HISTORY OF CONSTRUCTION

CFR 257.73(c)(1)

East & West Bottom Ash Pond Complex

Pirkey Plant
Hallsville, Texas

October, 2016

Prepared for: AEP/SWEPCO - Pirkey Plant

Hallsville, Texas

Prepared by: American Electric Power Service Corporation

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Columbus, OH 43215

AEP AMERICAN ELECTRIC POWER®

GERS – 16 – 032

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Attachments

<u>1.0</u> OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CCR 257.73(c)(1) with an evaluation of the facility.

<u>2.0</u> DESCRIPTION OF CCR THE IMPOUNDMENT

The Henry W. Pirkey Power Station is located at 2400 FM 3251 and south of Hallsville, Texas.
It is owned and operated by Southwest Electric Power Company (SWEPCO). The facility operates two surface impoundments for storing CCR materials called the East Bottom Ash Pond (East BAP) and the West Bottom Ash Pond (West BAP).

The East BAP is located directly adjacent to and east of the West BAP. The East BAP receives sluiced bottom ash and has a surface area of 30.9 acres and a storage capacity of 188 acre-feet. The pond is almost entirely incised, with a reported maximum embankment height of 4 feet.

The West BAP, which also receives sluiced bottom ash, is located northwest of the main plant buildings and shares its eastern border with the western border of the East BAP. The West BAP receives sluiced bottom ash and has a surface area of 30 acres and a storage capacity of 188 acre-feet. The maximum embankment height is 25 feet. Design material include in the provided documentation indicate that the main upstream embankment slopes are 3 feet horizontal to 1 foot vertical (3:1 H:V); while the main downstream slopes area 2.5:1 H:V.

<u>3.0</u> SUMMARY OF OWNERSHIP 275.73(c)(1)(i)

[The name and address of the person(s) owning or operating the CCR unit: the name associated with the CCR unit: and the identification number of the CCR unit if one has been assigned by the state.]

The AEP H.W. Pirkey Power station is located in southern Harrison County, approximately 5 miles southeast of Hallsville, Texas, and approximately 8 miles southwest of Marshall, Texas. The Plant Power Station Address is 2400 FM 3251, Hallsville, Texas . It is owned and operated by Southwestern Electric Power Company (SWEPCO). The facility Bottom Ash Complex operates two surface impoundments for storing CCR and a clear water pond for decant water.

<u>4.0</u> LOCATION OF THE CCR UNIT 275.73 (c)(1)(ii)

[The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 ½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.]

A location map is included in Attachment A.

5.0 STATEMENT OF PURPOSE 275.73 (c)(1)(iii)

[A statement of the purpose for which the CCR unit is being used.]

The Bottom Ash Pond Complex is a surface impoundment for storing CCR. The Bottom Ash Ponds within the complex are used for primary settling and storage of bottom ash. The decant water from the Bottom Ash ponds flow s into a secondary pond that provides storage of decant water.

6.0 NAME AND SIZE OF WATERSHED THE CCR UNIT IS LOCATED 275.73 (c)(1)(iv)

[The name and size in acres of the watershed within which the CCR unit is located.]

The Pirkey East BAP and West BAP are comