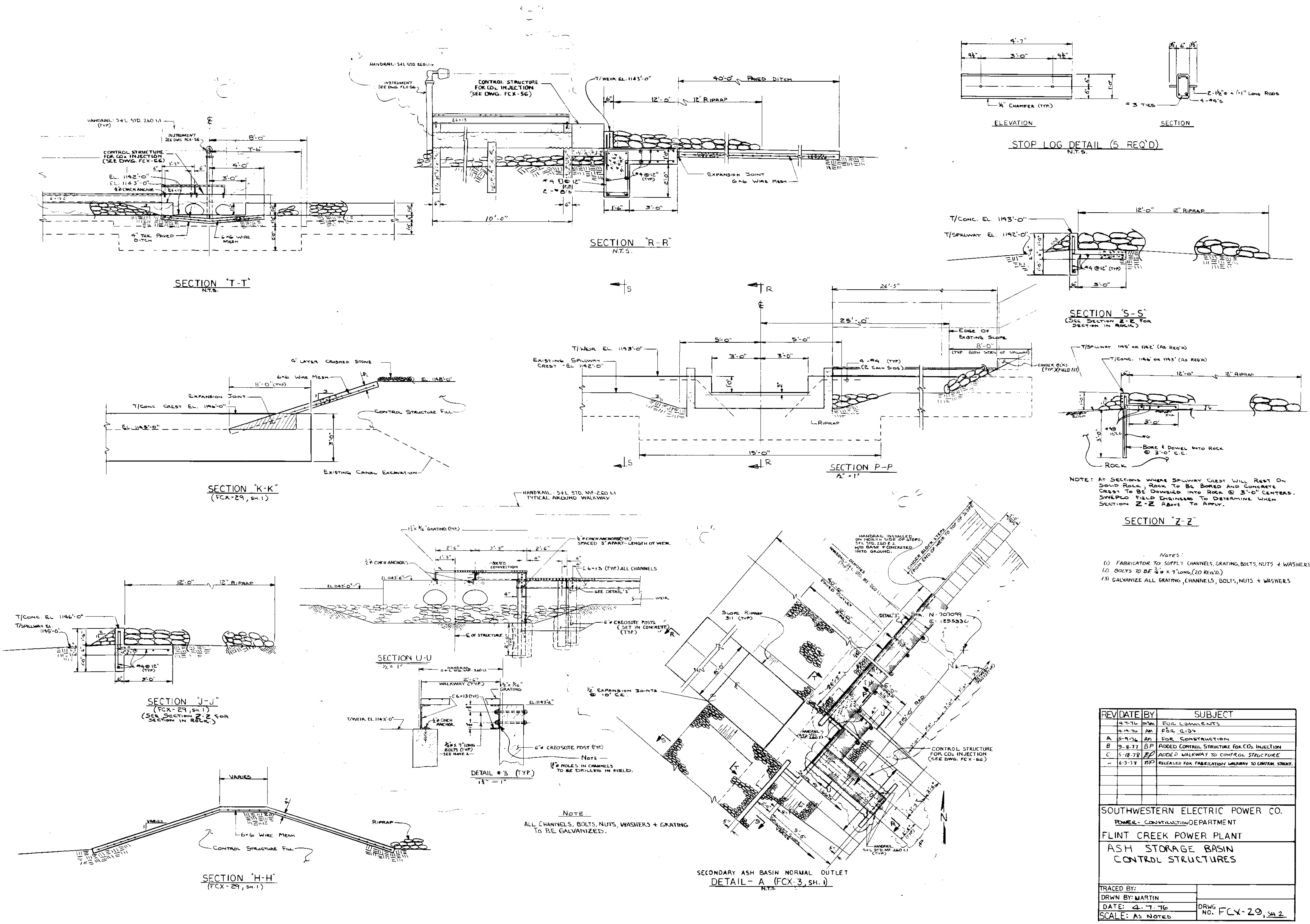
STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No. ... WESLEY ...
Wesley ... P.E.
9-22-2009

REV	DESCRIPTION	DATE	DR	BY	APP
A	RELEASED FOR QUOTES (NOT FOR CONSTRUCTION)		BP		WH
	RELEASED FOR COMMENTS (NOT FOR CONSTRUCTION)	9-22-2009	BP		WH

SECONDARY ASH SETTLING POND WEIR INSTALLATION
FLINT CREEK POWER PLANT
SOUTHWESTERN ELECTRIC POWER CO.

DRAFTING/ENGINEERING	DATE	SCALE:	DWG. NO.	REV
DR: BILL PORTER	9-21-2009	AEP	FCX - 104	A
ENG:			SHT. 1 of 2	
APP: Wes Holl	9-22-09			

AEPFC000160



REV	DATE	BY	SUBJECT
	4-9-76	MSM	FOR COMMENTS
	4-19-76	AM	FOR BIDS
A	5-19-76	AM	FOR CONSTRUCTION
B	9-8-77	BP	ADDED CONTROL STRUCTURE FOR CO2 INJECTION
C	5-18-78	BP	ADDED WALKWAY TO CONTROL STRUCTURE
–	6-5-78	BP	RELEASED FOR FABRICATION WALKWAY TO CONTROL STRUCT.

AEPFC000159

Hydraulic Analysis of Flint Creek Power Plant Ash Ponds

American Electric Power Company

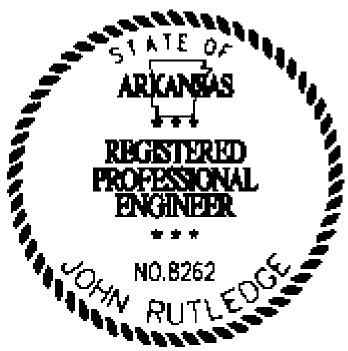
Prepared by:

FREESE AND NICHOLS, INC.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109
817-735-7300

AEP10431

Hydraulic Analysis of Flint Creek Power Plant Ash Ponds

American Electric Power Company



Prepared by:

FREESE AND NICHOLS, INC.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109
817-735-7300

AEP10431

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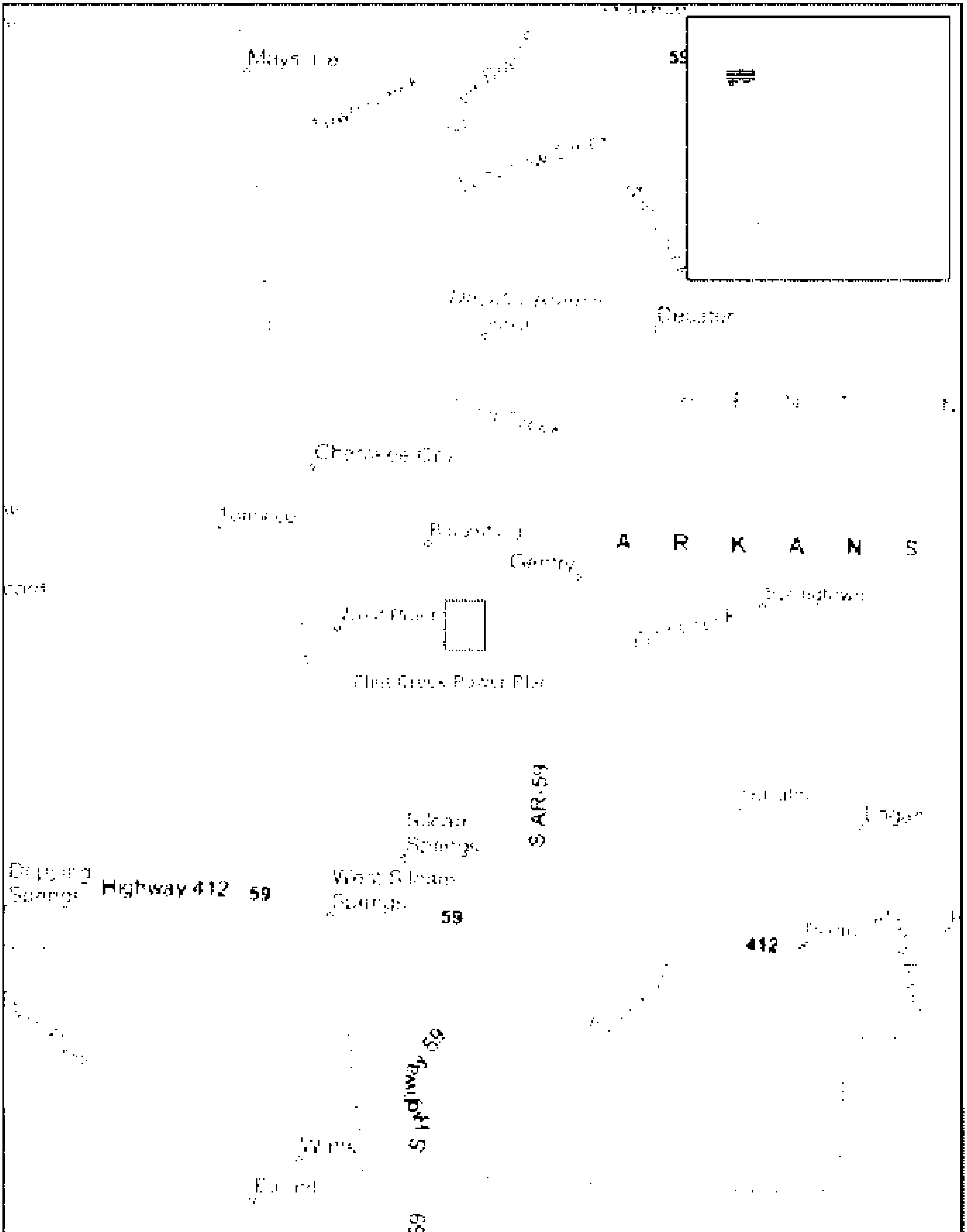
APPENDICES

1.0 INTRODUCTION

In November of 2010, Freese and Nichols, Inc., (FNI) was retained by American Electric Power (AEP) to perform various hydrologic and hydraulic calculations to determine the hydraulic adequacy of the Primary Ash and Secondary Ash Ponds for the Flint Creek Power Plant located near Gentry, Arkansas. This report summarizes the results of the analysis for the 10-year, 25-year, 100-year, 25% PMF, 50% PMF, and 100% PMF events.

The two Ash Ponds are situated immediately south of the Flint Creek Power Plant on the east side of Little Flint Creek Reservoir. The general location of the power plant and associated reservoirs is shown in Figure 1.



0 1.25 2.5 5 Miles

FLINT CREEK POWER PLANT ASH PONDS

LOCATION MAP

FIGURE 1

AEPFC000319

2.0 HYDROLOGIC MODEL DEVELOPMENT

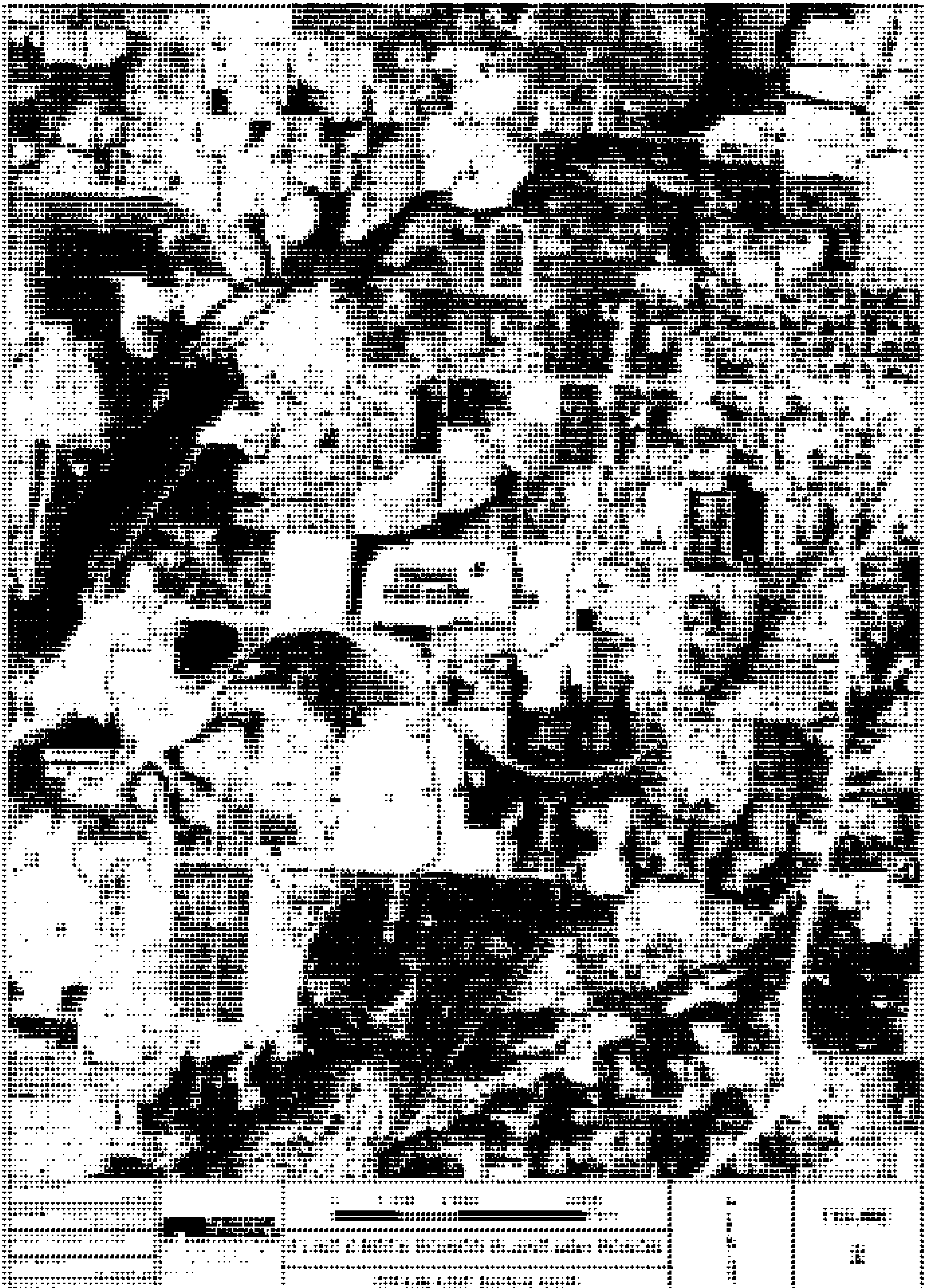
2.1 BASIN DELINEATION & CONNECTIVITY

The hydrologic model for the Flint Creek Power Plant Ash Ponds was created in HEC-HMS[1] and consisted of two total drainage basins, as shown in Figure 2. The total drainage area modeled is approximately 1.82 square miles, or 1,167 acres. One basin represents the total area that drains directly into the Primary Ash Pond, and the other represents the area that drains only to the Secondary Ash Pond. The basins were delineated from the National Elevation Dataset (NED) 10-meter resolution Digital Elevation Model (DEM).

The Primary Ash Pond is connected to the Secondary Ash Pond via a wide open channel controlled by a currently silted over concrete sill and a small weir box at a slightly lower elevation. Discharges from the Secondary Ash Pond flow into Little Flint Creek Reservoir through a similar structure. The concrete sill, however, is visible and the weir box has recently been replaced. Spillway capacities are discussed in further detail in Section 2.4.

Both the Flint Creek Power Plant and the City of Gentry Wastewater Treatment Plant discharge directly into the Primary Ash Pond. Discharges from the power plant consist of low volume wastewater and stormwater. Based on data from AEP, these discharges were assumed constant at a flow rate of 8.08 MGD, or 12.5 cfs.

AEPFC000320

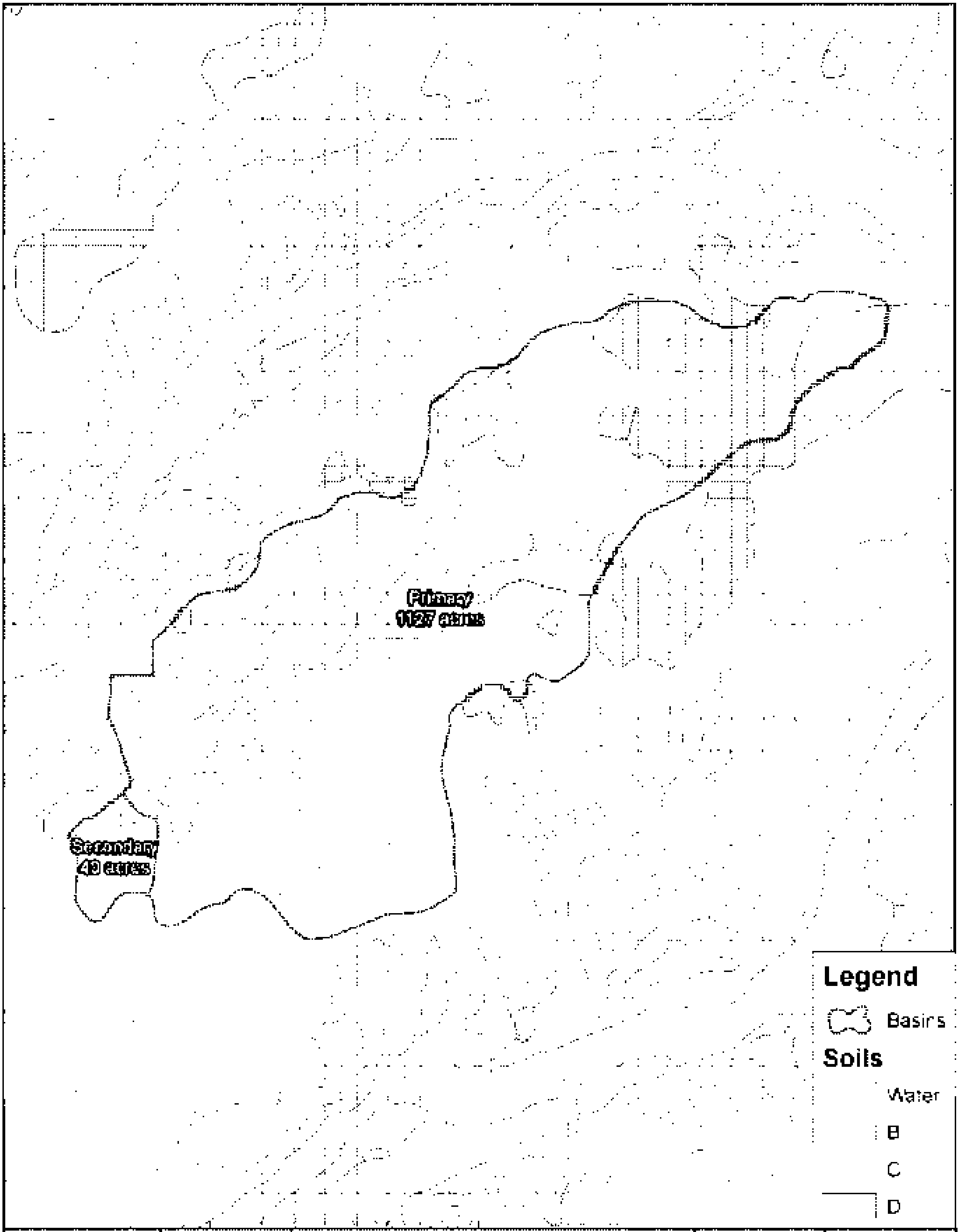


2.2 HYDROLOGIC PARAMETERS

The HEC-HMS model incorporates the NRCS Curve Number and Unit Hydrograph methods for each basin. In this model, the curve numbers were based on hydrologic soil classifications and land cover. The instantaneous runoff effect of open water surfaces was accounted for in the development of the curve numbers. The soils dataset was obtained from the NRCS Soil Survey Geographic Database[2] (SSURGO), and land use dataset was obtained from the USGS Seamless Data Warehouse[3] in the form of the National Land Cover Dataset (NLCD) for 2001. Spatial information about soil types and land use classifications is presented in Figures 3 and 4, respectively. Table 1 provides the matrix used in determining the curve number for each basin. The curve numbers shown in Table 1 are for Antecedent Moisture Condition (AMC) II. These values were incorporated in the model for the frequency storm events, such as the 100-year storm event, and the PMP event. Typically, a higher curve number would be used to simulate a worst-case scenario with the ground fully saturated. However, because of the long duration of the PMP event and the timing of the rainfall distribution, the ground will be fully saturated prior to the peak of the storm and a higher curve number will have no significant impact on the results.

Table 1 – Curve Number Calculation Matrix

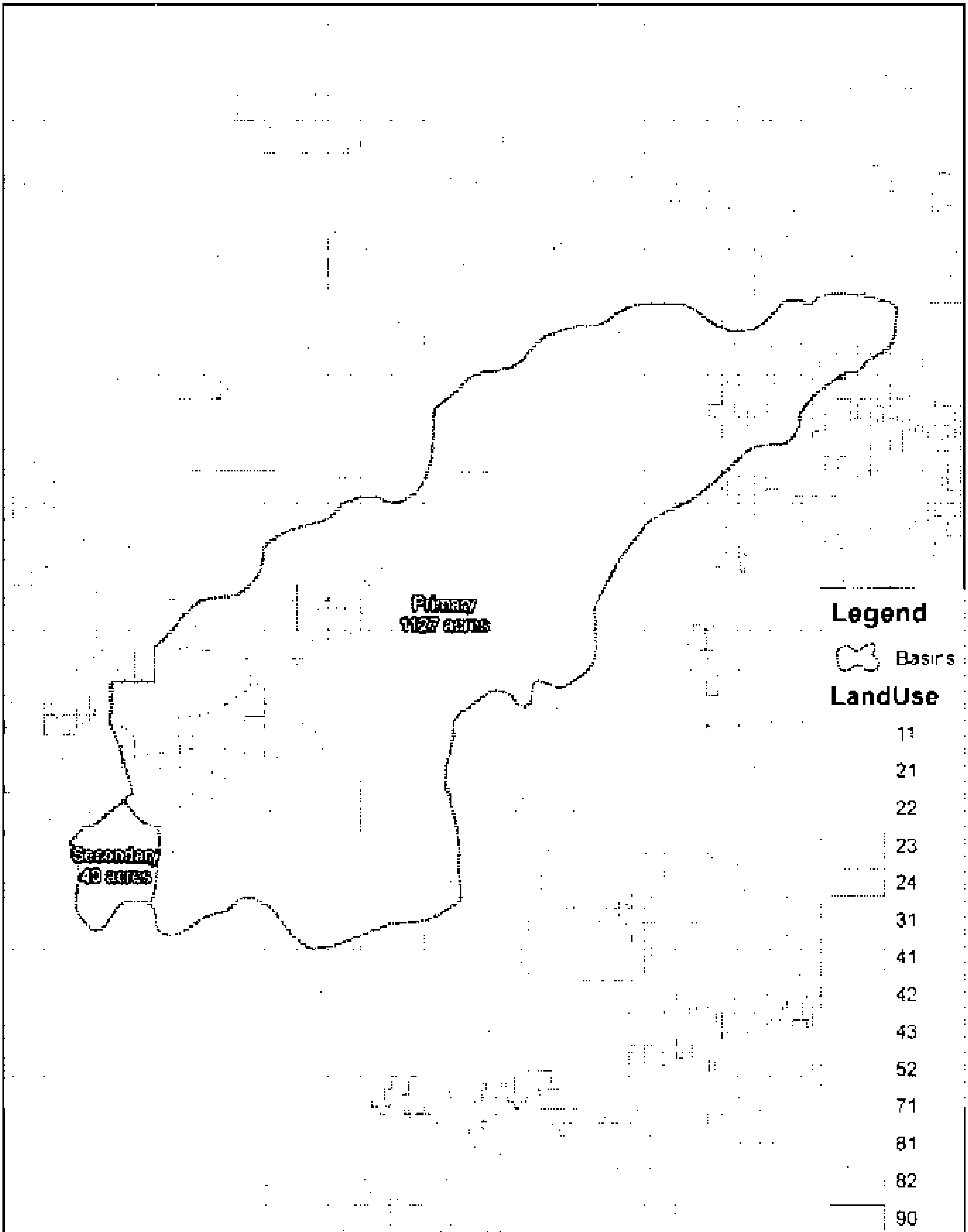
NLCD Classification		Curve Number (AMC II)					
#	Description	A	B	B/C	C	C/D	D
11	Open Water	100	100	100	100	100	100
21	Developed, Open Space	68	79	83	86	88	89
22	Developed, Low Intensity	51	68	74	79	82	84
23	Developed, Medium Intensity	77	85	88	90	91	92
24	Developed, High Intensity	89	92	93	94	95	95
31	Barren Land	77	86	89	91	93	94
41	Deciduous Forest	36	60	67	73	76	79
42	Evergreen Forest	36	60	67	73	76	79
43	Mixed Forest	36	60	67	73	76	79
52	Scrub/Shrub	35	56	63	70	74	77
71	Grassland/Herbaceous	39	61	68	74	77	80
81	Pasture/Hay	39	61	68	74	77	80
82	Cultivated Crops	67	78	82	85	87	89
90	Woody Wetlands	45	66	72	77	80	83



FLINT CREEK POWER PLANT ASH PONDS

HYDROLOGIC SOIL CLASSIFICATIONS

FIGURE 3



FREESE NICHOLS	0 1,000 2,000 4,000 Feet		FIGURE
	FLINT CREEK POWER PLANT ASH PONDS		4
	LAND COVER DATA		

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The only input into HEC-HMS for the NRCS Dimensionless Unit Hydrograph is a lag time, which is calculated based on basin conditions, such as hydraulic length and average slope, according to the NRCS TR-55 Method. Table 2 provides a summary of the hydrologic parameters for each basin.

Table 2 - Basin Parameters

Basin	Area (mi^2)	Lag Time (min)	Curve Number (AMC II)
Primary	1.76	46.58	76.6
Secondary	0.06	10.53	74.9

2.3 ELEVATION-STORAGE DATA

Elevation-storage data for each reservoir was obtained from a combination of two data sources. Volume calculations based on 5-foot contours were provided by AEP up to elevation 1145.0 ft-msl. The NED 10-meter DEM was utilized to calculate the available storage between this elevation and the top of dam elevation of 1155.0 ft-msl. These relationships were used in the hydrologic model for routing both frequency storm events and the PMF and are shown in Table 3 below.

Table 3 – Elevation-Storage Data

Primary		Secondary	
Elevation (ft-msl)	Storage (acre-ft)	Elevation (ft-msl)	Storage (acre-ft)
1115	0.00	1130	0.00
1120	4.59	1135	2.71
1125	23.05	1140	7.39
1130	50.92	1142.5	10.79
1135	86.32	1143	11.47
1140	133.10	1144	12.83
1144	182.55	1145	14.19
1145	186.13	1146	20.54
1146	190.47	1147	26.88
1147	195.62	1148	33.23
1148	201.66	1149	39.58
1149	208.67	1150	45.93
1150	222.59	1151	55.13
1151	263.45	1152	64.71
1152	312.36	1153	74.71
1153	363.73	1154	85.10
1154	417.40	1155	95.92
1155	473.32		

2.4 DISCHARGE RATING CURVES

Each dam has a single spillway structure with two components – a weir box acting as the principal spillway and a concrete sill acting as the emergency spillway. Information regarding the dimensions and elevations of each of these spillways was taken from a combination of original construction drawings and detailed descriptions from AEP personnel. Detailed calculations for the discharge rating curves of each spillway are included in Appendix B.

The principal spillway for the Primary Ash Pond consists of a weir box with a 4-foot wide weir with crest elevation of 1144.0 ft-msl. The weir equation used for this weir box was provided by AEP personnel. At elevation 1146.0 ft-msl, flow reaches the 228-foot long concrete sill, effectively the emergency spillway, and the weir box is assumed to be submerged, meaning flow is completely controlled by the emergency spillway. The sill is located relatively close to the flat natural grade and is currently covered with soil and light vegetation due to silting over the years. As such, the emergency spillway is modeled as a broad-crested weir, and the discharge rating curve was developed with a steady-state HEC-RAS[4] model. The HEC-RAS model accounts for submergence of the tailwater from the downstream lake, which will significantly restrict flow through the spillway. The discharge rating curve for the combined spillway of the Primary Ash Pond is shown in Table 4. A photograph of the spillway is shown in Figure 5.

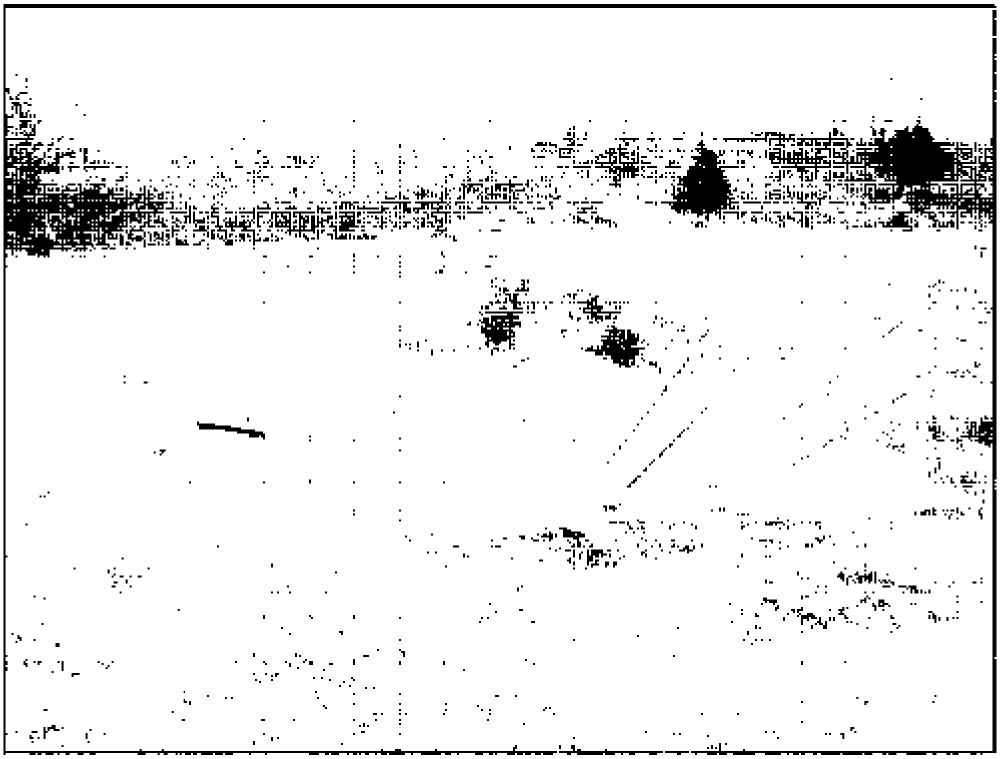

Figure 5 – Primary Ash Pond Spillway

The principal spillway for the Secondary Ash Pond consists of a recently reconstructed weir box with a 13-foot wide weir with crest elevation of 1142.5 ft-msl. Calculations at several critical discharges were given on the construction drawings for this modification. These values were interpolated between to obtain a discharge rating curve at even one-foot increments. At elevation 1145.0 ft-msl, flow reaches the 250-foot long concrete sill, effectively the emergency spillway, and the weir box is assumed to be submerged, meaning flow is completely controlled by the emergency spillway. While the concrete sill is more defined than the one at the Primary Ash Pond, the effects of submergence were still a concern due to the flat topography and Little Flint Creek Reservoir immediately downstream. Similar to the Primary Ash Pond spillway, this spillway was modeled in HEC-RAS. The discharge rating curve for the combined spillway of the Secondary Ash Pond is shown in Table 4. A photograph of the spillway is shown in Figure 6.

Figure 6 – Secondary Ash Pond Spillway

Table 4 – Discharge Rating Curves

Primary		Secondary	
Elevation (ft-msl)	Total Discharge (cfs)	Elevation (ft-msl)	Total Discharge (cfs)
1144	0	1142.5	0
1145	13	1143	17
1146	34	1144	78
1147	305	1145	165
1148	1,071	1146	536
1149	2,208	1147	1,355
1150	3,603	1148	2,419
1151	5,133	1149	3,735
1152	6,873	1150	5,310
1153	8,816	1151	7,118
1154	10,978	1152	9,174
1155	13,325	1153	11,463
		1154	13,974
		1155	16,484

2.5 FREQUENCY MODEL RESULTS

Three frequency storm events were analyzed for the Flint Creek Ash Pond system – the 10-year, 25-year, and 100-year storm events. The hydrologic model described in the preceding sections was implemented in analyzing these events. Curve numbers were set to Antecedent Moisture Condition II, and initial abstractions were calculated automatically by HEC-HMS. These assumptions represent normal conditions, as would be expected prior to one of these storm events. The precipitation data was obtained from the National Oceanic and Atmospheric Administration's Technical Memorandum NWS HYDRO-35[5] and Technical Paper 40.[6] These values are presented in **Table 5**. Each storm event was assumed to have a duration of 24 hours.

Table 5 – Frequency Precipitation Depths

Frequency (yrs)	Precipitation (in)							
	5 min	15 min	60 min	2 hr	3 hr	6 hr	12 hr	24hr
1	0.38	0.82	1.53	1.87	2.06	2.32	2.82	3.30
2	0.46	0.98	1.78	2.24	2.39	2.75	3.53	4.11
5	0.54	1.16	2.29	2.83	3.17	3.71	4.03	5.22
10	0.61	1.30	2.67	3.24	3.58	4.38	5.23	6.08
25	0.70	1.50	3.09	3.73	4.14	5.08	6.08	7.10
50	0.78	1.66	3.48	4.20	4.62	5.62	6.78	7.91
100	0.85	1.82	3.86	4.68	5.19	6.21	7.45	8.79
500	1.10	2.35	4.99	6.05	6.71	8.03	9.64	11.37

These precipitation depths serve as input data into the hydrologic model, and were routed through the model as described previously. According to standard engineering practice, flood routings were started at the lowest spillway crest elevation for each dam. This corresponds to elevation 1144.0 ft-msl and 1142.5 ft-msl for the Primary and Secondary Ash Ponds, respectively. The results of the 10-year, 25-year, and 100-year storm events are shown in Table 6.

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Table 6 – Frequency Model Results

	Peak Elevation (ft-msl)	Peak Inflow (cfs)	Peak Outflow (cfs)
10-Year Storm Results			
Primary	1148.55	1718.09	1700.04
Secondary	1147.33	1721.99	1706.83
25-Year Storm Results			
Primary	1148.94	2169.32	2149.13
Secondary	1147.75	2175.62	2156.64
100-Year Storm Results			
Primary	1149.48	2933.96	2862.69
Secondary	1148.35	2893.87	2874.07

2.6 PMF MODEL RESULTS

The Probable Maximum Flood (PMF) is defined as the greatest flood to be expected, and the Probable Maximum Precipitation (PMP) is theoretically the greatest depth of rainfall for a given duration that is physically possible over a given size storm area at a particular geographic location. Generally, the rainfall depth is calculated for the ten square miles of the watershed which receive the highest intensity rainfall.

Hydrometeorological Report No. 52 (HMR-52),[7] developed by the U.S. Army Corps of Engineers, was used to determine the rainfall for each basin. PMP estimates were taken from Hydrometeorological Report No. 51[8] and distributed according to HMR-52 to obtain average rainfall depths over the various drainage areas.

HMR-52 calculates rainfall depths for storm durations ranging from five minutes to seventy-two hours. Table 7 lists the point rainfall depths calculated by HMR-52 for storm durations from one hour to 72 hours. Because the total drainage area is less than ten square miles, the same rainfall depths were applied to both basins.HMR-52 also produces a 72-hour, critically stacked temporal distribution by arranging the incremental rainfall depths to produce the rainfall hyetograph shown in Figure 7.

Table 7 – HMR-52 Point Rainfall Depths

Storm Duration (hr)	Depth (in)
1	15.89
2	19.98
3	23.22
6	29.14
12	34.10
24	38.61
48	42.92
72	45.40

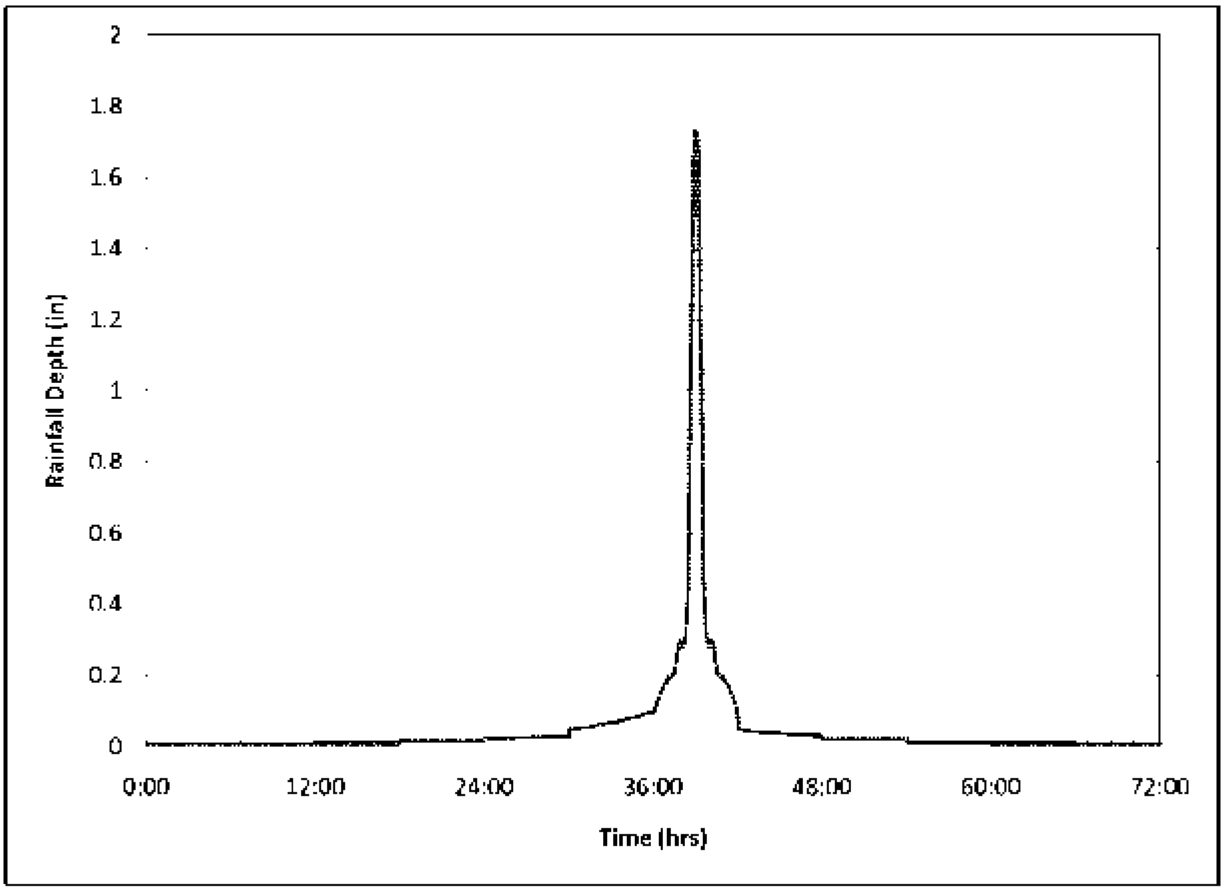

Figure 7 – PMP Rainfall Hyetograph

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The PMF was modeled as described previously, with flood routing started at the lowest spillway crest elevation – 1144.0 ft-msl and 1142.5 ft-msl for the Primary and Secondary Ash Ponds, respectively. Additionally, the 25% and 50% PMF were calculated for the two Ponds. Table 8 contains the results of these PMF model runs – the 25% PMF, 50% PMF, and 100% PMF, respectively.

Table 8 –PMF Model Results

	Peak Elevation (ft-msl)	Peak Inflow (cfs)	Peak Outflow (cfs)
25% PMF Results			
Primary	1150.04	3757.22	3627.15
Secondary	1148.94	3670.68	3660.88
50% PMF Results			
Primary	1151.96	7501.95	6713.03
Secondary	1150.80	6787.60	6764.12
100% PMF Results			
Primary	1154.87	14991.39	12803.89
Secondary	1153.45	13008.71	12600.25

3.0 SUMMARY AND CONCLUSIONS

Based on the results of the hydraulic analysis, both dams are hydraulically adequate for the full range of storm events from the 10-year to the 100% PMF event. Table 9 lists the pertinent elevation data for each dam, including the top of dam elevation and principal and emergency spillway crest elevations. Comparing these elevations to the maximum water surface elevations shown in Table 10 indicates that each dam would safely contain all flood events up to, and including, the 100% PMF. Additionally, the emergency spillway for both dams is engaged somewhat frequently, even during a storm event as low as the 10-year storm. This should have no adverse affects on these structures, as they appear to be designed to withstand frequent engaging.

Table 9 – Pertinent Dam Information

	Top of Dam (ft-msl)	Principal Spillway (ft-msl)	Emergency Spillway (ft-msl)
Primary	1155.00	1144.00	1146.00
Secondary	1155.00	1142.50	1145.00

Table 10 – Summary of Results

	10-year	25-year	100-year	25% PMF	50% PMF	100% PMF
Primary	1148.55	1148.94	1149.48	1150.04	1151.96	1154.87
Secondary	1147.33	1147.75	1148.35	1148.94	1150.80	1153.45

It should be noted that these results reflect the best understanding of existing conditions and could be significantly affected by major changes to either of the reservoirs. The assumptions in this analysis represent average reservoir conditions. In their current conditions, the Primary Ash and Secondary Ash Ponds associated with the Flint Creek Power Plant are deemed to be hydraulically adequate for any storm event up to, and including, the 100% PMF. Pertinent drawings for existing conditions are included in Appendix C.

Appendix A
References

References

1. U.S. Army Corps of Engineers, Hydrologic Engineering Center: *Hydrologic Modeling System HEC-HMS - User's Manual Version 3.4*, Davis, California, August 2009.

2. "Soil Data Mart." *NRCS Soil Survey Geographic (SSURGO) Database*. <http://soildatamart.nrcs.usda.gov>.

3. "National Land Cover Dataset 2001." *USGS Seamless Data Warehouse*. August 30, 2010. <http://seamless.usgs.gov/nlcd.php>.

4. U.S. Army Corps of Engineers, Hydrologic Engineering Center: *River Analysis System - User's Manual Version 4.1*, Davis, California, January 2010.

5. U.S. Department of Commerce, National Oceanic and Atmospheric Administration: *Technical Memorandum NWS HYDRO-35, Five- to 60-Minute Precipitation Frequency for the Eastern and Central United States*, Silver Spring, MD, June 1977.

6. U.S. Department of Commerce, Weather Bureau: *Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years*, Washington, D.C., May 1961.

7. U.S. Department of Commerce, National Oceanic and Atmospheric Administration and U.S. Department of the Army, Corps of Engineers: *Hydrometeorological Report No. 52, Application of Probable Maximum Precipitation Estimates, United States East of the 105th Meridian*, Washington, D.C., 1982.

8. U.S. Department of Commerce, National Oceanic and Atmospheric Administration and U.S. Department of the Army, Corps of Engineers: *Hydrometeorological Report No. 51, Probable Maximum Precipitation Estimates, United States East of the 105th Meridian*, Washington, D.C., 1978.

Appendix B
Discharge Rating Curve Calculations and Hydrologic Parameters

Primary Ash Pond

Weir Box

Elevation [ft-msl]	Discharge [cfs]
1144	0.00
1145	12.65
1146	33.91

$Q = 3.33(L\ 0.2H)H^{1.5}$

L 4 ft

Assumed rectangular, sharp-crested weir equation with end contractions accounted for; congruent with calculations made by AEP.

Secondary Ash Pond

Weir Box (from Plans)

Elevation [ft-msl]	Discharge [MGD]	Discharge [cfs]
1142.50	0.000	0.000
1142.70	2.495	3.860
1142.88	6.387	9.882
1143.95	47.806	73.967
1145.00	106.332	164.520

Values taken from plans for design of new spillway; linear interpolation between points.

HEC-RAS Plan: PrimarySpwy River: Primary Reach: Spwy

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Spwy	3045	PF 1	1.00	1144.00	1146.09		1146.09	0.000000	0.00	2098.65	1150.65	0.00
Spwy	3045	PF 2	10.00	1144.00	1146.19		1146.19	0.000000	0.00	2345.85	1153.29	0.00
Spwy	3045	PF 3	50.00	1144.00	1146.41		1146.41	0.000000	0.02	2601.38	1157.40	0.00
Spwy	3045	PF 4	100.00	1144.00	1146.57		1146.57	0.000000	0.03	2808.43	1161.52	0.00
Spwy	3045	PF 5	250.00	1144.00	1146.91		1146.91	0.000002	0.07	3400.29	1190.99	0.01
Spwy	3045	PF 6	500.00	1144.00	1147.32		1147.32	0.000004	0.12	3809.13	1204.75	0.01
Spwy	3045	PF 7	750.00	1144.00	1147.64		1147.64	0.000006	0.18	4252.38	1210.94	0.02
Spwy	3045	PF 8	1000.00	1144.00	1147.95		1147.95	0.000009	0.22	4625.24	1216.44	0.02
Spwy	3045	PF 9	1500.00	1144.00	1148.42		1148.42	0.000012	0.29	5229.47	1225.81	0.02
Spwy	3045	PF 10	2000.00	1144.00	1148.86		1148.86	0.000017	0.35	5767.45	1234.00	0.03
Spwy	3045	PF 11	2500.00	1144.00	1149.20		1149.21	0.000021	0.41	6150.26	1240.14	0.03
Spwy	3045	PF 12	3000.00	1144.00	1149.57		1149.57	0.000024	0.46	6653.41	1247.75	0.03
Spwy	3045	PF 13	3500.00	1144.00	1149.93		1149.93	0.000027	0.50	7100.37	1254.60	0.04
Spwy	3045	PF 14	4000.00	1144.00	1150.27		1150.27	0.000029	0.54	7631.30	1259.46	0.04
Spwy	3045	PF 15	5000.00	1144.00	1150.91		1150.92	0.000032	0.61	8344.24	1267.12	0.04
Spwy	3045	PF 16	6000.00	1144.00	1151.51		1151.52	0.000035	0.65	9101.04	1275.37	0.04
Spwy	3045	PF 17	7000.00	1144.00	1152.07		1152.07	0.000038	0.72	9913.03	1292.91	0.05
Spwy	3045	PF 18	8000.00	1144.00	1152.59		1152.60	0.000040	0.76	10455.11	1296.22	0.05
Spwy	3045	PF 19	9000.00	1144.00	1153.05		1153.09	0.000042	0.79	11121.41	1298.51	0.05
Spwy	3045	PF 20	10000.00	1144.00	1153.55		1153.56	0.000043	0.82	11734.40	1301.50	0.05
Spwy	3045	PF 21	11000.00	1144.00	1154.00		1154.01	0.000045	0.92	12321.34	1307.22	0.05
Spwy	3045	PF 22	12000.00	1144.00	1154.43		1154.45	0.000046	0.96	12856.15	1312.10	0.05
Spwy	3045	PF 23	13000.00	1144.00	1154.85		1154.87	0.000047	1.00	13436.61	1316.01	0.05
Spwy	3045	PF 24	14000.00	1144.00	1155.25		1155.27	0.000048	1.04	13957.30	1321.54	0.05
Spwy	3045	PF 25	15000.00	1144.00	1155.64		1155.66	0.000050	1.07	14480.41	1324.08	0.06
Spwy	2645	PF 1	1.00	1144.00	1146.09		1146.09	0.000000	0.00	1052.44	540.92	0.00
Spwy	2645	PF 2	10.00	1144.00	1146.19		1146.19	0.000000	0.01	1120.95	544.71	0.00
Spwy	2645	PF 3	50.00	1144.00	1146.41		1146.41	0.000001	0.04	1236.01	551.16	0.00
Spwy	2645	PF 4	100.00	1144.00	1146.57		1146.57	0.000002	0.07	1325.25	554.01	0.01
Spwy	2645	PF 5	250.00	1144.00	1146.91		1146.91	0.000008	0.17	1518.91	558.24	0.02
Spwy	2645	PF 6	500.00	1144.00	1147.31		1147.31	0.000021	0.30	1750.30	573.59	0.03
Spwy	2645	PF 7	750.00	1144.00	1147.63		1147.64	0.000034	0.41	1932.54	582.09	0.04
Spwy	2645	PF 8	1000.00	1144.00	1147.92		1147.92	0.000046	0.50	2106.29	586.63	0.04
Spwy	2645	PF 9	1500.00	1144.00	1148.40		1148.41	0.000065	0.68	2209.40	591.18	0.06
Spwy	2645	PF 10	2000.00	1144.00	1148.83		1148.84	0.000086	0.80	2661.06	603.62	0.06
Spwy	2645	PF 11	2500.00	1144.00	1149.17		1149.19	0.000105	0.93	2860.32	624.26	0.07
Spwy	2645	PF 12	3000.00	1144.00	1149.54		1149.55	0.000124	1.04	3112.26	645.20	0.08
Spwy	2645	PF 13	3500.00	1144.00	1149.89		1149.91	0.000138	1.13	3341.29	650.60	0.08
Spwy	2645	PF 14	4000.00	1144.00	1150.23		1150.25	0.000146	1.22	3565.63	654.73	0.09
Spwy	2645	PF 15	5000.00	1144.00	1150.81		1150.85	0.000167	1.36	3961.16	675.27	0.09
Spwy	2645	PF 16	6000.00	1144.00	1151.45		1151.49	0.000174	1.49	4392.45	687.09	0.10
Spwy	2645	PF 17	7000.00	1144.00	1152.01		1152.04	0.000182	1.61	4780.14	705.17	0.10
Spwy	2645	PF 18	8000.00	1144.00	1152.52		1152.56	0.000192	1.72	5161.71	720.17	0.11
Spwy	2645	PF 19	9000.00	1144.00	1152.91		1152.96	0.000199	1.82	5597.76	724.85	0.11
Spwy	2645	PF 20	10000.00	1144.00	1153.48		1153.53	0.000205	1.91	5852.04	746.29	0.11
Spwy	2645	PF 21	11000.00	1144.00	1153.92		1153.98	0.000211	1.99	6156.67	758.07	0.11
Spwy	2645	PF 22	12000.00	1144.00	1154.35		1154.41	0.000216	2.07	6613.57	773.21	0.11
Spwy	2645	PF 23	13000.00	1144.00	1154.76		1154.83	0.000220	2.15	6830.51	787.62	0.12
Spwy	2645	PF 24	14000.00	1144.00	1155.16		1155.23	0.000224	2.22	7152.83	800.65	0.12
Spwy	2645	PF 25	15000.00	1144.00	1155.56		1155.62	0.000228	2.29	7463.77	812.08	0.12
Spwy	2090	PF 1	1.00	1144.00	1146.09		1146.09	0.000000	0.00	475.34	221.75	0.00
Spwy	2090	PF 2	10.00	1144.00	1146.19		1146.19	0.000000	0.02	457.60	224.52	0.00
Spwy	2090	PF 3	50.00	1144.00	1146.41		1146.41	0.000003	0.10	516.01	226.64	0.01
Spwy	2090	PF 4	100.00	1144.00	1146.57		1146.57	0.000011	0.15	552.70	228.51	0.02
Spwy	2090	PF 5	250.00	1144.00	1146.90		1146.90	0.000046	0.41	633.44	231.60	0.04
Spwy	2090	PF 6	500.00	1144.00	1147.28		1147.29	0.000121	0.70	718.48	235.51	0.07
Spwy	2090	PF 7	750.00	1144.00	1147.58		1147.60	0.000202	0.96	790.00	238.56	0.09
Spwy	2090	PF 8	1000.00	1144.00	1147.84		1147.87	0.000282	1.22	852.51	241.15	0.11
Spwy	2090	PF 9	1500.00	1144.00	1148.29		1148.33	0.000420	1.64	960.49	245.04	0.14
Spwy	2090	PF 10	2000.00	1144.00	1148.67		1148.73	0.000578	2.00	1055.63	248.48	0.16
Spwy	2090	PF 11	2500.00	1144.00	1148.97		1149.05	0.000726	2.33	1131.50	250.55	0.18
Spwy	2090	PF 12	3000.00	1144.00	1149.33		1149.43	0.000840	2.67	1214.27	254.35	0.20
Spwy	2090	PF 13	3500.00	1144.00	1149.62		1149.74	0.000922	2.87	1298.46	256.04	0.21
Spwy	2090	PF 14	4000.00	1144.00	1149.93		1150.07	0.001010	3.10	1375.78	257.16	0.22
Spwy	2090	PF 15	5000.00	1144.00	1150.51		1150.69	0.001141	3.50	1530.13	264.91	0.24
Spwy	2090	PF 16	6000.00	1144.00	1151.05		1151.29	0.001240	3.85	1675.09	271.22	0.25
Spwy	2090	PF 17	7000.00	1144.00	1151.55		1151.83	0.001327	4.17	1813.40	275.19	0.27
Spwy	2090	PF 18	8000.00	1144.00	1152.02		1152.31	0.001400	4.46	1944.51	278.60	0.28
Spwy	2090	PF 19	9000.00	1144.00	1152.47		1152.79	0.001465	4.73	2066.57	281.44	0.29
Spwy	2090	PF 20	10000.00	1144.00	1152.90		1153.25	0.001521	4.95	2190.84	285.79	0.29
Spwy	2090	PF 21	11000.00	1144.00	1153.29		1153.68	0.001572	5.21	2307.63	288.55	0.30
Spwy	2090	PF 22	12000.00	1144.00	1153.65		1154.11	0.001618	5.43	2420.59	290.98	0.31
Spwy	2090	PF 23	13000.00	1144.00	1154.07		1154.55	0.001655	5.64	2531.20	294.04	0.31
Spwy	2090	PF 24	14000.00	1144.00	1154.43		1154.92	0.001697	5.85	2638.15	297.83	0.32
Spwy	2090	PF 25	15000.00	1144.00	1154.78		1155.30	0.001732	6.04	2744.33	300.66	0.32
Spwy	2040	PF 1	1.00	1145.00	1146.09		1146.09	0.000210	0.07	14.51	227.95	0.05

HEC-RAS Plan: PrimarySpwy River: Primary Reach: Spwy (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Spwy	2040	PF 2	10.00	1146.00	1146.19	1146.03	1146.19	0.000581	0.23	43.51	225.74	0.09
Spwy	2040	PF 3	50.00	1146.00	1146.40	1146.11	1146.40	0.001164	0.55	91.24	229.60	0.15
Spwy	2040	PF 4	100.00	1146.00	1146.55	1146.16	1146.56	0.001564	0.76	126.75	230.60	0.19
Spwy	2040	PF 5	250.00	1146.00	1146.86	1146.34	1146.88	0.002239	1.27	197.21	232.16	0.24
Spwy	2040	PF 6	500.00	1146.00	1147.21	1146.53	1147.26	0.002569	1.80	278.16	234.64	0.29
Spwy	2040	PF 7	750.00	1146.00	1147.47	1146.65	1147.55	0.003307	2.21	340.00	236.44	0.32
Spwy	2040	PF 8	1000.00	1146.00	1147.70	1146.84	1147.80	0.003716	2.55	392.51	237.82	0.34
Spwy	2040	PF 9	1500.00	1146.00	1148.09	1147.10	1148.24	0.004514	3.11	482.77	240.12	0.38
Spwy	2040	PF 10	2000.00	1146.00	1148.42	1147.33	1148.61	0.004967	3.58	557.90	242.11	0.41
Spwy	2040	PF 11	2500.00	1146.00	1148.66		1148.92	0.005036	4.03	622.43	243.58	0.44
Spwy	2040	PF 12	3000.00	1146.00	1148.95		1149.25	0.005131	4.39	697.74	245.31	0.45
Spwy	2040	PF 13	3500.00	1146.00	1149.24		1149.57	0.005170	4.68	769.22	247.09	0.45
Spwy	2040	PF 14	4000.00	1146.00	1149.50		1149.89	0.004976	4.86	841.06	248.70	0.45
Spwy	2040	PF 15	5000.00	1146.00	1150.08		1150.50	0.004766	5.24	978.60	252.08	0.45
Spwy	2040	PF 16	6000.00	1146.00	1150.60		1151.07	0.004591	5.57	1105.26	255.17	0.45
Spwy	2040	PF 17	7000.00	1146.00	1151.05		1151.60	0.004447	5.90	1222.52	256.05	0.45
Spwy	2040	PF 18	8000.00	1146.00	1151.53		1152.10	0.004335	6.12	1351.53	260.61	0.45
Spwy	2040	PF 19	9000.00	1146.00	1151.96		1152.58	0.004235	6.34	1464.11	263.56	0.46
Spwy	2040	PF 20	10000.00	1146.00	1152.35		1153.03	0.004156	6.61	1572.91	265.45	0.46
Spwy	2040	PF 21	11000.00	1146.00	1152.77		1153.47	0.004121	6.83	1677.54	268.00	0.46
Spwy	2040	PF 22	12000.00	1146.00	1153.14		1153.89	0.004086	7.03	1778.68	270.46	0.46
Spwy	2040	PF 23	13000.00	1146.00	1153.51		1154.30	0.004041	7.24	1874.11	272.65	0.47
Spwy	2040	PF 24	14000.00	1146.00	1153.89		1154.69	0.004009	7.44	1970.80	274.75	0.47
Spwy	2040	PF 25	15000.00	1146.00	1154.20		1155.07	0.003976	7.62	2057.42	276.70	0.47
Spwy	1950	PF 1	1.00	1146.00	1146.03	1146.03	1146.05	0.103844	0.16	6.24	207.77	0.17
Spwy	1950	PF 2	10.00	1146.00	1146.03	1146.03	1146.07	0.044290	1.59	6.26	227.17	1.09
Spwy	1950	PF 3	50.00	1146.00	1146.11	1146.11	1146.17	0.064052	1.99	25.19	222.29	1.06
Spwy	1950	PF 4	100.00	1146.00	1146.18	1146.18	1146.27	0.064745	2.42	41.44	224.66	1.00
Spwy	1950	PF 5	250.00	1146.00	1146.34	1146.34	1146.50	0.052570	3.22	79.45	225.61	1.00
Spwy	1950	PF 6	500.00	1146.00	1146.53	1146.53	1146.79	0.045116	4.14	121.08	230.77	1.00
Spwy	1950	PF 7	750.00	1146.00	1146.69	1146.69	1147.04	0.041348	4.73	159.34	231.75	1.00
Spwy	1950	PF 8	1000.00	1146.00	1146.84	1146.84	1147.25	0.039162	5.22	192.20	232.60	1.00
Spwy	1950	PF 9	1500.00	1146.00	1147.10	1147.10	1147.65	0.035550	5.96	252.23	234.18	1.00
Spwy	1950	PF 10	2000.00	1146.00	1147.33	1147.33	1147.99	0.033347	6.56	307.60	235.57	1.00
Spwy	1950	PF 11	2500.00	1146.00	1147.83		1148.37	0.017527	5.92	426.22	238.57	0.77
Spwy	1950	PF 12	3000.00	1146.00	1148.26		1148.76	0.012783	5.77	527.41	241.10	0.65
Spwy	1950	PF 13	3500.00	1146.00	1148.63		1149.13	0.010261	5.76	612.16	243.25	0.60
Spwy	1950	PF 14	4000.00	1146.00	1148.97		1149.46	0.008842	5.80	702.13	245.41	0.58
Spwy	1950	PF 15	5000.00	1146.00	1149.59		1150.13	0.007261	5.93	855.59	246.14	0.56
Spwy	1950	PF 16	6000.00	1146.00	1150.15		1150.75	0.006406	6.25	995.75	251.38	0.54
Spwy	1950	PF 17	7000.00	1146.00	1150.66		1151.25	0.005964	6.40	1125.57	254.55	0.52
Spwy	1950	PF 18	8000.00	1146.00	1151.13		1151.80	0.005502	6.62	1247.33	258.40	0.51
Spwy	1950	PF 19	9000.00	1146.00	1151.58		1152.28	0.005252	6.84	1360.45	261.06	0.51
Spwy	1950	PF 20	10000.00	1146.00	1152.00		1152.75	0.005015	7.04	1472.96	262.50	0.51
Spwy	1950	PF 21	11000.00	1146.00	1152.40		1153.19	0.004805	7.25	1578.75	266.99	0.50
Spwy	1950	PF 22	12000.00	1146.00	1152.78		1153.61	0.004588	7.44	1680.53	268.27	0.50
Spwy	1950	PF 23	13000.00	1146.00	1153.16		1154.02	0.004378	7.62	1780.76	270.60	0.49
Spwy	1950	PF 24	14000.00	1146.00	1153.50		1154.42	0.004196	7.81	1870.25	272.62	0.50
Spwy	1950	PF 25	15000.00	1146.00	1153.85		1154.80	0.004024	7.98	1970.72	274.69	0.50
Spwy	1865	PF 1	1.00	1142.50	1145.03		1145.03	0.000000	0.00	590.46	242.11	0.00
Spwy	1865	PF 2	10.00	1142.50	1145.09		1145.09	0.000000	0.02	597.04	242.61	0.00
Spwy	1865	PF 3	50.00	1142.50	1145.17		1145.17	0.000002	0.08	625.80	243.30	0.01
Spwy	1865	PF 4	100.00	1142.50	1145.28		1145.28	0.000007	0.16	652.70	244.13	0.02
Spwy	1865	PF 5	250.00	1142.50	1145.55		1145.56	0.000032	0.36	719.09	246.00	0.04
Spwy	1865	PF 6	500.00	1142.50	1145.94		1145.95	0.000076	0.62	815.36	248.69	0.05
Spwy	1865	PF 7	750.00	1142.50	1146.28		1146.30	0.000140	0.86	900.83	251.00	0.08
Spwy	1865	PF 8	1000.00	1142.50	1146.59		1146.61	0.000162	1.08	978.04	253.10	0.09
Spwy	1865	PF 9	1500.00	1142.50	1147.15		1147.19	0.000223	1.29	1115.26	256.76	0.11
Spwy	1865	PF 10	2000.00	1142.50	1147.60		1147.64	0.000280	1.62	1236.27	259.99	0.13
Spwy	1865	PF 11	2500.00	1142.50	1148.02		1148.07	0.000323	1.83	1345.06	262.86	0.14
Spwy	1865	PF 12	3000.00	1142.50	1148.40		1148.47	0.000455	2.06	1447.21	265.28	0.15
Spwy	1865	PF 13	3500.00	1142.50	1148.75		1148.84	0.000457	2.27	1541.45	267.97	0.17
Spwy	1865	PF 14	4000.00	1142.50	1149.09		1149.16	0.000502	2.57	1630.75	270.17	0.16
Spwy	1865	PF 15	5000.00	1142.50	1149.69		1149.82	0.000597	2.92	1796.52	274.03	0.19
Spwy	1865	PF 16	6000.00	1142.50	1150.25		1150.40	0.000778	3.15	1946.13	278.15	0.21
Spwy	1865	PF 17	7000.00	1142.50	1150.79		1150.94	0.000850	3.54	2082.02	281.40	0.22
Spwy	1865	PF 18	8000.00	1142.50	1151.25		1151.45	0.000914	3.81	2226.56	284.42	0.23
Spwy	1865	PF 19	9000.00	1142.50	1151.68		1151.92	0.000974	4.07	2364.06	287.26	0.24
Spwy	1865	PF 20	10000.00	1142.50	1152.10		1152.35	0.001027	4.25	2490.02	289.95	0.24
Spwy	1865	PF 21	11000.00	1142.50	1152.51		1152.81	0.001077	4.47	2594.55	292.51	0.25
Spwy	1865	PF 22	12000.00	1142.50	1152.83		1153.22	0.001124	4.78	2707.35	294.56	0.26
Spwy	1865	PF 23	13000.00	1142.50	1153.24		1153.65	0.001166	4.96	2814.73	297.16	0.27
Spwy	1865	PF 24	14000.00	1142.50	1153.65		1154.01	0.001206	5.18	2925.21	299.65	0.27
Spwy	1865	PF 25	15000.00	1142.50	1153.97		1154.39	0.001244	5.32	3030.20	301.67	0.28
Spwy	1575	PF 1	1.00	1142.50	1145.03		1145.03	0.000000	0.00	924.26	341.65	0.00
Spwy	1575	PF 2	10.00	1142.50	1145.09		1145.09	0.000000	0.01	936.41	351.27	0.00

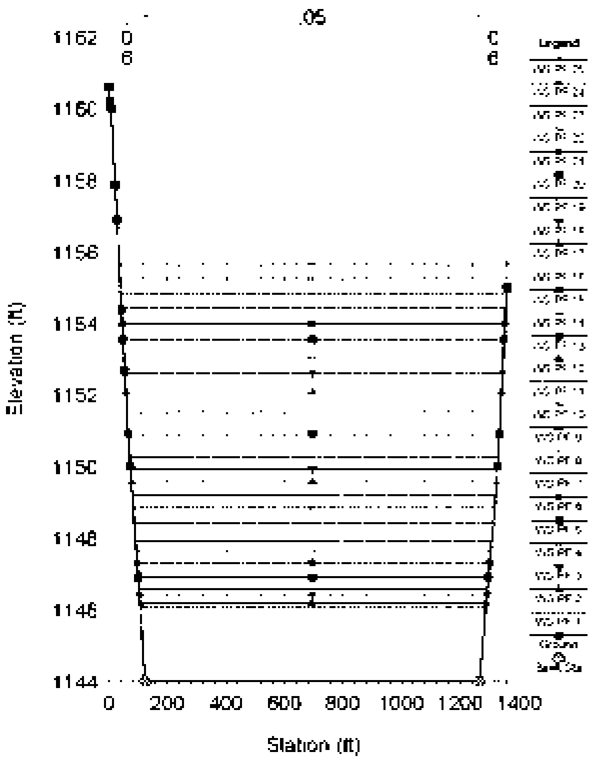
HEC-RAS Plan: PrimarySpwy River: Primary Reach: Spwy (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Spwy	1575	PF 3	50.00	1142.50	1145.17		1145.17	0.000001	0.05	951.21	393.50	0.01
Spwy	1575	PF 4	100.00	1142.50	1145.28		1145.28	0.000002	0.10	1002.45	395.60	0.01
Spwy	1575	PF 5	250.00	1142.50	1145.56		1145.56	0.000014	0.22	1130.74	400.88	0.02
Spwy	1575	PF 6	500.00	1142.50	1145.93		1145.93	0.000036	0.41	1296.14	402.06	0.04
Spwy	1575	PF 7	750.00	1142.50	1146.25		1146.27	0.000059	0.55	1402.62	414.92	0.05
Spwy	1575	PF 8	1000.00	1142.50	1146.55		1146.57	0.000081	0.63	1547.84	420.79	0.06
Spwy	1575	PF 9	1500.00	1142.50	1147.05		1147.10	0.000115	0.90	1770.31	431.11	0.07
Spwy	1575	PF 10	2000.00	1142.50	1147.55		1147.57	0.000152	1.07	1977.23	440.17	0.08
Spwy	1575	PF 11	2500.00	1142.50	1147.96		1147.99	0.000181	1.24	2156.83	448.21	0.09
Spwy	1575	PF 12	3000.00	1142.50	1148.34		1148.37	0.000206	1.38	2326.56	455.63	0.10
Spwy	1575	PF 13	3500.00	1142.50	1148.69		1148.72	0.000229	1.52	2487.29	462.48	0.11
Spwy	1575	PF 14	4000.00	1142.50	1149.02		1149.06	0.000249	1.64	2640.71	468.94	0.11
Spwy	1575	PF 15	5000.00	1142.50	1149.63		1149.68	0.000285	1.86	2928.41	480.61	0.12
Spwy	1575	PF 16	6000.00	1142.50	1150.18		1150.24	0.000316	2.03	3196.62	491.14	0.13
Spwy	1575	PF 17	7000.00	1142.50	1150.69		1150.75	0.000341	2.23	3450.75	495.14	0.14
Spwy	1575	PF 18	8000.00	1142.50	1151.17		1151.25	0.000364	2.39	3691.22	507.75	0.14
Spwy	1575	PF 19	9000.00	1142.50	1151.62		1151.71	0.000384	2.54	3921.40	512.04	0.15
Spwy	1575	PF 20	10000.00	1142.50	1152.05		1152.15	0.000402	2.64	4144.35	520.56	0.15
Spwy	1575	PF 21	11000.00	1142.50	1152.46		1152.57	0.000415	2.81	4356.47	529.44	0.16
Spwy	1575	PF 22	12000.00	1142.50	1152.85		1152.97	0.000424	2.94	4568.04	536.02	0.16
Spwy	1575	PF 23	13000.00	1142.50	1153.23		1153.36	0.000447	3.06	4774.53	540.46	0.16
Spwy	1575	PF 24	14000.00	1142.50	1153.60		1153.74	0.000459	3.17	4974.14	547.60	0.17
Spwy	1575	PF 25	15000.00	1142.50	1153.95		1154.10	0.000470	3.27	5166.51	554.60	0.17
Spwy	1150	PF 1	1.00	1142.50	1145.03		1145.03	0.000000	0.00	390.05	172.31	0.00
Spwy	1150	PF 2	10.00	1142.50	1145.06		1145.06	0.000000	0.03	395.47	172.78	0.00
Spwy	1150	PF 3	50.00	1142.50	1145.17		1145.17	0.000005	0.12	415.21	175.47	0.01
Spwy	1150	PF 4	100.00	1142.50	1145.25		1145.26	0.000019	0.23	433.70	177.04	0.03
Spwy	1150	PF 5	250.00	1142.50	1145.53		1145.54	0.000081	0.56	475.63	180.89	0.06
Spwy	1150	PF 6	500.00	1142.50	1145.88		1145.90	0.000219	0.92	544.45	185.15	0.09
Spwy	1150	PF 7	750.00	1142.50	1146.19		1146.22	0.000364	1.35	600.30	190.79	0.12
Spwy	1150	PF 8	1000.00	1142.50	1146.46		1146.50	0.000503	1.67	654.19	194.78	0.15
Spwy	1150	PF 9	1500.00	1142.50	1146.93		1147.00	0.000765	2.22	748.99	202.78	0.18
Spwy	1150	PF 10	2000.00	1142.50	1147.33		1147.43	0.000996	2.62	829.01	207.92	0.21
Spwy	1150	PF 11	2500.00	1142.50	1147.69		1147.83	0.001204	3.05	904.92	213.17	0.24
Spwy	1150	PF 12	3000.00	1142.50	1148.02		1148.19	0.001392	3.46	975.38	218.05	0.26
Spwy	1150	PF 13	3500.00	1142.50	1148.32		1148.52	0.001566	3.80	1041.74	222.53	0.28
Spwy	1150	PF 14	4000.00	1142.50	1148.60		1148.83	0.001724	4.12	1104.24	226.73	0.29
Spwy	1150	PF 15	5000.00	1142.50	1149.11		1149.41	0.002006	4.69	1222.09	234.41	0.32
Spwy	1150	PF 16	6000.00	1142.50	1149.58		1149.94	0.002252	5.20	1332.74	241.36	0.34
Spwy	1150	PF 17	7000.00	1142.50	1150.00		1150.44	0.002469	5.66	1435.75	247.17	0.36
Spwy	1150	PF 18	8000.00	1142.50	1150.40		1150.90	0.002657	6.07	1532.34	252.80	0.38
Spwy	1150	PF 19	9000.00	1142.50	1150.78		1151.34	0.002828	6.47	1624.01	257.07	0.40
Spwy	1150	PF 20	10000.00	1142.50	1151.14		1151.75	0.002981	6.83	1709.53	262.23	0.41
Spwy	1150	PF 21	11000.00	1142.50	1151.45		1152.15	0.003120	7.17	1810.05	266.60	0.42
Spwy	1150	PF 22	12000.00	1142.50	1151.80		1152.54	0.003253	7.50	1903.74	270.94	0.43
Spwy	1150	PF 23	13000.00	1142.50	1152.12		1152.92	0.003367	7.79	1991.10	275.14	0.44
Spwy	1150	PF 24	14000.00	1142.50	1152.42		1153.28	0.003466	8.08	2075.55	279.12	0.45
Spwy	1150	PF 25	15000.00	1142.50	1152.72		1153.62	0.003565	8.36	2156.09	282.96	0.46
Spwy	1010	PF 1	1.00	1145.00	1145.03	1145.03	1145.03	0.003548	0.16	6.41	250.00	0.17
Spwy	1010	PF 2	10.00	1145.00	1145.04	1145.04	1145.06	0.129570	1.12	8.94	250.00	1.04
Spwy	1010	PF 3	50.00	1145.00	1145.17	1145.17	1145.19	0.054490	1.63	29.79	250.00	0.85
Spwy	1010	PF 4	100.00	1145.00	1145.17	1145.17	1145.25	0.060580	2.34	42.69	250.00	1.00
Spwy	1010	PF 5	250.00	1145.00	1145.32	1145.32	1145.47	0.063572	3.18	78.70	250.00	1.00
Spwy	1010	PF 6	500.00	1145.00	1145.50	1145.50	1145.75	0.046321	4.00	124.95	250.00	1.00
Spwy	1010	PF 7	750.00	1145.00	1145.65	1145.65	1145.95	0.042967	4.61	162.69	250.00	1.01
Spwy	1010	PF 8	1000.00	1145.00	1145.79	1145.79	1146.19	0.040015	5.06	197.60	250.00	1.00
Spwy	1010	PF 9	1500.00	1145.00	1146.04	1146.04	1146.56	0.036501	5.80	258.64	250.00	1.00
Spwy	1010	PF 10	2000.00	1145.00	1146.25	1146.25	1146.89	0.034422	6.39	312.99	250.00	1.01
Spwy	1010	PF 11	2500.00	1145.00	1146.46	1146.46	1147.19	0.032770	6.90	364.32	250.00	1.00
Spwy	1010	PF 12	3000.00	1145.00	1146.64	1146.64	1147.47	0.031783	7.31	410.43	250.00	1.01
Spwy	1010	PF 13	3500.00	1145.00	1146.82	1146.82	1147.74	0.030756	7.70	454.74	250.00	1.01
Spwy	1010	PF 14	4000.00	1145.00	1146.99	1146.99	1147.99	0.029579	8.05	497.55	250.00	1.01
Spwy	1010	PF 15	5000.00	1145.00	1147.31	1147.31	1148.47	0.028520	8.66	577.27	250.00	1.00
Spwy	1010	PF 16	6000.00	1145.00	1147.61	1147.61	1148.92	0.027434	9.20	652.26	250.00	1.00
Spwy	1010	PF 17	7000.00	1145.00	1147.89	1147.89	1149.35	0.026477	9.70	722.12	250.00	1.01
Spwy	1010	PF 18	8000.00	1145.00	1148.15	1148.15	1149.75	0.025535	10.14	789.06	250.00	1.01
Spwy	1010	PF 19	9000.00	1145.00	1148.40	1148.40	1150.14	0.025325	10.54	854.10	250.00	1.00
Spwy	1010	PF 20	10000.00	1145.00	1148.66	1148.66	1150.50	0.024934	10.92	915.71	250.00	1.01
Spwy	1010	PF 21	11000.00	1145.00	1148.91	1148.91	1150.85	0.024590	11.26	977.05	250.00	1.00
Spwy	1010	PF 22	12000.00	1145.00	1149.15	1149.15	1151.22	0.023700	11.56	1037.76	250.00	1.00
Spwy	1010	PF 23	13000.00	1145.00	1149.37	1149.37	1151.57	0.023587	11.91	1097.16	250.00	1.00
Spwy	1010	PF 24	14000.00	1145.00	1149.59	1149.59	1151.90	0.023026	12.21	1146.45	250.00	1.00
Spwy	1010	PF 25	15000.00	1145.00	1149.81	1149.81	1152.15	0.022594	12.49	1201.29	250.00	1.00
Spwy	980	PF 1	1.00	1138.41	1138.63		1138.64	0.012976	0.76	1.31	10.26	0.41
Spwy	980	PF 2	10.00	1138.41	1138.92		1138.96	0.012407	1.13	6.73	15.08	0.49
Spwy	980	PF 3	50.00	1138.41	1139.45		1139.61	0.012370	2.82	17.24	21.09	0.50

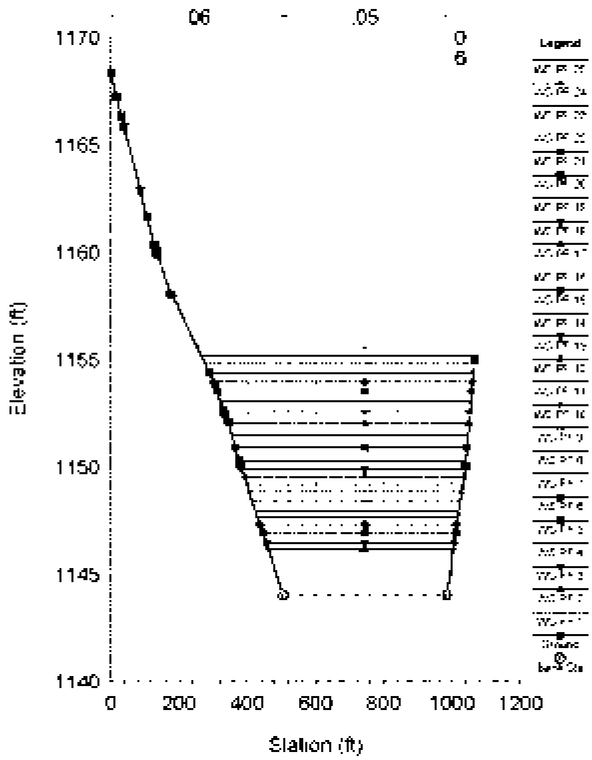
HEC-RAS Plan: PrimarySpwy River: Primary Reach: Spwy (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Spwy	980	PF 4	300.00	1138.41	1139.94		1140.14	0.012052	3.61	27.71	21.99	0.59
Spwy	980	PF 5	350.00	1138.41	1140.87		1141.22	0.012257	4.76	50.40	29.55	0.63
Spwy	980	PF 6	500.00	1138.41	1141.51		1142.44	0.012016	5.80	56.74	35.07	0.65
Spwy	980	PF 7	750.00	1138.41	1142.57	1142.61	1142.74	0.012193	6.16	124.26	147.45	0.65
Spwy	980	PF 8	1000.00	1138.41	1142.62	1142.02	1142.69	0.011107	6.54	190.91	190.22	0.65
Spwy	980	PF 9	1500.00	1138.41	1142.52	1142.52	1144.24	0.011420	7.71	207.25	207.21	0.69
Spwy	980	PF 10	2000.00	1138.41	1143.46	1143.24	1144.64	0.012476	8.41	264.45	214.15	0.72
Spwy	980	PF 11	2500.00	1138.41	1144.29	1144.15	1145.05	0.012485	7.54	443.59	223.15	0.74
Spwy	980	PF 12	3000.00	1138.41	1144.50	1144.40	1145.07	0.012356	9.37	511.36	228.47	0.74
Spwy	980	PF 13	3500.00	1138.41	1144.77		1145.67	0.012216	9.63	574.02	230.71	0.75
Spwy	980	PF 14	4000.00	1138.41	1145.03		1145.96	0.012140	9.51	632.47	212.80	0.75
Spwy	980	PF 15	5000.00	1138.41	1145.49		1146.49	0.012020	10.40	742.52	236.05	0.75
Spwy	980	PF 16	6000.00	1138.41	1145.92		1146.90	0.012002	10.88	844.72	240.19	0.76
Spwy	980	PF 17	7000.00	1138.41	1146.32		1147.46	0.011346	11.29	940.23	243.40	0.77
Spwy	980	PF 18	8000.00	1138.41	1146.69		1147.90	0.011451	11.67	1030.23	246.44	0.77
Spwy	980	PF 19	9000.00	1138.41	1147.04		1148.31	0.011524	12.07	1117.69	249.02	0.75
Spwy	980	PF 20	10000.00	1138.41	1147.37		1148.72	0.011772	12.28	1201.29	252.09	0.75
Spwy	980	PF 21	11000.00	1138.41	1147.69		1149.10	0.011728	12.67	1282.65	254.64	0.76
Spwy	980	PF 22	12000.00	1138.41	1148.00		1149.47	0.011363	12.96	1362.35	257.21	0.79
Spwy	980	PF 23	13000.00	1138.41	1148.29		1149.83	0.011354	13.25	1438.48	259.61	0.79
Spwy	980	PF 24	14000.00	1138.41	1148.57		1150.18	0.011517	13.57	1510.97	251.66	0.80
Spwy	980	PF 25	15000.00	1138.41	1148.45		1150.52	0.011587	13.78	1582.54	254.22	0.80
Spwy	680	PF 1	1.00	1135.00	1135.20	1135.15	1135.23	0.009558	0.65	1.44	10.74	0.56
Spwy	680	PF 2	10.00	1135.00	1135.53	1135.37	1135.57	0.010006	1.51	6.63	18.24	0.44
Spwy	680	PF 3	50.00	1135.00	1136.14	1135.73	1136.25	0.010102	2.67	18.75	21.74	0.51
Spwy	680	PF 4	100.00	1135.00	1136.62	1136.14	1136.80	0.010019	3.35	29.27	24.51	0.53
Spwy	680	PF 5	200.00	1135.00	1137.30	1136.50	1137.50	0.010009	4.42	56.30	30.11	0.57
Spwy	680	PF 6	500.00	1135.00	1138.66	1137.75	1139.12	0.010026	5.44	92.17	42.13	0.60
Spwy	680	PF 7	750.00	1135.00	1138.31	1137.45	1138.65	0.010016	4.75	141.49	111.04	0.60
Spwy	680	PF 8	1000.00	1135.00	1139.68	1139.62	1140.25	0.010010	6.07	211.16	150.02	0.63
Spwy	680	PF 9	1500.00	1135.00	1140.73	1140.11	1140.83	0.010004	7.32	316.31	209.54	0.65
Spwy	680	PF 10	2000.00	1135.00	1140.61	1140.47	1141.77	0.010002	7.81	404.04	215.03	0.66
Spwy	680	PF 11	2500.00	1135.00	1140.96	1140.74	1141.05	0.010002	5.27	457.25	217.59	0.66
Spwy	680	PF 12	3000.00	1135.00	1141.27	1141.01	1141.90	0.010005	8.58	553.34	225.90	0.67
Spwy	680	PF 13	3500.00	1135.00	1141.55	1141.27	1142.31	0.010005	8.86	618.50	230.51	0.68
Spwy	680	PF 14	4000.00	1135.00	1141.80	1140.44	1142.60	0.010002	9.18	679.51	234.47	0.68
Spwy	680	PF 15	5000.00	1135.00	1142.30	1141.79	1142.15	0.010001	9.70	792.96	237.43	0.69
Spwy	680	PF 16	6000.00	1135.00	1142.74	1142.10	1143.66	0.010010	10.16	906.00	242.00	0.70
Spwy	680	PF 17	7000.00	1135.00	1143.14	1142.42	1144.14	0.010007	10.58	1008.04	245.07	0.71
Spwy	680	PF 18	8000.00	1135.00	1143.52	1142.72	1144.58	0.010001	10.96	1092.11	248.51	0.71
Spwy	680	PF 19	9000.00	1135.00	1143.88	1142.95	1145.01	0.010007	11.27	1182.21	251.45	0.72
Spwy	680	PF 20	10000.00	1135.00	1144.23	1143.27	1145.42	0.010002	11.62	1268.66	254.25	0.72
Spwy	680	PF 21	11000.00	1135.00	1144.55	1143.55	1145.81	0.010001	11.98	1350.19	256.66	0.73
Spwy	680	PF 22	12000.00	1135.00	1144.86	1143.77	1146.19	0.010016	12.27	1432.41	259.50	0.73
Spwy	680	PF 23	13000.00	1135.00	1145.17	1144.01	1146.55	0.010012	12.55	1511.03	251.99	0.74
Spwy	680	PF 24	14000.00	1135.00	1145.45	1144.24	1146.90	0.010008	12.82	1588.16	254.08	0.74
Spwy	680	PF 25	15000.00	1135.00	1145.74	1144.47	1147.24	0.010005	13.08	1663.70	256.71	0.75

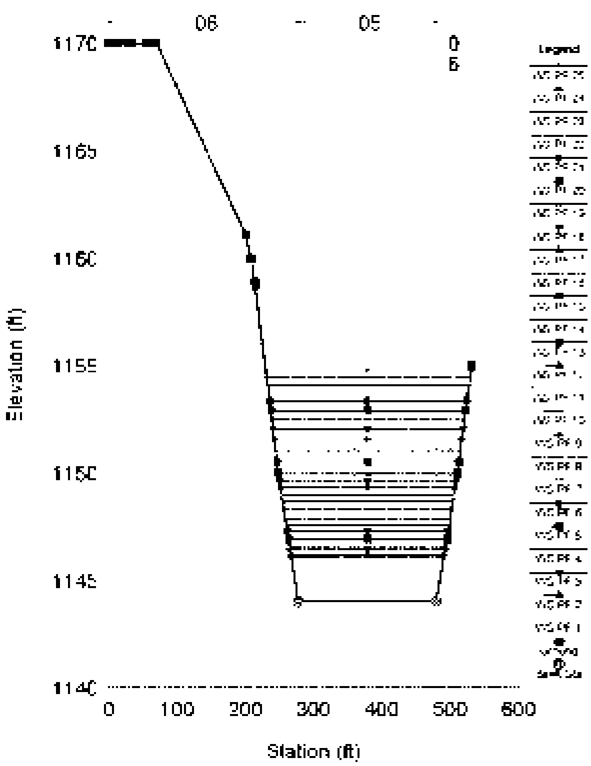
PrimarySpwy Plan: PrimarySpwy 1/10/2011
River = Primary Reach = Spwy RS = 3045



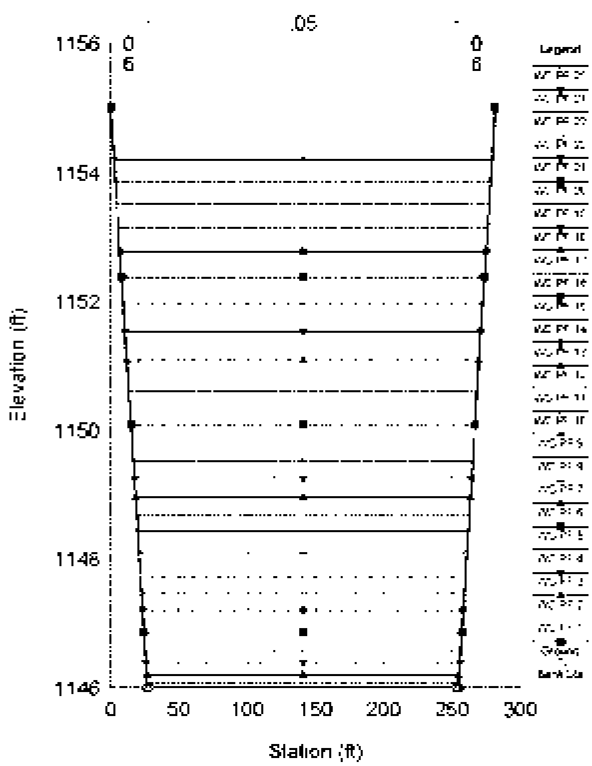
PrimarySpwy Plan: PrimarySpwy 1/10/2011
River = Primary Reach = Spwy RS = 2645



PrimarySpwy Plan: PrimarySpwy 1/10/2011
River = Primary Reach = Spwy RS = 2090



PrimarySpwy Plan: PrimarySpwy 1/10/2011
River = Primary Reach = Spwy RS = 2040 Primary Spillway



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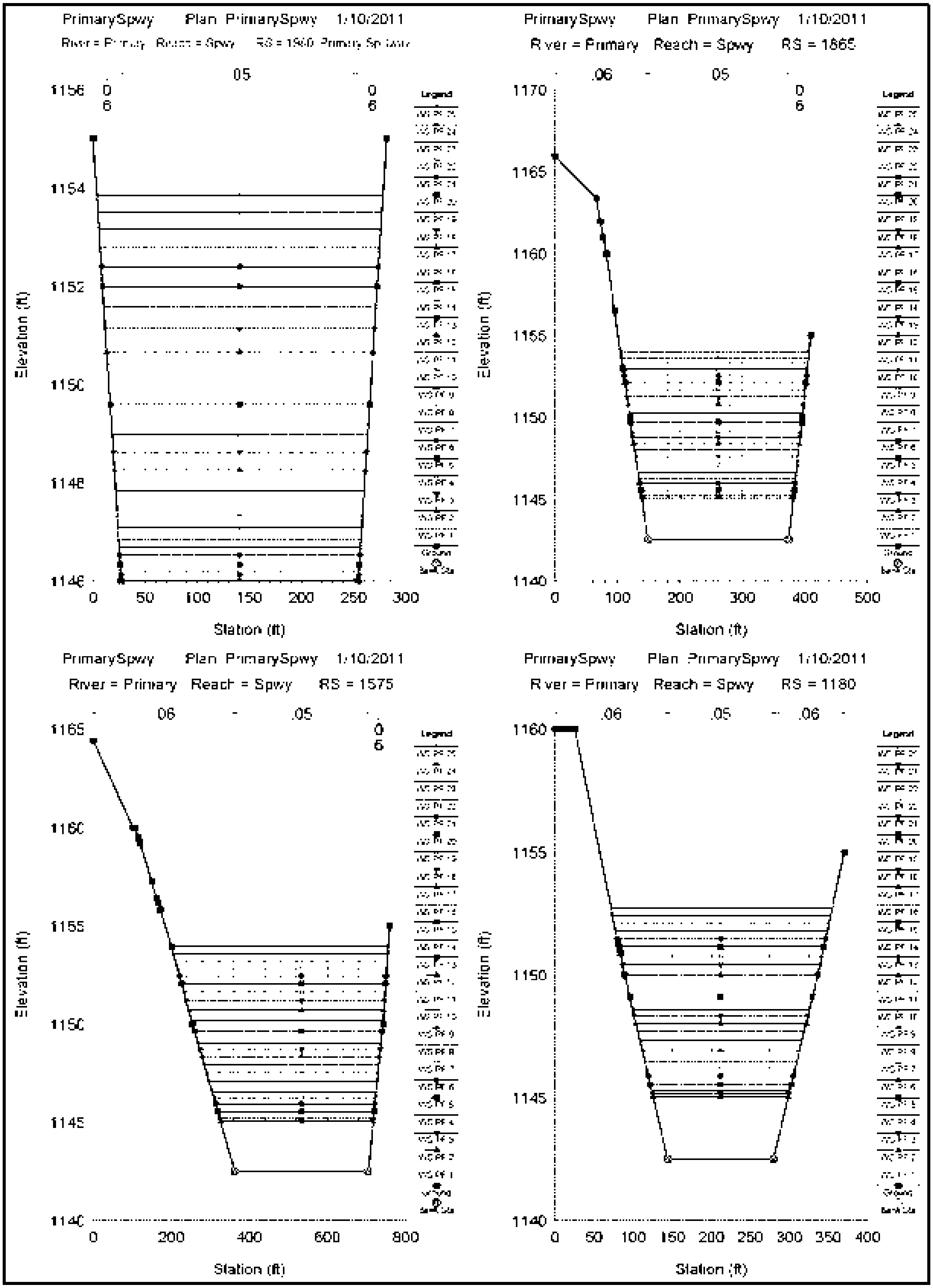
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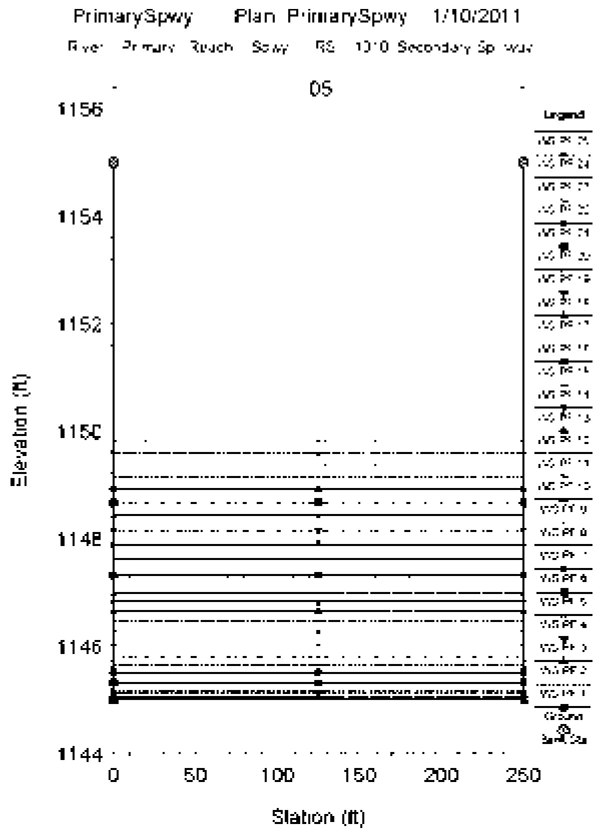
River = Primary Reach = Spwy RS = 1865
PrimarySpwy Plan PrimarySpwy 1/10/2011
River = Primary Reach = Spwy RS = 1575
PrimarySpwy Plan PrimarySpwy 1/10/2011
River = Primary Reach = Spwy RS = 1180
Elevation (ft)
Station (ft)
Legend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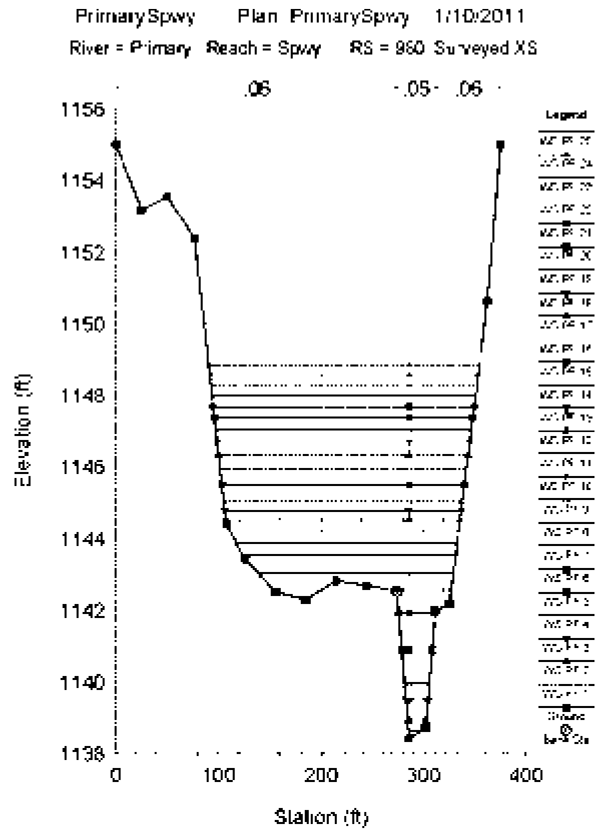
Elevation (ft)
Station (ft)
Legend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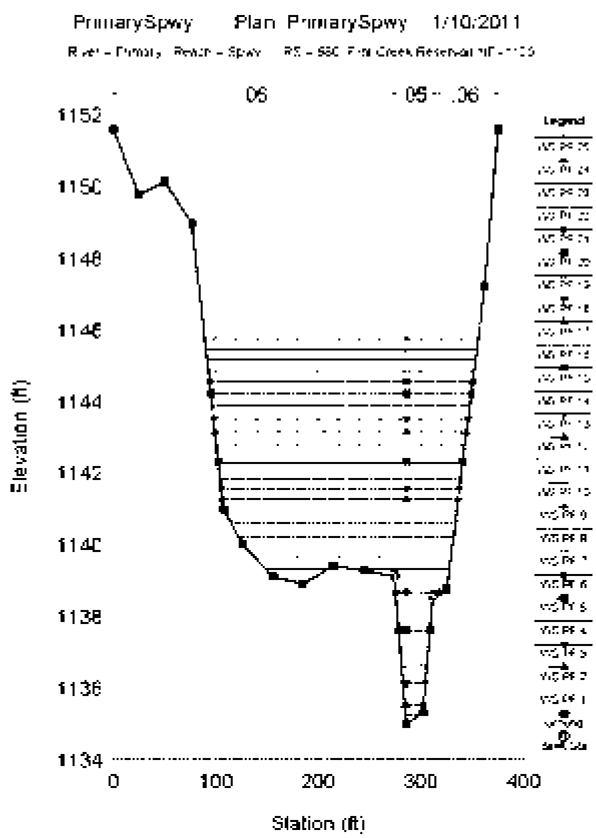
River = Primary Reach = Spwy RS = 960 Surveyed XS
.06
.05
.06
Elevation (ft)
Station (ft)
Legend


PrimarySpwy Plan: PrimarySpwy 1/10/2011
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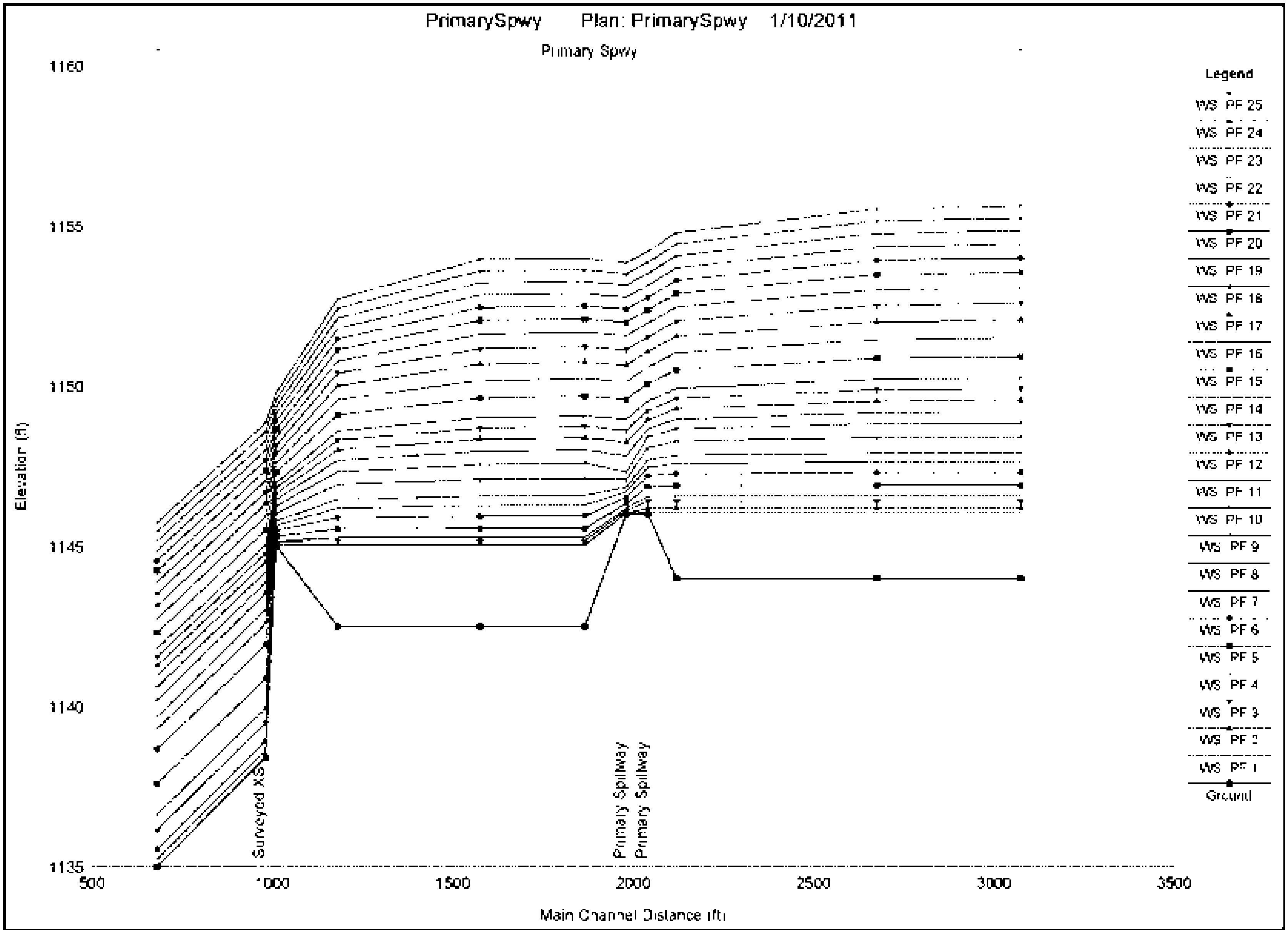
.05
.06
Elevation (ft)
Station (ft)
Legend



AEPFC000345

BASIN LAG TIME CALCULATION

USING NRCS TR55 METHOD TO COMPUTE TIME OF CONCENTRATION

Existing Conditions

Project Data:		Comments:
PROJECT	AEP10612	
LOCATION	Welsh Power Plant	
DATE	Dec-10	
BASIN COND		
BY:	JPM	
WSHED NAME	Primary	

SHEET FLOW (100' MAX)

Land Use Undeveloped	n value	% Land use	Inc n
Conc/gravel/asphalt/bare soil	0.015	0	0
Grass Short Prairie	0.15	0	0
Maintained Grass	0.03	0	0
Woods Light Underbrush	0.4	0	0
Woods Dense underbrush	0.8	0	0

based on information for imperviousness from Corps of Engineers

Land Use	% Conc	% Grass	n value	% Land Use	Inc n
Low D. Residential (1 - Acres)	25	75	0.21375	0	0
Med. D. Residential (1/3 Acres)	41	59	0.17135	100	0.17135
High D. Residential (1/4 Acres)	47	53	0.15545	0	0
Multifamily	70	30	0.0945	0	0
Mobile Home Parks	20	80	0.227	0	0
C.B.D.	95	5	0.02825	0	0
Strip Commercial	90	10	0.0415	0	0
Shopping Center	95	5	0.02825	0	0
Institutional-Schools	40	60	0.174	0	0
Industrial	90	10	0.0415	0	0
Highway ROW	35	65	0.18725	0	0
Public Utilities	60	40	0.121	0	0
Vacant urban land and	6	84	0.2361	0	0
Parks	0	0	0	0	
Other	0	0	0	0	0
		TOTAL		100	0.17135

LENGTH	100	FT	MAX 100'	
2YR 24 HOUR PRECIP	4.31	IN		
SLOPE	0.010	FT/FT		

$$T_t = 0.007 \times \frac{(n \cdot L)^{0.8}}{P_2^{0.5} \cdot S^{0.4}}$$

SHALLOW CONCENTRATED FLOW

1=PAVED 2=UNPAVED	1	
LENGTH	2362.91	FT
SLOPE	0.006	FT/FT
COMPUTED VELOCITY FROM FIGURE 3.1-	1.508	

$$T_t = \frac{L}{60 \cdot V}$$

CHANNEL FLOW

			TOPWIDTH	35
XSECT AREA	100.000	SQ FT	BOTTOM	5
			DEPTH	5
WETTED PERIMETER	36.623	FT		
SLOPE	0.008	FT/FT		
MANNINGS N	0.06			
COMPUTED VELOCITY	4.258	FT/S		
LENGTH	9995.43	FT		

$$V = \frac{1.49 \cdot \left(\frac{a}{P_w}\right)^{2/3} \cdot s^{1/2}}{n}$$

$$T_t = \frac{L}{60 \cdot V}$$

WATERSHED NUMBER	Conditions Primary	Adjusted Tc (Min)	NRCS Method Tc (Min)	Selected Tc (Min)
SHEET FLOW	Max 30 Min	30.0	12.39	12.39
SHALLOW CONCENTRATED FLOW			26.12	26.12
CHANNEL FLOW			39.12	39.12
TOTAL			77.63	77.63
			Lag (Hrs) =	0.78

$$T_c = T_{t1} + T_{t2} + T_{t3} + \ldots$$

Lag(min) =	46.58

BASIN LAG TIME CALCULATION

USING NRCS TR55 METHOD TO COMPUTE TIME OF CONCENTRATION

Existing Conditions

Project Data:		Comments:
PROJECT	33-P08412	
LOCATION	Welsh Power Plant	
DATE	Dec-10	
BASIN COND		
BY :	JPM	
WSHED NAME	Secondary	

SHEET FLOW (100' MAX)

Land Use Undeveloped	n value	% Land use	Inc n
Conc, gravel asphalt, bare soil	0.015	0	0
Grass Short Prairie	0.15	100	0.15
Maintained Grass	0.24	0	0
Woods Light Underbrush	0.4	0	0
Woods Dense underbrush	0.8	0	0
TOTAL		100	0.15

LENGTH	100	FT.	MAX 100'	
2 YR. 24 HOUR PRECIP	4.31	IN.		
SLOPE	0.029	FT/FT		

$$T_t = 0.007 \cdot \frac{(n \cdot L)^{0.8}}{P_2^{0.5} \cdot S^{0.4}}$$

SHALLOW CONCENTRATED FLOW

1=PAVED 2=UNPAVED	2	
LENGTH	1159.16	FT
SLOPE	0.017	FT/FT
COMPUTED VELOCITY FROM FIGURE 3.1	2.119	

$$T_t = \frac{L}{60 \cdot V}$$

	Conditions	Adjusted	NRCS Method	Selected
WATERSHED NUMBER	**Secondary**	Tc (Min)	Tc (Min)	**Tc (Min)**
SHEET FLOW	Max 30 Min	30.0	8.44	8.44
SHALLOW CONCENTRATED FLOW			9.12	9.12
TOTAL			17.56	17.56
			Lag (Hrs)	0.18

$$T_c = T_{t1} + T_{t2} + T_{t3} + T_{t4} + T_{t5} + T_{t6}$$

Lag(min)	10.53

AEPFC000347

Basin	Curve Number (AMC II)	Area_acre
Primary	76.6	1127.5
Secondary	74.9	39.9

Name	GRIDCODE	HSG	Area_ft^2	Area_acre	CN	Inc. CN
Primary	11	W	492113.109	11.297	100	1.002
Primary	23	W	6432.202	0.148	100	0.013
Primary	31	W	196628.865	4.514	100	0.400
Primary	41	W	151664.101	3.482	100	0.309
Primary	71	W	22148.379	0.508	100	0.045
Primary	81	W	58928.772	1.353	100	0.120
Primary	11	B	219057.220	5.029	100	0.446
Primary	21	B	412397.879	9.467	79	0.663
Primary	22	B	511234.844	11.736	68	0.708
Primary	23	B	656437.501	15.070	85	1.136
Primary	31	B	336825.792	7.732	86	0.590
Primary	41	B	1432215.235	32.879	60	1.750
Primary	71	B	192038.278	4.409	61	0.239
Primary	81	B	3304498.256	75.861	61	4.104
Primary	90	B	53877.802	1.237	66	0.072
Primary	11	C	10933.953	0.251	100	0.022
Primary	21	C	2381557.518	54.673	86	4.170
Primary	22	C	564650.628	12.963	79	0.908
Primary	23	C	173626.908	3.986	90	0.318
Primary	31	C	185483.243	4.258	91	0.344
Primary	41	C	1450486.842	33.299	73	2.156
Primary	71	C	335571.928	7.704	74	0.506
Primary	81	C	24105757.161	553.392	74	36.321
Primary	90	C	4267.451	0.098	77	0.007
Primary	21	D	1245218.812	28.586	89	2.257
Primary	22	D	1727655.376	39.662	84	2.955
Primary	23	D	164748.228	3.782	92	0.309
Primary	31	D	1950.419	0.045	94	0.004
Primary	41	D	733098.073	16.830	79	1.179
Primary	81	D	5876087.739	134.896	80	9.572
Primary	24	B	1488256.200	34.166	92	2.788
Primary	24	C	306439.480	7.035	94	0.587
Primary	24	C	310317.021	7.124	94	0.594
Secondary	11	B	60082.739	1.379	100	3.457
Secondary	41	B	192385.993	4.417	60	6.642

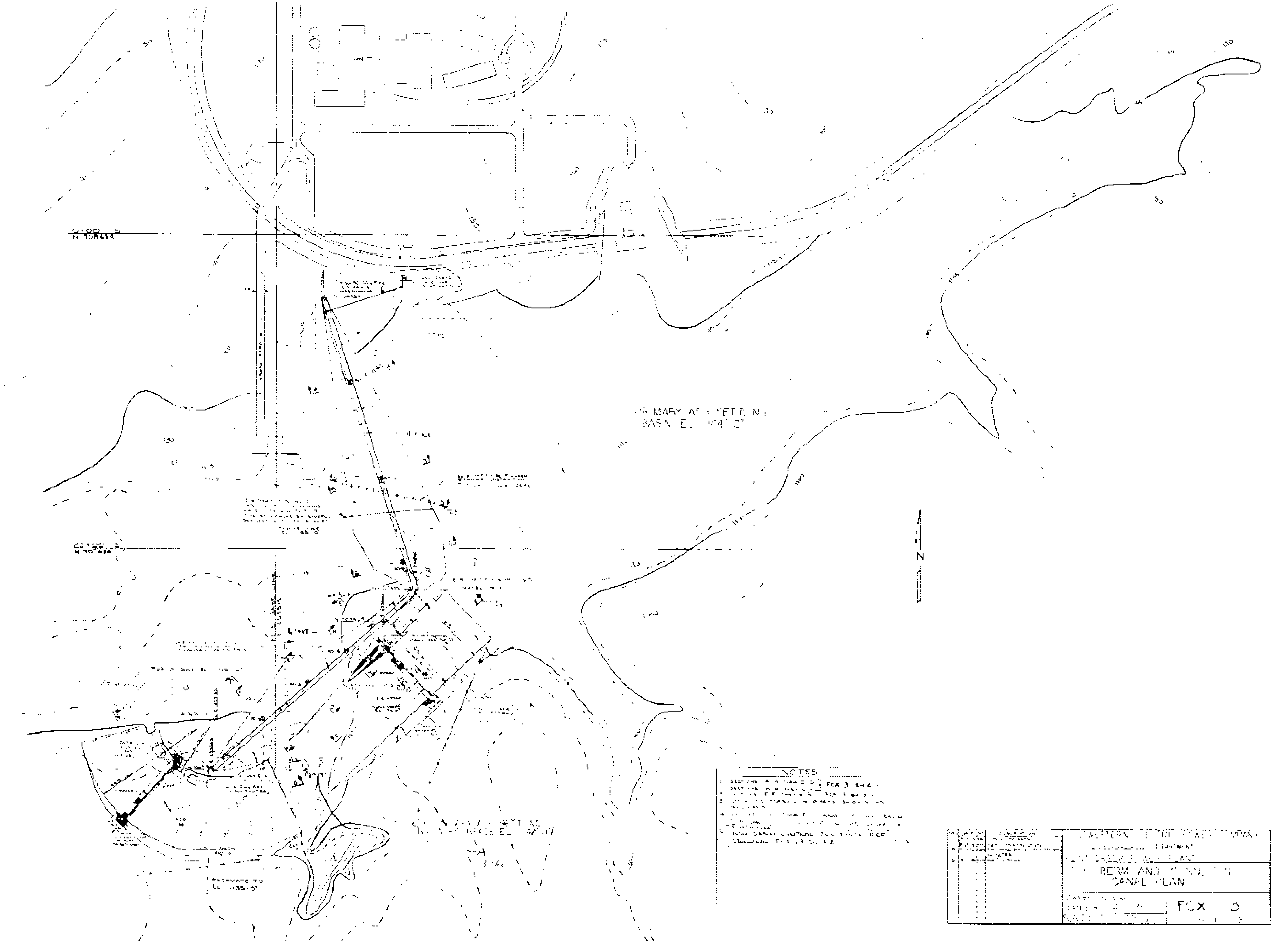
Basin	Area_acre
Primary	1127.47
Secondary	39.90

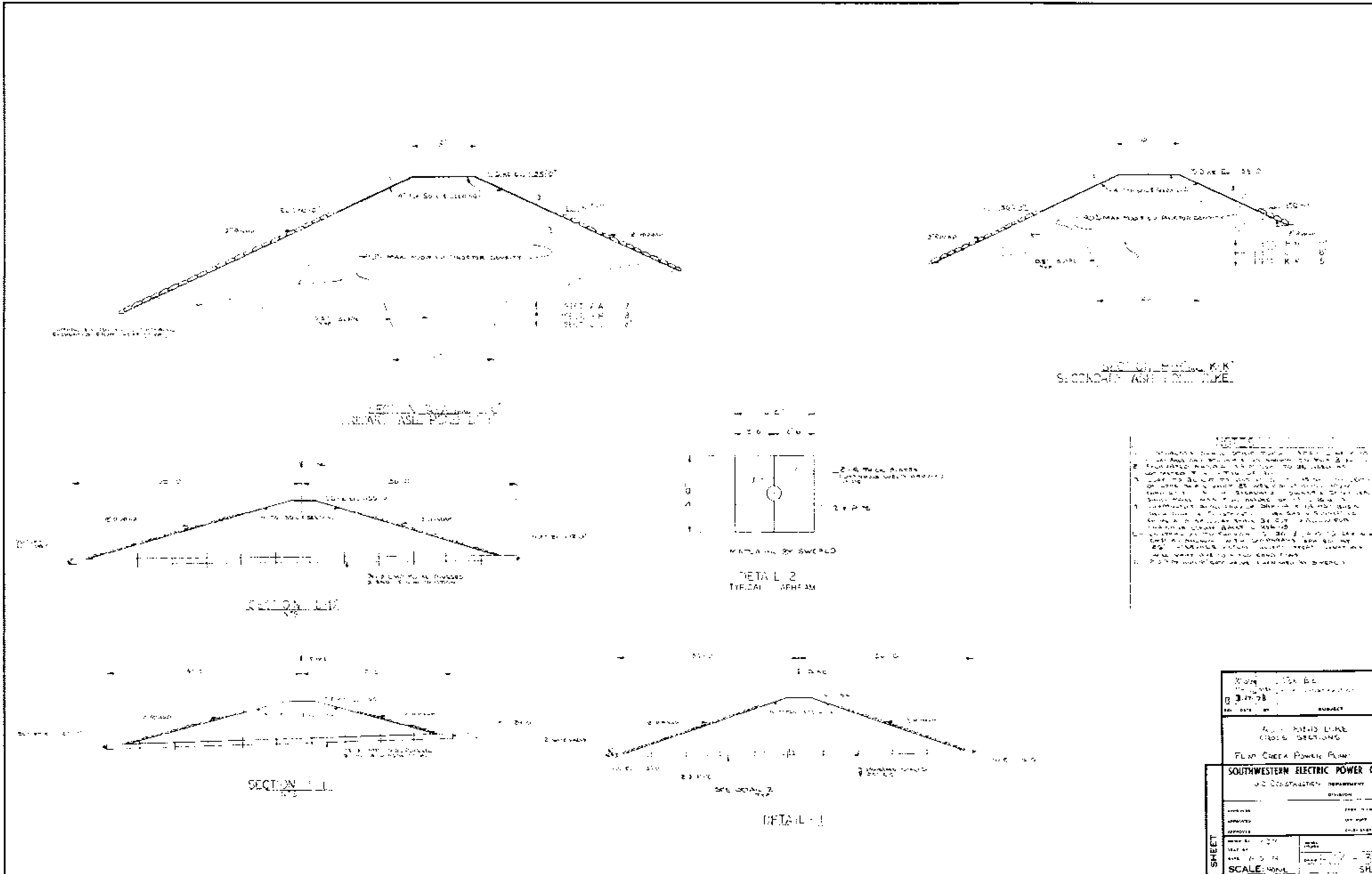
Curve Number Calculations

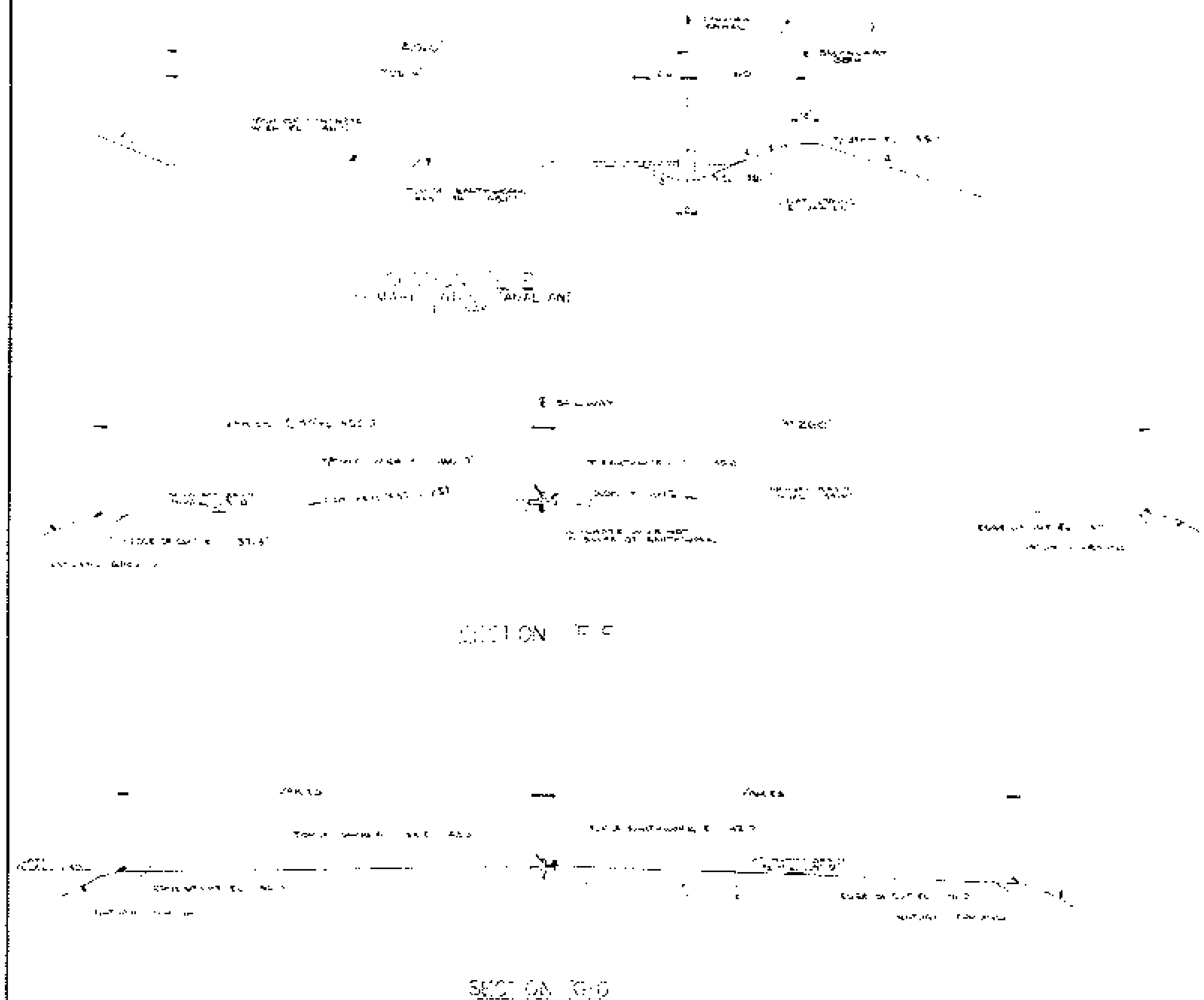
Name	GRIDCODE	HSG	Area_ft^2	Area_acre	CN	Inc. CN
Secondary	81	B	90951.376	2.088	61	3.192
Secondary	11	C	106317.260	2.441	100	6.117
Secondary	21	C	107888.311	2.477	86	5.339
Secondary	41	C	210068.421	4.823	73	8.824
Secondary	71	C	33928.559	0.779	74	1.445
Secondary	81	C	936337.296	21.495	74	39.868

			Curve Number						
GRIDCODE	**NLCD Description**	**TR-55 Description**	**A**	**B**	**B/C**	**C**	**C/D**	**D**	**W**
11	Open Water	Water	100	100	100	100	100	100	100
21	Developed, Open Space	Open Space - Poor	68	79	83	86	88	89	100
22	Developed, Low Intensity	Low Density Residential acre	51	68	74	79	82	84	100
23	Developed, Medium Intensity	High Density Residential	77	85	88	90	91	92	100
24	Developed, High Intensity	Commercial	89	92	93	94	95	95	100
31	Barren Land	Fallow - Bare	77	86	89	91	93	94	100
41	Deciduous Forest	Woods - Fair	36	60	67	73	76	79	100
42	Evergreen Gorest	Woods - Fair	36	60	67	73	76	79	100
43	Mixed Forest	Woods - Fair	36	60	67	73	76	79	100
52	Scrub/Shrub	Brush - Fair	35	56	63	70	74	77	100
71	Grassland/Herbaceous	Open Space - Good	39	61	68	74	77	80	100
81	Pasture/Hay	Open Space - Good	39	61	68	74	77	80	100
82	Cultivated Crops	Row Crops SR - Good	67	78	82	85	87	89	100
90	Woody Wetlands	Woods - Poor	45	66	72	77	80	83	100

Appendix C
Pertinent Drawings


N
NOTES
CANAL PLAN
FCX 3


SOUTHWESTERN ELECTRIC POWER CO.
SHEET
SCALE:
DETAIL 1
DETAIL 2
SECTION



SECTIONS

SOUTHWESTERN ELECTRIC POWER CO.

SHEET

SCALE:

FILE

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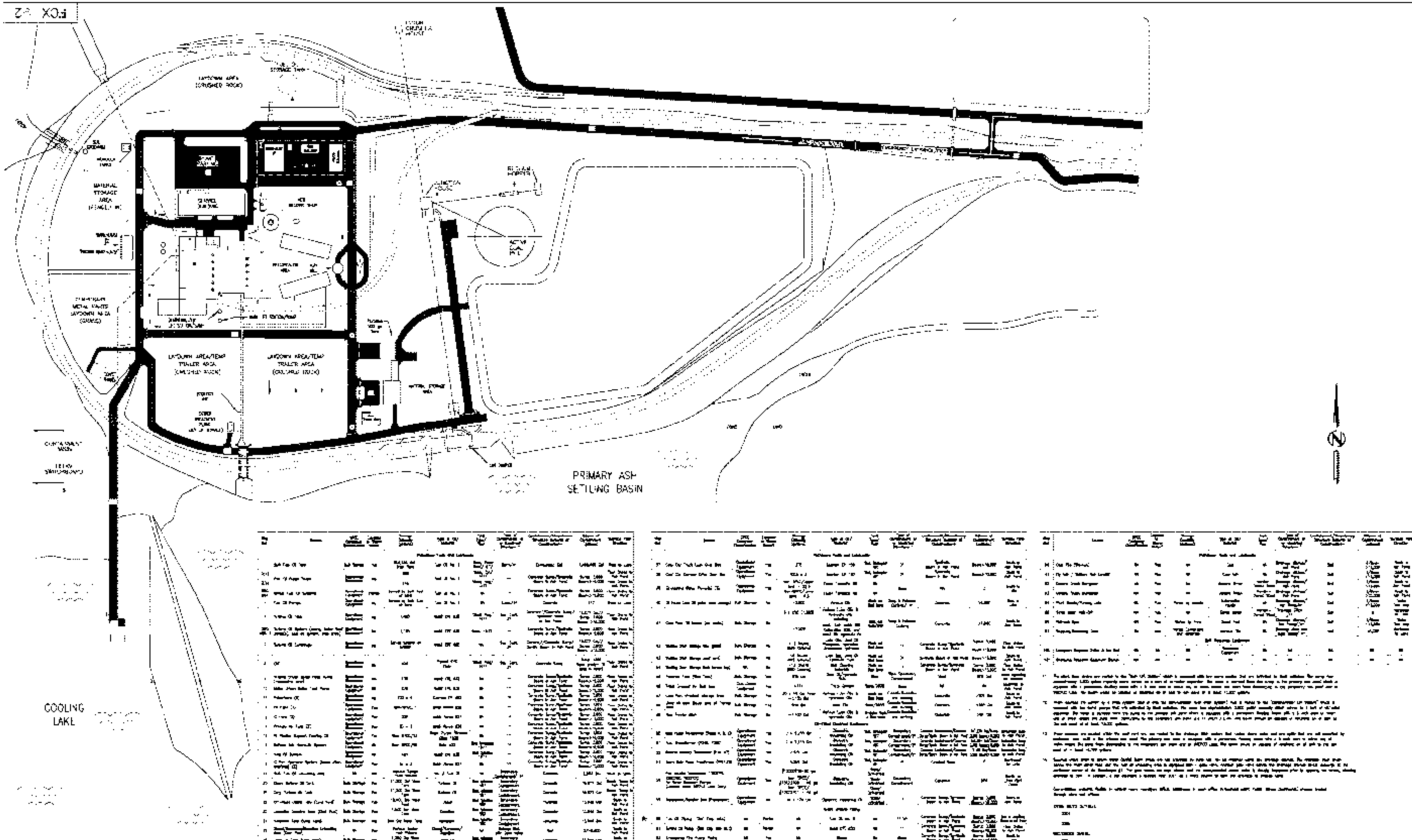


STORM WATER SITE MAP
FLINT CREEK POWER PLANT

SOUTHWESTERN ELECTRIC POWER CO

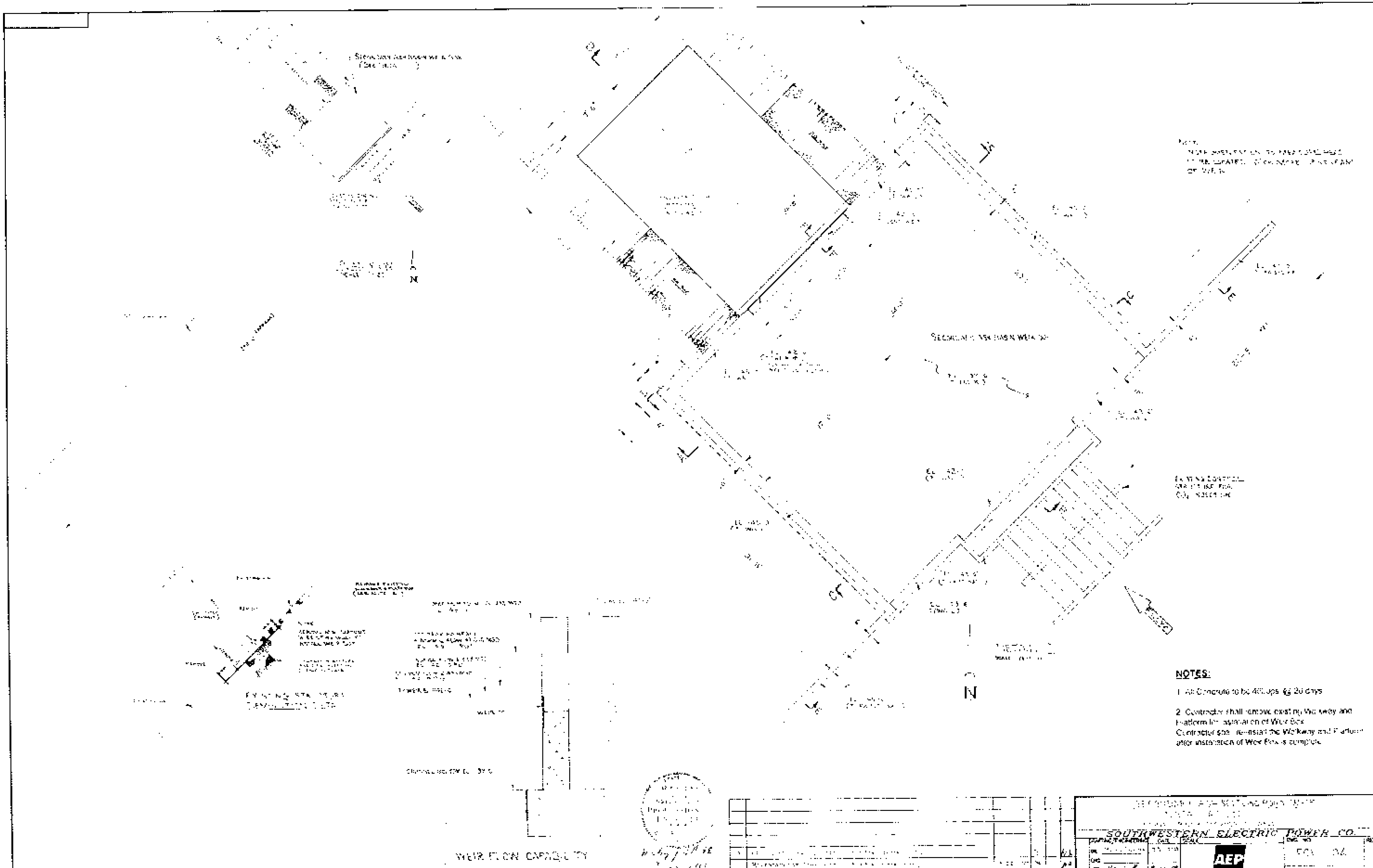
FCX-02

ASH BASIN CONTOURS

FLINT CREEK POWER PLANT

SOUTHWESTERN ELECTRIC POWER CO.

AEPFC000357



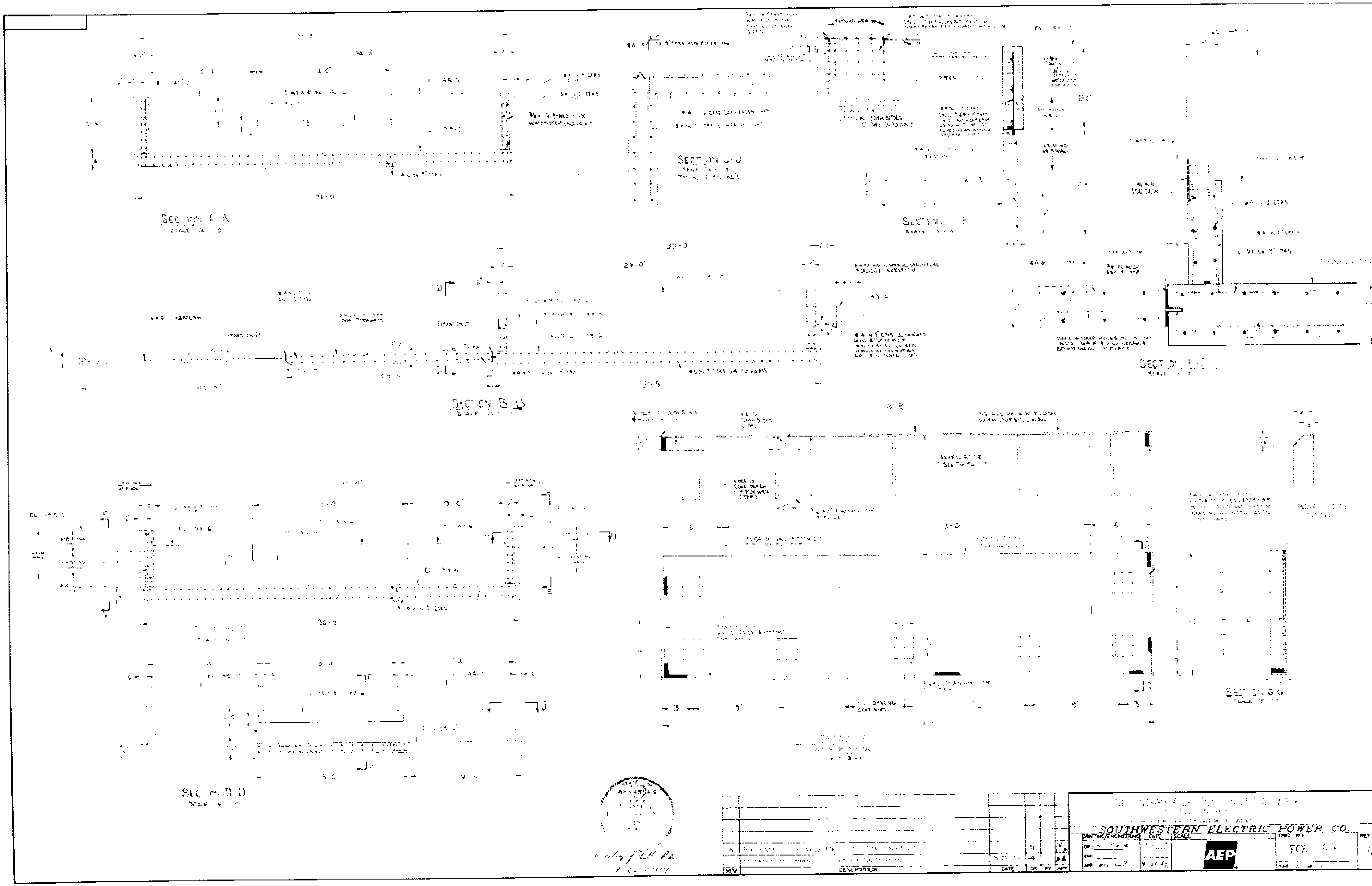
NOTES:

1. All Concrete to be 4000psi @ 28 days

2. Contractor shall remove existing Walkway and Platform for installation of Weir Box. Contractor shall reinstall the Walkway and Platform after installation of Weir Box is complete.

SOUTHWESTERN ELECTRIC POWER CO.

AEP


SOUTHWESTERN ELECTRIC POWER CO.

AMERICAN ELECTRIC POWER

FLINT CREEK POWER PLANT

DESIGN CALCULATIONS

SECONDARY ASH SETTLING POND WEIR

OUTFALL 101

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. [illegible]
WESLEY J. HULL

Wesley J. Hull, P.E
9-21-2007

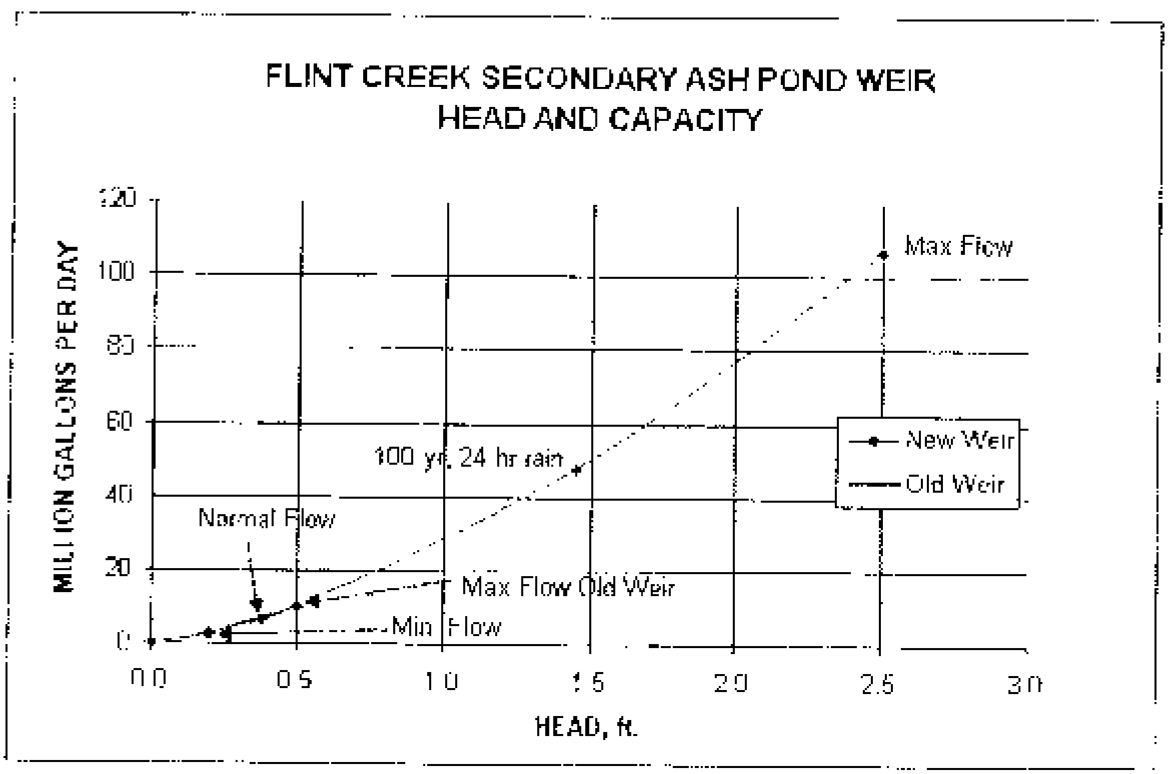
Overview

The calculations shown are for the proposed new weir at Flint Creek Power Plant's permitted Outfall 101. The Isco Open Channel Flow Measurement Handbook 6th Edition was used as a reference for the weir design.

The crest elevation of the proposed weir is the same as the existing one so that the pond's normal surface elevation will not be affected. The secondary ash pond's spillway will be raised by 2 feet to elevation 1145'-0" to eliminate the over topping situation experienced during high rainfall events by increasing the head and capacity of the weir.

A compound weir was considered but flow near the transition zone will introduce error. The weir type is sharp crested, rectangular, with end contractions and is designed to adequately handle a 100 year, 24 hour rainfall event.

These improvements will provide greater flow capability and improved accuracy by slowing the approach velocity.



1. Approximate rainfall runoff to basin

Watershed Area in acres $a := 635$

Typical runoff coefficient for heavy soil $p := 0.2$

From Rainfall Frequency Atlas, 100 yr 24 hr rain is 8.75 inches

Actual extreme rainfall NNDC Climate Data Online for Siloam Springs weather station is 9.1 inches.
Use 9" for 100 yr 24 hr rain event.

Rainfall in inches $R_{100} := 9.0$

Million gallons per day based on rainfall, water shed and runoff. Results in 40.819 MGD runoff to Sec. Ash Pond

$$MGD := a \cdot \frac{R_{100}}{12} \cdot p \cdot 0.3259 = 40.819$$

2. Consider flow from primary pond to secondary pond

Flow is through a 2' x 4' concrete submerged horizontal section 40' long. Head differences from one pond to the other controls flow. Note: stop logs are in place and can be used to reduce flow to the secondary pond.

Pri. Pond elv. $H_{pri} := 1144$ $height := 2$ $L_c := 40$ $k_{ent} := 1$

Sec. Pond elv. $H_{sec} := 1142$ $width := 4$ $k_{ext} := 1$

Cross sectional area $area := height \cdot width = 8.000$

Assume Concrete friction factor $f := 0.2$

Derived from Bernoulli equation. Using surface elv difference calculate velocity through section

$$V_c := \sqrt{\frac{(H_{pri} - H_{sec}) \cdot 2 \cdot 32.2}{f \cdot \frac{L_c}{\sqrt{area \cdot \frac{4}{\pi}}} + k_{ent} + k_{ext}}}$$

$$V_c = 9.142 \ \frac{ft}{sec}$$

Velocity is reasonable. Using velocity and cross sectional area flow is:

$$gpm_c := area \cdot V_c \cdot 7.48 \cdot 60 = 32824.930$$

$$MGD_c := gpm_c \cdot 1.440 \cdot 10^{-3} = 47.268$$

Therefore flow section from Primary ash Pond is capable of flowing the 100 yr 24 hr rainfall runoff to Sec Ash Pond

3. Use solve block to determine head on weir, given crest length and maximum flow:

Calculations are for rectangular weir with end contractions

Selected crest length of weir in feet: $L := 13$

Desired flow based on 100 yr 24 hr rainfall + current outflow in units of million gallons per day. Current outflow is typically in the 5 to 7 MGD range. Use 7 MGD as typical flow for calculations.

Maximum design flow is: $MGD := 40.819 + 7 = 47.819$

Initial guess head on the weir $x_h := 0.5$

Given

$MGD = 2.152 \cdot (L - 0.2 \cdot x_h) \cdot x_h^{1.5}$

$Head := Find(x_h)$ $Head = 1.451$ ***Head on weir:*** $Head \cdot 12 = 17.42$ inches

Check calculated gpm equals desired flow in million gallons per day

$gpm := 1495 \cdot (L - 0.2 \cdot Head) \cdot Head^{1.5}$ $= 33219.984$ $if(gpm \cdot 1.44 \cdot 10^{-3} > MGD, \text{"OK"}, \text{"Recalculate"}) = \text{"OK"}$

4. Determine overall dimensions of the approach channel:

Approach channel dimensions are based on ratios to the maximum design flow head in units of feet. The Isco Open Channel Flow Measurement Handbook 6th Edition was used as the reference.

Dimensions are in units of feet.

Crest length of weir in feet	$L = 13.000$	$if(L > 3 \cdot Head, \text{"OK"}, \text{"To Short"}) = \text{"OK"}$
Measurement point of head:	$D1 := 4 \cdot Head$	$D1 = 5.805$
Minimum crest height	$D2 := 2 \cdot Head$	$D2 = 2.903$
Minimum end contraction	$D3 := 2 \cdot Head$	$D3 = 2.903$
Cross Section Depth	$D4 := Head + D2$	$D4 = 4.354$
Approach Length to weir	$D5 := 20 \cdot Head$	$D5 = 29.025$

5. Determine channel width using the cross section depth and an acceptable approach velocity

For accuracy the desired channel velocity is no more than 0.5 ft/sec

Given

$V_{app} := 0.5$ $\qquad x_b := 8 \cdot Head$

$$V_{app} = \frac{gpm}{x_b \cdot (D4) \cdot 7.48 \cdot 60}$$

$D6 := Find(x_b)$ $\qquad if(D6 > 8 \cdot Head, "OK", "To Short") = "OK"$ $\qquad D6 = 34.002$

Re-calculate D3 based on D6 for acceptable velocity $\qquad D3 := \frac{D6 - L}{2} = 10.501$

6. WEIR SUMMARY

DIMENSIONS, ft.		FLOW	
Head on weir	Head = 1.451	Million per day	MGD = 47.819
Crest length of weir in feet	L = 13.000	Gallons per minute	gpm 33219.984
Measurement upstream of weir	D1 = 5.805	Velocity in channel	V_{app} = 0.500
Minimum crest height	D2 = 2.903		
Minimum end contraction	D3 = 10.501		
Cross Section Depth	D4 = 4.354		
Approach Length to weir	D5 = 29.025		
Channel width	D6 = 34.002		

Elevations & Dimensions

Elevation top of weir plate	1142'-6"
Elevation bottom of channel	1139'-6"
Elevation of maximum expected head	1143'-11-7/16"
Elevation of new spillway	1145'-0"

ETTL Engineers & Consultants Inc.

GEOTECHNICAL * MATERIALS * ENVIRONMENTAL * DRILLING * LANDFILLS

August 18, 2010

W. Greg Carter, P.E.
American Electric Power
21797 SWEPCO Plant Road
Gentry, AR 72734

SUBJECT: Flint Creek Power Station, Existing Ash Storage Ponds Embankment Investigation, Pittsburg, Texas
Geotechnical Investigation
ETTL Job No. G3243-09

Dear Mr. Carter:

Submitted herein is the report summarizing the results of a geotechnical investigation conducted at the site of the above referenced project.

If you have any questions concerning this report, please contact us. We are also available to perform any construction materials testing and inspection services that you may require.

Thank you for the opportunity to be of service.

Sincerely,
ETTL Engineers & Consultants Inc.

Robert M. Duke
Senior Project Manager

Stephen R. Richards, P.E.
Principal Consultant

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 8984
STEPHEN R. RICHARDS

CERTIFICATE OF AUTHORIZATION
ETTL ENGINEERS & CONSULTANTS, INC.
No. 288
ARKANSAS - ENGINEER

August 18, 2010

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Geotechnical Investigation
Flint Creek Power Station
Existing Ash Storage Ponds Embankment Investigation
Gentry, Arkansas

Submitted to

American Electric Power
Gentry, Arkansas

Prepared by

ETTL Engineers & Consultants Inc.
Tyler, Texas

(Revision 2)
August 2010

AEPFC000097

EXECUTIVE SUMMARY

This Executive Summary is provided as a brief synopsis of the specific recommendations and design criteria provided in the attached report. It is not intended as a substitute for a thorough reading of the report in its entirety.

Project Description

Evaluation of the existing earthen embankments for the ash ponds at the Flint Creek Power Station. Slope stability and seepage analyses for the embankments were performed using information obtained from soil borings located on the crest and downstream toe of the embankments. The embankments for the Primary and Secondary Bottom Ash Ponds were investigated.

Site Description

This investigation was conducted on the Flint Creek Power Station embankments that are located at the plant which is located at 21797 SWEPCO Plant Road. The power plant is located on the northeast side of the Reservoir and the ash ponds are located to the south of the plant on the east side of the reservoir.

Depth & Number of Borings

Three borings were drilled to 30 feet deep at the native soil level and four borings were drilled to 50 feet deep in the crests of the embankments. The four deep borings were converted to piezometers.

Soils Encountered

The fill material in the containment berm consists primarily of stiff to very stiff lean clay (CL) or fat clay (CH) with gravel and medium dense clayey gravel (GC) or clayey sand (SC) with gravel overlying native soils which consist primarily of weathered limestone with layers of stiff to hard lean clay (CL) with gravel. The limestone encountered typically consisted of solid layers less than 14 inches thick. The Rock Quality Designation (RQD) of the cores is less than 25%. Atterberg Plasticity Indices of the tested soils ranged from 5 to 47.

Groundwater Depth

Found to range from elevation 1119 to 1135 msl in the open boreholes. Groundwater is anticipated to be between the lake elevation of 1140 and the primary and secondary pond elevations of 1146 and 1143 respectively.

Embankment Stability

The existing berm slopes are acceptable ***if conditions are maintained***. A minimum factor of safety of 1.6 in the long term was found on the Secondary Ash Pond. Rapid drawdown of the level of water in the individual ponds lowers the predicted overall stability factors of safety to a minimum of 1.2 at the Primary Ash Pond (assuming no ash in the pond left against the slope).

TABLE OF CONTENTS

1.0 INTRODUCTION

This study was performed at the request and authorization to proceed granted by Greg Carter, P E with AEP, Hallsville, Texas in accordance with our proposal dated October 13, 2009. Field operations were conducted on November 3rd though November 6th, 2009.

The purpose of this investigation was to define and evaluate the general subsurface conditions for the primary and secondary ash ponds at the Flint Creek Power Plant in Gentry, Arkansas. Specifically, the study was planned to determine the following

- Subsurface stratigraphy within the limits of exploratory borings;
- Classification, strength, and permeability characteristics of the embankment and foundation soils; and
- Slope stability and seepage of the existing embankments;

To determine this information a variety of tests were performed on the soil and ash samples. The scope of testing for this report comprised Standard Penetration, Atterberg liquid and plastic limits, Percentage of Fines Passing the No. 200 sieve and Natural Moisture Content, Unconsolidated Undrained Triaxial tests, and Permeability These tests were conducted to classify the soil strata according to a widely used engineering classification system; identify, and provide quantitative data for soils; define shear strength characteristics; define seepage characteristics; and determine the slope stability of the existing embankments.

The conclusions and recommendations that follow are based on limited information regarding site topography provided to ETTL by others. *Should any portion of this information prove incorrect, this firm should be notified in order to assess the need for revisions to this report.* Borings were drilled at locations based on a site plan provided by the client.

2.0 PROJECT DESCRIPTION

This project entails the evaluation of the existing earthen embankments at the Flint Creek Power Station. Slope stability and seepage analyses for the embankments was performed using information obtained from soil borings located on the crest and outside toe of the embankments. The embankments for the Primary and Secondary ash ponds were evaluated:

One seepage and one stability analyses was conducted for each pond. Table 2.0 below, lists the number of borings and depths for each pond as well as the piezometers installed.

Table 2.0 Boring and Piezometer Depths and Locations

Pond	Boring Numbers & Depths	Piezometer Numbers and Depths
Primary Ash Pond	B-3 – 37 feet deep B-4 – 50 feet deep B-5 – 30 feet deep	B-3 – 37 feet deep B-4 – 50 feet deep
Secondary Ash Pond	B-1 – 48 feet deep B-2 – 50 feet deep B-6 – 23 feet deep B-7 – 11 feet deep	B-1 – 48 feet deep B-2 – 50 feet deep

3.0 SITE DESCRIPTION

This investigation was conducted on the Flint Creek Power Station embankments that are located throughout the plant which is located at 21797 SWEPCO Plant Road. The Ash ponds are located south of the plant and east of the reservoir. See the Plans of Borings for the locations of the embankments investigated.

4.0 FOUNDATION STRATIGRAPHY & PROPERTIES

Regional, local, and site-specific environmental characteristics have been identified by review of the surface, subsurface, and groundwater data gathered during the course of this study.

4.1 Surface Water Characteristics

The site is situated on a topographically level feature, with a slight slope from northeast to southwest. The surface elevation of the study site is 1100 to 1160 feet above mean sea level (msl). Little Flint Creek enters the subject site along the western portion of the property and flows into the reservoir. The ash ponds are located on an unnamed tributary that flows along the south side of the property into the reservoir. Surface water runoff from the site is expected to move to the southwest along Little Flint Creek.

4.2 Regional Geology

4.2.1 Stratigraphy and Structure

The State of Arkansas can be divided geologically into two general areas of nearly equal size. The northwestern half is part of a physiographic division that is known as the Interior Highlands, and the southeastern half is part of the Gulf Coastal Plain. The rocks in the highland area are dominated by well-lithified sandstones, shales, limestones, and dolostones of Paleozoic age. The rocks of the Ozarks tilt slightly to the south and have a dendritic drainage pattern. Since shales and siltstones erode faster than sandstones and limestones, the basic topography is flat-topped mountains with stepped flanks. By contrast, the topographic expression of the Ouachitas to the south is controlled not only by the erosional resistance of the rocks, but also by their internal structure. The strata are complexly folded and frequently faulted. The mountains are mostly east-west-trending ridges supported by erosionally resistant rocks and separated by less resistant rocks.

4.2.2 Boone Formation

The Boone Formation outcrops at the study site. The Boone Formation is predominately lower Mississippian in age. The overlying soils are of the Bodine Series, which vary in thickness from 10 feet to 50 feet. These soils were developed in residuum from very cherty limestones on strong to steep slopes. The soils are coarser textured and more yellow than the Baxter soils, also more cherty. In general they may be described as brown to reddish-brown to brownish-yellow clay, silty and very cherty. The high content of chert is a major factor of the soils and tends to obscure other morphology.

The Boone Formation is described as a cherty limestone, consisting of beds of chert and thin to massively bedded limestone, which vary in character in lateral extent. The Boone can be distinguished by presence of chert, which is seen in the exposures or in the subsurface cores. The Chert beds cover most of the slopes and valley floors.

When first exposed the chert is compact and a light gray color. On weathering it may become yellowish brown from iron staining, fragmental, light and porous, also many diverse colors. It may occur as concretions in limestone beds, as lenses and as massive beds. The Boone has considerable silica in these beds and upon removal of the lime by solution the remaining rock has a porous texture. This is also referred to as "Cripoli". Some of the limestone beds are charged with bituminous matter, which gives off an odor when broken and exhibit a dark residue appearing as dried asphalt.

Solution waters create some caves and voids throughout the Boone and it is not uncommon to penetrate a void while drilling this formation.

In this area of Little Flint Creek the thickness of Boone could be as much as 350 feet. It is believed that none of the borings in this investigation penetrated any formation older than the Boone.

4.2 Geologic Processes

4.2.1 Fault Systems and Structural Processes

The project site was examined for the presence of faulting by reviewing available literature, maps, and site reconnaissance, in addition to the examination of the subsurface boring data for the site.

There are minor faults running northeast and southwest approximately two to five miles in either direction of this site. Structures that formed on the flank of the Ozark dome of the late Paleozoic Ouachita orogeny are identified as monoclinal folds that displace the generally flat lying Boone Formation. Both east-striking normal faults and broader northeast-striking dextral strike-slip fault zones probably reflect Pennsylvanian-Early Permian deformation of the developing Ouachita orogeny. The caves and voids throughout the Boone mentioned above can also produce localized sinkholes.

4.2.1.1 Seismic Design Parameters

Data regarding soil type and density to a depth of 100 feet is needed to designate a design class for the profile where liquefaction potential is not considered. However, we predict that the site could be classified **Class D** based on the limited data available.

A seismic impact zone is an area with a 10 percent or greater probability that the maximum horizontal acceleration in rock, expressed as a percentage of the earth's gravitational pull, will exceed 0.10g in 50 years.

Based on the maps and the site coefficients determined for **site class C** contained in the IBC, parameters as listed below are recommended by the Code:

Site Coefficients:	$F_a = 1.60$ $F_v = 2.40$
Maximum Earthquake Spectral Response Acceleration Parameters:	$S_{MS} = 0.217$* $S_{M1} = 0.139$
Design Spectral Response Acceleration Parameters:	$S_{DS} = 0.144$ $S_{D1} = 0.093$

*Note: Acceleration used for seismic evaluation.

4.2.1.2 Liquefaction

Liquefaction is a phenomenon where soil pore pressure builds up rapidly during cyclic loading causing a loss of shear strength and consequent significant ground movement both laterally and vertically. In layman's terms the soil turns into quick sand, losing ability to support load, and can spread laterally out from under foundations. Foundations sitting on sand that liquefies during an earthquake can sink into the soil.

Recent research[1,2] has shown that liquefaction potential exists not only in relatively clean sands, but also, under certain circumstances, in sands, silts and clayey soils of low plasticity (PI<12 or up to 20 if MC>0.85*Liquid Limit) with significant fines content. In order for liquefaction to be triggered, the water content of finer soils needs to be high (generally > 80-85% of the Liquid Limit) and the density relatively low (assessed in terms of the SPT blow count generally where N1 (SPT Value normalized for overburden pressure) is low). In addition, the frequency and magnitude of ground shaking has to reach a certain threshold, which is related to the soil properties and local geology.

The native soils are predominantly clayey gravel (GC) and lean clay with gravel (CL) over limestone. These characteristics taken together with the fact that the site is in a zone of relatively low maximum ground acceleration indicate a negligible risk of liquefaction.

4.2.2 Erosional Processes

Erosional processes in the area of study are limited to those produced by the drainage systems of Little Flint Creek. Due to the geology and the gentle relief of the site topography, erosion is minimal.

4.3 Soil Stratigraphy

Detailed on the attached boring logs are the specific types and depths of the various soil strata encountered. The logs show defined boundaries between various soil types, but in reality the transition between types is generally gradual.

The fill material in the containment berm consists primarily of stiff to very stiff lean clay (CL) or fat clay (CH) with gravel and medium dense clayey gravel (GC) or clayey sand (SC) with gravel overlying native soils which consist primarily of weathered limestone with layers of stiff to hard lean clay (CL) with gravel. The limestone encountered typically consisted of solid layers less than 14 inches thick. The Rock Quality Designation (RQD) of the cores is less than 25%. Atterberg Plasticity Indices of the tested soils ranged from 5 to 47.

5.0 GROUNDWATER OBSERVATIONS

Groundwater was measured at each boring location during drilling operations and four piezometers were installed. Two new piezometers were installed on each embankment for the Primary and Secondary ash ponds. Groundwater levels in the piezometers have not been measured to date. Groundwater was found to range from elevation 1119 to 1135 (msl) in the open boreholes. Groundwater is anticipated to be between the lake elevation of 1140 and the primary and secondary pond elevations of 1146 and 1143 respectively

It should be noted, however, that seasonal groundwater conditions might vary throughout the year depending upon prevailing climatic conditions. This magnitude of variance will be largely dependent upon the fluctuation of pond and lake levels.

5.1 Piezometers

Four piezometers were installed for the two embankments at the site. These piezometers will be used to monitor the water level in the embankments. Piezometers were installed in the boring locations selected by AEP prior to the site work. The piezometers are numbered based on the

1 Idriss, I.M. and Boulanger, R.W., Semi Empirical Procedures for Evaluating Liquefaction Potential During Earthquakes, Invited Paper, 11th International Conference on Soil Dynamics and Earthquake Engineering, Berkley, CA, January 2004.

2 Seed, R. B., et al, Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework, 26th Annual ASCE Los Angeles Spring Seminar, April 2003.

boring number where each was installed (i.e. B-1 was installed at boring location B-1). Copies of the Well Logs and State of Arkansas Well Reports may be found in the Appendix.

Upon completion of drilling activities for the geotechnical borings, the piezometers were installed in the open borehole to the depth approximating the natural ground level. If the boring was deeper than the depth of proposed screening, the boring was backfilled with bentonite to the appropriate depth. The 2-inch piezometer was installed within the open borehole along with a 1-inch PVC pipe. Fresh water was pumped within the 1-inch PVC pipe until the water flowing back from the bottom of the borehole to the surface had thinned. The piezometers were constructed of schedule 40, 2-inch diameter, PVC pipe consisting of new, box-wrapped, flush-joint threaded screen (0.010-inch mill slot) and casing. This installation depth should measure the final groundwater elevation after the water through the embankment has stabilized. This is the depth predicted by the seepage analyses below.

The filter pack material placed around the well screen consisted of 20/40 silica sand. The filter pack sand was gravity placed into the annular space around the screen between the well and the borehole wall. Filter pack material was poured until the top of the filter pack extended two (2) feet above the top of the screen. Material thickness in the annular space was verified using a weighted fiberglass measuring tape or through the use of a 1-inch PVC pipe. The top of the filter pack was then sealed with bentonite pellets, which were allowed to gravity flow into the annular space to a minimum thickness of two (2) feet. The bentonite seal was hydrated with water. An additional bentonite seal was placed within the remaining portion of the annular seal to the surface. The piezometers were protected with flush mount surface completions.

5.2 Embankment Seepage Studies

5.2.1 Seepage Losses and Pressures

The anticipated water level due to seepage through the embankments was investigated based on the high water level anticipated in each individual pond using the computer program SEEP 2D by Environmental Modeling Systems, Incorporated. The seepage both through the embankment and through the foundation soils at each embankment location was estimated based on the permeability tests of soils encountered at the site. The permeabilities of representative samples of the soil ranged from 2.4×10^{-8} cm/sec to 9.4×10^{-9} cm/sec (test results included in the Appendix). Permeabilities of the weathered rock layers were not tested, but due to the possibility of interconnected voids, permeabilities of the rock mass could vary widely, estimated (in published literature for this kind of geology) to range from 1×10^{-3} cm/sec to 1×10^{-8} cm/sec. We understand that grout curtains that were installed around the perimeter to keep the reservoir filled to a useable level. This fact substantiates the existence of significant interconnected voids in the rock mass. Due to the high plasticity of the soil interlayered with rock seams, we anticipate that the permeabilities of the soil seams will be similar to those of the surficial clays tested. Based on the possibility of gravel seams in the fill as well as in the native soils, flows were also calculated by increasing the average flow rate (i.e. increasing the permeability) by a factor of 10 (i.e., 1×10^{-8} cm/sec would become 1×10^{-7} cm/sec).

Seepage losses for the highest permeability predicted for the embankments are predicted at 0.03 gallon per day (gpd) per foot of dam length based on the assumptions above (which do not account for significant seepage losses in the voids in the rock mass).

Table 5.2.1.1 – Permeability Test Results			
Boring	**Depth**	**Unit Weight (pcf)**	**Permeability (cm/sec)**
B-1	18' - 20'	125.1	1.5×10^{-8}
B-1	33' - 35'	130.5	1.5×10^{-8}
B-2	8' - 10'	129.6	9.4×10^{-9}
B-2	23' – 25'	131.3	2.4×10^{-8}
B-7	5' – 7'	127.1	2.0×10^{-8}

Table 5.2.1.2 – Embankment Seepage Rates	
Embankment	**Seepage Rates (Cubic Feet per Day per Foot) Max/Min**
Primary Ash Pond	4×10^{-3} /5×10^{-4}
Secondary Ash Pond	4×10^{-3} /1×10^{-4}

The water levels at the piezometers are predicted to reach slightly above the average of the upstream (pond) and downstream (lake) normal pool elevations. Water levels approaching the pond level could indicate a seepage pressure not anticipated in this design. Levels found to be within 1 foot of the pond levels should be brought to the attention of ETTL for additional study.

6.0 POND EMBANKMENT SECTIONS

The berm heights ranged from 35 feet for the Secondary Ash Pond to a maximum of around 46 feet for the Primary Ash Pond.

6.1 Slope Stability Analysis

All embankment slopes must be stable with respect to shear failure through the embankment and/or the foundation strata. The existing slopes are standing (and have been doing so for approximately 30 years) with no obvious slope failures. Therefore, all slopes must have a Factor of Safety at or above 1 under current conditions. However, according to the Corps of Engineers, the Factor of Safety for long term stability should be a minimum of 1.5 for all new construction. Older dams with a long history may be less, but for this study, a minimum of 1.5 was still utilized. This study was conducted to assure that the embankments meet the minimum Safety Factors.

Slope stability was evaluated using the computer program Geostase developed by Gregory Geotechnical Software (Geostase is the latest version of GSTABL7 and has not been released generally yet). The program is capable of calculating the factor of safety for potential failure surfaces using several different methods. The analyses for this project were conducted using the modified Bishop method as this was believed to be the most appropriate approach. The program has an automatic search routine for determining the minimum factor of safety. The resulting analyses are depicted graphically and are included in the Appendix

The surveyed boring elevations were used for an embankment top elevation and the original topographical maps along with the construction plans for the embankments were used in order to determine cross sections for the stability analyses.

What was believed to be the "worst case" embankment cross section (based on visual observations during the initial site visit) was used in the analysis. The tallest section was chosen. The soil strengths were modeled using 85 percent of the strength test values determined from testing where a test was conducted. Where no triaxial test was conducted, average strength values of the fill and native soils were used based on the soil types as well as correlations with SPT blow counts. These average results were also reduced by 15 percent. Reductions of 15% were used in an attempt to accommodate potential variations in the soil as well as to compensate for the limited amount of data. Due to the amount of gravel in the samples, only three triaxial tests were possible. The original embankment subgrade was assumed to be gravel and not solid rock based on the poor recovery (RQD<25%), the thin layers of accrual rock cored and significant clay seams found in the samples. Based on the rounded edges, the surficial native soils are gravel in a clay matrix. We have assumed that these subgrade soils extend deeper than first layer of solid rock encountered since the rock seams were still thin in most locations and in order to use a more conservative basis for analysis. Results of the Triaxial tests are summarized in **Table 6.1.1** below. The rock mass strength was determined using the strength of the cores tested and the computer program RocLab 1.0 from Rockscience. This program predicts the strength of the entire rock mass based on the Hoek-Brown criterion and backcalculates a cohesion and friction angle for the rock mass. The test results are included in the Appendix.

Table 6.1.1 - Summary of Soil Test Results

Boring	Depth	Fill or Native	Soil Classification	Effective Stress Parameters		Total Stress Parameters	
				Friction Angle	Cohesion (psf)	Friction Angle	Cohesion (psf)
B-2	3'-7'	Fill	CH	33.7	0	15.9	345
B-2	23'-35'	Native	CL	33.0	90	18.3	275
B-3	3'-7'	Fill	CL	24.0	460	14.1	575
B-1	43'	Native Rock	LS	38.5	1000	38.5	1000

Three cases were analyzed for each slope: steady-state (long term), steady state with seismic loads and rapid drawdown of the water in the ash ponds. In the rapid drawdown study, the water in the ash ponds is removed, but the water level in the embankment remains. For the evaluation of steady-state conditions, the soils were evaluated using *effective* stress parameters. For the rapid drawdown case the slopes were evaluated using *total* stress parameters. Graphical representations of the slope stability results are included in the **Appendix**. Results of the analysis are summarized in **Table 6.1.2**, below.

Table 6.1.2 Slope Stability Analyses Results

Pond	Steady State Factor of Safety	Steady State with Seismic Factor of Safety	Rapid Drawdown Factor of Safety
Primary Ash Pond	1.9	1.3	1.2
Secondary Ash Pond	1.6	1.2	1.5

It should be noted that due to the karst nature of the rock at the site, factors other than those considered in this analysis may affect the stability of the slopes in question. Solution cavities of varying sizes characterize this geology. It was not possible within the limited scope of this investigation to map cavities. Consequently, no cavities were assumed to be present. However, no significant cavities were encountered in any of the borings of this study other than vuggy rock. In addition, the strength obtained from compression testing of solid rock cores was reduced significantly using the GSI approach in an attempt to predict the strength of vuggy rock used in the analysis.

6.2 Slope Protection

Earthen embankment slopes require some form of protection from excessive erosion. A good cover of approved grasses should provide adequate slope protection. The embankments appeared to have adequate vegetation, but some of the locations had been recently cleared of trees. Bushes and trees of two feet or more in height are not considered satisfactory slope protection because of the harmful effect on grass and the hazards of tree roots.

A routine and periodic maintenance program should be implemented to prevent excessive growth. Animal control should also be considered an integral part of routine embankment maintenance.

7.0 EMBANKMENT MONITORING

Visual drive-by inspections and cursory on-foot inspections should be performed in accordance with AEP requirements. As a minimum, dam safety inspections should be conducted biannually.

Should any unusual occurrences be noted in connection with the operation of the dams, either as a result of the cursory drive-by inspections or as the result of the detailed dam safety inspections, AEP Geotechnical Engineering, and ETTL Engineers & Consultants Inc. should be immediately notified for evaluation and development, if necessary, of a Remedial Action Plan.

8.0 LIMITATIONS

Geotechnical design work is characterized by the presence of a calculated risk that soil and groundwater conditions may not have been fully revealed by the exploratory borings. This risk derives from the practical necessity of basing interpretations and design conclusions on a limited sampling of the subsoil stratigraphy at the project site. The number of borings and spacing is chosen in such a manner as to decrease the possibility of undiscovered anomalies, while considering the nature of loading, size and cost of the project. The recommendations given in this report are based upon the conditions that existed at the boring locations at the time they were drilled. The term "existing groundline" or "existing subgrade" refers to the ground elevations and soil conditions at the time of our field operations.

It is conceivable that soil conditions throughout the site may vary from those observed in the exploratory borings. If such discontinuities do exist, they may not become evident until construction begins or possibly much later. Consequently, careful observations by the geotechnical engineer must be made of the construction as it progresses to help detect significant and obvious deviations of actual conditions throughout the project area from those inferred from the exploratory borings. Should any conditions at variance with those noted in this report be encountered during construction, this office should be notified immediately so that further investigations and supplemental recommendations can be made.

This company is not responsible for the conclusions, opinions, or recommendations made by others based on the contents of this report. The recommendations made in this report are applicable only to the proposed scope of work as defined in **SECTION 2.0 PROJECT DESCRIPTION** and may not be used for any other work without the express written consent of ETTL Engineers. The purpose of this study is only as stated elsewhere herein and is not intended to comply with the requirements of 30 TAC 330 Subchapter T regarding testing to determine the presence of a landfill. Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No warranties are either expressed or implied.

APPENDIX

I.0 FIELD OPERATIONS
Subsurface conditions were defined by 7 sample core borings drilled to depths ranging from 30 to 50 feet and. ETTL personnel drilled the borings at locations selected based on a site visit in conjunction with the client. Field boring logs were prepared as drilling and sampling progressed. The final boring logs are also included in the Appendix. Descriptive terms and symbols used on the logs are in accordance with the Unified Soil Classification System (ASTM D 2487). A reference key is provided on the final page of this report.

Truck and track-mounted drill rigs utilizing dry auger drilling procedures were used to advance the borings. Samples were continuous in the upper 10 feet and at 5 feet intervals below 10 feet (or at major strata changes). Soils were sampled by means of a 1 3/8-inch I.D. by 24-inch long split-spoon sampler driven into the bottom of the borehole in accordance with ASTM D 1586 procedures. In conjunction with this sampling technique, the Standard Penetration Test was conducted by recording the N-value, which is the number of blows required by a 140-pound weight falling 30 inches to drive a split-spoon sampler 1 foot into the ground. For very dense strata, the number of blows is limited to a maximum of 50 blows within a 6-inch increment. Where possible, the sampler is "seated" six inches before the N-value is determined. The N-value obtained from the Standard Penetration Test provides an approximate measure of the relative density, which correlates with the shear strength of soil. The disturbed samples were removed from the sampler, logged, packaged, and transported to the laboratory for further identification and classification.

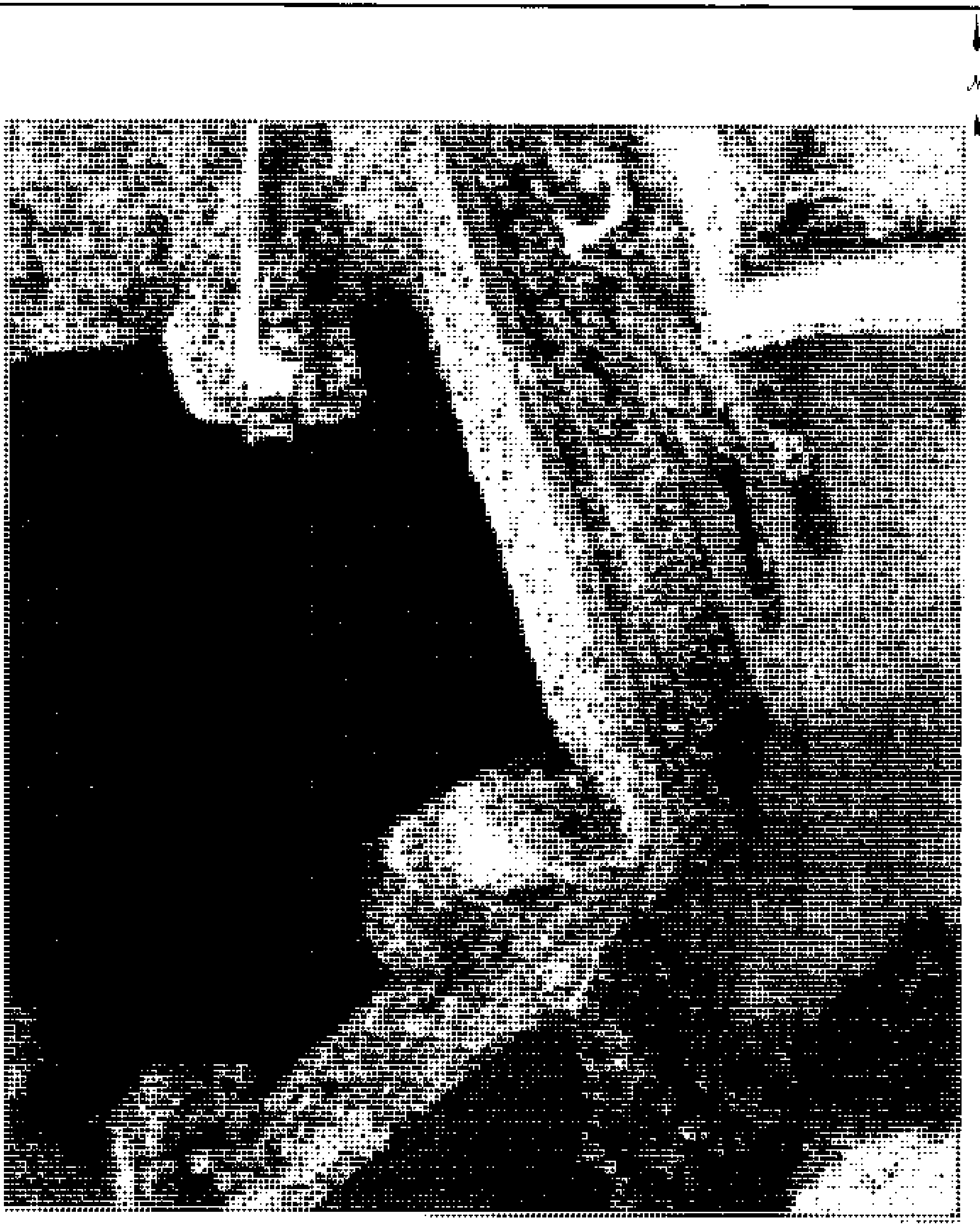
Soils were sampled by means of a 3-inch O.D. by 24-inch long thick-walled Shelby Tube sampler. Using the drilling rig's hydraulic pressure, the sampler was pushed smoothly into the bottom of the borehole. The consistency of these samples was measured in the field by a calibrated pocket penetrometer. These values, recorded in tons per square foot, are shown on the boring logs. Such samples were extruded in the field, logged, sealed to maintain *in situ* conditions, and packaged for transport to the laboratory.

All boreholes were backfilled with grout after collecting final groundwater readings. Samples obtained during our field studies and not consumed by laboratory testing procedures will be retained in our Tyler office free of charge for a period of 60 days. To arrange storage beyond this point in time, please contact the Tyler office.

II.0 LABORATORY TESTING
Upon return to the laboratory, a geotechnical engineer visually examined all samples and several specimens were selected for representative identification of the substrata. By determining the Atterberg liquid and plastic limits (ASTM D 4318) and percentage of fines passing the No. 200 sieve (ASTM D 1140), field classification of the various strata was verified. Also conducted were natural moisture content tests (ASTM D 2216).

Size distribution of several soil samples was determined using a Hydrometer test (ASTM D 422). Permeabilities (ASTM D 5084) were also performed on a representative samples.

Strength characteristics of the cohesive substrata were evaluated by conducting unconsolidated, undrained triaxial compression tests (ASTM D 2850) on selected undisturbed field samples obtained with the Shelby tube sampler. Direct Shear tests (ASTM D 3080) were performed on undisturbed samples retrieved during drilling operations. The results of these tests are either presented in the individual log of boring provided in this Appendix or as a separate result behind the logs in the Appendix.



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FLINT CREEK POWER PLANT GENTRY, ARKANSAS

PLATE 1 - PLAN OF BORINGS

JOB NO.: G3243-09

DATE: JAN. 2010

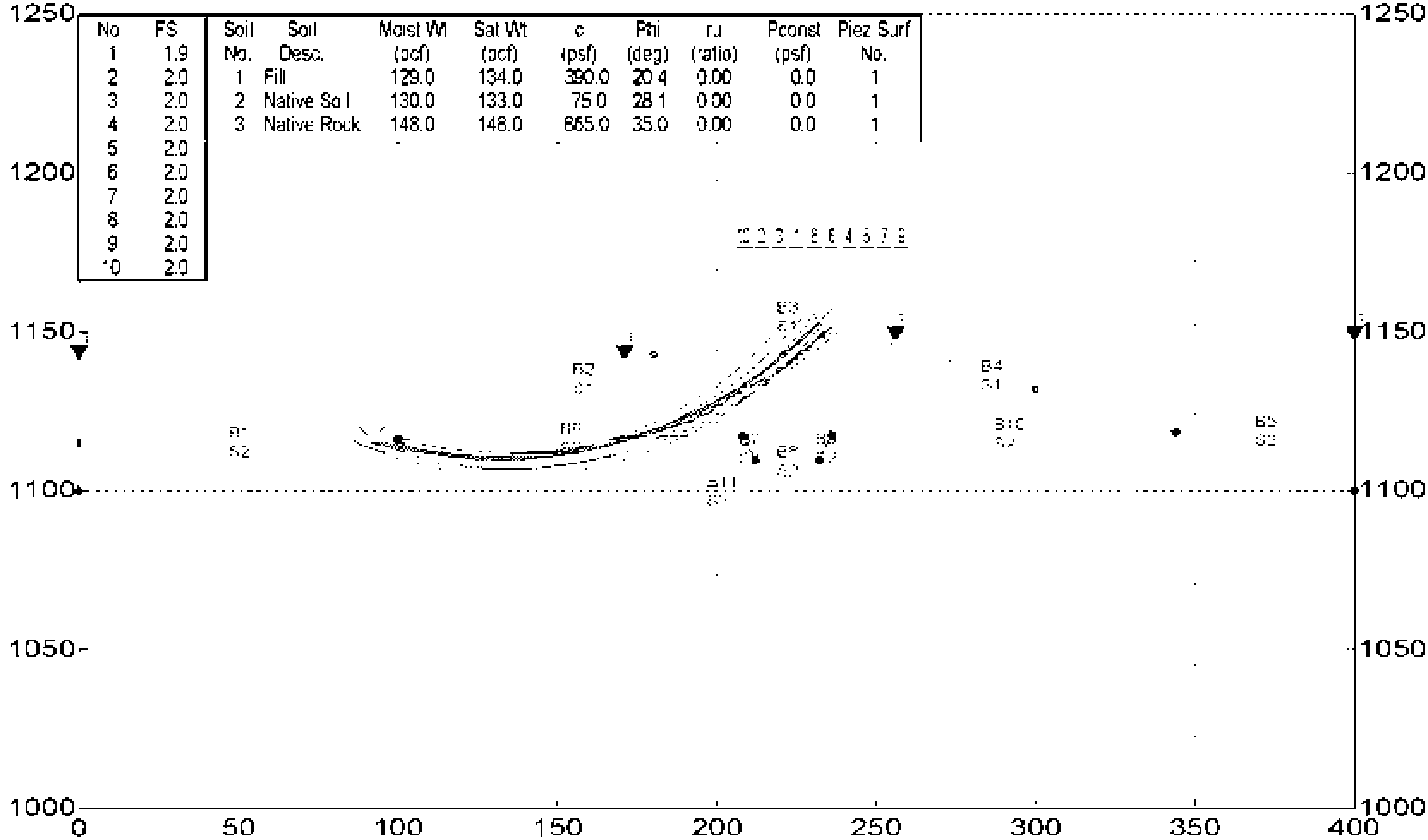
SCALE: N.T.S.

APPROVED BY:

DRAWN BY: K.C.R.

Flint Creek Power Station, Gentry, Arkansas
Primary Ash Pond, Steady State

ETC Engineering & Consultants\Job Files\3243-09 AEP Flint Creek Power Plant Bottom Ash Ponds Geo Stability Analysis\Slope Stabi ity\Primary SS.in



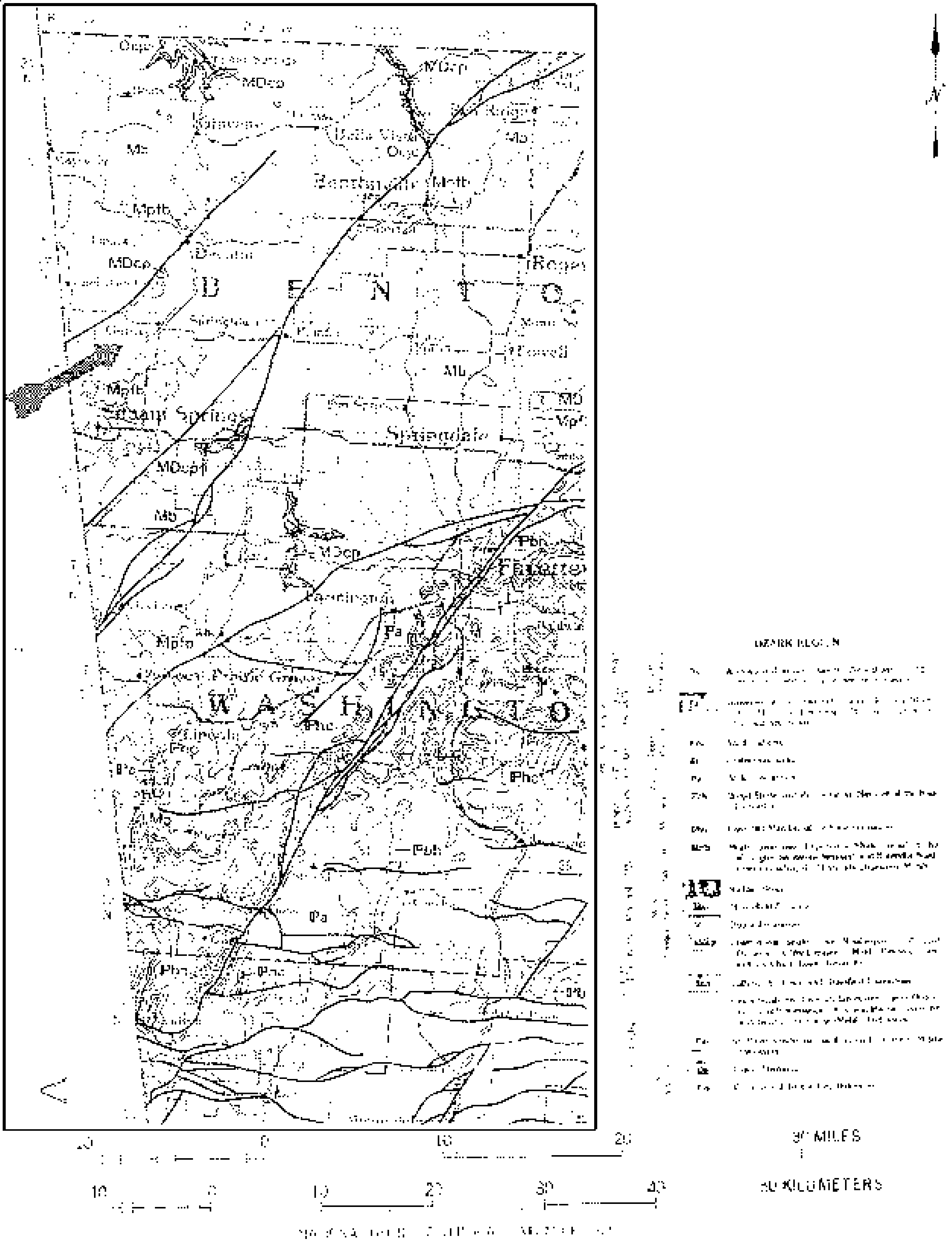
No	FS
1	1.9
2	2.0
3	2.0
4	2.0
5	2.0
6	2.0
7	2.0
8	2.0
9	2.0
10	2.0

Soil No.	Soil Desc.	Moist Wt (pcf)	Sat Wt (pcf)	c (psf)	Phi (deg)	ru (ratio)	Pconst (psf)	Piez Surf No.
1	Fill	129.0	134.0	390.0	20.4	0.00	0.0	1
2	Native Soil	130.0	133.0	75.0	28.1	0.00	0.0	1
3	Native Rock	148.0	148.0	665.0	35.0	0.00	0.0	1

GEOSTASE FSmin = 1.9

Modified Bishop Method

PLATE P.1



GEOLOGIC MAP OF ARKANSAS

ETTL ENGINEERS & CONSULTANTS

SITE SURFACE GEOLOGY

JOB NO. [illegible]	
DATE: 1983	
SCALE: 1:500,000	

AEPFC000044

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MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

LOG OF BORING B-1

PROJECT: Flint Creek Power Plant, Gentry, Arkansas

PROJECT NO.: G3243-09

BORING TYPE: Flight Auger

DATE: 11/3/09

SURFACE ELEVATION: 1154.8

DEPTH (ft)	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	MOISTURE CONTENT (%)	LL	PL	PI	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED
0	GC	CLAYEY GRAVEL(GC) red and tan	P=3.5						
			P=1.5	13	30	16	14	32	+40Sieve=61%, +4 Sieve=55%
5		--dense	N=43						
		--red, tan, and white							
		--medium dense	N=17	11	30	16	14	23	+40Sieve=71%, +4 Sieve=62%
10									
			N=25						
15		--native soil							
		--gray, tan, and red; moist	P=2.5	12	43	16	27	28	+40Sieve=64%, +4 Sieve=56%
20									
	CL	LEAN CLAY(CL) red and tan; saturated	P=4.5+						
25									

Water Level: Initial / Measured / Revised

Water Observations: Seepage @ 23' while drilling. Water level @ 23' and open to 39' upon completion and after 30 minutes.

Key to Abbreviations:
N - Std. Pen. Blows/ft
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
V - Lab Vane Shear (tsf)

Notes: GPS Coordinates: N 36°15.00', W 94°31.496'

LOG OF BORING B-1

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MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: Flint Creek Power Plant
Gentry, Arkansas

PROJECT NO.: G3243-09 BORING TYPE: Flight Auger

DATE 11/3/09

SURFACE ELEVATION 1154.8

DEPTH (ft)	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
28–30	CH	SANDY FAT CLAY(CH) hard; red and tan; with gravel	P=4.5+					17	50	20	30	54	+40Sieve=40%, +4 Sieve=34%
33–35	CL	LEAN CLAY(CL) very stiff, red and tan	P=2.5										
38–40	CL	LEAN CLAY WITH SAND(CL) very stiff, red and gray	P=3.5					30	41	18	23	83	+40Sieve=7% -4 Sieve=0%
43–48		LIMESTONE moderately strong; limestone seams ~16"; gray; crystalline clay; thick bedded; fresh; unfeatured ~RQD<0.25		151	326.00		0						

Bottom of Boring @ 48'

Water Level: 1st ∇ Measured ▼ Perched ▼

Water Observations: Seepage @ 23' while drilling. Water level @ 23' and open to 39' upon completion and after 30 minutes.

Key to Abbreviations: N - Std. Pen. Blows / ft; P - Pocket Penetrometer (tsf); T - Torvane (tsf); Lab Vane Strength

Notes: GPS Coordinates: N 36°15.007, W 94°31.496'

ETTL ENGINEERS & CONSULTANTS	LOG OF BORING B-2	DATE 11/3/09
MAIN OFFICE 1717 East Erwin Tyler, Texas 75702 (903) 595-4421	PROJECT: Flint Creek Power Plant, Gentry, Arkansas PROJECT NO.: G3243-09 BORING TYPE: Flight Auger	SURFACE ELEVATION 1155.1

LOG OF BORING B-2

DEPTH (ft)	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	MOISTURE CONTENT (%)	LL	PL	PI	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
0	GC	CLAYEY GRAVEL(GC) medium dense; red and tan; with gravel	N=18	14	44	20	24	40	+40 Sieve=52%, +4 Sieve=42%
	CH	FAT CLAY WITH SAND(CH) stiff; red and tan	P=4.5+	30	61	26	35	80	+40 Sieve=7%, +4 Sieve=2%
5			P=2.0						
	GC	CLAYEY GRAVEL(GC) medium dense; red and tan; with sand and gravel	P=3.5	15	62	18	44	47	+40 Sieve=49%, +4 Sieve=37%
10									
	CL	SANDY LEAN CLAY(CL) red and tan; with gravel							
15									
	GC	CLAYEY GRAVEL(GC) medium dense; red and tan; moist --native soil	P=2.0	12	38	15	23	13	+40 Sieve=81%, +4 Sieve=76%
20									
	CL	SANDY LEAN CLAY(CL) very stiff; red and tan; with gravel	P=3.0						
25									

Chart columns: BLOW COUNT (20, 40, 60, 80); Qu (tsf) (1, 2, 3, 4); PPR (tsf) (1.0, 2.0, 3.0, 4.0); Torvane (tsf) (1.0, 2.0, 3.0, 4.0); DRY DENSITY (pcf); COMPRESSIVE STRENGTH (tsf); FAILURE STRAIN (%); CONFINING PRESSURE (psi); Natural Moisture Content and Atterberg Limits (Plastic Limit, Moisture Content, Liquid Limit; 20, 40, 60, 80); ATTERBERG LIMITS (%).

Water Level: Initial, Measured, Perched

Water Observations: Seepage @ 20' while drilling. Water level @ 20' and open upon completion and after 1 hour.

Key to Abbreviations:
N = Std. Pen. Blows/ft
P = Pocket Penetrometer (tsf)
T = Torvane (tsf)
L = Lab Vane Shear (tsf)

Notes: GPS Coordinates: N 36°15.025', W 94°31.467'

LOG OF BORING B-2

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1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: Flint Creek Power Plant, Gentry, Arkansas

PROJECT NO.: G3243-09

BORING TYPE: Flight Auger

DATE: 11/3/09

SURFACE ELEVATION: 1155.1

DEPTH (ft)	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (psf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MOISTURE CONTENT (%)	LL	PL	PI	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
		P=3.5					19	45	17	28	60	+40Sieve=35%, +4 Sieve=28%
30												
		P=3.9										
35	LIMESTONE – 14" thick layer											
	LIMESTONE – 8" thick limestone ledge											
		SF					24	53	22	31	7	+40Sieve=92%, +4 Sieve=86%
40												
		N=50/0.5"										
45	--rock cuttings; RQD<0.25			171.00		0						
	solid rock seam @ 48'		148									
50	Bottom of Boring @ 50'											

Water Observations: Seepage @ 20' while drilling. Water level @ 20' and open upon completion and after 1 hour.

Key to Abbreviations: N - Standard Penetration (Blows/ft); P - Pocket Penetrometer (tsf); T - Torvane (tsf); SF - Unconfined Strength (tsf)

Notes: GPS Coordinates: N 36°15.025', W 94°31.467'

AEPFC000048

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(903) 595-4421

LOG OF BORING B-3

PROJECT: Flint Creek Power Plant
Gentry, Arkansas

PROJECT NO.: G3243-09 BORING TYPE: Flight Auger

DATE 11/4/09

SURFACE ELEVATION 1154.7

MATERIAL DESCRIPTION

DEPTH (ft)	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
0	CL	SANDY LEAN CLAY(CL) very stiff; gray and tan, with gravel	N=19						
		--brown and red, with gravel	P=2.0	20	37	15	22	63	+40Sieve=23%, +4 Sieve=18%
5		--gray and tan; with gravel	P=1.6						
	CH	SANDY FAT CLAY(CH) stiff; tan and red with gravel	N=11	19	64	17	47	57	+40Sieve=28%, +4 Sieve=19%
10		--very stiff	N=27						
15									
	GC	CLAYEY GRAVEL(GC) medium dense; gray and tan; with gravel --native soil	N=22	19	27	18	9	42	+40Sieve=51%, +4 Sieve=37%
20		--brown		13	30	17	13	39	+40Sieve=54%, +4 Sieve=42%
25									

Chart columns: BLOW COUNT (20, 40, 60, 80); Qu (tsf) (1, 2, 3, 4); PPR (tsf) (1.0, 2.0, 3.0, 4.0); Torvane (tsf) (1.0, 2.0, 3.0, 4.0); DRY DENSITY (pcf); COMPRESSIVE STRENGTH (tsf); FAILURE STRAIN (%); CONFINING PRESSURE (psi); Natural Moisture Content and Atterberg Limits: Plastic Limit, Moisture Content, Liquid Limit (20, 40, 60, 80)

Water Level: 1st ▽ Measured ▼ Perched ▼

Water Observations: Dry and open to 31' upon completion.

Key to Abbreviations: N - Std. Pen. Blows (ft); P - Pocket Penetrometer (tsf); T - Torvane (tsf); Lab Vane Strength

Notes: GPS Coordinates: N 36°15.116', W 94°31.449'

AEPFC000049

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Tyler, Texas 75702
(903) 595-4421

LOG OF BORING B-3

PROJECT: Flint Creek Power Plant
Gentry, Arkansas

PROJECT NO.: G3243-09

BORING TYPE: Flight Auger

DATE: 11/4/09

SURFACE ELEVATION: 1154.7

DEPTH (ft)	MATERIAL DESCRIPTION	FIELD STRENGTH DATA
	LIMESTONE rock cuttings	
	--RQD<0.25	
30		
		P=4.0
	LIMESTONE	
35		
	--RQD<0.25	
	Bottom of Boring @ 37'	

Water Observations: Dry and open to 31' upon completion.

Notes: GPS Coordinates: N 36°15.116', W 94°31.449'

AEPFC000050

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MAIN OFFICE
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(903) 595-4421

LOG OF BORING B-4

PROJECT: Flint Creek Power Plant
Gentry, Arkansas

PROJECT NO.: G3243-09 **BORING TYPE:** Flight Auger

DATE 11/4/09

SURFACE ELEVATION 1154.9

DEPTH (ft)	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	MOISTURE CONTENT (%)	LL	PL	PI	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
0	CL	SANDY LEAN CLAY(CL) stiff; tan and gray; with gravel	N=8	20	40	17	23	52	#40 Sieve=42%, #4 Sieve=30%
			N=13						
5	GC	CLAYEY GRAVEL(GC) medium dense; tan and red	N=13	10	48	20	28	22	#40 Sieve=71%, #4 Sieve=62%
	CL	LEAN CLAY WITH GRAVEL(CL) stiff; red and tan	P=1.5						
10		--reddish brown and tan	P=4.5+	21	28	16	12	51	#40 Sieve=44%, #4 Sieve=31%
15									
	CL	SANDY LEAN CLAY(CL) very stiff; tan and gray; with gravel --native soil	N=21						
20									
	GC	CLAYEY GRAVEL(GC) medium dense; tan and red; with gravel	N=18	9	45	20	25	38	#40 Sieve=55%, #4 Sieve=46%
25									

Blow Count: 20 40 60 80; Qu (tsf): 1 2 3 4; PPR (tsf): 1.0 2.0 3.0 4.0; Torvane (tsf): 1.0 2.0 3.0 4.0

Natural Moisture Content and Atterberg Limits: Plastic Limit, Moisture Content, Liquid Limit: 20 40 60 80

Water Level: First, Measured, Perched

Water Observations: Dry and open to 36' upon completion and after 30 minutes.

Key to Abbreviations: N - Std. Pen. Blows/ft; P - Pocket Penetrometer (tsf); T - Torvane (tsf); - Lab Vane Shear (tsf)

Notes: GPS Coordinates: N 36°15.149', W 94°31.463'

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1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

LOG OF BORING B-4

PROJECT: Flint Creek Power Plant
Gentry, Arkansas

PROJECT NO.: G3243-09 **BORING TYPE:** Flight Auger

DATE 11/4/09

SURFACE ELEVATION 1154.9

DEPTH (ft)	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED
27.5	CL	SANDY LEAN CLAY(CL) very stiff; tan, red, and gray; with gravel	N=19						
32.5	GC	CLAYEY GRAVEL(GC) loose; tan, gray, and red; saturated	N=8						
37.5	CL	SANDY LEAN CLAY(CL) very stiff; tan, gray, and red; with gravel	N=18	18	43	16	27	60	+40 Sieve=32%, +4 Sieve=25%
42.5		--soft	N=5						
43.5	GP	GRAVEL(GP) white							
47.5	CL	SANDY LEAN CLAY(CL) stiff; red; with gravel	N=10						
50		Bottom of Boring @ 50'							

Column headings also include: SAMPLES, GEOLOGIC UNIT, WATER LEVEL; BLOW COUNT (20, 40, 60, 80); Qu (tsf) (1, 2, 3, 4); PPR (tsf) (1.0, 2.0, 3.0, 4.0); Torvane (tsf) (1.0, 2.0, 3.0, 4.0); DRY DENSITY (pcf); COMPRESSIVE STRENGTH (tsf); FAILURE STRAIN (%); CONFINING PRESSURE (psi); Natural Moisture Content and Atterberg Limits (Plastic Limit, Moisture Content, Liquid Limit; 20, 40, 60, 80); OTHER TESTS PERFORMED (Page Ref. #).

Water Level: 1st ▽ Measured ▼ Perched ▼

Water Observations: Dry and open to 36' upon completion and after 30 minutes.

Key to Abbreviations:
N - Std. Pen. Blows/ft
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
U - Unconfined Strength (tsf)

Notes: GPS Coordinates: N 36°15.149', W 94°31.463'

AEPFC000052

LOG OF BORING B-5

ETTL ENGINEERS & CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

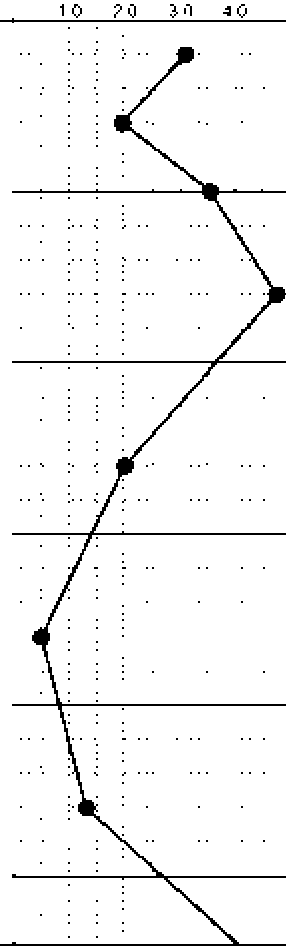
PROJECT: Flint Creek Power Plant
Gentry, Arkansas

PROJECT NO.: G3243-09 **BORING TYPE:** Flight Auger

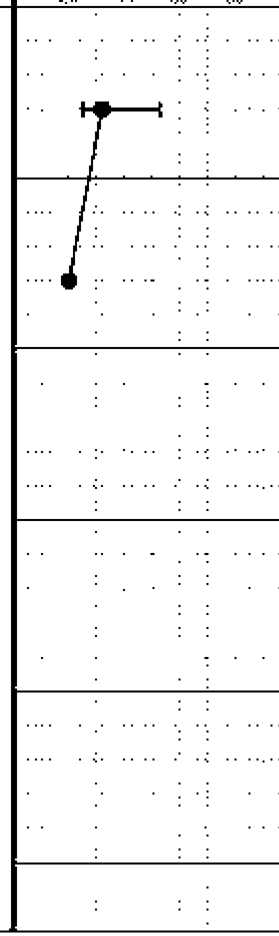
DATE 11/5/09

SURFACE ELEVATION 1142.6

DEPTH (ft)	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
0	GC	CLAYEY GRAVEL (GC) very dense, red and white	N=62						
		--dense	N=39	32	53	25	28	41	+40 Sieve=55%, +4 Sieve=41%
5	GP	POORLY GRADED GRAVEL (GP) very dense; white, with limestone gravel	N=71						
		--very dense	N=50/2"	20				4	+40 Sieve=95%, +4 Sieve=76%
10									
			N=40						
15									
			N=10						
20									
			N=26						
25									



DRY DENSITY (pcf) | COMPRESSIVE STRENGTH (tsf) | FAILURE STRAIN (%) | CONFINING PRESSURE (psi)



Water Level Observations: Dry and open to 20' upon completion and after 30 minutes.

Key to Abbreviations: N - Std. Pen. Blows/ft; P - Pocket Penetrometer (tsf); T - Torvane (tsf)

Notes: GPS Coordinates: N 36°15.176', W 94°31.492'

LOG OF BORING B-5

ETTL ENGINEERS & CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: Flint Creek Power Plant
Gentry, Arkansas

PROJECT NO.: G3243-09

BORING TYPE: Flight Auger

DATE: 11/5/09

SURFACE ELEVATION: 1142.6

DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT	WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	BLOW COUNT / Qu (tsf) / PPR (tsf) / Torvane (tsf)	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	Natural Moisture Content and Atterberg Limits	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
					--no recovery	N=50/3"												
30					Bottom of Boring @ 30'													

Water Level: Initial / Measured / Perched

Water Observations: Dry and open to 20' upon completion and after 30 minutes.

Key to Abbreviations:
N - Std. Pen. Blows / ft
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
- Vane Shear (tsf)

Notes: GPS Coordinates: N 36°15.176', W 94°31.492'

AEPFC000054

LOG OF BORING B-6

ETTL ENGINEERS & CONSULTANTS

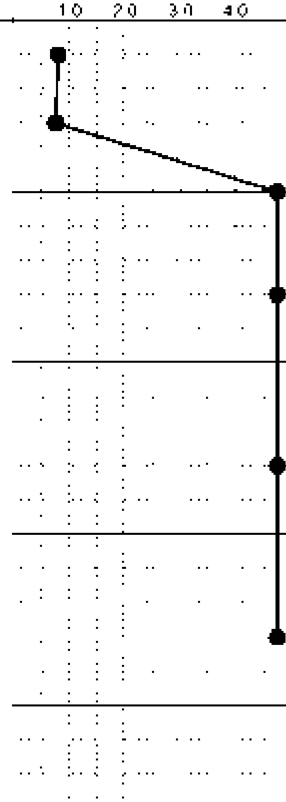
MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
903) 595-4421

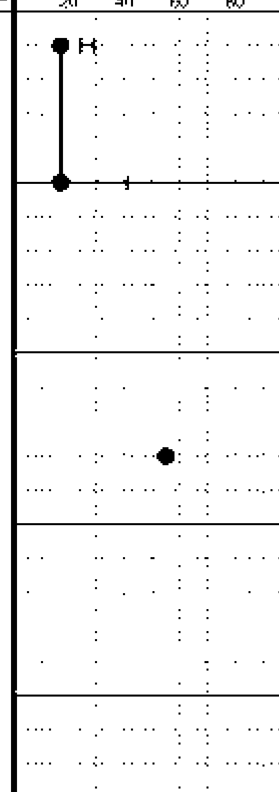
PROJECT: Flint Creek Power Plant
Gentry, Arkansas

PROJECT NO.: G3243-09 **BORING TYPE:** Rotary Wash

DATE 11/5/09

SURFACE ELEVATION 1141.3





DEPTH (ft)	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
0	GC	CLAYEY GRAVEL(GC) medium dense; red and brown	N=16	17	29	24	5	28	+40Sieve=66% +4 Sieve=48%
		--red and tan	N=15						
5	CL	LEAN CLAY(CL) very stiff, tan and yellow	N=24	17	41	18	23	88	+40Sieve=2% +4 Sieve=4%
		--hard, red	N=50/2"						
10		ROCK - 12" thick layer							
		LIMESTONE white; with layers of clayey gravel and rock							
		--RQD<0.25	N=50/2"	55				34	+40Sieve=59% +4 Sieve=29%
15									
		--RQD<0.25	N=50/1"						
20									

Bottom of Boring @ 23'
Refusal @ 23', Core bit broken

Water Level: Dry / Measured / Perched

Water Observations: Dry and open upon completion.

Key to Abbreviations: N - Std. Pen. Blows/ft; P - Pocket Penetrometer (tsf); T - Torvane (tsf); Lab Vane Strength

Notes: GPS Coordinates: N 36°15.055', W 94°31.458'

AEPFC000055

LOG OF BORING B-7

ETTL ENGINEERS & CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: Flint Creek Power Plant
Gentry, Arkansas

PROJECT NO.: G3243-09 **BORING TYPE:** Flight Auger

DATE 11/6/09

SURFACE ELEVATION 1140.9

DEPTH (ft)	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	MOISTURE CONTENT (%)	LL	PL	PI	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED
0	SC	CLAYEY SAND(SC) medium dense; tan and brown; with gravel	N=23						
	GC	CLAYEY GRAVEL(GC) loose; tan and brown	N=6	14	23	18	5	33	+40Sieve=63%, +4 Sieve=59%
5	CL	SANDY LEAN CLAY(CL) stiff; red and tan; with gravel	P=2.0						
	CL	LEAN CLAY WITH SAND(CL) gray and tan	P=1.5	13	24	15	9	80	+40 Sieve=4%, +4 Sieve=0%
10		--limestone rock @ 11'	N=50/2"						

Bottom of Boring @ 11'
Refusal @ 11'

Water Level: Initial / Measured / Finished

Water Observations: Seepage @ 11' while drilling. Water level @ 11' and open upon completion.

Key to Abbreviations:
N - Std. Pen. Blows / ft
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
Q - Unconfined Strength

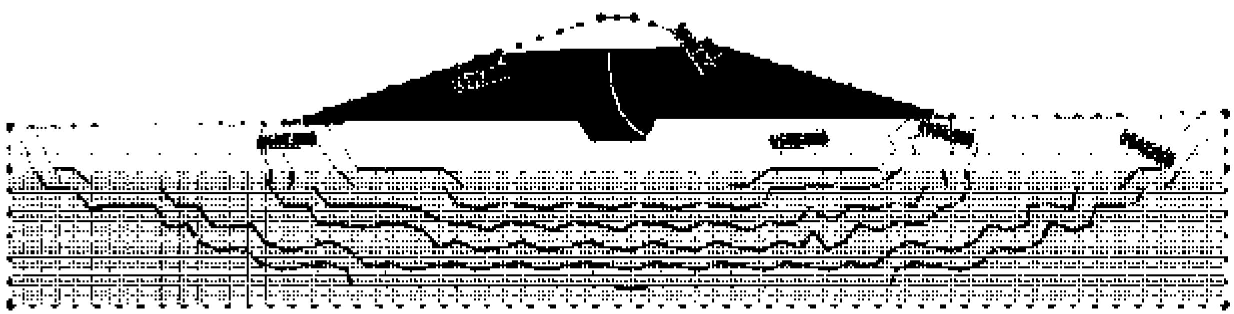
Notes: GPS Coordinates: N 36°14.995', W 94°31.527'

AEPFC000056

Flint Creek Primary Ash Pond

Line Flow Rates

Total Flowrate [illegible]



Materials

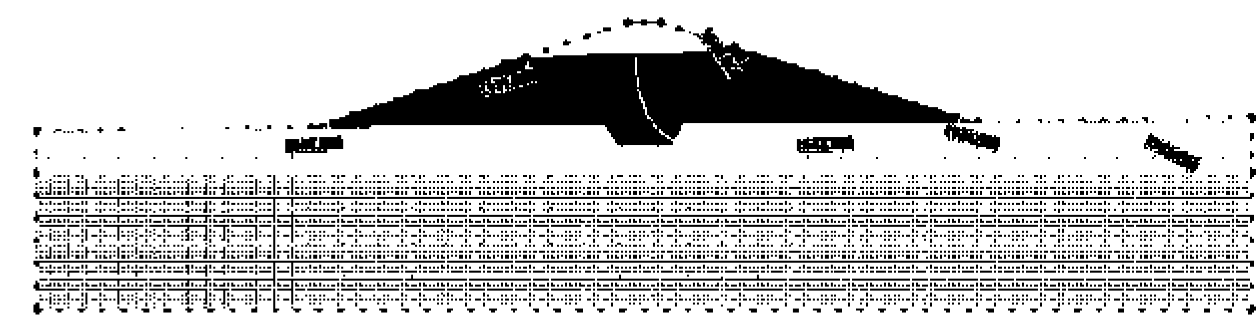
Fill

Native Soil

Shallow Rock

Flint Creek Primary Ash Pond

High Pool Rates



Materials

Fill

Native Soil

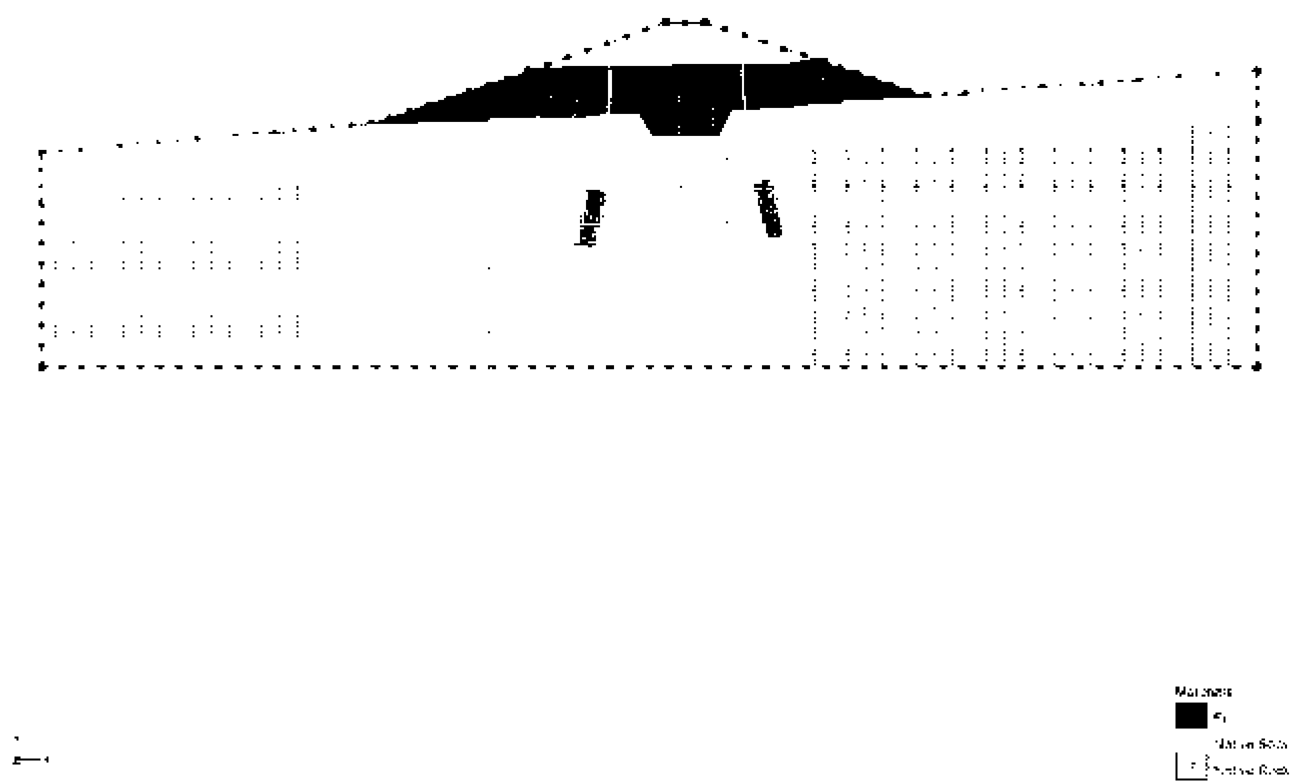
Native Rock

AEPFC000058

Flint Creek Secondary Ash Pond

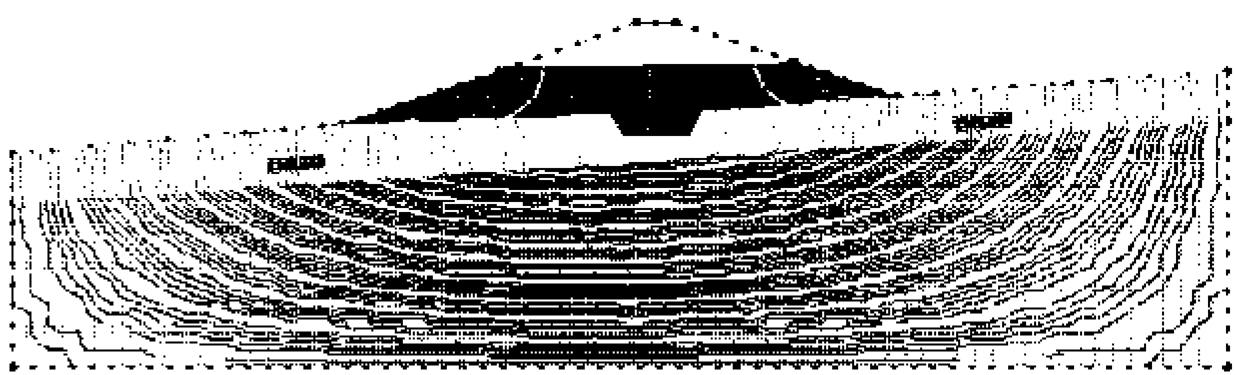
User Flow Rates

Total Flowrate [illegible]



Flint Creek Secondary Ash Pond

High Flow Rates



AEPFC000060

Flint Creek Power Station, Gentry, Arkansas
Primary Ash Pond, Steady State with Seismic

S:\GETTech\2009 Geotech Consultants\Prj 243-09 AEP Flint Creek Power Plant Bottom Ash Ponds Geo Stability Analysis\Slope Stability\Primary SS seismic.in

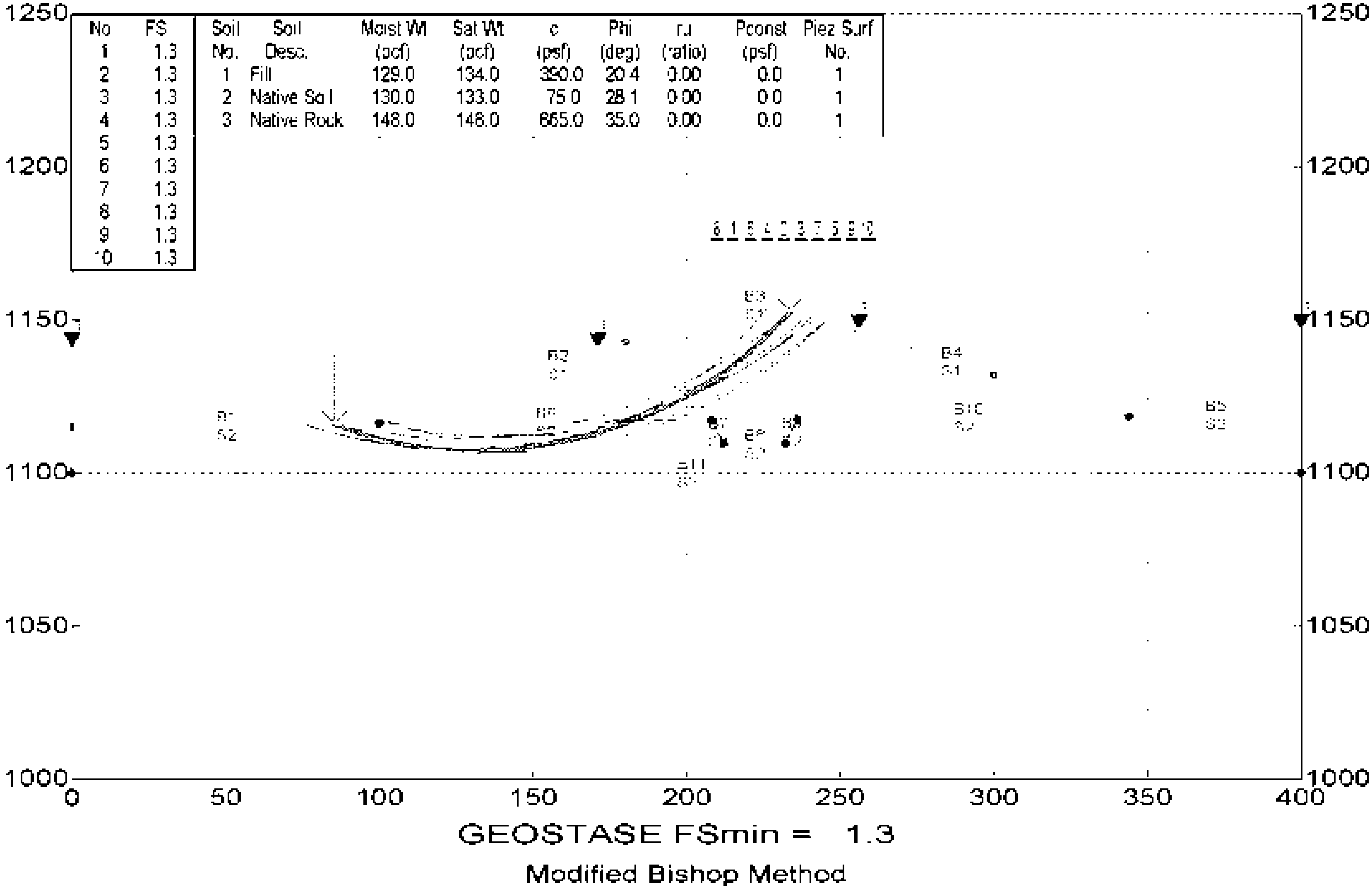


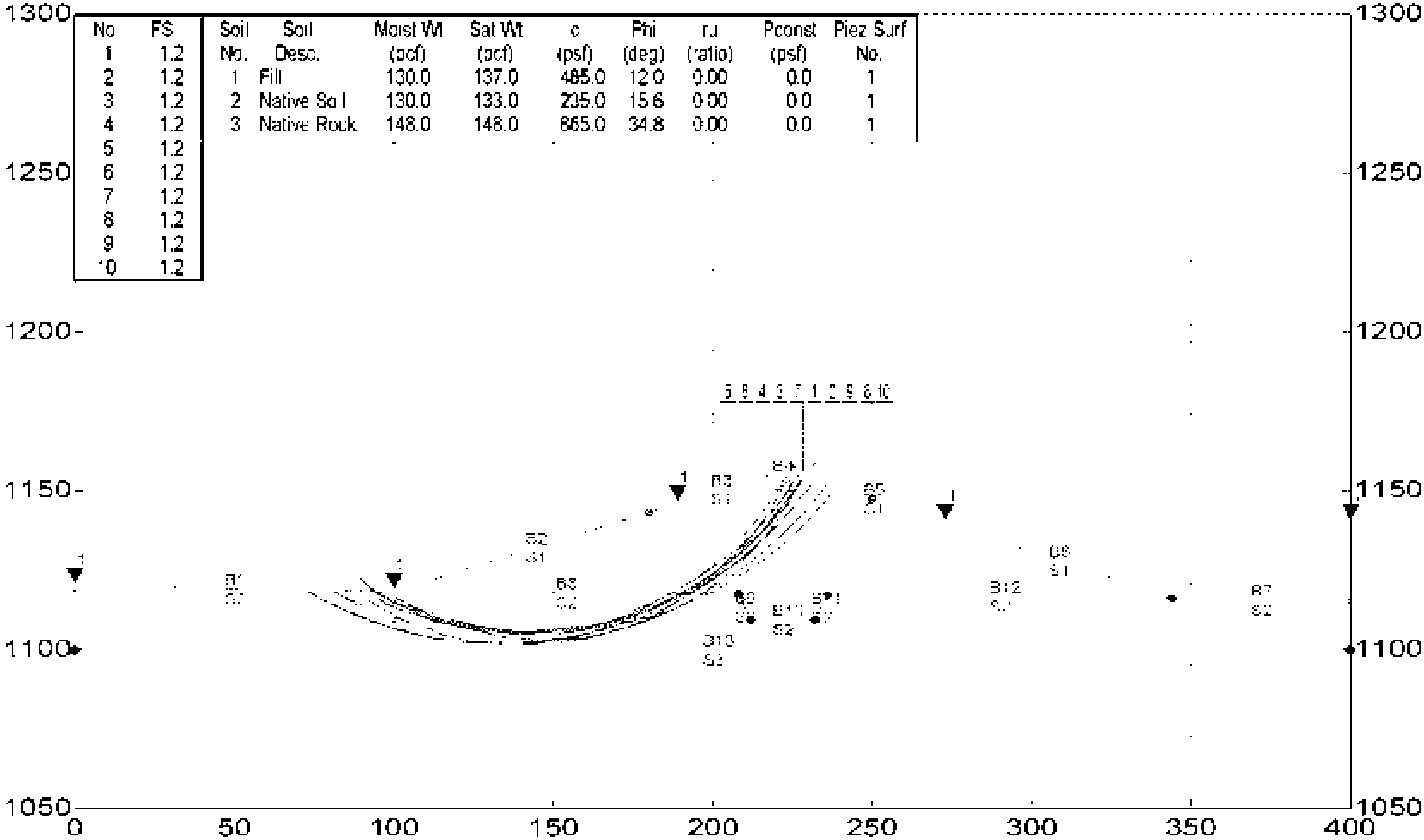
PLATE P.1S

Flint Creek Power Station, Gentry, Arkansas
Primary Ash Pond, Rapid Drawdown

E:\Geotechnical\Job Files\3243-09 AEP Flint Creek Power Plant Bottom Ash Ponds Geo Stability Analysis\Slope Stability\Primary RD.in

No	FS
1	1.2
2	1.2
3	1.2
4	1.2
5	1.2
6	1.2
7	1.2
8	1.2
9	1.2
10	1.2

Soil No.	Soil Desc.	Moist Wt (pcf)	Sat Wt (pcf)	c (psf)	Phi (deg)	ru (ratio)	Pconst (psf)	Piez Surf No.
1	Fill	130.0	137.0	485.0	12.0	0.00	0.0	1
2	Native Soil	130.0	133.0	205.0	15.6	0.00	0.0	1
3	Native Rock	148.0	148.0	665.0	34.8	0.00	0.0	1



GEOSTASE FSmin = 1.2

Modified Bishop Method

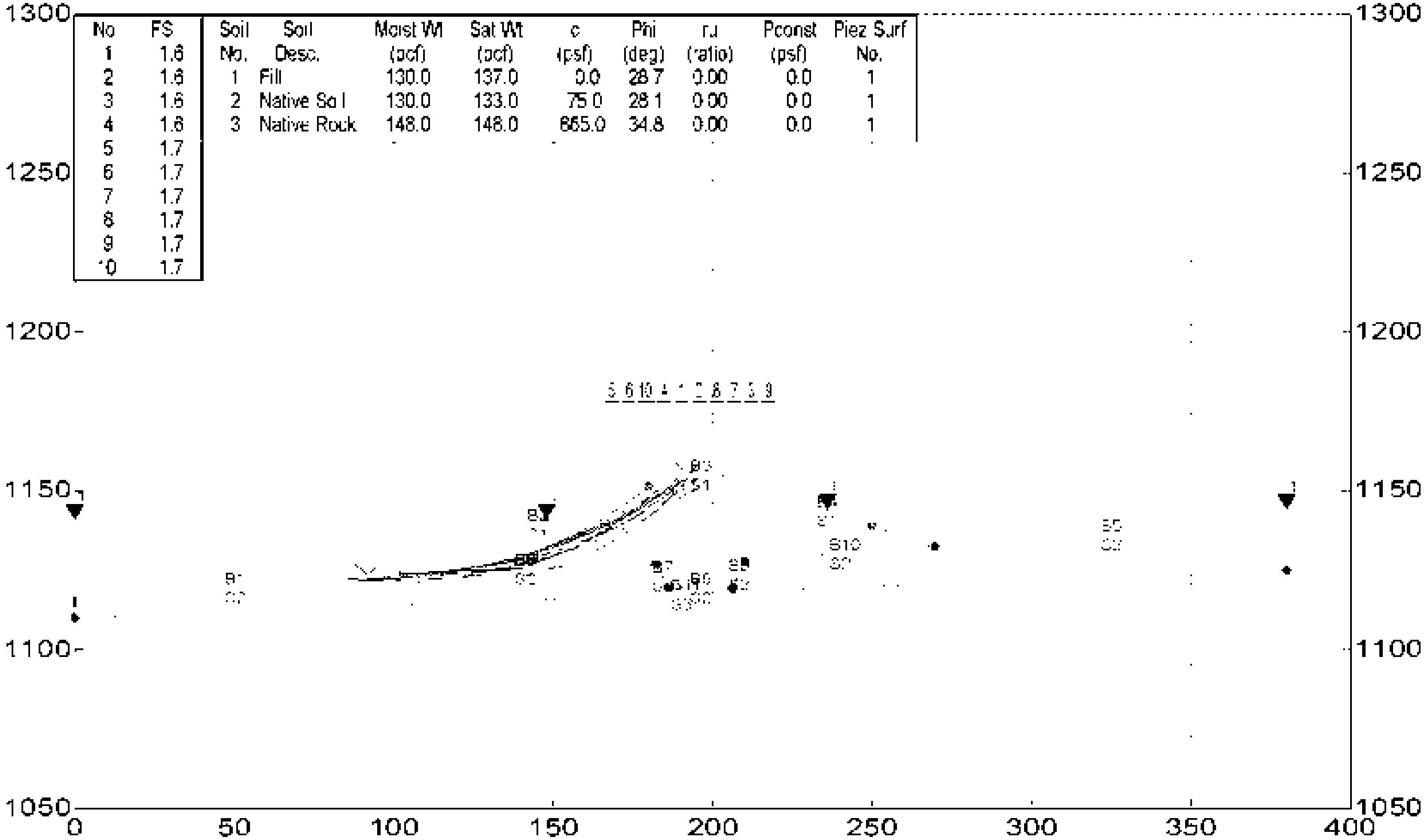
PLATE P.2

Flint Creek Power Station, Gentry, Arkansas
Secondary Ash Pond, Steady State

S:\GTE\Eng2009\GeoMechanical\Jobs\Files\3243-09 AEP Flint Creek Power Plant Bottom Ash Ponds Geo Stability Analysis\Slope Stability\Secondary SS.in

No	FS
1	1.6
2	1.6
3	1.6
4	1.6
5	1.7
6	1.7
7	1.7
8	1.7
9	1.7
10	1.7

Soil No.	Soil Desc.	Moist Wt (pcf)	Sat Wt (pcf)	c (psf)	Phi (deg)	ru (ratio)	Pconst (psf)	Piez Surf No.
1	Fill	130.0	137.0	0.0	28.7	0.00	0.0	1
2	Native Soil	130.0	133.0	75.0	28.1	0.00	0.0	1
3	Native Rock	148.0	148.0	665.0	34.8	0.00	0.0	1



GEOSTASE FSmin = 1.6

Modified Bishop Method

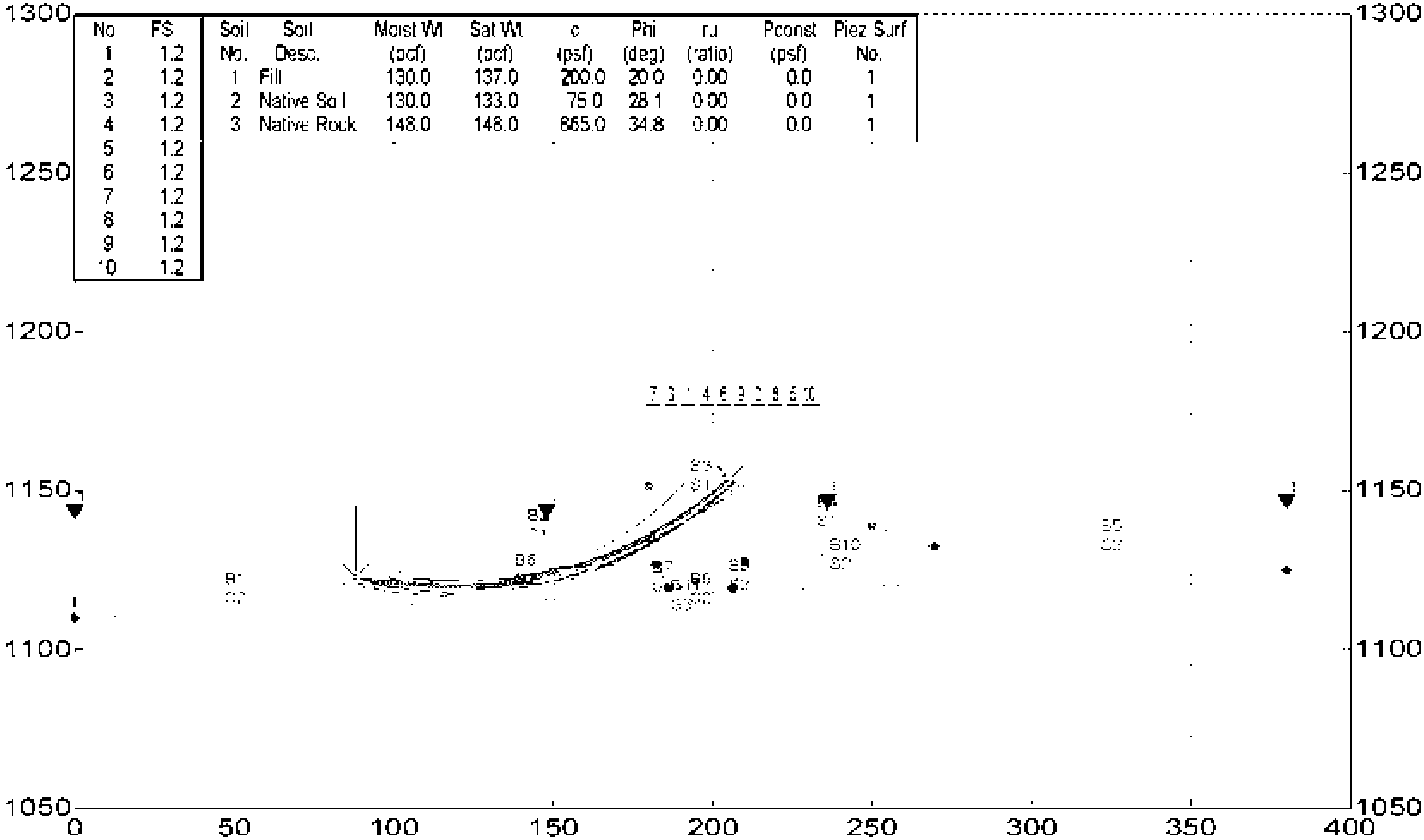
PLATE S.1

Flint Creek Power Station, Gentry, Arkansas
Secondary Ash Pond, Steady State with Seismic

S:\Soil Eng 2008 Geotech Consult Job Files\3243-09 AEP Flint Creek Power Plant Bottom Ash Ponds Geo Stability Analysis\Slope Stability\Secondary SS Seismic.in

No	FS
1	1.2
2	1.2
3	1.2
4	1.2
5	1.2
6	1.2
7	1.2
8	1.2
9	1.2
10	1.2

Soil No.	Soil Desc.	Moist Wt (pcf)	Sat Wt (pcf)	c (psf)	Phi (deg)	ru (ratio)	Pconst (psf)	Piez Surf No.
1	Fill	130.0	137.0	200.0	20.0	0.00	0.0	1
2	Native Soil	130.0	133.0	75.0	28.1	0.00	0.0	1
3	Native Rock	148.0	148.0	665.0	34.8	0.00	0.0	1



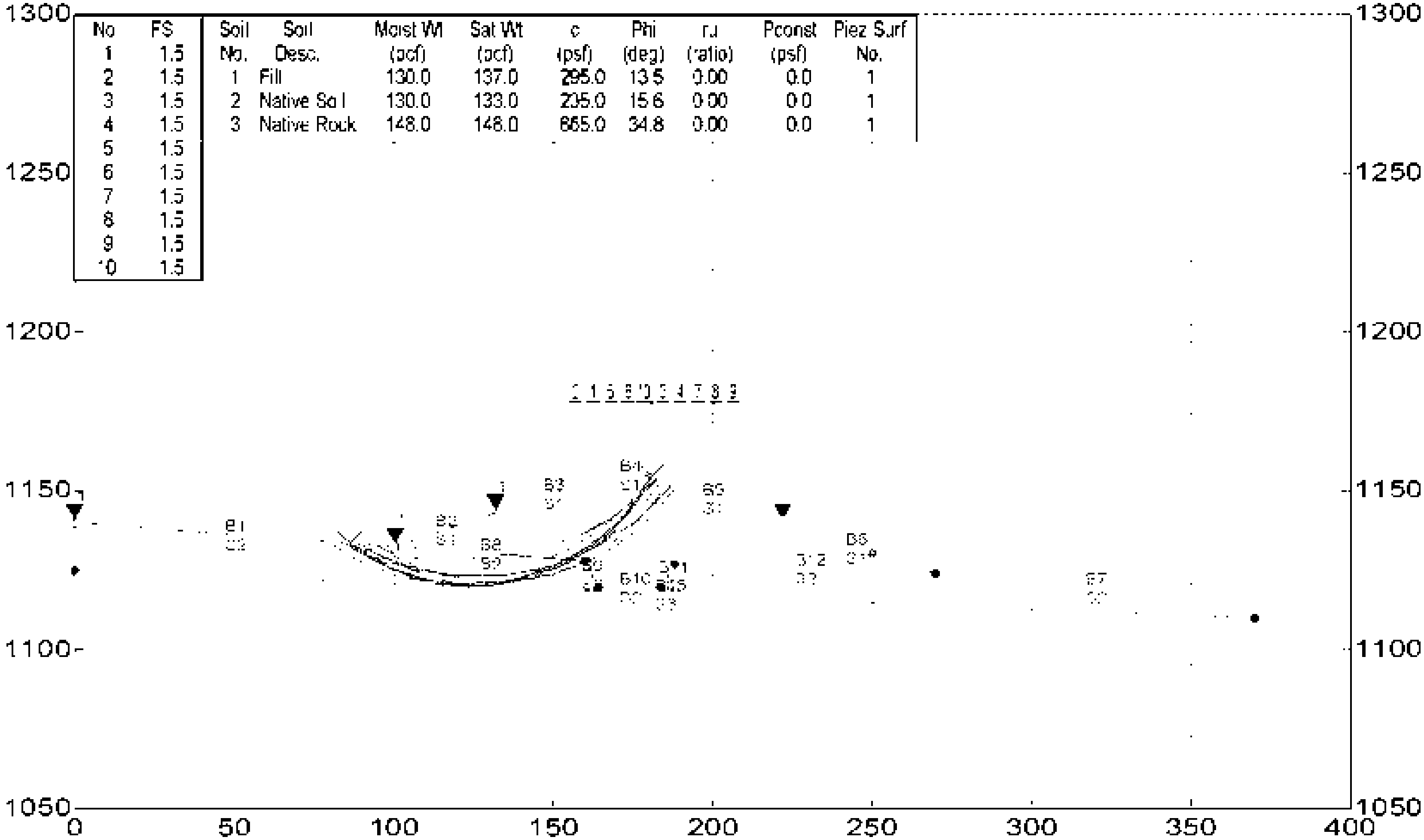
GEOSTASE FSmin = 1.2

Modified Bishop Method

PLATE S.1S

Flint Creek Power Station, Gentry, Arkansas
Secondary Ash Pond, Rapid Drawdown

…\3243-09 AEP Flint Creek Power Plant Bottom Ash Ponds Geo Stability Analysis\Slope Stability\Secondary RD.in



GEOSTASE FSmin = 1.5

Modified Bishop Method

PLATE S.2

AEPFC000065

PROJECT INFORMATION

PROJECT Flint Creek Power Plant
LOCATION Gentry, AR
PROJECT NO G 2243 - 09
CLIENT AEP
December 2009

TRIAXIAL TEST PROGRAM BY GARRY H. GREGORY, P.E.

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VERSION 1.0 AUGUST 1992 REVISED MARCH 24 1999

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ETTL ENGINEERS AND CONSULTANTS, INC
1717 East Erwin
Tyler, TX 75702

TEST DESCRIPTION

TYPE OF TEST & NO CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Redd Brown & Tan & Gray Fat Clay w/ Gravel
Sampled on Site, B-2 3' to 7' deep
ASSUMED SPECIFIC GRAVITY 2.7 + 40 Sieve
LL: PL: PI: Percent -200
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

Number of Specimens = 3

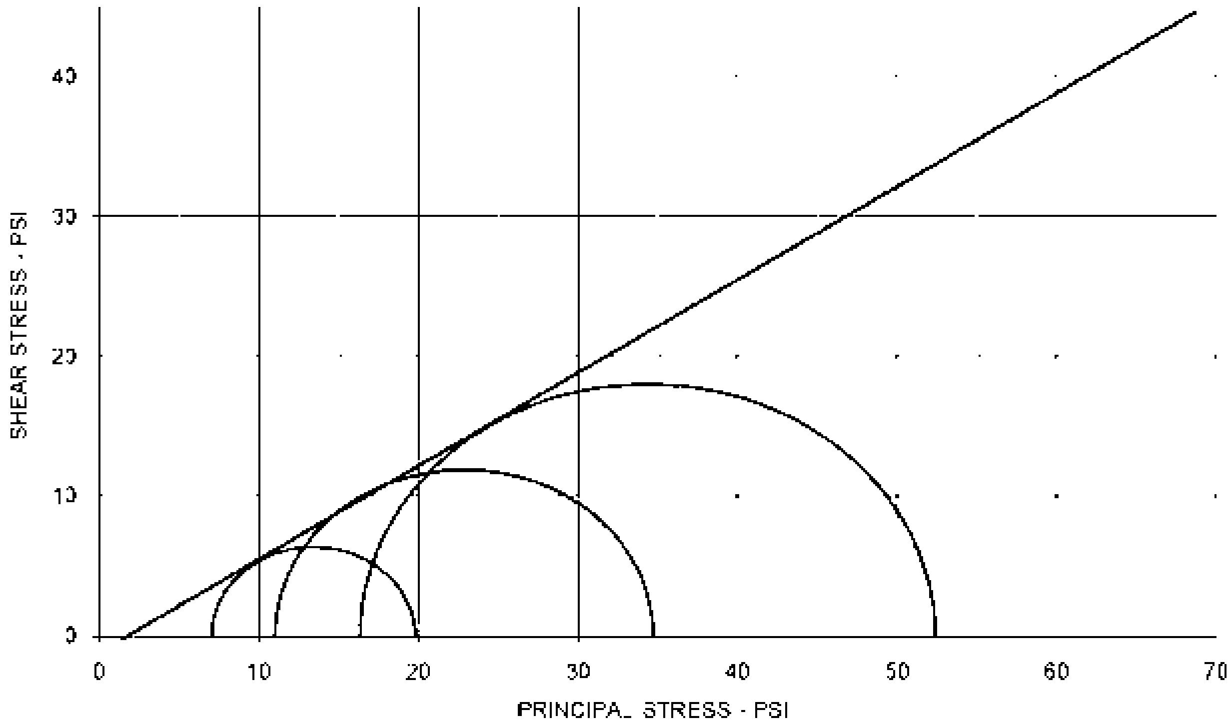
PLATE: B.1

PLATE: B.2

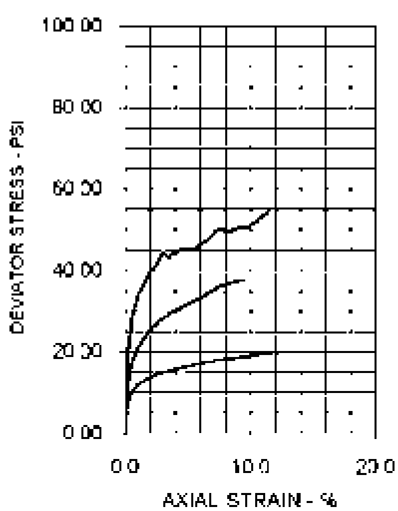
PLATE: B.3

AEPFC000066

TRIAXIAL SHEAR TEST REPORT



EFFECTIVE STRESS PARAMETERS	ϕ' = 33.7 deg	c' = -1.2 psi



SPECIMEN NO	1	2	3	4
INITIAL				
Moisture Content - %	16.9	15.1	21.1	
Dry Density - pcf	108.9	113.4	107.0	
Diameter - inches	2.79	2.75	2.76	
Height - inches	5.68	4.33	5.19	
AT TEST				
Final Moisture - %	21.7	19.9	19.4	
Dry Density - pcf	109.4	114.8	109.2	
Calculated Diameter (in.)	2.79	2.74	2.73	
Height - inches	5.68	4.28	5.12	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	12.74	23.73	35.99	
Total Pore Pressure - psi	62.9	59.0	73.6	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.6	1.4	
σ_1' Failure - psi	19.80	34.74	52.37	
σ_3' Failure - psi	7.06	11.01	16.38	

TEST DESCRIPTION

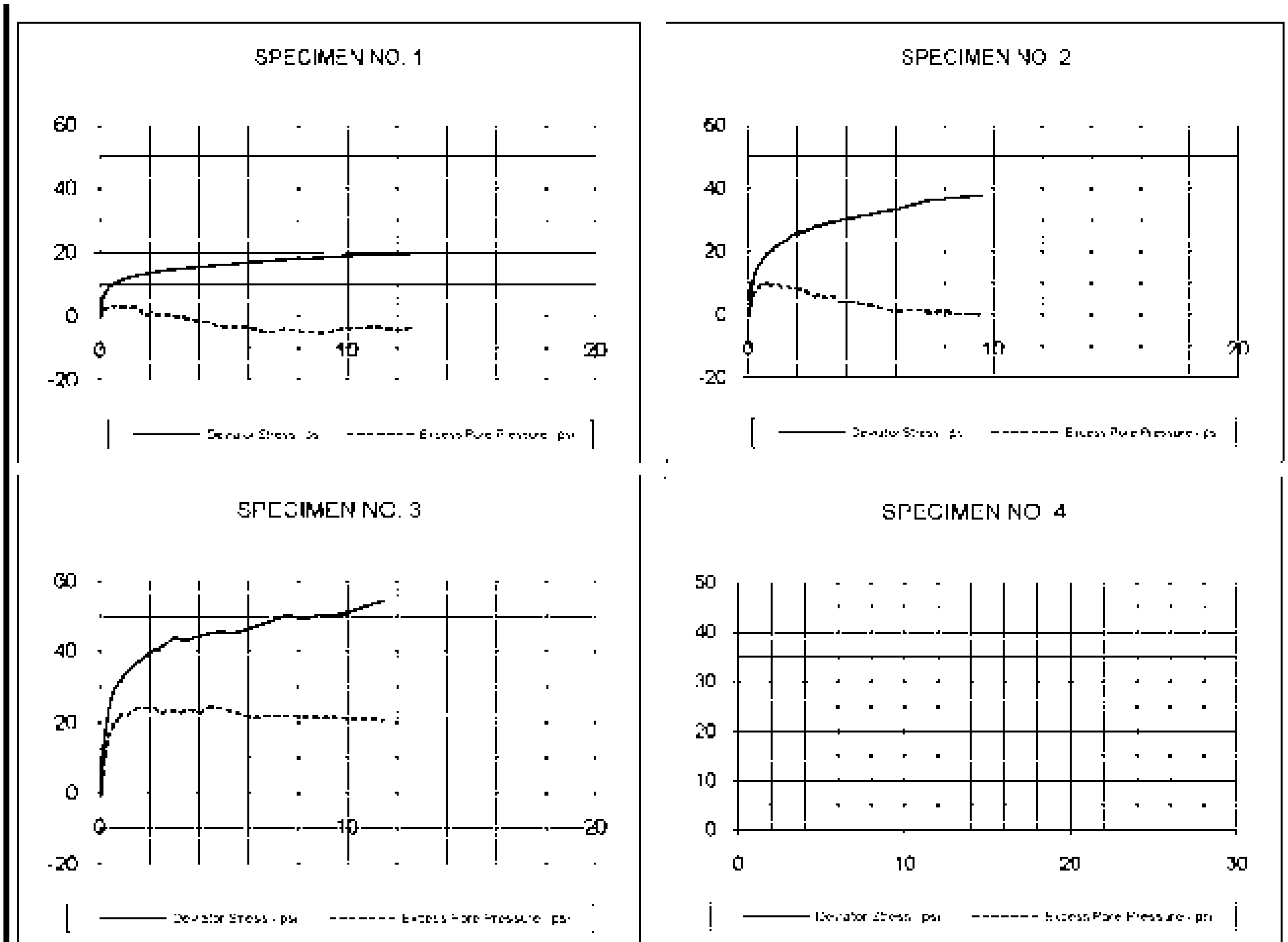
TYPE OF TEST & NO: CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Redd. Brown & Tan & Gray Fat Clay w/ Gravel
Sampled on Site. B-2 3' to 7' deep
ASSUMED SPECIFIC GRAVITY: 2.7 + 40 Sieve
LL: PL: PI: Percent -200:
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

PROJECT INFORMATION

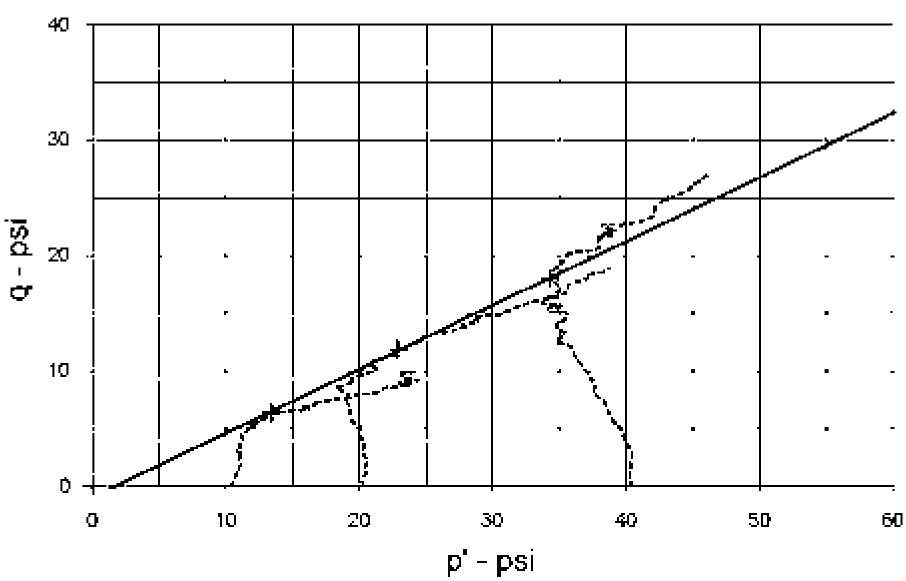
PROJECT: Flint Creek Power Plant
LOCATION: Gentry AR
PROJECT NO. G 3243 - 09
CLIENT: AEP
December 2009

ETTL ENGINEERS & CONSULTANTS	PLATE: B.1

G 3243-09, B-2 3'-7' Flint Creek



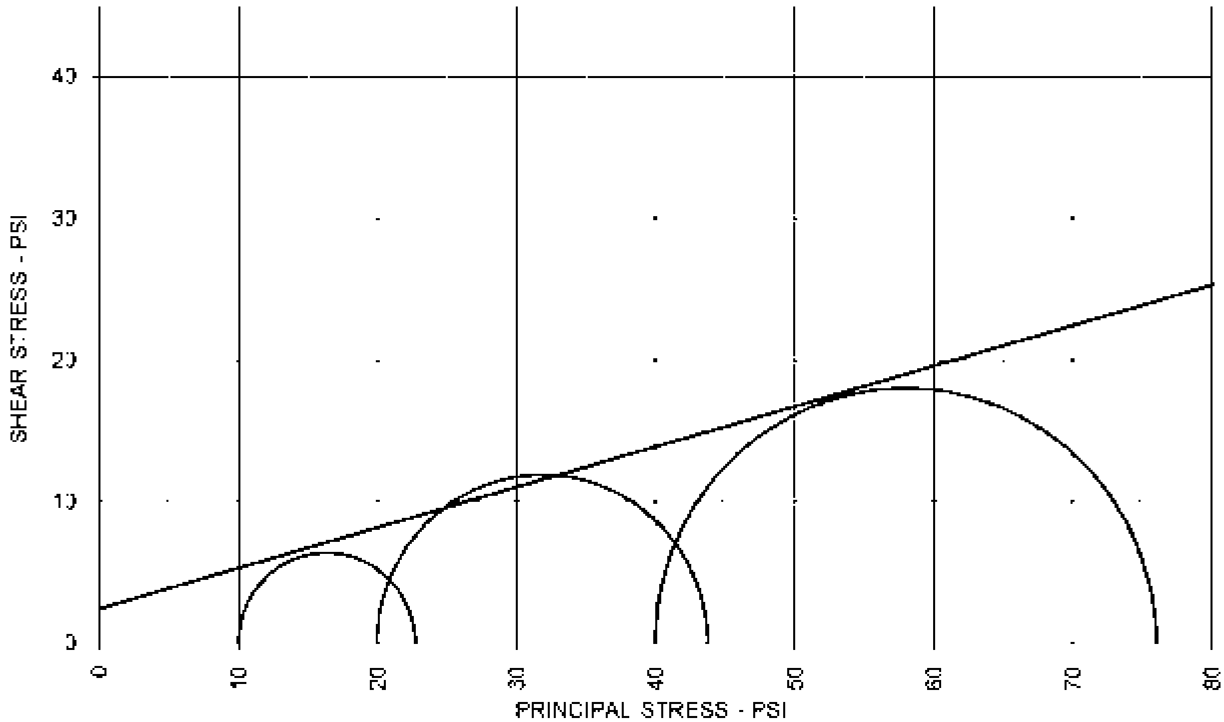
p - q DIAGRAM



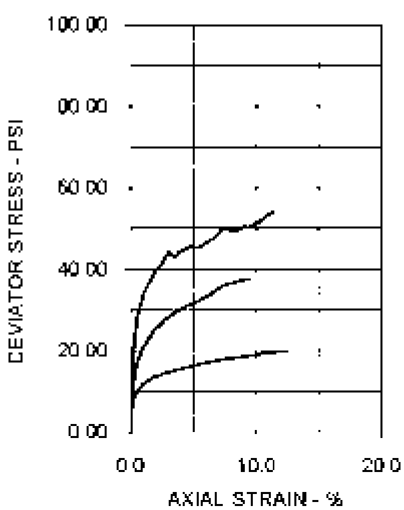
EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 29.0	a (psi) = -1.0
PROJECT Flint Creek Power Plant		TYPE OF TEST & NO. CU with PP	
PROJECT NO G 3243 - 09		ETTL ENGINEERS & CONSULTANTS	PLATE B.2
DESCRIPTION Redd. Brown & Tan & Gray Fat Clay w/ Gravel			

G 3243-09, B-2 3'-7' Flint Creek

TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS	φ = 15.9 deg	c = 2.4 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	16.9	15.1	21.1	
Dry Density - pcf	108.9	113.4	107.0	
Diameter - inches	2.79	2.75	2.76	
Height - inches	5.68	4.33	5.19	
AT TEST				
Final Moisture - %	21.7	18.9	19.4	
Dry Density - pcf	109.4	114.8	109.2	
Calculated Diameter (in.)	2.79	2.74	2.73	
Height - inches	5.68	4.28	5.12	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	12.74	23.73	35.99	
Total Pore Pressure - ps	62.9	59.0	73.6	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.6	1.4	
σ_1 Failure - psi	22.74	43.73	75.99	
σ_3 Failure - psi	10.00	20.00	40.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Redd. Brown & Tan & Gray Fat Clay w/ Gravel
Sampled on Site. B-2 3' to 7' deep
ASSUMED SPECIFIC GRAVITY 2.7 + 40 Sieve
LL: PL PI: Percent -200:
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant
LOCATION: Gentry, AR
PROJECT NO. G 3243 - 09
CLIENT: AEP
December 2009

ETTL ENGINEERS & CONSULTANTS PLATE: B.3

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant
LOCATION: Gentry, AR
PROJECT NO: G 2243 - 09
CLIENT: AEP
December 2009

TRIAXIAL TEST PROGRAM BY GARRY H. GREGORY, P.E.

[illegible]
VERSION 1.0 AUGUST 1992 REVISED MARCH 24, 1999

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ETTL ENGINEERS AND CONSULTANTS, INC
1717 East Erwin
Tyler, TX 75702

TEST DESCRIPTION

TYPE OF TEST & NO: CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Reddish Brown & Tan Lean Clay
Sampled on Site, B-2, 23 to 35' deep
ASSUMED SPECIFIC GRAVITY: 2.7 + 40 Sieve
LL: PL: PI: Percent -200
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

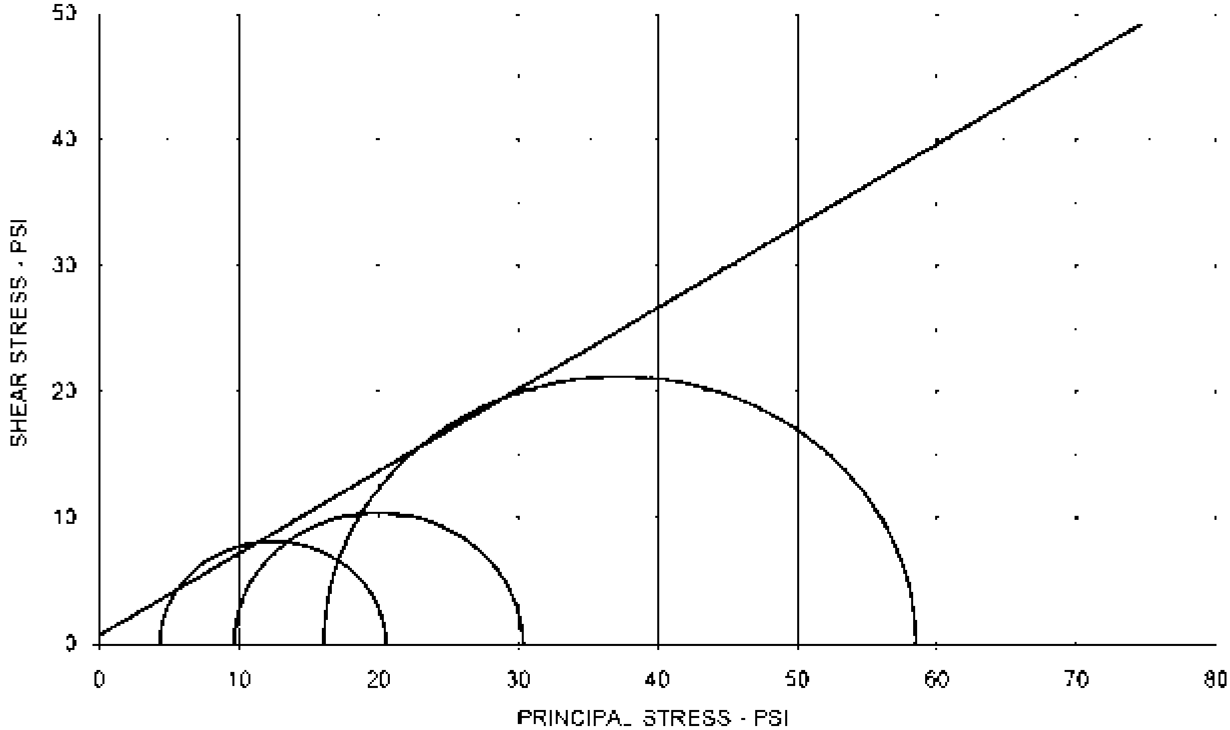
Number of Specimens = 3

PLATE: B.1

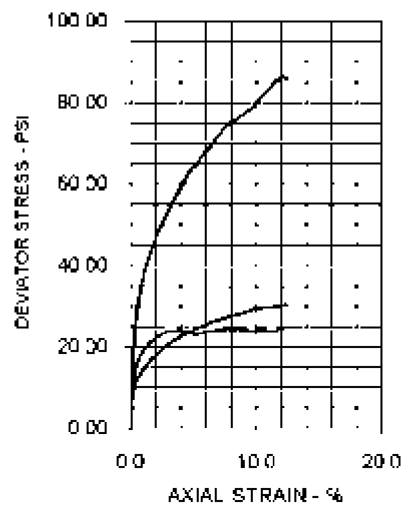
PLATE: B.2

PLATE: B.3

TRIAXIAL SHEAR TEST REPORT



EFFECTIVE STRESS PARAMETERS	φ ' = 33.0 deg	c' = 0.6 psi



SPECIMEN NO	1	2	3	4
INITIAL				
Moisture Content - %	21 8	20 0	17.7	
Dry Density - pcf	103 5	109 2	114.4	
Diameter - inches	2 78	2 76	2 80	
Height inches	5 68	5 67	5 69	
AT TEST				
Final Moisture - %	23 5	21 0	16.6	
Dry Density - pcf	103 8	110 3	117.0	
Calculated Diameter (in.)	2 77	2 74	2 78	
Height - inches	5 65	5 63	5 64	
Effect Cell Pressure - psi	10 0	20 0	40.0	
Failure Stress - psi	16 18	20.70	42 40	
Total Pore Pressure - psi	55.6	60 4	73.9	
Strain Rate - inches/min.	0.00050	0.00050	0 00050	
Failure Strain - %	1 5	1 5	1.5	
σ_1' Failure - psi	20 55	30.34	58 49	
σ_3' Failure - psi	4 37	9.64	16 09	

TEST DESCRIPTION

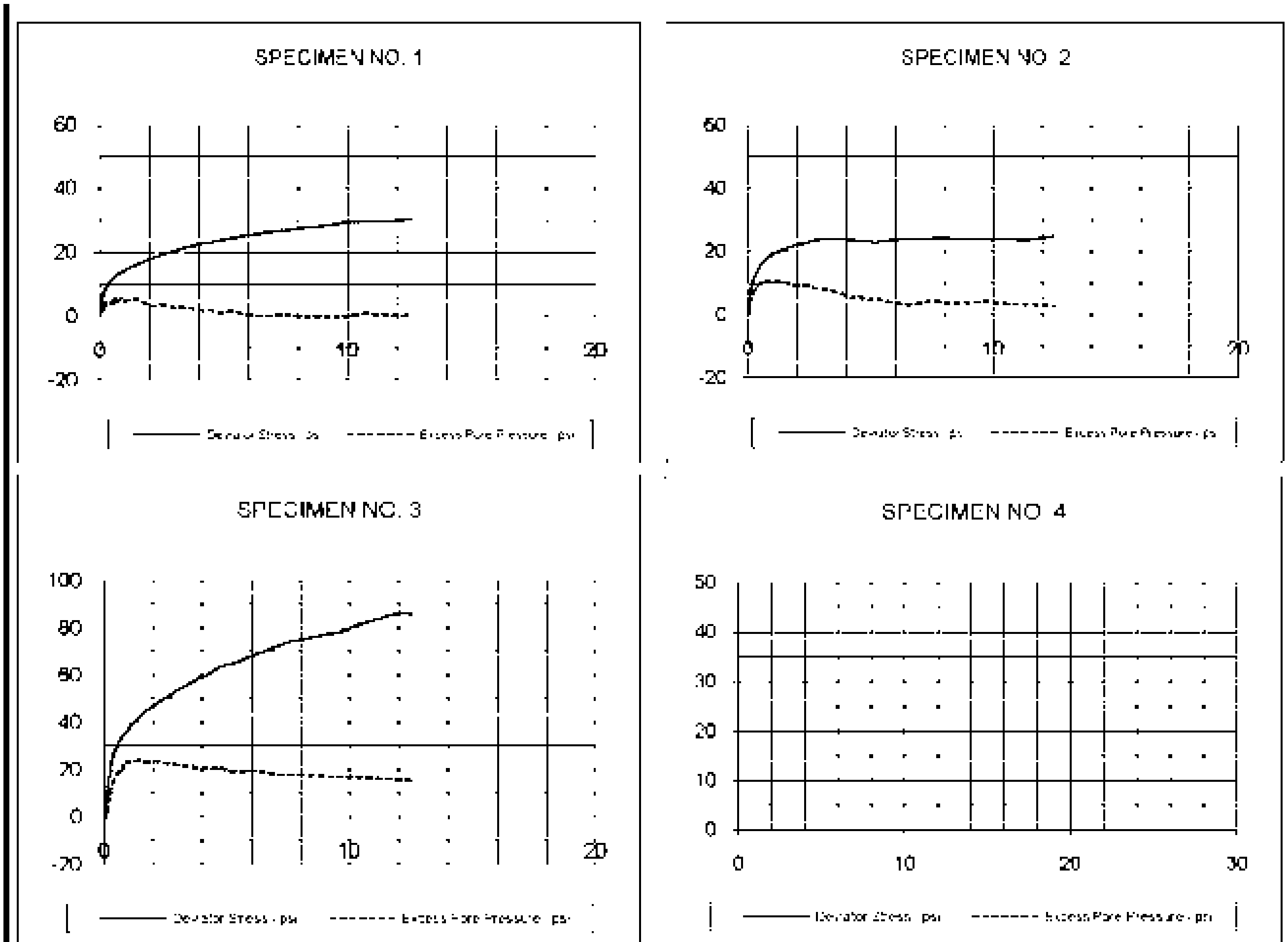
TYPE OF TEST & NO: CU with PP
SAMPLE TYPE Shelby Tube Sample
DESCRIPTION Reddish Brown & Tan Lean Clay
Sampled on Site. B-2 23 to 35' deep
ASSUMED SPECIFIC GRAVITY 2 7 + 40 Sieve
LL: PL PI: Percent -200:
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve
G 3243-09, B-2 23'-35' Flint Creek

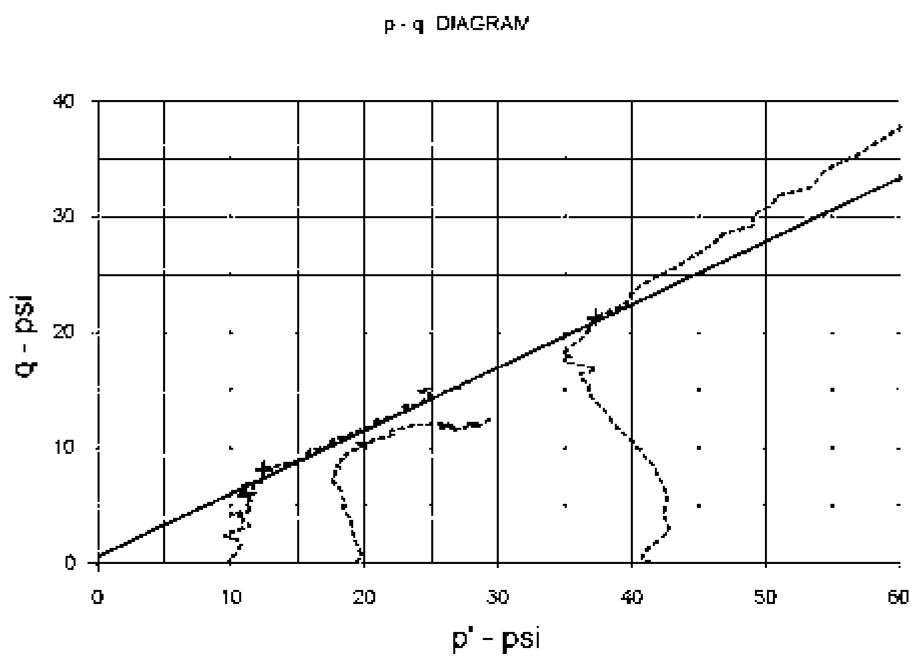
PROJECT INFORMATION

PROJECT: Flint Creek Power Plant
LOCATION Gentry AR
PROJECT NO. G 3243 - 09
CLIENT: AEP
December 2009

ETTL ENGINEERS & CONSULTANTS — PLATE: B.1

AEPFC000071

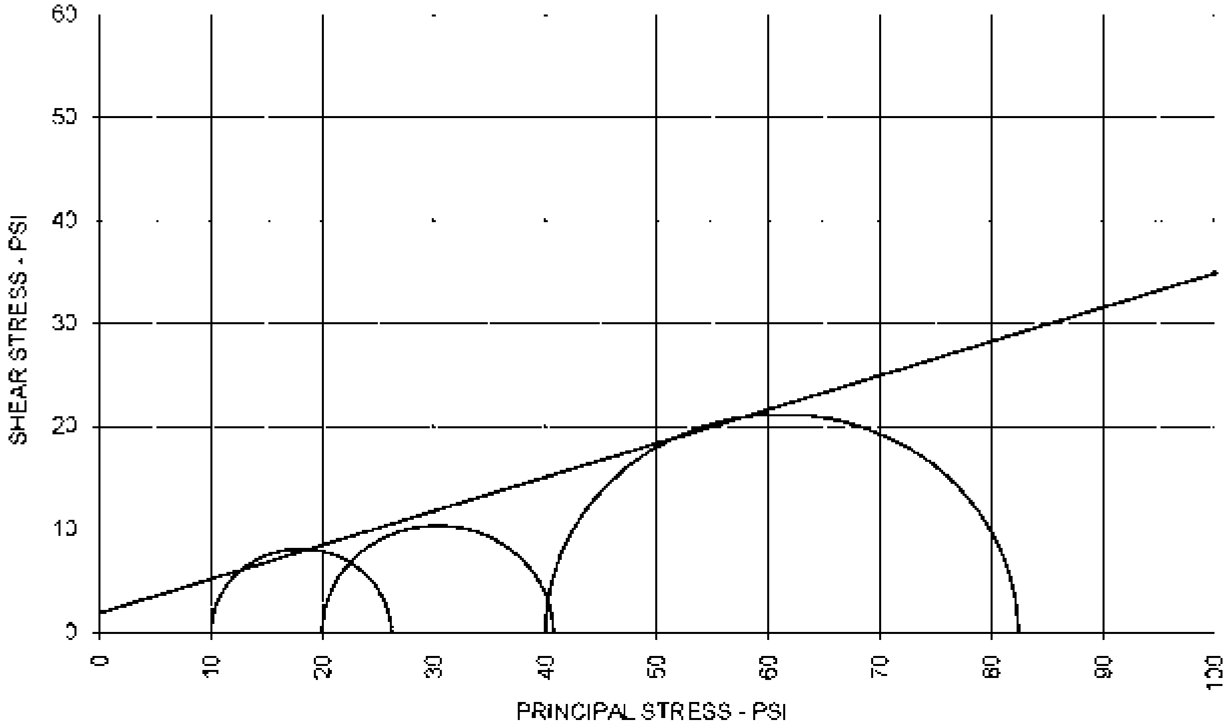




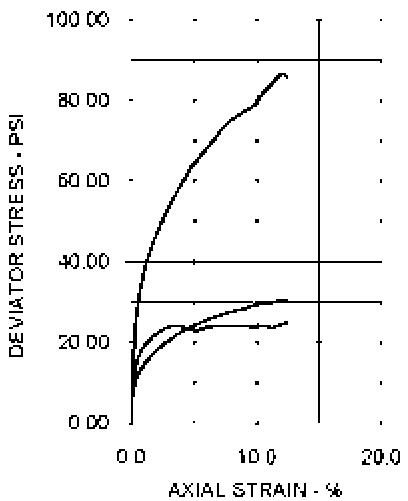
EFFECTIVE STRESS PARAMETERS	R^2 = 0.98	α (deg) = 28.6	a (psi) = 0.5
PROJECT Flint Creek Power Plant		TYPE OF TEST & NO. CU with PP	
PROJECT NO G 3243 - 09		ETTL ENGINEERS & CONSULTANTS	PLATE B.2
DESCRIPTION Reddish Brown & Tan Lean Clay			

G 3243-09, B-2 23'-35' Flint Creek

TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS	φ = 18.3 deg	c = 1.9 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	21.8	20.0	17.7	
Dry Density - pcf	103.5	109.2	114.4	
Diameter - inches	2.78	2.76	2.80	
Height - inches	5.68	5.67	5.69	
AT TEST				
Final Moisture - %	23.5	21.0	16.6	
Dry Density - pcf	103.8	110.3	117.0	
Calculated Diameter (in.)	2.77	2.74	2.76	
Height - inches	5.65	5.63	5.64	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	16.18	20.70	42.40	
Total Pore Pressure - psi	55.6	60.4	73.9	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.5	1.5	
σ_1 Failure - psi	26.18	40.70	82.40	
σ_3 Failure - psi	10.00	20.00	40.00	

TEST DESCRIPTION

TYPE OF TEST & NO. CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Reddish Brown & Tan Lean Clay
Sampled on Site. B-2 23' to 35' deep
ASSUMED SPECIFIC GRAVITY. 2.7 + 40 Sieve
LL. PL. P Percent -200
REMARKS. Diameter and Both Ends Trimmed + # 4 Sieve

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant
LOCATION: Gentry, AR
PROJECT NO. G 3243 - 09
CLIENT: AEP
December 2009

ETTL ENGINEERS & CONSULTANTS — PLATE: B.3

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant
LOCATION: Gentry, AR
PROJECT NO: G 3240 - 09
CLIENT: AEP
December 2009

TRIAXIAL TEST PROGRAM BY GARRY H. GREGORY, P.E.

[illegible]
VERSION 1.0 AUGUST [illegible] REVISED MARCH [illegible]

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TEST DESCRIPTION

TYPE OF TEST & NO: CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Red, Brown & Tan Sandy Lean Clay w/ Gravel
Sampled on Site, B-3 3' to 7' deep
ASSUMED SPECIFIC GRAVITY: 2.7 - 40 Sieve
LL: PL: PI: Percent -200:
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

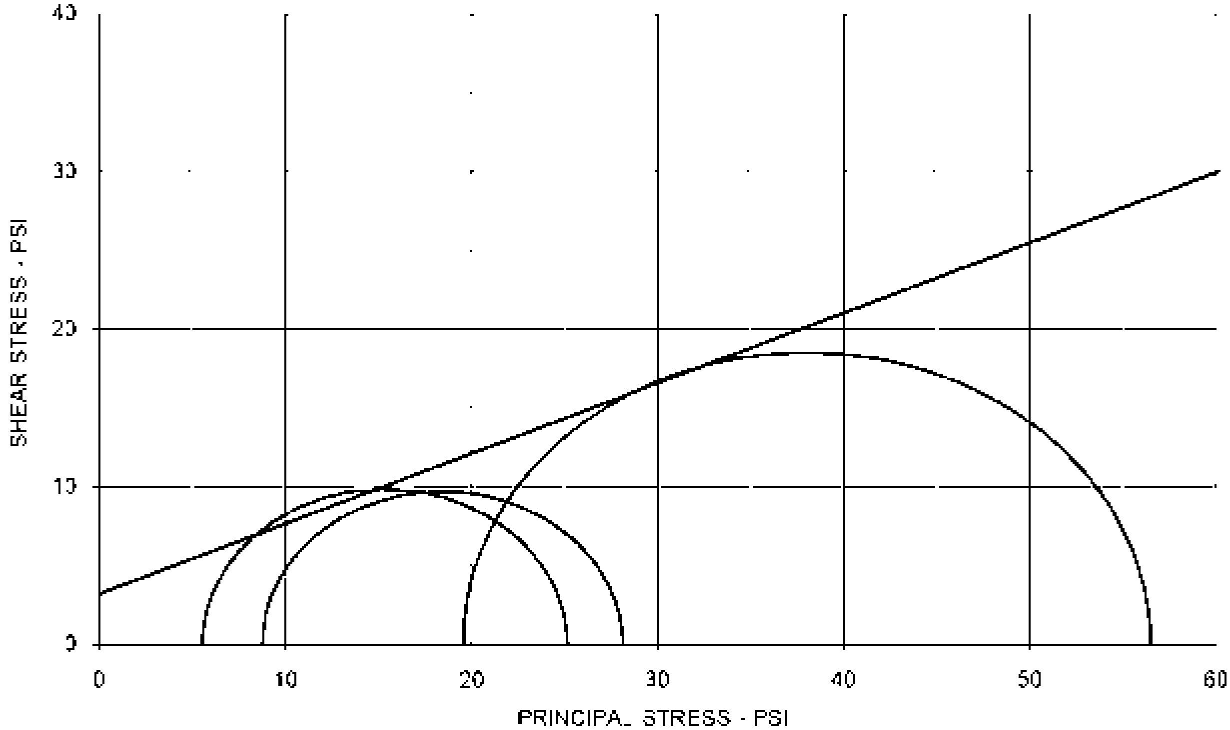
PLATE: B.1

PLATE: B.2

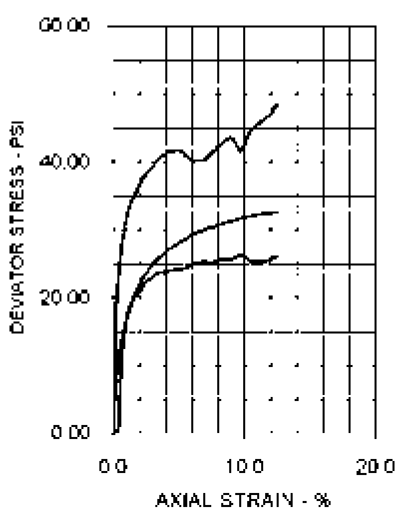
PLATE: B.3

Number of Specimens = 3

TRIAXIAL SHEAR TEST REPORT



EFFECTIVE STRESS PARAMETERS	φ' = 24.0 deg	c' = 3.2 psi



SPECIMEN NO	1	2	3	4
INITIAL				
Moisture Content - %	17.6	20.3	17.6	
Dry Density - pcf	107.9	108.2	107.7	
Diameter - inches	2.76	2.76	2.77	
Height - inches	5.68	5.68	5.69	
AT TEST				
Final Moisture - %	24.0	22.3	22.0	
Dry Density - pcf	108.5	107.0	109.8	
Calculated Diameter (in.)	2.76	2.75	2.75	
Height - inches	5.67	5.64	5.62	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	19.56	19.31	36.95	
Total Pore Pressure - psi	54.4	61.2	70.5	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.5	2.1	
σ_1' Failure - psi	25.12	28.08	56.49	
σ_3' Failure - psi	5.56	8.77	19.54	

TEST DESCRIPTION

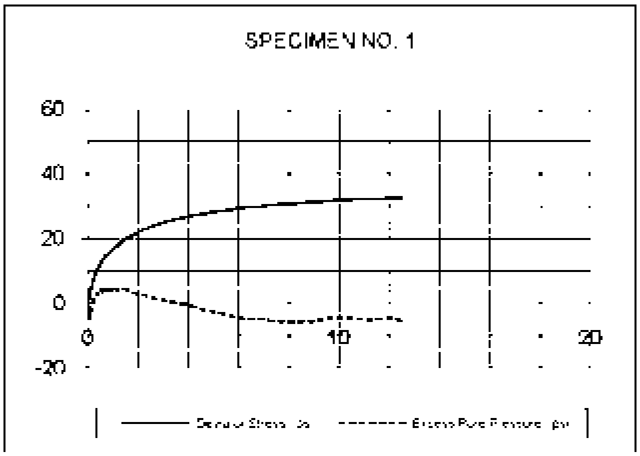
TYPE OF TEST & NO: CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Redd. Brown & Tan Sandy Lean Clay w/ Gravel
Sampled on Site, B-3 3' to 7' deep
ASSUMED SPECIFIC GRAVITY: 2.7 + 40 Sieve
LL: PL: PI: Percent -200:
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

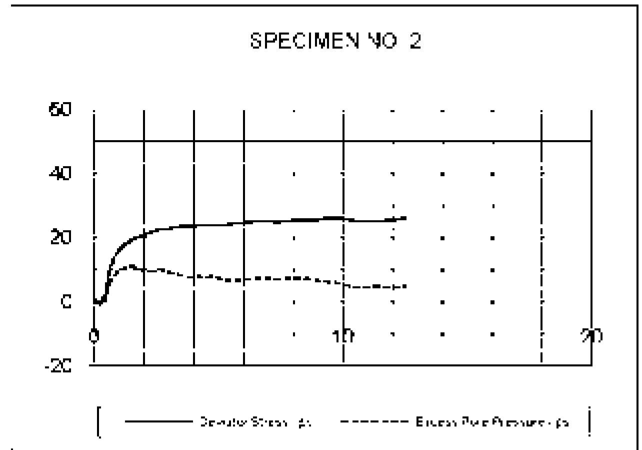
PROJECT INFORMATION

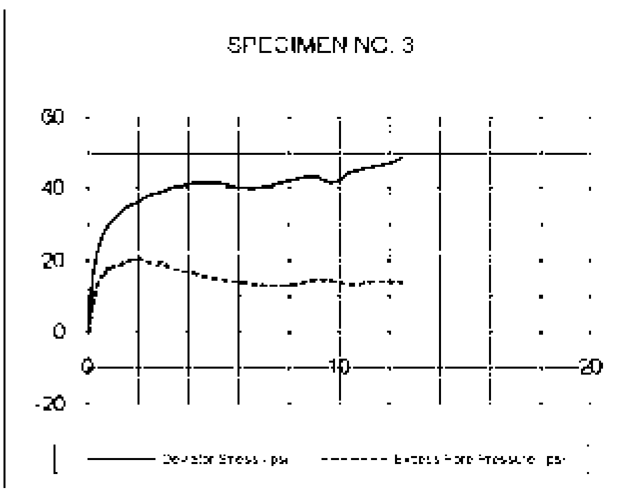
PROJECT: Flint Creek Power Plant
LOCATION: Gentry, AR
PROJECT NO. G 3243 - 09
CLIENT: AEP
December 2009

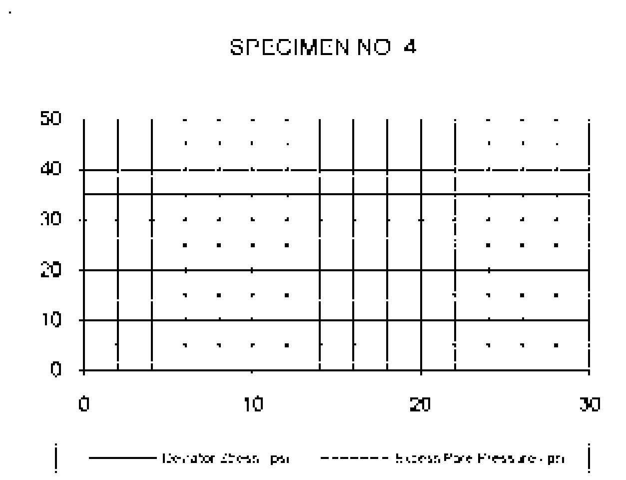
ETTL ENGINEERS & CONSULTANTS	PLATE: B.1

G-3243-09, B-3 3'-7' Flint Creek

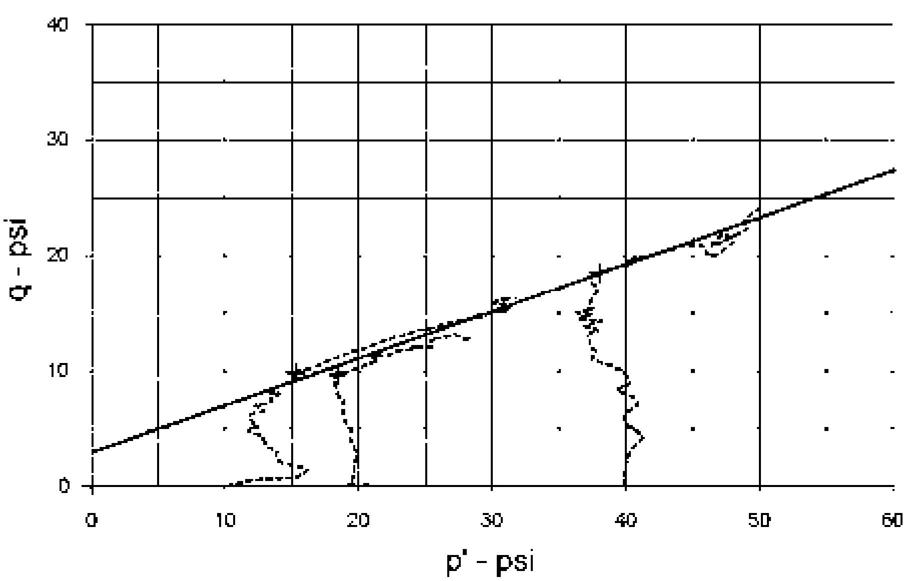








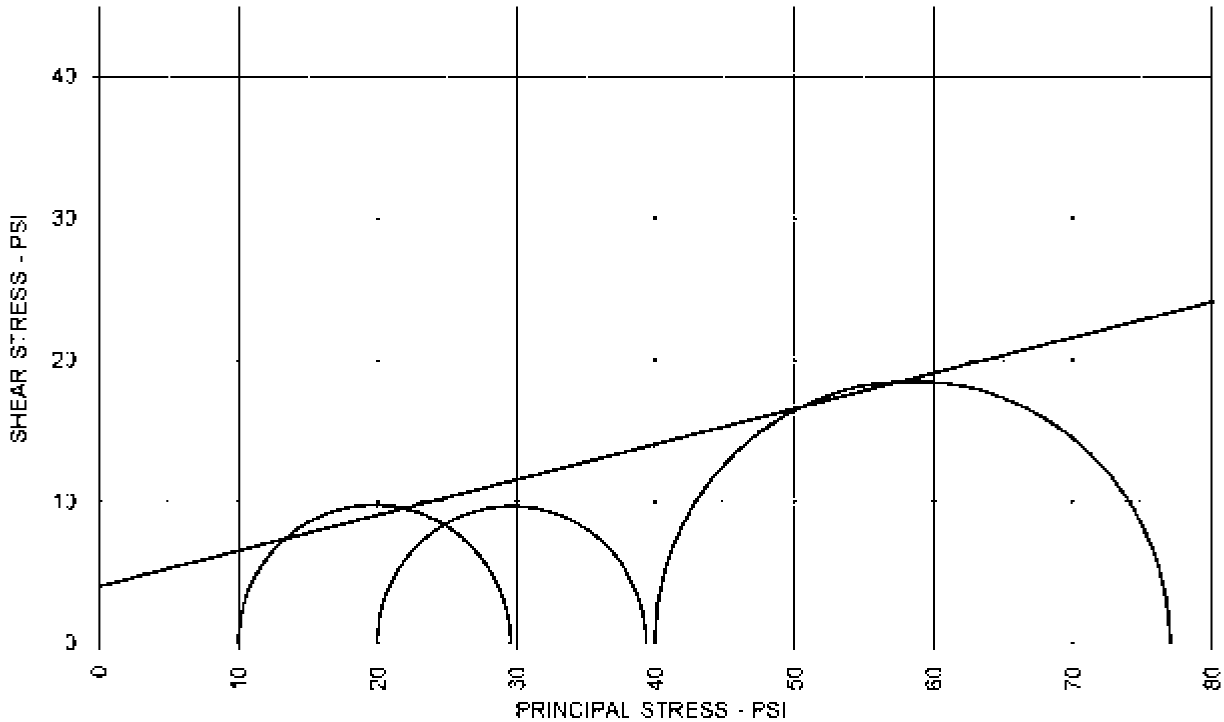
p - q DIAGRAM



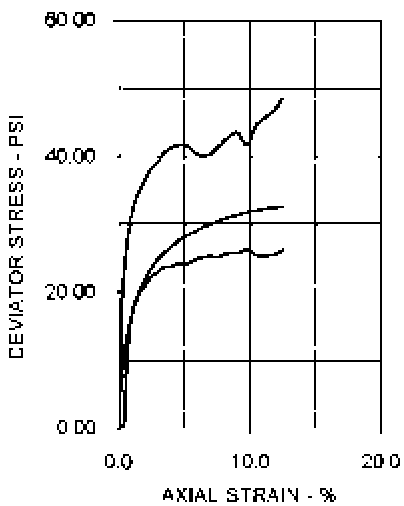
EFFECTIVE STRESS PARAMETERS	R^2 = 0.98	α (deg) = 22.2	a (psi) = 2.9
PROJECT Flint Creek Power Plant		TYPE OF TEST & NO. CU with PP	
PROJECT NO. G 3243 - 09		ETTL ENGINEERS & CONSULTANTS	PLATE B.2
DESCRIPTION Redd. Brown & Tan Sandy Lean Clay w/ Gravel			

G 3243-09, B-3 5'-7' Flint Creek

TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS	ϕ = 14.1 deg	c = 4.0 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	17.6	20.3	17.6	
Dry Density - pcf	107.9	105.2	107.7	
Diameter - inches	2.76	2.76	2.77	
Height - inches	5.68	5.68	5.69	
AT TEST				
Final Moisture - %	24.0	22.3	22.0	
Dry Density - pcf	106.5	107.0	109.8	
Calculated Diameter (in.)	2.76	2.75	2.75	
Height - inches	5.67	5.64	5.62	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	19.56	19.31	36.95	
Total Pore Pressure - ps	54.4	61.2	70.5	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.5	2.1	
σ_1 Failure - psi	29.56	39.31	76.95	
σ_3 Failure - psi	10.00	20.00	40.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Redd. Brown & Tan Sandy Lean Clay w/ Gravel
Sampled on Site: B-3 3' to 7' deep
ASSUMED SPECIFIC GRAVITY: 2.7 + 40 Sieve
LL: PL: PI: Percent -200:
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant
LOCATION: Gentry, AR
PROJECT NO. G 3243 - 09
CLIENT: AEP
December 2009

ETTL ENGINEERS & CONSULTANTS

PLATE: B.3

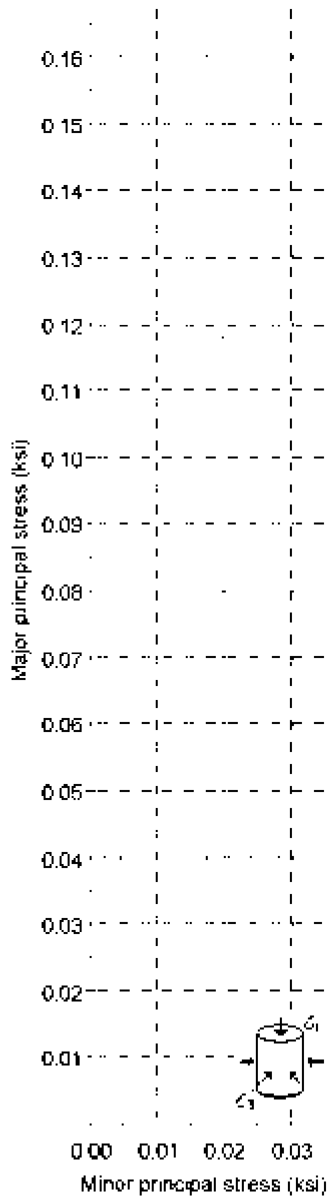
Analysis of Rock Strength using RocLab

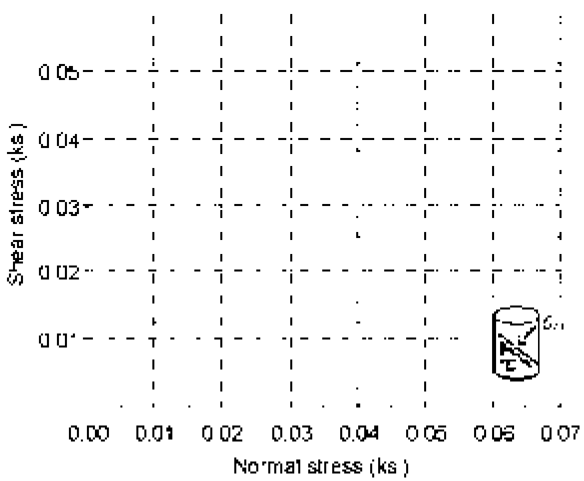
Hoek-Brown Classification
intact uniaxial comp. strength (sigci) = 4.5 ksi
GSI = 10   mi = 6   Disturbance factor (D) = 0
intact modulus (Ei) = 1600 ksi

Hoek-Brown Criterion
mb = 0.321   s = 4.54e-5   a = 0.585

Mohr-Coulomb Fit
cohesion = 0.007 ksi   friction angle = 38.55 deg

Rock Mass Parameters
tensile strength = -0.001 ksi
uniaxial compressive strength = 0.013 ksi
global strength = 0.209 ksi
deformation modulus = 48.81 ksi





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HYDRAULIC CONOUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project :	AEP Flint Creek Power Plant Bottom Ash Ponds							
Date:	12/29/2009			Panel Number : P-3 , ASTM D 5084				
Project No	G 3243-095			Permometer Data				
Boring No	B-1	a_p =	0.031416 cm^2		Set Mercury to Pipet Rp at beginning	Exp. Vol.	1.7	cm^3
Sample		a_a =	0.767120 cm^2			Pipet **Rp**	**6.7**	cm
Depth (ft)	18'-20'	M_1 =	0.030180	C = 0.000433212		Annulus **Ra**	1.5	cm^3
Other Location		M_2 =	1.040953	T = 0.201660671				
Material Description :	Gray Tan & Red Clayey Gravel							

SAMPLE DATA

Wet Wt. sample + ring or tare			538.52	g
Tare or ring Wt			0.0	g
Wet Wt. of Sample			538.52	g
Diameter :	2.76	in	7.01	cm
Length	2.74	in	6.97	cm
Area:	5.97	in^2	38.54	cm^2
Volume :	16.40	in^3	268.68	cm^3
Unit Wt (wet):	**125.07**	pcf	**2.00**	g/cm^3
Unit Wt (dry):	**100.71**	pcf	**1.61**	g/cm^3

Before Test		After Test	
Tare No.:	T 5	Tare No.:	T-25
Wet Wt +tare	538.52	Wet Wt +tare	662.56
Dry Wt +tare	433.64	Dry Wt +tare	549.81
Tare Wt.	0.00	Tare Wt.	116.17
Dry Wt :	433.64	Dry Wt.	433.64
Water Wt	104.88	Water Wt	112.75
% moist	**24.2**	% moist	**26.0**

Assumed Specific Gravity	**2.75**	Max Dry Density(pcf) =	100.7528	CMC =	24.1859607
		% of max =	100.0	+/- CMC =	0.00
Calculated % saturation	101.46	Void ratio (e) =	**0.70**	Porosity (n) =	**0.41**

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 5.2 cm Hydraulic Gradient = 9.33

Date	elapsed t (seconds)	Z (pipet @ t)	\Zp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft /day)	Reset = *
12/29/2009	3300	6	0.6588251	24.5	0.899	1.68E-08	4.77E-05	
12/29/2009	4080	5.9	0.7588251	24.5	0.899	1.59E-08	4.50E-05	
12/29/2009	4980	5.8	0.8588251	24.5	0.899	1.49E-08	4.22E-05	
12/29/2009	6120	5.7	0.9588251	24.5	0.899	1.37E-08	3.88E-05	

SUMMARY

ka = 1.53E-08 cm/sec Acceptance criteria = 25 %

k			Vm	
k1 =	1.68E-08	cm/sec	9.9	%
k2 =	1.59E-08	cm/sec	3.6	%
k3 =	1.49E-08	cm/sec	2.8	%
k4 =	1.37E-08	cm/sec	10.7	%

$$Vm = \frac{|ka - ki|}{ka} \times 100$$

Hydraulic conductivity	k =	**1.53E-08**	cm/sec	**4.34E-05**	ft/day
Void Ratio	e =	**0.70**			
Porosity	n =	**0.41**			
Bulk Density	γ =	**2.00**	g/cm^3	**125.1**	pcf
Water Content	W =	**0.39**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**1.57E-13**	cm^2	(at 20 deg C)	

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HYDRAULIC CONDUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project : AEP Flint Creek Power Plant Bottom Ash Ponds
Date 12/29/2009 Panel Number : P-3 ASTM D 5084
Project No. : G 3243-095

Permometer Data

Boring No	B-1	a_p =	0.031416 cm^2		Set Mercury to Pipet Rp at beginning	Pipet Rp (initial)	1.8	cm^3
Sample:		a_a =	0.767120 cm^2			Pipet Rp	6.7	cm^3
Depth (ft):	33'-35'	M_1 =	0.030180	C = 0.000429887		Annulus Ra	1.5	cm^3
Other Location		M_2 =	1.040953	T = 0.203783414				

Material Description Red & Tan Lean Clay

SAMPLE DATA

Wet Wt. sample + ring or tare :			584.74	g
Tare or ring Wt			0.0	g
Wet Wt. of Sample :			584.74	g
Diameter	2.79	in	7.09	cm
Length :	2.79	in	7.08	cm
Area:	6.12	in^2	39.47	cm^2
Volume :	17.06	in^3	279.61	cm^3
Unit Wt.(wet)	**130.49**	pcf	**2.09**	g/cm^3
Unit Wt.(dry)	**110.22**	pcf	**1.77**	g/cm^3

	Before Test		After Test
Tare No.:	T 7	Tare No :	T 24
Wet Wt.+tare	422.13	Wet Wt.+tare	698.21
Dry Wt.+tare	390.91	Dry Wt.+tare	599.86
Tare Wt	221.16	Tare Wt	112.38
Dry Wt :	169.75	Dry Wt.	487.48
Water Wt	31.22	Water Wt	98.35
% moist :	**18.4**	% moist.:	**20.2**

Assumed Specific Gravity **2.72** Max Dry Density(pcf) = 110.2686 OMC = 18.3917526
% of max = 100.0 +/- OMC = 0.00
Calculated % saturation 101.51 Void ratio (e) = **0.54** Porosity (n) = **0.35**

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 5.1 cm Hydraulic Gradient = 9.09

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft/day)	Reset = *
12/29/2009	3480	6	0.657171	24.5	0.899	1.60E-08	4.53E-05	
12/29/2009	4260	5.9	0.757171	24.5	0.899	1.52E-08	4.31E-05	
12/29/2009	4920	5.8	0.857171	24.5	0.899	1.51E-08	4.28E-05	
12/29/2009	6420	5.6	1.057171	24.5	0.899	1.46E-08	4.14E-05	

SUMMARY

k_a = 1.52E-08 cm/sec Acceptance criteria = 25 %

ki			Vm	
k1 =	1.60E-08	cm/sec	4.9	%
k2 =	1.52E-08	cm/sec	0.1	%
k3 =	1.51E-08	cm/sec	0.9	%
k4 =	1.46E-08	cm/sec	4.0	%

$$Vm = \frac{|ka-ki|}{ka} \times 100$$

Hydraulic conductivity	k =	**1.52E-08**	cm/sec	**4.31E-05**	ft/day
Void Ratio	e =	**0.54**			
Porosity	n =	**0.35**			
Bulk Density	γ =	**2.09**	g/cm^3	**130.5**	pcf
Water Content	W =	**0.33**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**1.56E-13**	cm^2	(at 20 deg C)	

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HYDRAULIC CONOUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project : AEP Flint Creek Power Plant Bottom Ash Ponds
Date: 12/29/2009 Panel Number : P-3 , ASTM D 5084
Project No G 3243-095 Permometer Data

Boring No	B-2	a_p =	0.031416 cm^2		Set Mercury to Pipet Rp at beginning	[illegible]	1.7 cm
Sample		a_a =	0.767120 cm^2			Pipet Rp	**6.7** cm
Depth (ft)	8'-10'	M_1 =	0.030180	C = 0.000430497		Annulus Ra	1.5 cm^3
Other Location		M_2 =	1.040953	T = 0.201660671			

Material Description : Red & Tan Clayey Gravel

SAMPLE DATA

Wet Wt sample + ring or tare			570.81	g
Tare or ring Wt			0.0	g
Wet Wt. of Sample			570.81	g
Diameter :	2.78	in	7.06	cm
Length	2.77	in	7.03	cm
Area:	6.06	in^2	39.10	cm^2
Volume :	16.77	in^3	274.83	cm^3
Unit Wt (wet):	**129.60**	pcf	**2.08**	g/cm^3
Unit Wt (dry):	**110.28**	pcf	**1.77**	g/cm^3

	Before Test		After Test
Tare No.:	T 2	Tare No.:	T-23
Wet Wt +tare	299.84	Wet Wt +tare	715.92
Dry Wt +tare	287.43	Dry Wt +tare	608.75
Tare Wt.	216.62	Tare Wt.	140.31
Dry Wt :	70.81	Dry Wt.	468.44
Water Wt	12.41	Water Wt	107.17
% moist	**17.5**	% moist	**22.9**

Assumed Specific Gravity **2.95** Max Dry Density(pcf) = 110.3225 CMC = 17.5257732
% of max = 100.0 +/- CMC = 0.00
Calculated % saturation 100.72 Void ratio (e) = **0.67** Porosity (n) = **0.40**

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 5.2 cm Hydraulic Gradient = 9.25

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft/day)	Reset = *
12/29/2009	2460	6.3	0.3588251	24.5	0.899	1.18E-08	3.35E-05	
12/29/2009	3900	6.2	0.4588251	24.5	0.899	9.64E-09	2.73E-05	
12/29/2009	5520	6.1	0.5588251	24.5	0.899	8.39E-09	2.38E-05	
12/29/2009	7200	6	0.6588251	24.5	0.899	7.67E-09	2.17E-05	

SUMMARY

ka = 9.38E-09 cm/sec Acceptance criteria = 50 %

k			Vm	
k1 =	1.18E-08	cm/sec	26.1	%
k2 =	9.64E-09	cm/sec	2.8	%
k3 =	8.39E-09	cm/sec	10.6	%
k4 =	7.67E-09	cm/sec	18.3	%

$$Vm = \frac{|ka-ki|}{ka} \times 100$$

Hydraulic conductivity	k =	**9.38E-09**	cm/sec	**2.66E-05**	ft/day
Void Ratio	e =	**0.67**			
Porosity	n =	**0.40**			
Bulk Density	γ =	**2.08**	g/cm^3	**129.6**	pcf
Water Content	W =	**0.31**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**9.61E-14**	cm^2	(at 20 deg C)	

AEPFC000081

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HYDRAULIC CONOUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project :	AEP Flint Creek Power Plant Bottom Ash Ponds							
Date:	12/29/2009		Panel Number : P-3 , ASTM D 5084					
Project No	G 3243-095				Permometer Data			
Boring No	B-2	a_p =	0.031416 cm^2		Set Mercury to Pipet Rp at beginning	Equil. Point	1.7	cm
Sample		a_a =	0.767120 cm^2			Pipet Rp	**6.7**	cm
Depth (ft)	23'-25'	M_1 =	0.030180	C =	0.000430195	Annulus Ra	1.5	cm^3
Other Location		M_2 =	1.040953	T =	0.201660671			

Material Description : Red & Tan Sandy Lean Clay

SAMPLE DATA

Wet Wt sample + ring or tare			586.16	g				
Tare or ring Wt			0.0	g		Before Test		After Test
Wet Wt. of Sample			586.16	g	Tare No.:	T-8	Tare No.:	T-27
Diameter :	2.79	in	7.08	cm^2	Wet Wt +tare	586.16	Wet Wt +tare	730.20
Length	2.79	in	7.07	cm	Dry Wt +tare	505.60	Dry Wt +tare	646.06
Area:	6.10	in^2	39.39	cm^2	Tare Wt.	0.00	Tare Wt.	140.46
Volume :	17.00	in^3	278.61	cm^3	Dry Wt :	505.6	Dry Wt.	505.6
Unit Wt (wet):	**131.28**	pcf	**2.10**	g/cm^3	Water Wt	80.56	Water Wt	84.14
Unit Wt (dry):	**113.24**	pcf	**1.81**	g/cm^3	% moist	**15.9**	% moist	**16.6**

Assumed Specific Gravity	**2.60**	Max Dry Density(pcf) =	113.2859	CMC =	15.9335443
		% of max =	100.0	+/- CMC =	0.00
Calculated % saturation	99.93	Void ratio (e) =	**0.43**	Porosity (n) =	**0.30**

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 5.2 cm   Hydraulic Gradient = 9.19

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft/day)	Reset = *
12/29/2009	2400	6	0.6588251	24	0.910	2.32E-08	6.59E-05	
12/29/2009	3540	5.7	0.9588251	24	0.910	2.38E-08	6.73E-05	
12/29/2009	3960	5.6	1.0588251	24	0.910	2.37E-08	6.73E-05	
12/29/2009	4380	5.5	1.1588251	24	0.910	2.38E-08	6.74E-05	

SUMMARY

ka = 2.36E-08 cm/sec   Acceptance criteria = 25 %

k			Vm	
k1 =	2.32E-08	cm/sec	1.6	%
k2 =	2.38E-08	cm/sec	0.5	%
k3 =	2.37E-08	cm/sec	0.5	%
k4 =	2.38E-08	cm/sec	0.6	%

$$Vm = \frac{|ka-ki|}{ka} \times 100$$

Hydraulic conductivity	k =	**2.36E-08**	cm/sec	**6.70E-05**	ft/day
Void Ratio	e =	**0.43**			
Porosity	n =	**0.30**			
Bulk Density	γ =	**2.10**	g/cm^3	131.3	pcf
Water Content	W =	**0.29**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**2.42E-13**	cm^2	(at 20 deg C)	

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707 West Cotton Street
Longview, Texas 75601-6205
903-758-0915 Phone
903-758-8245 Fax

ETTL Engineers & Consultants Inc.

GEOTECHNICAL • MATERIALS • ENVIRONMENTAL • DRILLING • LANDFILLS

HYDRAULIC CONOUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project : AEP Flint Creek Power Plant Bottom Ash Ponds

Date: 12/29/2009 — Panel Number: P-3 ASTM D 5084

Project No: G 3243-095 — Permometer Data

Boring No	B-7	a_p =	0.031416 cm²		Set Mercury to Pipet Rp at beginning	Exp. Point	1.7	cm
Sample		a_a =	0.767120 cm²			Pipet Rp	6.7	cm
Depth (ft)	5'-7'	M_1 =	0.030180	C =	0.000434383	Annulus Ra	1.5	cm³
Other Location		M_2 =	1.040953	T =	0.201660671			

Material Description: Red & Tan Sandy Lean Clay with gravel

SAMPLE DATA

Wet Wt. sample + ring or tare			540.64	g					
Tare or ring Wt			0.0	g		Before Test		After Test	
Wet Wt. of Sample			540.64	g	Tare No.:	T 4	Tare No.:	T-20	
Diameter:	2.75	in	6.98	cm	Wet Wt.+tare	439.69	Wet Wt.+tare	707.29	
Length	2.73	in	6.94	cm	Dry Wt.+tare	400.57	Dry Wt.+tare	600.06	
Area:	5.93	in^2	38.26	cm²	Tare Wt.	219.47	Tare Wt.	160.23	
Volume:	16.20	in^3	265.52	cm³	Dry Wt.:	181.1	Dry Wt.	439.83	
Unit Wt (wet).	**127.05**	pcf	**2.04**	g/cm³	Water Wt	39.12	Water Wt	107.23	
Unit Wt (dry):	**104.48**	pcf	**1.67**	g/cm³	% moist	**21.6**	% moist	**24.4**	

Assumed Specific Gravity	**2.80**	Max Dry Density(pcf) =	104.5286	OMC =	21.6013252
		% of max =	100.0	+/- OMC =	0.00
Calculated % saturation	101.43	Void ratio (e) =	**0.67**	Porosity (n) =	**0.40**

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 5.2 cm — Hydraulic Gradient = 9.37

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft/day)	Reset = *
12/29/2009	3120	5.9	0.7588251	24.5	0.899	2.08E-08	5.90E-05	
12/29/2009	3720	5.8	0.8588251	24.5	0.899	2.00E-08	5.66E-05	
12/29/2009	4380	5.7	0.9588251	24.5	0.899	1.92E-08	5.43E-05	
12/29/2009	5040	5.6	1.0588251	24.5	0.899	1.86E-08	5.28E-05	

SUMMARY

ka = 1.96E-08 cm/sec — Acceptance criteria = 25 %

k			Vm	
k1 =	2.08E-08	cm/sec	5.9	%
k2 =	2.00E-08	cm/sec	1.7	%
k3 =	1.92E-08	cm/sec	2.4	%
k4 =	1.86E-08	cm/sec	5.2	%

$$Vm = \frac{|ka - ki|}{ka} \times 100$$

Hydraulic conductivity	k =	**1.96E-08**	cm/sec	**5.57E-05**	ft/day
Void Ratio	e =	**0.67**			
Porosity	n =	**0.40**			
Bulk Density	γ =	**2.04**	g/cm³	**127.1**	pcf
Water Content	W =	**0.36**	cm³/cm³	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**2.01E-13**	cm²	(at 20 deg C)	

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903-758-8245 Fax

ENVIRONMENTAL LOG

Client: Flint Creek Power Plant

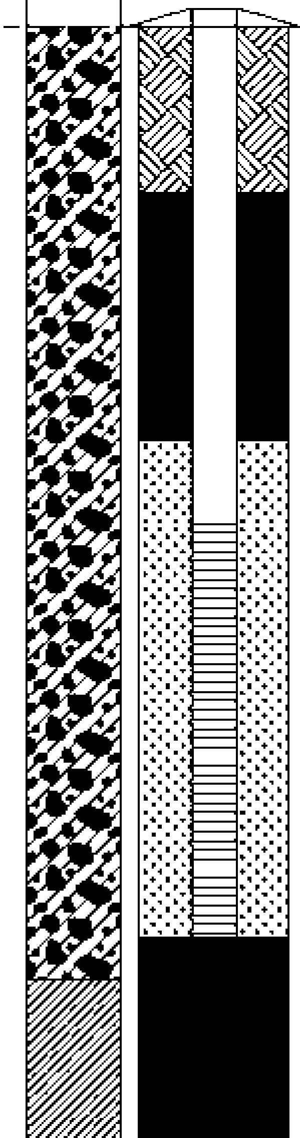
Project No: G3243-09 **Phase** **Task**

Well No. B-1

Location Gentry, Arkansas

Surface Elev.

Depth Feet Sampler	Overburden/Lithologic Description	Field Strength Data	Graphic Log	Well Construction Graphics	Depth Feet	Well Construction Details
						T.O.C. Elev.
0	Ground Surface				0	
	CLAYEY GRAVEL(GC) red and tan					
5					5	
	–dense					
	–red, tan, and white medium dense					
10					10	
15					15	
	–native soil					
	–gray, tan, and red; moist					
20					20	
	LEAN CLAY(CL) red and tan; saturated					
25					25	



Continued Next Page

Driller Tommy Cook

Logged By James Griffith

Drilling Started 11/3/09

Drilling Completed 11/3/09

Construction Completed

Development Completed

Type of Well

Drilling Method Rotary Wash

Borehole Diameter 6.5"

Well Casing 2.0" **Dia.** 0.0' **to** 12.0'

Casing Type PVC

Well Screen 2.0" **Dia.** 12.0' **to** 22.0'

Screen Type Slotted

Slot Size 0.010"

Grout Type Bentonite

Bentonite Seal 0-4' & 22-48'

Filter Pack Qty. 10-22'

Filter Pack Type 20/40 Sand

Static Water Level

Notes: Seepage @ 25' while drilling.

ETTL Engineers & Consultants Inc.

AEPFC000084

ENVIRONMENTAL LOG

Client: Flint Creek Power Plant

Project No: G3243-09 Phase Task

Well No. B-1

Location Gentry, Arkansas

Surface Elev.

Depth Feet Sampler	Overburden/Lithologic Description	Field Strength Data	Graphic Log	Well Construction Graphics	Depth Feet	Well Construction Details
	Continued from previous page					
	SANDY FAT CLAY(CH) hard; red and tan with gravel					
30					30	
	LEAN CLAY(CL) very stiff; red and tan					
35					35	
	LEAN CLAY WITH SAND(CL) very stiff; red and gray					
40					40	
	LIMESTONE moderately strong; limestone seams ~16" gray crystalline clay; thick bedded; fresh; unfeatured					
45	–RQD<0.25				45	
	Bottom of Boring @ 48'					
50						
55						
60						

ETTL Engineers & Consultants Inc.

AEPFC000085

ENVIRONMENTAL LOG

Client: Flint Creek Power Plant

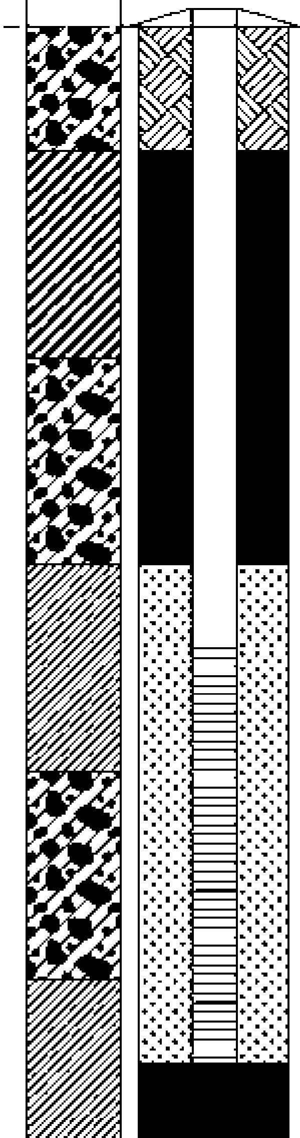
Project No: G3243-09 **Phase** **Task**

Well No. B-2

Location Gentry, Arkansas

Surface Elev.

Depth Feet	Sampler	Overburden/Lithologic Description	Field Strength Data	Depth Feet	Well Construction Details
					T.O.C. Elev.
0		Ground Surface		0	
		CLAYEY GRAVEL(GC) medium dense red and tan with gravel			
		FAT CLAY WITH SAND(CH) stiff red and tan			
5				5	
		CLAYEY GRAVEL(GC) medium dense red and tan with sand and gravel			
10				10	
		SANDY LEAN CLAY(CL) red and tan with gravel			
15				15	
		CLAYEY GRAVEL(GC) medium dense red and tan moist --native soil			
20				20	
		SANDY LEAN CLAY(CL) very stiff red and tan with gravel			
25				25	



Continued Next Page

Driller Tommy Cook

Logged By James Griffith

Drilling Started 11/3/09

Drilling Completed 11/3/09

Construction Completed

Development Completed

Type of Well

Drilling Method Rotary Wash

Borehole Diameter 6.5"

Well Casing 2.0" **Dia.** 0.0' **to** 15.0'

Casing Type PVC

Well Screen 2.0" **Dia.** 15.0' **to** 25.0'

Screen Type Slotted

Slot Size 0.010"

Grout Type Bentonite

Bentonite Seal 0-3' & 25-50'

Filter Pack Qty. 13-25'

Filter Pack Type 20/40 Sand

Static Water Level

Notes: Seepage @ 20' while drilling.

ETTL Engineers & Consultants Inc.

AEPFC000086

ENVIRONMENTAL LOG			Well No. B-2	
Client: Flint Creek Power Plant			Location Gentry, Arkansas	
Project No: G3243-09	Phase	Task	Surface Elev.	Page 2 of 2

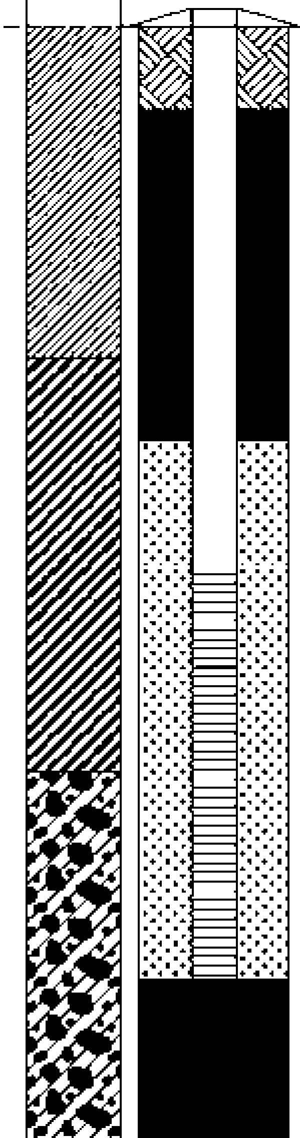
Depth Feet Sampler	Overburden/Lithologic Description	Field Strength Data	Graphic Log	Well Construction Graphics	Depth Feet	Well Construction Details
	Continued from previous page					
30					30	
35					35	
	LIMESTONE ~ 14" thick layer					
	LIMESTONE ~ 8" thick limestone ledge					
40					40	
45					45	
	--rock cuttings RQD<0.25					
	--solid rock seam @ 48'					
50					50	
	Bottom of Boring @ 50'					
55						
60						

ENVIRONMENTAL LOG

Client: Flint Creek Power Plant
Project No: G3243-09 **Phase** **Task**

Well No. B-3
Location Gentry, Arkansas
Surface Elev.

Depth Feet	Sampler	Overburden/Lithologic Description	Field Strength Data	Graphic Log	Well Construction Graphics	Depth Feet	Well Construction Details
							T.O.C. Elev.
0		**Ground Surface**				0	
		SANDY LEAN CLAY(CL) very stiff; gray and tan; with gravel					
		--brown and red; with gravel					
5						5	
		--gray and tan; with gravel					
		SANDY FAT CLAY(CH) stiff; tan and red; with gravel					
10						10	
		--very stiff					
15						15	
		CLAYEY GRAVEL(GC) medium dense; gray and tan; with gravel					
		--native soil					
20						20	
		--brown					
25						25	



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Driller Tommy Cook
Logged By James Griffith
Drilling Started 11/4/09
Drilling Completed 11/4/09
Construction Completed
Development Completed
Type of Well

Drilling Method Rotary Wash
Borehole Diameter 6.5"
Well Casing 2.0" **Dia.** 0.0' **to** 13.0'
Casing Type PVC
Well Screen 2.0" **Dia.** 13.0' **to** 23.0'
Screen Type Slotted
Slot Size 0.010"
Grout Type Bentonite

Bentonite Seal 0-2' & 23-37'
Filter Pack Qty. 13-23'
Filter Pack Type 20/40 Sand
Static Water Level
Notes:

ENVIRONMENTAL LOG

Client: Flint Creek Power Plant

Project No: G3243-09 **Phase** **Task**

Well No. B-3

Location Gentry, Arkansas

Surface Elev.

Depth Feet Sampler	Overburden/Lithologic Description	Field Strength Data	Graphic Log	Well Construction Graphics	Depth Feet	Well Construction Details
	Continued from previous page					
	LIMESTONE rock cuttings					
30	--RQD<0.25				30	
	LIMESTONE					
35					35	
	--RQD<0.25					
	Bottom of Boring @ 37'					
40						
45						
50						
55						
60						

ENVIRONMENTAL LOG

Client: Flint Creek Power Plant

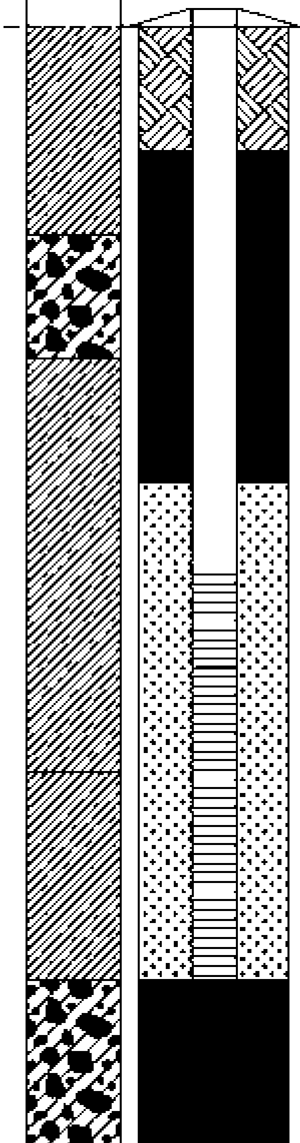
Project No: G3243-09 **Phase** **Task**

Well No. B-4

Location Gentry, Arkansas

Surface Elev.

Depth Feet / Sampler	Overburden/Lithologic Description	Field Strength Data	Graphic Log	Well Construction Graphics	Depth Feet	Well Construction Details
						T.O.C. Elev.
0	Ground Surface				0	
	SANDY LEAN CLAY(CL) stiff; tan and gray; with gravel					
5					5	
	CLAYEY GRAVEL(GC) medium dense; tan and red					
	LEAN CLAY WITH GRAVEL(CL) stiff; red and tan					
10					10	
	--reddish brown and tan					
15					15	
	SANDY LEAN CLAY(CL) very stiff; tan and gray; with gravel					
	--native soil					
20					20	
	CLAYEY GRAVEL(GC) medium dense; tan and red; with gravel					
25					25	



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Driller Tommy Cook	**Drilling Method** Rotary Wash	**Bentonite Seal** 0-3' & 23-50'
Logged By James Griffith	**Borehole Diameter** 6.5"	**Filter Pack Qty.** 13-23'
Drilling Started 11/4/09	**Well Casing** 2.0" **Dia.** 0.0' **to** 13.0'	**Filter Pack Type** 20/40 Sand
Drilling Completed 11/4/09	**Casing Type** PVC	**Static Water Level**
Construction Completed	**Well Screen** 2.0" **Dia.** 13.0' **to** 23.0'	
Development Completed	**Screen Type** Slotted	**Notes:**
Type of Well	**Slot Size** 0.010"	
	Grout Type Bentonite	

ENVIRONMENTAL LOG

Client: Flint Creek Power Plant

Project No: G3243-09 **Phase** **Task**

Well No. B-4

Location Gentry, Arkansas

Surface Elev.

Depth Feet	Sampler	Overburden/Lithologic Description	Field Strength Data	Graphic Log	Well Construction Graphics	Depth Feet	Well Construction Details
		Continued from previous page					
		SANDY LEAN CLAY(CL) very stiff; tan, red, and gray; with gravel					
30						30	
		CLAYEY GRAVEL(GC) loose; tan, gray, and red; saturated					
35						35	
		SANDY LEAN CLAY(CL) very stiff; tan, gray, and red; with gravel					
40						40	
		--soft					
		GRAVEL(GP) white					
45						45	
		SANDY LEAN CLAY(CL) stiff; red; with gravel					
50						50	
		Bottom of Boring @ 50'					
55							
60							

ETTL Engineers & Consultants Inc.

AEPFC000091

STATE OF ARKANSAS
REPORT ON WATER WELL CONSTRUCTION & PUMP INSTALLATION

A

1. Contractor Name & Number: ETTL Engineers & Consultants Inc C# 1401
2. Driller Name & Number: Thomas Cook D# 2418
3. Pump Installer Name & Number: P#
4. Date Well Completed: Nov. 3, 2009 New Well [X] Replace or Work-over [ ]

5 COUNTY	6 FRACTION	7 SECTION	8 TOWNSHIP	9 RANGE
Benton	NE ¼ of SW ¼ of	8	T18N	R33W

10 LOCATE WITH 'X' IN SECTION BELOW

11 LONGITUDE 94 ° 31 ' 29.8 "

11 LATITUDE 36 ° 15 ' 0.3 "

B

1. DESCRIPTION OF FORMATION: DEPTHS IN FEET

B-1	FROM	TO
clayey sand-Red, Tan & Gray	0	22

ATTACH ADDITIONAL SHEETS IF NECESSARY

2. TOTAL DEPTH OF WELL 22 ft
3. DEPTHS TO WATER PRODUCING FORMATIONS. 23
4. STATIC WATER LEVEL Ft below land surface
5. YIELD gallons per [ ] min [ ] hr
6. DIAMETER OF BORE HOLE 6.5 IN

C PUMP REPORT NA

1. TYPE PUMP: SUBMERSIBLE [ ] TURBINE [ ] JET [ ]
2. SETTING DEPTH: FEET
3. BRAND NAME AND SERIAL NUMBERS:
4. RATED CAPACITY gallons per minute
5. TYPE LUBRICATION
6. DROP PIPE OR COLUMN PIPE SIZE
7. WIRE SIZE
8. PRESSURE TANK . . . SIZE, MAKE, MODEL
9. DATE OF INSTALLATION OR REPAIR
10. Is there an abandoned water well on the property?

D

1. LAND OWNER OR OTHER CONTACT PERSON:
   NAME AEP
   STREET ADDRESS 21797 SWEPCO Plant Rd.
   CITY Gentry, AR 72734
2. CASING FROM 0' TO 12' W/ 2 "ID
   FROM TO W/ "ID
   TYPE CASING: PVC
3. SCREEN
   TYPE PVC DIA 2" SLOT/GA 0.010"
   SET FROM 12 FT TO 22 FT
   TYPE: DIA SLOT/GA
   SET FROM FT TO FT
4. GRAVEL PACK FROM 10 FT TO 22 FT
5. BACK FILLED WITH: Bentonite
   FROM 4 FT TO 10 FT
6. SEALED WITH: Cement
   FROM 0 FT TO 4 FT
   FROM FT TO FT
7. DISINFECTED WITH: NA
8. USE OF WELL:
   DOMESTIC [ ] COMMERCIAL [ ]
   IRRIGATION [ ] MONITOR [X]
   LIVESTOCK/POULTRY [ ] TEST WELL [ ]
   OIL/GAS SUPPLY [ ] SEMI-PUBLIC [ ]
   PUBLIC SUPPLY [ ] OTHER
   (A/C HEATPUMP TYPE WELLS)
   SOURCE [ ] RETURN [ ]
   CLOSED LOOP [ ]
9. (For A/C only) Will system also be used for purposes other than Heating or Air Conditioning?
   If yes, name use: yes [ ] no [ ]
10. (For A/C open-loop only) Into what medium is water returned?
11. REMARKS
    Flush mount surface completion
12. SIGNED Thomas Cook DATE 12-2-09

AWW 7 JAN 89
ACI-6946

Arkansas Water Well Construction Commission, 101 East Capitol, Suite 350, Little Rock, AR 72201

COMMISSION COPY

AEPFC000092

STATE OF ARKANSAS
REPORT ON WATER WELL CONSTRUCTION & PUMP INSTALLATION

A

1 Contractor Name & Number: ETTL Engineers & Consultants Inc C# 1401

2 Driller Name & Number: Thomas Cook D# 2418

3 Pump Installer Name & Number: P#

4 Date Well Completed: Nov. 3, 2009 New Well [X] Replace or Work-over [ ]

5 COUNTY	6 FRACTION	7 SECTION	8 TOWNSHIP	9 RANGE
Benton	NE ¼ of SW ¼ of	8	T18N	R33W

10 LOCATE WITH 'X' IN SECTION BELOW

11 LONGITUDE 94 ° 31 ' 28.0 "

11 LATITUDE 36 ° 15 ' 1.5 "

B

1 DESCRIPTION OF FORMATION: DEPTHS IN FEET

B-2	FROM	TO
Clayey Sand- Red & Tan	0	25

ATTACH ADDITIONAL SHEETS IF NECESSARY

2 TOTAL DEPTH OF WELL 25 ft

3 DEPTHS TO WATER PRODUCING FORMATIONS. dry

4 STATIC WATER LEVEL Ft below land surface

5 YIELD gallons per [ ] min [ ] hr

6 DIAMETER OF BORE HOLE 6.5 IN

C

PUMP REPORT NA

1 TYPE PUMP: SUBMERSIBLE [ ] TURBINE [ ] JET [ ]

2 SETTING DEPTH: FEET

3 BRAND NAME AND SERIAL NUMBERS:

4 RATED CAPACITY gallons per minute

5 TYPE LUBRICATION

6 DROP PIPE OR COLUMN PIPE SIZE

7 WIRE SIZE

8 PRESSURE TANK . . . SIZE, MAKE, MODEL

9 DATE OF INSTALLATION OR REPAIR

10 Is there an abandoned water well on the property?

D

1 LAND OWNER OR OTHER CONTACT PERSON:

NAME AEP

STREET ADDRESS 21797 SWEPC Plant Rd.

CITY Gentry, AR 72734

2 CASING FROM 0 TO 15 W/ 2 "ID
FROM TO W/ "ID

TYPE CASING: PVC

3 SCREEN
TYPE: PVC DIA 2" SLOT/GA 0.010
SET FROM 15 FT TO 25 FT
TYPE: DIA SLOT/GA
SET FROM FT TO FT

4 GRAVEL PACK FROM 13 FT TO 25 FT

5 BACK FILLED WITH: Bentonite
FROM 3 FT TO 13 FT

6 SEALED WITH: Cement
FROM 0 FT TO 3 FT
FROM FT TO FT

7 DISINFECTED WITH: NA

8 USE OF WELL:

DOMESTIC	[ ]	COMMERCIAL	[ ]
IRRIGATION	[ ]	MONITOR	[X]
LIVESTOCK/POULTRY	[ ]	TEST WELL	[ ]
OIL/GAS SUPPLY	[ ]	SEMI-PUBLIC	[ ]
PUBLIC SUPPLY	[ ]	OTHER	

(A/C HEATPUMP TYPE WELLS)

SOURCE	[ ]	RETURN	[ ]
CLOSED LOOP	[ ]		

9 (For A/C only) Will system also be used for purposes other than Heating or Air Conditioning?
If yes, name use: yes [ ] no [ ]

10 (For A/C open-loop only) Into what medium is water returned?

11 REMARKS
Flush mount surface completion

12 SIGNED Thomas Cook DATE 12-4-09

AWWC 7 JAN 89 Arkansas Water Well Construction Commission, 101 East Capitol, Suite 350, Little Rock, AR 72201
ACI 5946

COMMISSION COPY

AEPFC000093

STATE OF ARKANSAS
REPORT ON WATER WELL CONSTRUCTION & PUMP INSTALLATION

A
1 Contractor Name & Number: ETTL Engineers & Consultants Inc C# 1401
2 Driller Name & Number: Thomas Cook D# 2418
3 Pump Installer Name & Number: P#
4 Date Well Completed: Nov. 4, 2009 New Well [X] Replace or Work-over [ ]

5 COUNTY	6 FRACTION	7 SECTION	8 TOWNSHIP	9 RANGE
Benton	SE ¼ of NW ¼ of	8	T18N	R33W

10 LOCATE WITH 'X' IN SECTION BELOW

11 LONGITUDE 94 ° 31 ' 26.9 "
11 LATITUDE 36 ° 15 ' 7.0 "

B
1 DESCRIPTION OF FORMATION: DEPTHS IN FEET

B-3	FROM	TO
Clayey Sand-Gray, Tan and Red	0	23

ATTACH ADDITIONAL SHEETS IF NECESSARY

2 TOTAL DEPTH OF WELL 23 ft
3 DEPTHS TO WATER PRODUCING FORMATIONS. 11.5
4 STATIC WATER LEVEL Ft below land surface
5 YIELD gallons per ☐ min ☐ hr
6 DIAMETER OF BORE HOLE 6.5 IN

C
PUMP REPORT NA
1 TYPE PUMP: SUBMERSIBLE ☐ TURBINE ☐ JET ☐
2 SETTING DEPTH: FEET
3 BRAND NAME AND SERIAL NUMBERS:
4 RATED CAPACITY gallons per minute
5 TYPE LUBRICATION
6 DROP PIPE OR COLUMN PIPE SIZE
7 WIRE SIZE
8 PRESSURE TANK . . . SIZE, MAKE, MODEL
9 DATE OF INSTALLATION OR REPAIR
10 Is there an abandoned water well on the property?

D
1 LAND OWNER OR OTHER CONTACT PERSON:
NAME AEP
STREET ADDRESS 21797 SWEPCO Plant Road
CITY Gentry, AR 72734

2 CASING FROM 0' TO 13' W/ 2 "ID
FROM TO W/ "ID
TYPE CASING: PVC

3 SCREEN
TYPE: PVC DIA 2" SLOT/GA 0.010"
SET FROM 13 FT TO 23 FT
TYPE: DIA SLOT/GA
SET FROM FT TO FT

4 GRAVEL PACK FROM 10 FT TO 23 FT
5 BACK FILLED WITH: Bentonite
FROM 2 FT TO 10 FT
6 SEALED WITH: Cement
FROM 0 FT TO 2 FT
FROM FT TO FT
7 DISINFECTED WITH: NA

8 USE OF WELL:

DOMESTIC	☐	COMMERCIAL	☐
IRRIGATION	☐	MONITOR	☒
LIVESTOCK/POULTRY	☐	TEST WELL	☐
OIL/GAS SUPPLY	☐	SEMI-PUBLIC	☐
PUBLIC SUPPLY	☐	OTHER	

(A/C HEATPUMP TYPE WELLS)
SOURCE ☐ RETURN ☐
CLOSED LOOP ☐

9 (For A/C only) Will system also be used for purposes other than Heating or Air Conditioning?
If yes, name use: yes ☐ no ☐
10 (For A/C open-loop only) Into what medium is water returned?
11 REMARKS
Flush mount surface completion
12 SIGNED Thomas Cook DATE 12-8-09

COMMISSION COPY

STATE OF ARKANSAS
REPORT ON WATER WELL CONSTRUCTION & PUMP INSTALLATION

A 1 Contractor Name & Number: ETTL Engineers & Consultants Inc C# 1401
2 Driller Name & Number: Thomas Cook D# 2418
3 Pump Installer Name & Number: P#
4 Date Well Completed: Nov. 4, 2009 New Well [X] Replace or Work-over [ ]

5 COUNTY	6 FRACTION	7 SECTION	8 TOWNSHIP	9 RANGE
Benton	SE ¼ of NW ¼ of	8	T18N	R33W

LONGITUDE 11 94 ° 31 ' 27.8 "
LATITUDE 11 36 ° 15 ' 8.9 "

10 LOCATE WITH 'X' IN SECTION BELOW

B 1 DESCRIPTION OF FORMATION: DEPTHS IN FEET

B-4	FROM	TO
Clayey Sand-Tan, Gray and Red	0	23

ATTACH ADDITIONAL SHEETS IF NECESSARY

2 TOTAL DEPTH OF WELL 23 ft
3 DEPTHS TO WATER PRODUCING FORMATIONS 23
4 STATIC WATER LEVEL 7.5 Ft below land surface
5 YIELD gallons per [ ] min [ ] hr
6 DIAMETER OF BORE HOLE 6.5 IN

C PUMP REPORT NA
1 TYPE PUMP: SUBMERSIBLE [ ] TURBINE [ ] JET [ ]
2 SETTING DEPTH: FEET
3 BRAND NAME AND SERIAL NUMBERS:
4 RATED CAPACITY gallons per minute
5 TYPE LUBRICATION
6 DROP PIPE OR COLUMN PIPE SIZE
7 WIRE SIZE
8 PRESSURE TANK . . . SIZE, MAKE, MODEL
9 DATE OF INSTALLATION OR REPAIR
10 Is there an abandoned water well on the property?

D 1 LAND OWNER OR OTHER CONTACT PERSON:
NAME AEP
STREET ADDRESS 21797 SWEPCO Plant Rd.
CITY Gentry, AR72734

2 CASING FROM 0' TO 13' W/ 2 "ID
FROM TO W/ "ID
TYPE CASING: PVC

3 SCREEN
TYPE PVC DIA 2" SLOT/GA 0.010
SET FROM 13 FT TO 23 FT
TYPE: DIA SLOT/GA
SET FROM FT TO FT

4 GRAVEL PACK FROM 11 FT TO 23 FT
5 BACK FILLED WITH: Bentonite
FROM 3 FT TO 11 FT
6 SEALED WITH: Cement
FROM 0 FT TO 3 FT
FROM FT TO FT
7 DISINFECTED WITH NA

8 USE OF WELL:
DOMESTIC [ ] COMMERCIAL [ ]
IRRIGATION [ ] MONITOR [X]
LIVESTOCK/POULTRY [ ] TEST WELL [ ]
OIL/GAS SUPPLY [ ] SEMI-PUBLIC [ ]
PUBLIC SUPPLY [ ] OTHER

(A/C HEATPUMP TYPE WELLS)
SOURCE [ ] RETURN [ ]
CLOSED LOOP [ ]

9 (For A/C only) Will system also be used for purposes other than Heating or Air Conditioning?
If yes, name use. yes [ ] no [ ]
10 (For A/C open-loop only) Into what medium is water returned?
11 REMARKS
Flush mount surface completion
12 SIGNED Thomas Cook DATE 12-9-09

COMMISSION COPY

AEPFC000095

CONTRACT

SOUTHWESTERN ELECTRIC POWER COMPANY

MACHEN CONSTRUCTION COMPANY

FLINT CREEK POWER PLANT

SITE WORK

SEPTEMBER 6, 1974

OWNER'S COPY

SOUTHWESTERN ELECTRIC POWER COMPANY

Shreveport, Louisiana

This agreement made this 18th day of February, 1975, by and between Machen Construction Company, (hereinafter called the "Contractor"), Little Rock, Arkansas, and Southwestern Electric Power Company, (hereinafter called the "Owner").

WITNESSETH:

(1) This contract is to be performed by Machen Construction Company (Contractor), within the State of Arkansas, and the parties hereto covenant and agree that it is and shall be construed as an Arkansas Contract, in accordance with the laws of the State of Arkansas, and the parties hereto shall have all the rights, privileges, remedies and immunities applicable under the laws of said State.

(2) Contractor agrees to complete the plant site clearing, grubbing and grading, railroad bed construction, ash pit dike construction and related work, and excavation and embankment for the Generating Plant area, as set forth in the Specifications, at Owner's Flint Creek Power Plant site located in Benton County, approximately two and one-half (2-1/2) miles southwest of Gentry, Arkansas.

(3) Contractor agrees to do the work in accordance with the Specifications and Drawings attached hereto and made a part hereof. Any changes in the Specifications or Drawings will not be a part of this contract until ordered in writing by the Owner.

(4) Contractor agrees to furnish in good operating condition all construction equipment, tools and supplies necessary to complete the work in the time set forth in paragraph 6.

(5) Contractor covenants, represents, and warrants:

(a) That all applicable provisions of Executive Order No. 11,246, dated September 24, 1965, the Rules and Regulations promulgated thereunder by the Office of Federal Contract Compliance of the United States Department of Labor, and all applicable requirements of the Equal Employment Opportunities subchapter of the Civil Rights Act of 1964, have been fully met and observed in respect of the manufacture of the materials and equipment or the performance of services covered by this order;

FLINT CREEK POWER PLANT

SOUTHWESTERN ELECTRIC POWER COMPANY

GENERAL CONDITIONS

1. GENERAL

These specifications cover the Plant Area clearing and grubbing, plant site and coal yard grading, ash pit dike construction and related work, railroad bed construction, excavation and embankment for generating plant area, and other work as per attached drawing(s) and the following specifications. We have attempted to list all major requirements of construction, and any requirements not specifically covered by these specifications and/or drawings, but essential to the accomplishment of this project as proposed herein will be considered a part of the contract price to satisfactorily complete this job.

2. DRAWINGS

Drawings will show the scope of the work. All such drawings shall be considered as a part of these specifications.

3. INTERPRETATION OF DRAWINGS AND BIDDING DOCUMENTS

If any Contractor contemplating submission of a bid for the proposed work is doubtful as to the true meaning of any part of the specifications, or other contract documents, or finds discrepancies in or omissions from the drawings or specifications, he shall submit to Southwestern Electric Power Company, hereinafter referred to as "Owner", a written request for interpretation or correction thereof. Interpretation or correction of the contract documents will be mailed or delivered to each Contractor receiving a set of documents. The Owner will not be responsible for any other explanations or interpretation of the proposed documents.

4. CHANGES AND ALTERATIONS

The Owner, through its inspector or accredited representative, will have the right to make such changes and alterations in the quantities of work as may be considered necessary or desirable, and such changes shall not be considered as a waiver of any condition of the contract, nor shall they invalidate any of the provision thereof. The Contractor shall perform the work as increased or decreased, and no allowances will be made for anticipated profits. Altered quantities will be paid for at the contract unit price.

beyond the control of the party affected, including, but not limited to, acts of governmental authority, acts of God, strikes or other concerned acts of workmen, unavailability or substitution or diversion of labor or materials and operating equipment, fires, floods, explosions, riots, war, rebellion, and sabotage, but the foregoing shall not be considered a waiver of either party's obligations under this agreement.

21. PROTECTION OF ADJOINING PROPERTY

The said Contractor shall take proper means to protect the adjacent or adjoining property or properties in any way encountered, or which may be injured or seriously affected by any process of construction, to be undertaken under this agreement, from all damage or injury by reason of said process of construction; and he shall be liable for any and all claims for such damage on account of his failure to fully protect all adjoining property. The Contractor shall be responsible for the protection from damage by fire, falling trees or any other cause resulting from the contract work, of the property, crops, timber, grass, livestock, fences, gaps, gates, cattleguards, buildings, or any other assets of adjoining landowners. The Contractor shall be responsible for the repair of such damaged property and shall make repairs without delay.

22. HEADINGS OF ARTICLES

The headings of articles, sections, paragraphs, and other parts of the contract are for convenience only and do not define, limit or construe the contents thereof.

23. PAYMENT

A. Purchaser agrees to pay the Contractor monthly as the work is completed but the total of such payments on account shall at no time exceed ninety percent (90%) of the mutually agreed upon value of the work completed.
B. Ten percent (10%) upon completion of work and accept.
C. Owner shall furnish engineering required to determine quantities for payment.

24. PROTECTION OF BENCHMARKS

Benchmarks, stakes, marks, etc., shall be carefully preserved by the Contractor, and in case of careless destruction or removal by him or his employees, such benchmarks, stakes, marks, etc., shall be replaced by the Owner at the Contractor's expense.

25. ENGINEER

Whenever the word Engineer is used in this contract, it shall be understood as referring to the Owner's authorized engineer or supervisor unless specifically noted otherwise.

JOB SPECIFICATIONS
FOR
ASH PIT DIKES
FLINT CREEK POWER PLANT

GENERAL DESCRIPTION

The coal fired plant will require an area for storage of ash. A forty-one (41) acre pit will be utilized as a settling area for ash. A smaller pit will be used as a secondary settling area. The effluent of this secondary will then flow into the main lake.

This specification will cover construction of the containment dikes, clearing the primary and secondary settling basins, building the interconnecting canal and excavating within the secondary basin. Cross sections of the dikes and interconnecting canal are shown on FCX-3. Areas to be excavated or filled are shown on FCX-4.

This specification will also cover the placement of temporary culverts under the dikes and construction of a spillway connecting the secondary ash settling basin to the lake as shown on Drawing FCX- 4 .

JOB SPECIFICATION
FLINT CREEK - UNIT 1
SOUTHWESTERN ELECTRIC POWER COMPANY

ASH PIT DIKES

SCOPE OF WORK

Construction of ash pond DIKES, including clearing, grubbing, placing compacted fill, structures on dike pipes through dike. Wier box complete by others

1-1 WORK FURNISHED AND INSTALLED OR PERFORMED: Contractor shall furnish, fabricate, deliver and unload materials and equipment for, shall store, protect and remove materials and equipment from storage for, and shall install, construct, erect or perform and finish the following WORK:

a. Earthwork, including clearing and grubbing, excavation, backfilling, filling and soil compaction control.

b. Construction of earth dikes along the sides and within the ASH Storage Area.

c. Miscellaneous Construction including concrete work, metalwork, carpentry work, and galvanized corrugated metal pipes.

d. Grass work, including soil preparation, seeding, fertilizing and maintenance.

e. Bedding courses and riprap as shown on the drawing.

1-2 RESPONSIBILITY FOR RESTRICTION OF NATURAL DRAINAGE DURING FILL PLACEMENT:

Contractor shall not place any fill for dikes, etc., across routes of natural drainage until provisions are made to drain surface runoff into drainage ditches forming a part of the WORK.

No surface runoff shall be ponded or restricted to a greater degree than would have occurred naturally either before the beginning of construction or after completion of the WORK, unless approved by Purchaser's representative.

Should ponding or restriction of surface runoff result in water being backed up onto property not owned by Purchaser or onto Purchaser's property where work by other contractors is either under way or completed or where materials or equipment are being stored, all damages resulting therefrom shall be responsibility of Contractor.

Temporary Slopes: Temporary construction slopes in excavation or in fill used for temporary drainage channels shall not be steeper than 3 horizontal to 1 vertical, except as indicated on the drawings or as approved.

ASH PIT DIKES

SOUTHWESTERN ELECTRIC POWER COMPANY

DIVISION 2 - TECHNICAL REQUIREMENTS

SECTION 2-1: EARTHWORK

2-1.1 SECTION SCOPE

2-1.1.1 This section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated), or as required to properly complete the WORK:

2-1.2 Services of Testing Laboratory
2-1.3 Soil Data and Topography
2-1.4 Removal of Sod and Topsoil
2-1.5 Excavation
2-1.6 Compacted Fill
2-1.7 Equipment
2-1.8 Fill Placement
2-1.9 Backfill
2-1.10 Excavation & Fill for Corrugated Metal Drainage Piping
2-1.11 Drainage Ditches
2-1.12 Bedding Course for Riprap
2-1.13 Riprap
2-1.14 Grading
2-1.15 Seeding

2-1.2 SERVICES OF TESTING LABORATORY
Will be furnished by Purchaser for use in connection with controlled compacted fill, as specified in Article 6.2 of Form 1714.

2-1.3 SOIL DATA AND TOPOGRAPHY
As specified in Article 2 of Form 1714. Drawings are included, and borings will be available for inspection at SWEPCo or Stewart, White & Associates, Inc.

2-1.4 REMOVAL OF SOD AND TOPSOIL
As specified in Article 4.6 of Form 1714. Stockpile topsoil on site, where and as requested by Purchaser's representative, for later reuse. Dispose of sod on site as requested by Purchaser's representative.

2-1.5 EXCAVATION

2-1.5.1 As specified in Article 5 of Form 1714. Dispose of all excavated materials on site, either as fill material or in stockpile area, as requested by Purchaser's representative. The Contractor's unit pri
excavation shall be based on a free haul distance of 2000 feet. In the event that the Contr
required to haul dirt in excess of the 2000 foot free haul distance he shall be paid at the un
id for overhaul per yard - quarter. Item 140 (Overhaul) of the 1972 Texas Highway Standar
ification is hereby referenced as the governing specification. The 2000 foot free haul distan
substituted for the 600 foot free haul distance specification in Item 140. Approval and author
in writing from the Engineer must be obtained before payment will be made for overhaul.

2-1.5.2 Area of stockpile shall be cleaned of vegetation and disposed of as specified in Article 4.5 of Form 1714.

2-1.5.3 Dewatering: As specified in Article 5.3 of Form 1714 and as indicated on the design drawings. During course of the WORK, Contractor shall maintain sufficient slope in excavation and on fill area to permit drainage of surface water and maintaining a dry working condition.

2-1.6 COMPACTED FILL

2-1.6.1 Conform to the applicable requirements of Article 6 of Form 1714 and requirements hereinafter specified.

2-1.6.2 Class and Type: One of the following as indicated on the drawings:

a. Class 1, Regular Compacted Fill, Type RCF1, Granular Material.

b. Class 1, Regular Compacted Fill, Type RCF2, Cohesive Material.

c. Class 2, Controlled Compacted Fill, Type CCF1, Granular Material.

d. Class 2, Controlled Compacted Fill, Type CCF2, Cohesive Material.

2-1.6.3 Material: Shall be impervious fill material obtained from excavation and borrow areas on site as indicated on the drawings, or from other approved stockpiles or borrow areas off site. All sources of dike fill shall be designated and approved by the Purchaser's representative. The fill material shall not contain any cobbles or broken rock larger than nine (9) inches maximum dimension at time of placement and compaction.

2-1.6.4 Compaction Densities: Dike fill shall be loosely placed in layers not exceeding ten (10) inches. Each layer of fill shall be thoroughly compacted by means of a sheepsfoot roller or pneumatic tired rollers of adequate capacity and through sufficient coverages to obtain not less than 90 percent of the maximum Modified Proctor density in accordance with ASTM Test D1557, latest edition.

2-1.6.5 Disposal of Organic Materials: Vegetation, organic material, and other foreign materials removed in preparation of subgrade, as specified in Articles 6.3.3 and 6.4.3.2 of Form 1714, shall be disposed of on the site as requested by Purchaser's representative.

2-1.6.6 Preparation of Subgrade: Prior to placement of fill material and after stripping, the subgrade shall be compacted (proofrolled) through sufficient passes of an approved sheepsfoot roller capable of densifying the present surface to not less than 90 percent of the maximum Modified Proctor density in accordance with ASTM Test D1557.

2-1.7 EQUIPMENT

2-1.7.1 Compaction Equipment: Equipment to be used for constructing fill may consist of any type normally considered suitable to construct embankments for dams or highways. Main compaction equipment, including heavy pneumatic tired rollers, sheepsfoot rollers, vibratory compactors, shall be subject to approval of Purchaser's representative.

a. In addition to the foregoing equipment, Contractor shall have the following equipment available at the WORK:

a.1 Power tampers to be used for compaction of material in areas where it is impractical to use a roller or tractor.

a.2 A plain cylindrical roller, weighing not less than 1,000 pounds per lineal foot for rolling the surface of fill smooth for drainage in case of heavy precipitation.

a.3 Discs, harrows, and motor graders for drying and maintaining fill.

2-1.8 FILL PLACEMENT

2-1.8.1 As specified in Paragraph 6.4.5 of Form 1714, and as follows:

a. Distribution and gradation of materials throughout rolled fill shall be such that fill will be free from lenses, pockets, streaks or layers of material differing materially in texture or gradation from surrounding material. Combined excavation and placing operations shall be such that materials when compacted in the fill will be blended sufficiently to secure the best practicable degree of compaction, and stability. Travel on the fill shall be satisfactorily controlled to prevent tracking or cutting fill.

b. Successive loads of material shall be dumped so as to produce the best practicable distribution of material, and for this purpose locations in earth fill where individual loads shall be deposited may be designated. If the surface of any layer of material to be placed thereon has formed a hard over-compacted crust from traffic, it shall be moistened or both moistened and scarified as required before the succeeding layer of material is placed.

c. When rain is expected, and at the end of each working day, fill shall be rolled with a plain cylindrical roller to form a smooth surface with sufficient slope to cause rapid runoff of rainwater. Before resuming placement, this surface shall be scarified and moistened, as required. If Purchaser's representative determines that the rolled surface of any layer of earth fill in place is too wet for proper compaction of fill thereon, it shall be removed, allowed to dry, or shall be worked with a harrow, scarifier or other suitable equipment, to reduce water content to the required amount, and then shall be recompacted. Do not place the next succeeding layer of fill until approval to proceed is given by Purchaser's representative and the Consulting Engineers.

d. All openings through embankments required for construction and temporary drainage purposes shall be subject to approval. Approach or construction ramps for dikes and embankments shall be removed and those on the outside face shall be removed and/or trimmed, as requested.

2-1.9 BACKFILL

2-1.9.1 As specified in Article 7 of Form 1714.

2-1.9.2 Material shall be same as indicated in Article 2-1.6.3 for Compacted Fill.

2-1.10 EXCAVATION AND FILL FOR CORRUGATED METAL DRAIN PIPING

As specified in Article 9 of Form 1746.

2-1.11 DRAINAGE DITCHES

Cut and/or fill drainage ditches (if required) to cross sections and profiles indicated on the drawings. All surfaces shall be well compacted.

2-1.13 RIPRAP

2-1.13.1 Material:

a. Riprap shall consist of quarried stone, or other stone, free from structural defects and of approved quality. Stone containing shale, unsound sandstone or any other material which will readily disintegrate under handling and placing or weathering, shall not be used. Any stone which is free from incipient fractures and seams and has given evidence of ability to withstand weathering after long exposure to the elements shall be considered suitable for this purpose. Upon presentation of satisfactory evidence of ability to withstand weathering, such stone may be used without laboratory testing.

b. In case newly quarried stone or stone of questionable weathering quality is proposed, it shall be subjected to the sodium sulphate soundness test and shall show a loss, after cycles, of not more than 25 percent. Materials failing this test may be approved if, when subjected to fifty cycles of freezing and thawing, it has a loss not greater than 25 percent. Soundness method AASHO T104 (ASTM C88), "Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate" or T103, "Method of Test for Soundness of Aggregates by Freezing and Thawing" shall be used.

c. The moist unit weight of riprap shall not be less than 164 pounds per cubic foot.

2-1.13.2 Size and Gradation

a. Riprap shall be reasonably well graded and quarried stone shall have a gradation conforming to the following weight limits:

a.1 Maximum size................................450 lbs.

a.2 At least 25 percent greater than..............200 lbs.

a.3 45 percent - 75 percent from - to.............80-120 lbs.

a.4 Not more than 25 percent less than............50 lbs.

a.5 Sand and rock dust not more than..............5 percent

b. The shortest dimension of any stone shall be not less than 1/3 of the longest dimension for at least 60 percent of the riprap. For the balance, the shortest dimension shall be not less than 1/5 of the longest dimension.

c. Alternate sizes and gradations will be considered for the WORK if they will achieve the desired performance at less cost. If an alternate is proposed, size and gradation of alternate shall be stated in the Bid Proposal, together with the price saving.

2-1.13.3 Placing:

a. Riprap shall be placed by dragline, clamshell or similar equipment which shall be operated so as to place each load of material in approximately its final position without further reworking, and without excessive height of drop.

b. Placement operations, including handling, stockpiling and transporting, shall be accomplished in such manner so as to produce a reasonably well graded mass of rock with minimum percentage of voids, free from objectionable pockets of small stones and clusters of large stones and having a reasonably regular finished surface.

c. Riprap shall be placed on the face of the dikes to the lines and grades and to the minimum thickness indicated on the drawings. The riprap shall be placed to this full minimum thickness in one operation. Thickness shall not be less than the minimum at any point. Hand placing to a limited extent may be required, but only to the extent necessary to secure results specified foregoing.

d. In no case shall a bulldozer be used in shaping the riprap slopes.

2-1.14 GRADING

As specified in Article 8 of Form 1714, and as indicated on the drawings.

2-1.15 SEEDING

2-1.15.1 All slopes and surfaces, as indicated on the drawings, shall be seeded as hereinafter specified.

2-1.15.2 Topsoil:

a. Material: Approved topsoil from topsoil previously excavated and stockpiled on the site or approved topsoil from sources off the property or both.

b. Placing:

b.1 Spread topsoil evenly to a depth which, after settlement and compaction, shall be 4 inches. Do not spread when ground or topsoil is excessively wet or otherwise in any condition detrimental to the work; if existing surface has become hardened or crusted, rake or otherwise break up to provide bond with layer of topsoil.

b.2 After spreading has been completed, rake up and remove large clods, stones larger than 2 inches in any dimension, roots, stumps, and other litter or deleterious material.

b.3 Completed finish grading shall provide a smooth grade, true to indicated elevations, cross sections and profiles, properly drained and free from pockets or high spots, and as approved for subsequent fertilizing and seeding operations as hereinafter specified.

2-1.15.3 Fertilizing:

a. Material: Ready-mixed material having an analysis of 16-8-8 nitrogen, available phosphoric acid and water soluble potash. Deliver to job in sealed containers with weight, analysis, and name of manufacturer clearly indicated on each container.

b. Storage: Store in such a manner as will not impair fertilizer's effectiveness.

c. Coverage: 300 lbs. per acre.

2-1.15.4 Seeding:

a. Seeding Time: Do fertilizing and seeding as soon as possible after completion of finish topsoil work. However, do no fertilizing or seeding during windy weather or when ground is wet or in an otherwise untillable condition.

b. Seed:

b1. Seed shall be un-Hulled Bermuda and Rye grass with purity and germination of 95 and 90, respectively.

b2. Coverage: Bermuda 5 lbs. per 1000 SY - Rye grass 21 lbs. per 1000 SY

b3. All seed shall comply with all applicable laws and regulations of the State of Arkansas and of U.S. Department of Agriculture.

c. Have seed delivered to job in sealed containers.

d. Furnish to Purchaser duplicate signed copies of statement by seed vendor that each lot of seed has been tested by a recognized laboratory for seed testing within six months of date of delivery, and complies with all requirements for the specified seed.

e. Protection: Immediately after seeding, cover seeded areas with two (2) tons per acre of straw mulch and anchor this by spraying with cutback asphalt (RC-3) at the rate of .10 gallon per sq. yd.

f. Sowing and Maintaining, Etc.: Methods of preparation of seed beds, fertilizing, seeding, sprinkling, maintaining, repair, and reseeding as required will be at option of Contractor. Work shall not be considered complete until after a uniform and dense stand of healthy grass has been produced in accordance with these specifications, free from bare spots and gullies formed by erosion, and when accepted in writing by Purchaser.

SARGENT & LUNDY
ENGINEERS
CHICAGO

ASH PIT DIKES

SOUTHWESTERN ELECTRIC POWER COMPANY
FLINT CREEK POWER PLANT - UNIT #1
DIVISION 2 - TECHNICAL REQUIREMENTS

SECTION 2-2: CLEARING AND GRUBBING

2-2.1 SECTION SCOPE

2-2.1.1 This Section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated, or as required to properly complete the WORK

2-2.1.2 Requirements of Division 1, General Requirements, also apply to the WORK under this Section 2-2.

2-2.2 TREE REMOVAL AND CLEARING

2-2.2.1 Conform to applicable requirements of Article 4 of Form 1714, and to requirements hereinafter specified.

2-2.2.2 Tree Removal:

a. Clear and grub all trees in the following areas.

1. Dike borrow areas.

2. Within the toes (the entire base) of lake and ash pond dikes.

b. All other trees within the lake and ash pond dikes shall be shear dozed at ground level.

c. Remove and dispose of off the site all partially buried logs, down timber, snags, brush, hedges, bushes and all other vegetation or organic material, all rubbish, debris and other foreign or objectionable material above ground surface.

d. Remove all floating debris in swampy areas and dispose of off site. Cut all trees in swampy areas as directed by Owner's Engineer.

2-2.2.3 CLEARING

a. Contractor shall have full property rights to all timber cut by him, and may sell, off the site only, all merchantable timber which he cuts. Merchantable timber may be processed either on the site or off the site, as agreed to with Purchaser, but shall all be removed from the site before completion of the WORK.

2-2.2.4 ESTIMATED QUANTITY: 50 acres clearing
12 acres clearing and grubbing

2-2.2.5 BASIS FOR PAYMENT: Price per acre clearing
Price per acre clearing and grubbing

STANDARD SPECIFICATION FOR
EARTHWORK

(Form 1714)

1 GENERAL

1.1 Earthwork shall conform to the requirements of this Standard Specification, the Job Specification, and the design drawings. In the event of variance between this Standard Specification and the Job Specification or design drawings, the Job Specification and the design drawings shall take precedence

1.2 Where the terms "as indicated" or "indicated" are used in this Standard Specification, they shall mean "as shown, noted, called for or specified".

1.3 All references to the following publications are to the latest issue of each, together with the latest additions and/or amendments thereto, as of the date of Contract, unless otherwise indicated; references to the sponsoring agencies will be made in accordance with the abbreviations indicated:

1.3.1 ASTM .... American Society for Testing and Materials Standard Specifications.

1.3.2 ASA .... American Standards Association Standard Specifications.

1.3.3 AASHO .... American Association of State Highway Officials Standard Specifications.

2. SOIL DATA AND TOPOGRAPHY

2.1 Soil Data: Drawings show borings made at site, and logs given thereon indicate character of soil. This information furnished for Contractor's convenience; in using it Contractor assumes the risk, as Purchaser and the Consulting Engineers assume no responsibility for accuracy of information shown thereon. Contractor will be permitted to make his own soil investigations, but same shall be made at no cost to Purchaser.

2.2 Topography: Drawings indicate elevations, dimensions and/or cross sections, profiles and contour lines of existing ground. This information furnished for Contractor's convenience; in using it Contractor assumes the risk, as Purchaser and the Consulting Engineers assume no responsibility for accuracy of information shown thereon. Contractor will be permitted to make his own investigation of topography during bid period, but same shall be made at no cost to Purchaser.

3. LINES AND GRADES

3.1 Contractor shall lay out lines and grades from existing base lines and bench marks on property and be fully responsible for correctness of such lines and grades and for proper execution of WORK to such lines and grades

3.2 Purchaser reserves right to verify correctness of lines and grades during progress of WORK. Such verification by Purchaser will not relieve Contractor of responsibility as specified foregoing.

3.3 Contractor shall notify Consulting Engineers of any differences in location of existing work from that indicated, wherever such differences may affect new work.

3.4 Contractor shall preserve and maintain all bench marks and reference points established by Purchaser. Should Contractor, during prosecution of WORK, destroy or remove any bench marks and/or reference points established by Purchaser, the cost to Purchaser of re-establishing these bench marks and/or reference points will be charged to Contractor.

4 CLEARING

4.1 Prior to performing excavation or fill work, areas in which such work is to be done shall be cleared, grubbed and the top soil and sod removed. No clearing, grubbing or removal of top soil and sod shall be done outside designated areas without specific approval.

4.2 If extensive clearing, grubbing and removal of top soil and sod is required, the Job Specification or drawings will specifically so indicate. If such work is incidental, then it will not be specifically indicated and shall be performed prior to, but as part of, excavation work.

4.3 Clearing:

4.3.1 Clearing is defined as removal and disposal of all trees, down timber, snags, brush, hedges, bushes and all other vegetation or organic materials, and also all rubbish, debris or other foreign or objectionable materials above ground surface, except removal of sod and top soil.

4.3.2 Removal of structures, such as buildings, roadways, fences, etc., is classified as demolition and not as clearing, and will be indicated in the Job Specification (under Demolition Work) or on drawings.

4.3.3 Trees shall be filled in such manner as not to damage other trees or other vegetation which are to remain in place nor damage existing structures and facilities nor constitute a hazard to traffic or life.

4.4 Grubbing: Grubbing is defined as removal and disposal of all stumps, large roots, buried logs and all other objectionable material from below ground surface. Explosives may be used only if specifically approved and their use shall conform to all applicable laws and safety regulations.

4.5 Disposal:

4.5.1 All materials from clearing and grubbing operations shall be Contractor's property and shall be promptly disposed of off the site unless otherwise indicated in the Job Specification or on drawings; accumulation of such materials on premises not permitted.

4.5.2 Burning of Debris on Premises: If burning of debris on premises is permitted by the Job Specification, drawings or Purchaser, conform to following requirements:

4.5.2.1 Burn debris only in areas specifical'y designated by Purchaser.

4.5.2.2 Prior to burning any material, secure approval and permits from, and comply with all regulations of all authorities and all public bodies having jurisdiction in area of WORK.

4.5.2.3 Neatly pile all combustible material and burn when in suitable condition. Do piling in such manner and in such locations as to cause least fire risk.

4.5.2.4 Burn material thoroughly and completely so that materials are reduced to ashes, with no charred pieces, such as charred logs, remaining. Ashes and charcoal residue need not be removed. Combustible materials difficult to burn, such as tree stumps and root clumps, may be buried below grade, with not less than 1'-0" of cover over them and level with surrounding grade, if grubbing is not required for the WORK; if grubbing is required, then all such unburnable materials shall be disposed of off the premises.

4.5.2.5 Fire Protection: Provide fire fighting facilities, satisfactory to authorities having jurisdiction and to Purchaser and maintain such facilities in first class operating condition during course of burning operations.

4.6 Removal of Top Soil and Sod:

4.6.1 Top soil and sod shall be removed as part of excavation work, unless the Job Specification or drawings indicate that top soil and/or sod shall be removed and stored for reuse by Contractor or by others.

4.6.2 If top soil is indicated to be removed for reuse, it shall be carefully stripped off, stored in separate stockpiles and kept clean and free of all foreign material. Sod and other vegetation shall be removed from the top soil before it is stockpiled.

4.6.3 If sod is indicated to be removed for reuse, it shall be carefully removed, rolled up, and stored in a suitable and well protected manner, as approved.

4.6.4 If top soil and/or sod is indicated to be reused by Contractor, any and all excess stockpiles remaining on completion of WORK shall be removed and disposed of off the premises unless otherwise requested.

5. EXCAVATION

5.1 Excavation is defined to include all incidental clearing, all excavation and disposal of excavated materials, all protection, sheeting, shoring, bracing and cofferdams, all dewatering, and preparation of bearing areas as required to properly install and complete the WORK, regardless of portions of WORK for which required, and regardless of nature of materials encountered in excavating. Dredging shall be performed only if specified in the Job Specification or on the drawings.

5.2 Classification: Excavation shall be classified as earth or rock excavation, as follows:

5.2.1 Earth excavation is all material not classified as rock excavation.

5.2.2 Rock Excavation:

5.2.2.1 Rock excavation is defined as any material that requires the continuous use of drilling and blasting, or drilling, channeling, etc., and shall include granite, trap, quartzite, chert, limestone, hard sandstone, hard shale or slate or other similarly hard materials, as well as rocks and boulders measuring 1/2 cubic yard or more.

5.2.2.2 The Job Specification or drawings will indicate whether blasting is permitted. Blasting, if permitted, shall conform to requirements of 5.11, following.

5.3 Dewatering: Contractor shall provide and operate all dewatering equipment required for areas excavated by Contractor, and be responsible for maintaining a dry site satisfactory to Purchaser and Consulting Engineers.

5.4 Protection and Support:

5.4.1 Contractor shall provide all protection and support as required to properly install the WORK, as required for protection and support of the WORK and of adjacent structures and improvements, and as required for safety of traffic and life.

5.4.2 Protection and support shall include temporary sheeting, bracing, shoring and cofferdams, and also, where indicated, permanent sheeting, bracing and shoring. All temporary sheeting, bracing, shoring and cofferdams shall be as approved, and all such temporary work shall be removed by Contractor when its use is no longer required, unless otherwise requested or approved.

5.4.3 Banks of excavations shall be protected and supported, where necessary or where requested, so that the banks and bottoms will be maintained and adjacent structures or other construction will be protected from damage caused by any earth or rock movement.

5.4.4 Protection and support shall be arranged for minimum interference with pipe laying, electrical ductwork installation and similar work.

5.4.5 Temporary Cofferdams: Contractor shall design temporary cofferdams required by him to perform his work and shall submit drawings thereof for approval. These drawings shall show all data on which the design is based. No such work shall be installed until such approval is received, and the work shall be done only in accordance with these approved drawings.

5.5 Earth excavations shall be of sufficient size to allow for placing of formwork for concrete, for inspection of formwork and surfaces of completed concrete, and for dampproofing, waterproofing, pipework, electrical ductwork, etc. Rock excavations shall be to neat lines unless otherwise indicated; where overbreak of rock occurs behind a vertical face of concrete placed against rock, overbreak shall be filled with the same concrete as required for the vertical face, and no payment will be made for concrete fill.

5.6 Excavations shall be carried to elevations indicated on drawings, and as follows:

5.6.1 Earth Excavation: Foundation excavations carried below the indicated level shall be filled with the same concrete as required for the foundation; other earth excavations carried below the indicated level shall be brought up to the proper level with compacted fill, sand, crushed stone, gravel or concrete, as determined most suitable by the Consulting Engineers.

5.6.2 Rock Excavation: When designated or approved elevations have been reached, rock surfaces shall be leveled off and all loose rock removed. Where overbreak of rock results in dropping elevations of rock surfaces below designated or approved elevations, overbreak shall be filled with the same concrete as required for the foundations.

5.6.3 No payment will be made for any of the foregoing specified fill required to remedy over-excavation in earth or overbreak in rock.

5.7 Hand excavation shall be used, if requested, for trenching or other excavation adjacent to structures or equipment where use of mechanical excavating equipment is not considered advisable by Purchaser or the Consulting Engineers.

5.8 Bearing Areas:

5.8.1 Bearing areas for all foundations shall be inspected and approved by Purchaser or the Consulting Engineers before any concrete is placed. If bearing areas are not suitable, as determined by the Consulting Engineers, Contractor may be requested to carry the excavations deeper to more suitable bearing material; such additional excavation will be paid for on the unit price basis set forth for the WORK. Contractor may also be requested by the Consulting Engineers to make auger borings or other tests at bearing areas to determine thickness of bearing stratum; these tests will be paid for on a unit price or cost plus basis, whichever is set forth for this item.

5.8.2 All foundations shall be placed on undisturbed soil unless otherwise indicated or approved.

5.8.3 Before placing any concrete for beams or slabs on fill, the soil shall be well tamped.

5.8.4 Before placing any concrete on soil that will absorb water, the surface of the soil shall be thoroughly wet with clean water immediately before the concrete is placed.

5.9 Excavation for Pipework and Electrical Ductwork:

5.9.1 Make excavation for this work true to grade, profile and alignment, and so as to provide full, even and continuous bedding. For pipework, normally excavate trenches to match curve of pipe; however, flat beds may be used if as economical as curved beds, or shall be used if indicated.

5.9.2 Where granular bedding under pipework or ductwork is indicated in the Job Specification or on drawings, excavate the additional amount required to place the indicated depth of bedding material.

5.10 Disposal of Excavated Materials:

5.10.1 Deposit and spread, or stockpile, excavation materials suitable (in opinion of Consulting Engineers) for fill or backfill, in quantities required and approved, on premises where requested.

5.10.2 For excavated materials not suitable for fill or backfill, the Job Specification or drawings will indicate whether such material is to be disposed of on or off premises, and disposal shall accordingly be as follows:

5.10.2.1 For such material to be disposed of on premises, deposit or spread on premises where approved or requested.

5.10.2.2 For such material to be disposed of off premises, promptly remove this material as excavated; stockpiling of such material will not be permitted

5.10.3 After completion of fill and backfill work, or when approved or requested, dispose of any and all excess stockpiles or excess excavated materials either on or off the premises as specified in 5.10.2 foregoing

5.11 Requirements for Blasting: If use of blasting is approved by Purchaser or Consulting Engineers, blasting shall conform to following requirements:

5.11.1 Blasting shall be performed only when proper precautions are taken for protection of persons, the work, private property, etc. Caps or other exploders or fuses shall in no case be stored or transported in same place in which dynamite or other explosives are transported. Location of storage magazines, methods of transportation and, in general, precautions taken to prevent accidents shall, at all times, be subject to approval of Purchaser or Consulting Engineers, but Contractor shall at all times be liable for any injuries to persons or property caused by explosives.

5.11.2 Every possible precaution shall be taken in blasting operations to preserve rock outside lines of excavation in soundest possible condition. Blasting shall be done only to lines and grades indicated on drawings or as approved by Consulting Engineers.

5.11.3 Explosives shall be of such quantity and power and shall be used in such locations as will not tend to open seals, or to crack or damage rock outside prescribed limits of excavation. If needed, firing of blast shall be controlled by use of delayed explosives. Whenever, in the opinion of Consulting Engineers, continuation of blasting may injure rock on which or against which concrete is to be placed, use of explosives shall be discontinued and excavation shall be completed by wedging, boring, channeling or other suitable means.

5.11.4 Contractor shall submit plans and methods of operation for rock excavation work before work is started. Approval of method of blasting or of strength and amount of explosives used will not relieve Contractor of responsibility for blasting operations.

5.11.5 For blasting, Contractor shall employ a supervisor thoroughly experienced in this type of work and shall at all times maintain rigid inspection to see that intent of these requirements are fully complied with.

5.11.6 Contractor shall maintain a complete and detailed record of blasting operations, in a form approved by Purchaser, and shall submit copies of such records to Purchaser as requested

5.12 Dredging:

5.12.1 Before submittal of bid, Contractor shall obtain a sweeping map from The U. S. Army Corps of Engineers, and shall also determine from them the full extent of their requirements as it will affect the WORK.

5.12.2 Contractor shall furnish, establish and maintain in good order all range marks, stakes, gauges and buoys required for proper execution of this work, and furnish, on request, the use of such boats, boatmen, laborers and materials forming a part of the ordinary and usual equipment and crew used for this work as may be necessary for Purchaser, Consulting Engineers and Corps of Engineers to inspect work.

5.12.3 Contractor shall provide sounding and sweeping equipment and labor to sound and sweep dredged areas to establish that indicated grade, profile and alignment are met.

5.12.4 As soon as possible after completion of dredging work, Contractor shall thoroughly examine dredged area by sounding and sweeping to determine that completed work meets all requirements indicated on drawings and all requirements specified by Corps of Engineers. Arrange with Purchaser for representatives of Purchaser, Consulting Engineers and Corps of Engineers to be present when sounding and sweeping is performed. However, the presence of these representatives shall in no way relieve Contractor of responsibility for accuracy and proper completion of the work.

5.12.5 Any shoals, lumps or other lack of Contract dimensions disclosed by the foregoing examination shall be remedied by Contractor, and shall again be sounded, and swept if required, until the entire dredged area is satisfactory in every respect to Purchaser, Consulting Engineers and Corps of Engineers.

5.12.6 Contractor shall maintain a complete record of soundings, in a form approved by Consulting Engineers, and shall submit copies of such records to Consulting Engineers as requested.

6. FILL

6.1 Fill includes the following two classes, with two types under each class; the use of each shall be as indicated in the Job Specification or on the drawings:

6.1.1 Class 1: Regular compacted fill, Types RCF1 and RCF2.

6.1.2 Class 2: Controlled compacted fill, Types CCF1 and CCF2.

6.2 Services of Testing Laboratory: Where controlled compacted fill is specified, Purchaser will furnish services of a Testing Laboratory to determine suitability of fill material, to set optimum moisture contents, and to perform field tests to check on compliance with moisture and density requirements. Contractor shall furnish Testing Laboratory with all required quantities of fill material, from the same source as will be used for the WORK, as required for test purposes.

Form 1714

6.3 Class 1, Regular Compacted Fill-

6.3.1 The two types are based on the materials specified for use as fill, as follows:

6.3.1.1 Type RCF1: Granular material (sand, crushed stone, gravel, etc).

6.3.1.2 Type RCF2: Cohesive material (clay, sandy loam, silty loam, etc).

6.3.2 Material: The Job Specification or drawings will indicate the source of materials to be used, such as material previously excavated at the site, or from borrow pits, or from off site sources, etc. All material used shall be as approved by Purchaser and/or the Consulting Engineers

6.3.3 Preparation of Subgrade: Prior to placing regular compacted fill, strip areas to be covered of all vegetation or other organic material or other foreign or deleterious material.

6.3.4 Compaction Densities: Build up fill to grade elevations indicated or required, with suitable moisture control and compaction throughout placing, as specified in 6.3.5 following, to produce a completed fill capable of supporting trucks and other heavy construction equipment

6.3.5 Placing of Fill: Place as follows, unless otherwise approved or requested:

6.3.5.1 Place fill, with suitable moisture content, in uniform horizontal layers not over 9" deep before compaction

6.3.5.2 For Type RCF1 granular fill, compact by successive high speed passage of heavy tractors (with treads covering 100% of area), or with other vibratory type equipment, as approved.

6.3.5.3 For Type RCF2 cohesive fill, compact by use of sheeps foot roller or with other ramming type equipment, as approved

6.3.5.4 In places inaccessible to large equipment, obtain required compaction with mechanical vibrators for Type RCF1 granular fill, and with mechanical rammers for Type RCF2 cohesive fill.

6.4 Class 2, Controlled Compacted Fill:

6.4.1 The two types are based on the materials specified for use as fill, as follows:

6.4.1.1 Type CCF1: Granular material (sand, crushed stone, gravel, etc.)

6.4.1.2 Type CCF2: Cohesive material (clay, sandy loam, silty loam, etc.)

6.4.2 Material: Conform to same requirements specified in 6.3.2 for granular fill

6.4.3 Preparation of Subgrade:

6.4.3.1 Subgrade to receive controlled compacted fill shall be inspected by Purchaser or the Consulting Engineers to determine if it is suitable and has sufficient bearing capacity for the fill material and loads to be placed over it. If subgrade is not suitable, as determined by the Consulting Engineers, Contractor may be requested to perform additional excavation as specified in 5.8 for Bearing Areas, with compensation as specified therein.

6.4.3.2 Prior to placing controlled compacted fill, strip areas to be covered of all vegetation, top soil and all organic material or other foreign or deleterious materials.

6.4.3.3 Thoroughly break and turn soil underlying the filled area to depth of 6" before deposition of fill material. Do breaking of ground no more than 200 feet in advance of placing fill.

6.4.4 Compaction Densities: Build up fill to grade elevations indicated or required, with suitable moisture control and compaction throughout placing, as specified in 6.4.5 following, to produce following densities:

6.4.4.1 Decidedly granular fill material: 90% of its maximum density.

6.4.4.2 All other fill material: 95% of its maximum density.

6.4.5 Placing of Fill: Place as follows, unless otherwise approved or requested:

6.4.5.1 Place fill, with optimum moisture content, in uniform horizontal layers not over 6" deep before compaction. Add water, or dry out fill, to maintain optimum moisture content throughout placing and compaction.

6.4.5.2 For Type CCF1 granular fill, compact by successive high speed passage of heavy tractors (with treads covering 100% of area), or with other <u>vibratory type</u> equipment, as approved.

6.4.5.3 For Type CCF2 cohesive fill, compact by use of sheeps foot roller or with other <u>ramming type</u> equipment, as approved.

6.4.5.4 In places inaccessible to large equipment, obtain required compaction with mechanical vibrators for Type CCF1 granular fill, and with mechanical rammers for Type CCF2 cohesive fill.

7. <u>BACKFILL</u>

7.1 Backfill includes general backfilling around all work excavated for by Contractor, and also all other backfill indicated on drawings as by Contractor.

7.2 Backfill shall be approved materials previously excavated at the site or materials obtained from approved borrow pits and shall be free of sod or other deleterious or foreign matter.

7.3 Backfill shall be built up to the grade elevations indicated or required, with suitable moisture control and compaction throughout placing, in the same manner as specified in 6.3 for Regular Compacted Fill, Types RCF1 and RCF2.

7.4 Backfill against foundation walls shall be placed only when directed, 7.5 Backfill Around Underground Piping: Place backfill around underground piping, drain lines, etc., only after piping, drain lines, etc., have been tested and/or inspected and approved. Use special care in backfilling to see that backfill is free of cinders or other materials which may be injurious, in opinion of Consulting Engineers, to such piping, drain lines, etc. Provide backfill free from rocks, hard lumps or clods larger than 3 inches. Do not use sod. Place backfill below top of piping, drain lines, etc., in alternate layers on each side of piping, drain lines, etc. Backfill around corrugated metal drainage pipe, corrugated structural plate pipe or welded steel plate pipe shall also conform to requirements specified in 7.6, following.

7.6 Backfill For Corrugated and Welded Steel Pipe:

7.6.1 Where flat beds for this piping is indicated in Job Specification or on drawings, provide flat granular bedding fill under pipe, with depth of bedding as indicated on drawings. Provide greater depth bedding fill if required by unsuitable soil conditions, as determined by the Consulting Engineers.

7.6.2 Granular Bedding: Use clean crushed stone or gravel, or other approved material, with 1-1/2" maximum size.

7.6.3 After pipe is in place on flat bed, provide controlled compacted granular fill under haunches. Use clean crushed stone, gravel or coarse sand, or other approved material, with 1-1/2" maximum size.

7.6.4 Also provide same controlled compacted granular fill up to center line of pipe.

7.6.5 Fill above center line of pipe and up to grade with select material, as approved, with controlled compaction.

7.6.6 Controlled compaction shall conform to requirements specified in 6.4 for Controlled Compacted Fill, Types CCF1 and CCF2. Services of Testing Laboratory will also be furnished for this work as specified in 6.2 foregoing.

7.6.7 Use extreme care in placing all compacted fill to maintain fill at approximately the same level (not to exceed one foot differential) on both sides of pipes throughout entire placing of compacted fill.

7.7 Backfill for Electrical Ductruns:

7.7.1 Requirement of Standard Specification STD-EF-103 that clay or loam backfill shall be used for ductruns shall not apply. Any approved previously excavated material may be used for backfill over ductruns that are cast in place, provided that maximum size of material shall not exceed two inches (2").

7.7.2 For precast concrete ductruns, provide a layer of clean, washed sand not less than 2" thick on SIDES AND TOP, with balance of backfill approved previously excavated material not exceeding 2" maximum size. Provide sand cushion for precast ductruns as specified in Job Specification under Concrete Work, or as indicated on drawings.

7.8 Backfill in Roadways: Where existing roadways are cut to install new work, backfill such areas as quickly as possible after completion (including testing, if required) of new work. Bring backfill to within 10" of road surface ready for installation of new roadway by Contractor or by others as indicated in Job Specification or on drawings.

8. **GRADING**: Consists of rough grading and finish grading, as follows:

8.1 Rough Grading: Cut, fill, spread and level during course of WORK to elevations indicated.

8.2 Finish Grading: Fine grade and level to provide a smooth finish grade free of debris, foreign matter, objectionable stones, clods, lumps, pockets or high spots, properly drained and true to indicated elevations. Do finish grading only near completion of WORK or when requested.

NAME OF DAM: Little Flint Creek Dam 1133.2 ft INSPECTED BY: Don Maples, Greg Carter INSPECTION DATE: 8/6/09

EMBANKMENT

1 of 2

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
CREST	1	SURFACE CRACKING	None			
	2	CAVE IN, ANIMAL BURROW	None			
	3	LOW AREA(S)				
	4	HORIZONTAL ALIGNMENT				
	5	RUTS AND/OR PUDDLES	ok			
	6	VEGETATION CONDITION	ok			
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP				
	10	SLOPE PROTECTION				
	11	SINKHOLE, ANIMAL BURROW	by spring, [illegible] hole			
	12	EMB.-ABUT. CONTACT				✓
	13	EROSION				
	14	VEGETATION CONDITION	Left of spillway [illegible]			
	15					
	16	Woody vegetation	Spring trees			✓

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

Co Rd spring

15" 1½

new? spring 15' downstream of bridge on Rt bank

7½" inlet side of culvert @ spring house

pipe drain @ valve key below [illegible] recovery [illegible] 6¼"

Culvert pipe by spillway gate 15" @ pipe inlet

NAME OF DAM: Little Flint Creek Dam **INSPECTED BY:** **INSPECTION DATE:**

EMBANKMENT

2 of 2

AREA INSPECTED	ITEM NO.		OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)	→ No flow Rt of Upper Berm Drain [illegible] wet spot			
	18	SEEPAGE	Rt of Seep A along toe. Still wet			
	19	SLIDE, SLOUGH, SCARP				
	20	EMB.-ABUT. CONTACT				
	21	CAVE IN, ANIMAL BURROW	6" dia 12" dia [illegible] P9 about P13 [illegible]		P10	
	22	EROSION Slight	Drainage gully 30' L of Seep C depression			
	23	UNUSUAL MOVEMENT				
	24	VEGETATION CONTROL	needs att!			
	25	Right Groin	Cut 10' past Spring basin drain pipe trees			
	26					
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS	P Thursday - repair			
	28	STAFF GAUGE AND RECORDER				
	29	WEIRS				
	30	SURVEY MONUMENTS				
	31	DRAINS				
	32	FREQUENCY OF READINGS				
	33	LOCATION OF RECORDS				
	34					
	35					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

Drip from ~~[illegible]~~ pipe left & P5

Spring basin drain pipe - NO crack - not leaking

Toe drain - combined flows L side 5/8

W & W's to right - Dry

~~Bo~~ Berm Drain Outfall weir 3/4" @ V

Spillway Seepage Weir 3/4
Seeping 2 gal in 15 sec
2 gal per

NAME OF DAM: Little Flint Creek Dam **INSPECTED BY:** **INSPECTION DATE:**

SPILLWAYS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
ERODIBLE CHANNEL N/A	51	SLIDE, SLOUGH, SCARP	see bottom - flow from			
	52	EROSION				
	53	VEGETATION CONDITION				
	54	DEBRIS				
	55	Concrete ogee crest - good				
	56					
NON-ERODIBLE PRINCIPAL CHANNEL	57	SIDEWALLS				
	58	CHANNEL FLOOR				
	59	UNUSUAL MOVEMENT				
	60	APPROACH AREA				
	61	WEIR OR CONTROL				
	62	DISCHARGE AREA				
	63					
	64					
DROP INLET N/A	65	INTAKE STRUCTURE				
	66	TRASHRACK				
	67	STILLING BASIN				
	68					
	69					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

F2 below ... level
A1 B1 G1 E2
D ... C1
Flow G2 F1, E1, D2 C2 B2 A2

Seeping Rt wall ... 5' ...
15' ...

NAME OF DAM: Little Flint Creek Dam INSPECTED BY: INSPECTION DATE:

OUTLET WORKS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE				
	71	TRASHRACK				
	72	STILLING BASIN				
	73	PRIMARY CLOSURE				
	74	SECONDARY CLOSURE				
	75	CONTROL MECHANISM				
	76	OUTLET PIPE				
	77	OUTLET TOWER				
	78	EROSION ALONG DAM TOE				
	79	SEEPAGE				
	80	UNUSUAL MOVEMENT				
	81					
	82					
	83					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

Seeps

Right toe Culvert weir 2" 2 gal in 4.49, 4.41, 4.72 sec - use 4.5sec

Left toe weir - 2½" 2 gal in 2.86, 2.89, 3.02 sec - use 2.9sec

Seep A - Water in black pipe but no noticeable flow
pipe to left drain not flowing

Seep B - Black pipe - No flow

Seep C - No flow from pipe

Recent ~~flow~~ seep below Dam on road to dam toe

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond **INSPECTED BY:** **INSPECTION DATE:**

EMBANKMENT

1 of 2

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
CREST	1	SURFACE CRACKING				
	2	CAVE IN, ANIMAL BURROW				
	3	LOW AREA(S)	ok			
	4	HORIZONTAL ALIGNMENT				
	5	RUTS AND/OR PUDDLES				
	6	VEGETATION CONDITION	~~[illegible]~~			
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP				
	10	SLOPE PROTECTION				
	11	SINKHOLE, ANIMAL BURROW				
	12	EMB.-ABUT. CONTACT				
	13	EROSION				
	14	VEGETATION CONDITION	Spray or cut trees on upstream slope			✓
	15		Also weed eat above rip rap			
	16					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

AEPFC000430

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond **INSPECTED BY:** **INSPECTION DATE:**

EMBANKMENT
2 of 2

AREA INSPECTED	ITEM NO.		OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)				
	18	SEEPAGE				
	19	SLIDE, SLOUGH, SCARP				
	20	EMB.-ABUT. CONTACT				
	21	CAVE IN, ANIMAL BURROW				
	22	EROSION				
	23	UNUSUAL MOVEMENT	[illegible]			
	24	VEGETATION CONTROL	V trees on downstream (lake) side slope			✓
	25		Weed eat above rip rap			
	26					
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS	~~check~~ open lid on 1 of 2 monitoring wells			
	28	STAFF GAUGE AND RECORDER				
	29	WEIRS				
	30	SURVEY MONUMENTS				
	31	DRAINS				
	32	FREQUENCY OF READINGS				
	33	LOCATION OF RECORDS				
	34					
	35					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

unable to find seep identified in March 2009

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond **INSPECTED BY:** **INSPECTION DATE:**

SPILLWAYS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
ERODIBLE CHANNEL N/A	51	SLIDE, SLOUGH, SCARP				
	52	EROSION				
	53	VEGETATION CONDITION	Need to control brush in emergency spillway left of [illegible] between 1° & 2° ash ponds.			✓
	54	DEBRIS				
	55					
	56					
NON-ERODIBLE PRINCIPAL CHANNEL	57	SIDEWALLS				
	58	CHANNEL FLOOR				
	59	UNUSUAL MOVEMENT				
	60	APPROACH AREA				
	61	WEIR OR CONTROL				
	62	DISCHARGE AREA				
	63					
	64					
DROP INLET N/A	65	INTAKE STRUCTURE				
	66	TRASHRACK				
	67	STILLING BASIN				
	68					
	69					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Primary Bottom Ash Pond INSPECTED BY: INSPECTION DATE:

OUTLET WORKS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE				
	71	TRASHRACK				
	72	STILLING BASIN				
	73	PRIMARY CLOSURE				
	74	SECONDARY CLOSURE				
	75	CONTROL MECHANISM				
	76	OUTLET PIPE				
	77	OUTLET TOWER				
	78	EROSION ALONG DAM TOE				
	79	SEEPAGE				
	80	UNUSUAL MOVEMENT				
	81					
	82					
	83					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Secondary Bottom Ash Pond **INSPECTED BY:** **INSPECTION DATE:**

EMBANKMENT

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
CREST	1	SURFACE CRACKING				
	2	CAVE IN, ANIMAL BURROW				
	3	LOW AREA(S)				
	4	HORIZONTAL ALIGNMENT				
	5	RUTS AND/OR PUDDLES				
	6	VEGETATION CONDITION				
	7					
	8					
UPSTREAM SLOPE	9	SLIDE, SLOUGH, SCARP				
	10	SLOPE PROTECTION				
	11	SINKHOLE, ANIMAL BURROW				
	12	EMB.-ABUT. CONTACT				
	13	EROSION				
	14	VEGETATION CONDITION	Spray or cut trees on slope & weed eat upper part			✓
	15					
	16					

CHECK ( ) ACTION NEEDED

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Secondary Bottom Ash Pond **INSPECTED BY:** **INSPECTION DATE:**

EMBANKMENT

2 of 2

AREA INSPECTED	ITEM NO.		OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM SLOPE	17	WET AREA(S) (NO FLOW)				
	18	SEEPAGE				
	19	SLIDE, SLOUGH, SCARP				
	20	EMB.-ABUT. CONTACT				
	21	CAVE IN, ANIMAL BURROW				
	22	EROSION				
	23	UNUSUAL MOVEMENT				
	24	VEGETATION CONTROL	spray or cut trees on slope & sapling growth			✓
	25					
	26					
INSTRUMENTATION	27	PIEZOMETERS/OBSERV. WELLS				
	28	STAFF GAUGE AND RECORDER				
	29	WEIRS				
	30	SURVEY MONUMENTS				
	31	DRAINS				
	32	FREQUENCY OF READINGS				
	33	LOCATION OF RECORDS				
	34					
	35					

CHECK ( ) ACTION NEEDED

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Secondary Bottom Ash Pond **INSPECTED BY:** **INSPECTION DATE:**

SPILLWAYS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	MONITOR	INVESTIGATE	REPAIR
				CHECK ( ) ACTION NEEDED		
ERODIBLE CHANNEL N/A	51	SLIDE, SLOUGH, SCARP				
	52	EROSION				
	53	VEGETATION CONDITION	Clean out vegetation [illegible] in inner spillway adjacent to weir			✓
	54	DEBRIS				
	55					
	56					
NON-ERODIBLE PRINCIPAL CHANNEL	57	SIDEWALLS				
	58	CHANNEL FLOOR				
	59	UNUSUAL MOVEMENT				
	60	APPROACH AREA				
	61	WEIR OR CONTROL				
	62	DISCHARGE AREA				
	63					
	64					
DROP INLET N/A	65	INTAKE STRUCTURE				
	66	TRASHRACK				
	67	STILLING BASIN				
	68					
	69					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

NAME OF DAM: Flint Ck. Secondary Bottom Ash Pond INSPECTED BY: INSPECTION DATE:

OUTLET WORKS

1 of 1

AREA INSPECTED	ITEM NO.	CONDITION	OBSERVATIONS	CHECK ( ) ACTION NEEDED: MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS	70	INTAKE STRUCTURE				
	71	TRASHRACK				
	72	STILLING BASIN				
	73	PRIMARY CLOSURE				
	74	SECONDARY CLOSURE				
	75	CONTROL MECHANISM				
	76	OUTLET PIPE				
	77	OUTLET TOWER				
	78	EROSION ALONG DAM TOE				
	79	SEEPAGE				
	80	UNUSUAL MOVEMENT				
	81					
	82					
	83					

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE.

Site Name:	Flint Creek	Date:	2-15-11
Unit Name:	Primary Bottom Ash Pond	Operator's Name:	SWEPCO
Unit I.D.:		Hazard Potential Classification:	High ☐ Significant ☐ Low ☒
Inspector's Name:	McLaren / Shepard		

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	x		18. Sloughing or bulging on slopes?		x
2. Pool elevation (operator records)?		x	19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	x		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	x		Is water entering inlet, but not exiting outlet?		x
5. Lowest dam crest elevation (operator records)?	x		Is water exiting outlet, but not entering inlet?		x
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	x	
7. Is the embankment currently under construction?		x	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	x		From underdrain?	N/A	
9. Trees growing on embankment? (If so, indicate largest diameter below)		x	At isolated points on embankment slopes?		x
10. Cracks or scarps on crest?		x	At natural hillside in the embankment area?		x
11. Is there significant settlement along the crest?		x	Over widespread areas?		x
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		x
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		x	"Boils" beneath stream or ponded water?		x
14. Clogged spillways, groin or diversion ditches?		x	Around the outside of the decant pipe?		x
15. Are spillway or ditch linings deteriorated?		x	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?		x	23. Water against downstream toe?	x	
17. Cracks or scarps on slopes?		x	24. Were Photos taken during the dam inspection?	x	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Issue #	Comments

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit AR0037842 **INSPECTOR** John Fazio

Date 3-1-2009 to 2-28-2011

Impoundment Name Primary Bottom Ash Pond

Impoundment Company SWEPCO

EPA Region 6

State Agency Arkansas Department of Environmental Quality

(Field Office) Address 4170 West 6th St, Suite #5, Fayetteville AR 72704

Name of Impoundment Outfall 101

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ☒ **Update** ☐

	Yes	No
Is impoundment currently under construction?	☐	☒
Is water or ccw currently being pumped into the impoundment?	☒	☐

IMPOUNDMENT FUNCTION: Settling Pond

Nearest Downstream Town Name: Watts

Distance from the impoundment: Approximately 32 miles along river

Location:

Latitude	36 Degrees	6	Minutes	28	Seconds	**N**
Longitude	94 Degrees	34	Minutes	17	Seconds	**W**

State Oklahoma **County** Adair

	Yes	No
Does a state agency regulate this impoundment?	☐	☒

If So Which State Agency?

HAZARD POTENTIAL *(In the event the impoundment should fail, the following would occur):*

- [ ] **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

- [x] **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

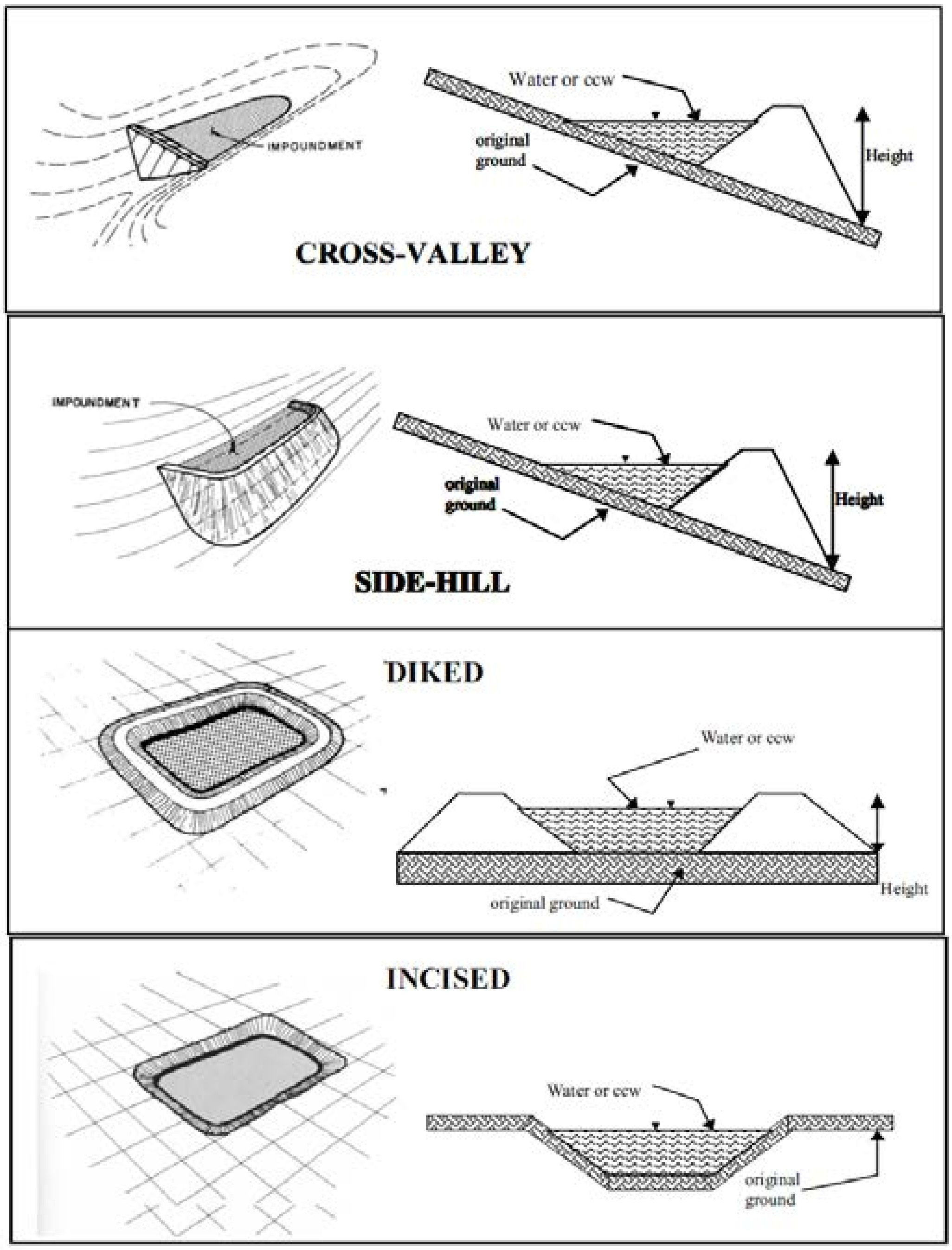
- [ ] **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

- [ ] **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

If failure occurred it would discharge into much larger cooling pond and would not affect level in cooling pond significantly.

CONFIGURATION:



☒ Cross-Valley ☐ Side-Hill ☐ Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft)	46.5	**Embankment Material**	Native Clay
Pool Area (ac)	42.8	**Liner**	N/A
Current Freeboard (ft)	10	**Liner Permeability**	N/A

<u>**TYPE OF OUTLET** (Mark all that apply)</u>

☐ **Open Channel Spillway**

☐ Trapezoidal

☐ Triangular

☐ Rectangular

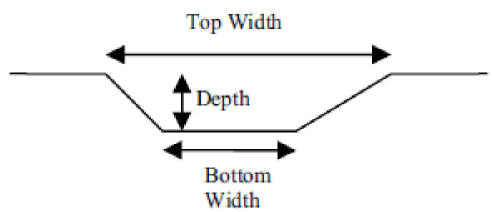
☐ Irregular

depth (ft)

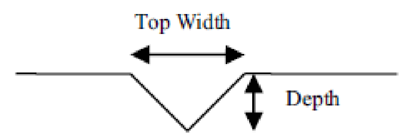
average bottom width (ft)

top width (ft)

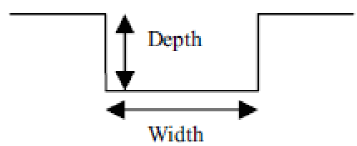
<u>TRAPEZOIDAL</u>



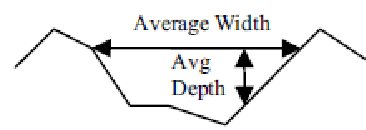
<u>TRIANGULAR</u>



<u>RECTANGULAR</u>

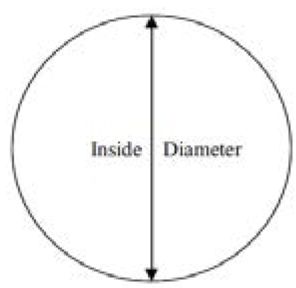


<u>IRREGULAR</u>



☒ **Outlet**

48” wide X 24” high inside dimensions
(Reinforced Concrete)



<u>**Material**</u>

☐ corrugated metal

☐ welded steel

☒ concrete

☐ plastic (hdpe, pvc, etc.)

☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☒	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By **SWEPCO – in house staff**

	Yes	No
Has there ever been a failure at this site?	☐	☒
If So When?		

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	☐	☒
If So When?		

If So Please Describe :

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	☒
If so, which method (e.g., piezometers, gw pumping,...)?		

If So Please Describe :

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that. No, Pond embankment was structurally designed and keyed into native soils that were cleared and grubbed.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation? Documentation was on site

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes? No

Site Name:	**Flint Creek**	Date:	**2-15-11**
Unit Name:	**Secondary Bottom Ash Pond**	Operator's Name:	**SWEPCO**
Unit I.D.:		Hazard Potential Classification:	**High** ☐ **Significant** ☐ **Low** ☒
	Inspector's Name:	McLaren / Shepard	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	x		18. Sloughing or bulging on slopes?		x
2. Pool elevation (operator records)?		x	19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	x		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	x		Is water entering inlet, but not exiting outlet?		x
5. Lowest dam crest elevation (operator records)?	x		Is water exiting outlet, but not entering inlet?		x
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	x	
7. Is the embankment currently under construction?		x	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	x		From underdrain?	N/A	
9. Trees growing on embankment? (If so, indicate largest diameter below)		x	At isolated points on embankment slopes?		x
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11. Is there significant settlement along the crest?		x	Over widespread areas?		x
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		x
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14. Clogged spillways, groin or diversion ditches?		x	Around the outside of the decant pipe?		x
15. Are spillway or ditch linings deteriorated?		x	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?		x	23. Water against downstream toe?	x	
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Issue #	Comments

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit AR0037842 **INSPECTOR** John Fazio

Date 3-1-2009 to 2-28-2011

Impoundment Name Secondary Bottom Ash Pond

Impoundment Company SWEPCO

EPA Region 6

State Agency (Field Office) Address Arkansas Department of Environmental Quality 4170 West 6th St, Suite #5, Fayetteville AR 72704

Name of Impoundment Outfall 101

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ☒ **Update** ☐

	Yes	No
Is impoundment currently under construction?	☐	☒
Is water or ccw currently being pumped into the impoundment?	☒	☐

IMPOUNDMENT FUNCTION: Settling Pond

Nearest Downstream Town Name: Watts

Distance from the impoundment: Approximately 32 miles along river

Location:

Latitude	36 Degrees	6	Minutes	28	Seconds	**N**
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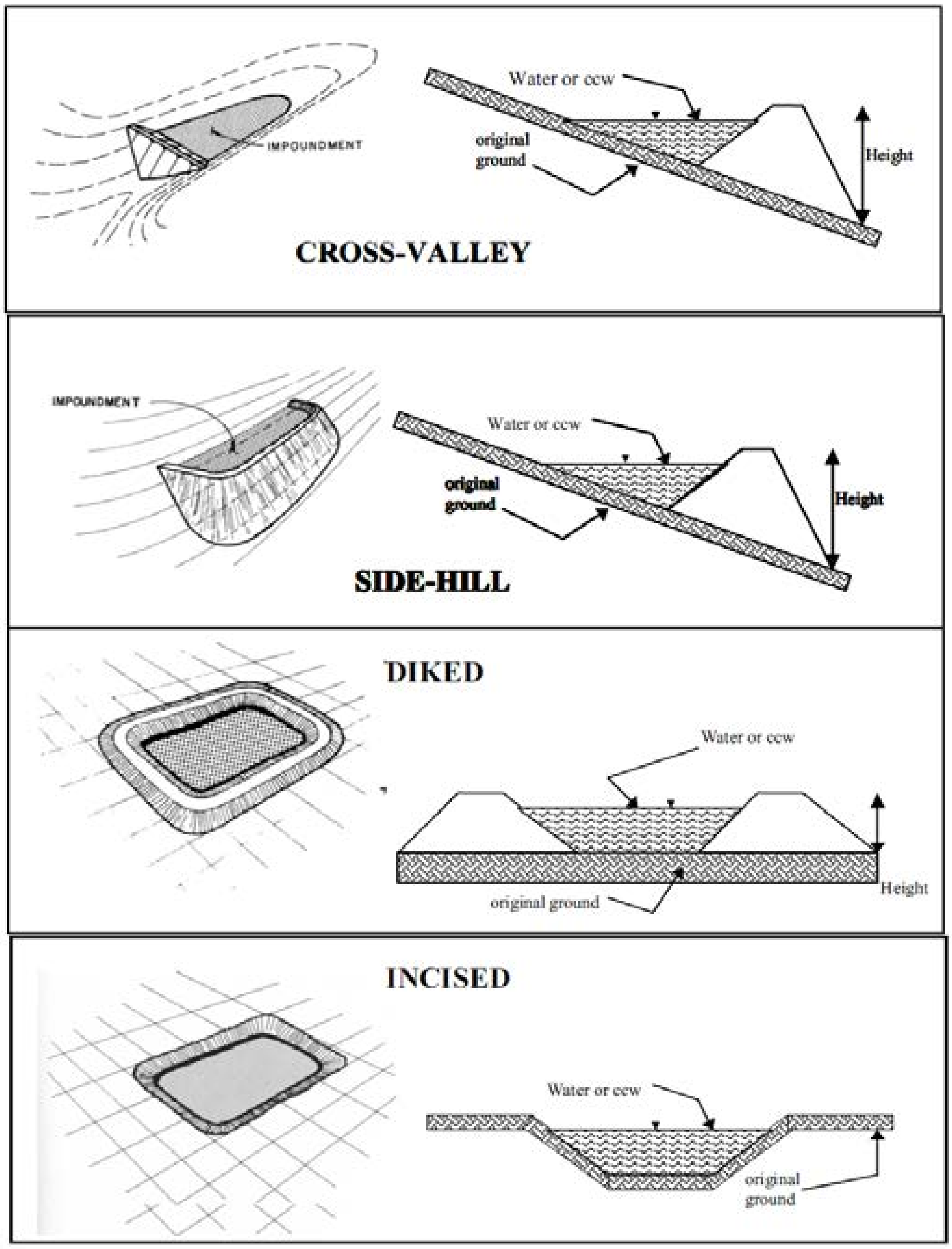


☒ Cross-Valley	☐ Side-Hill	☐ Diked
☐ Incised (form completion optional)	☐ Combination Incised/Diked	

Embankment Height (ft) 35.0 **Embankment Material** Native Clay

Pool Area (ac) 3.7 **Liner** N/A

Current Freeboard (ft) 12 **Liner Permeability** N/A

TYPE OF OUTLET (Mark all that apply)

☒ **Open Channel Spillway**

☐ Trapezoidal

☐ Triangular

☒ Rectangular

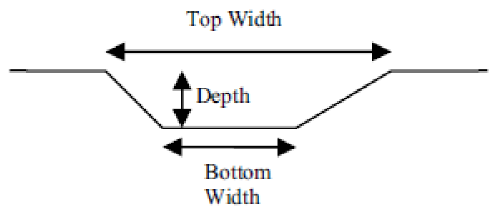
☐ Irregular

2.5 depth (ft)

13.0 average bottom width (ft)

13.0 top width (ft)

TRAPEZOIDAL



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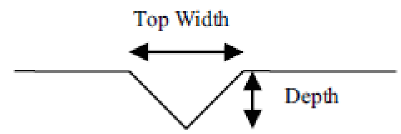

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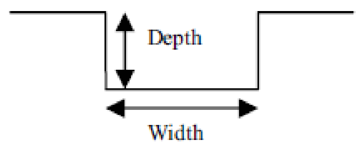

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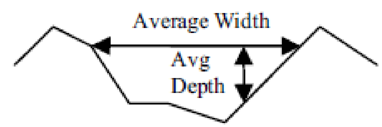

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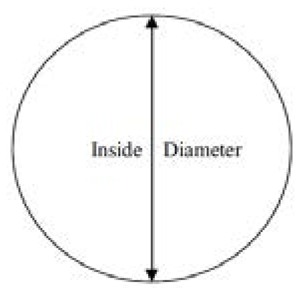

Material

☐ corrugated metal

☐ welded steel

☒ concrete

☐ plastic (hdpe, pvc, etc.)

☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☒	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By SWEPCO – in house staff

	Yes	No
Has there ever been a failure at this site?	☐	☒

If So When?

If So Please Describe :

	Yes	No
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If So When?		

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If so, which method (e.g., piezometers, gw pumping,...)?		

If So Please Describe :

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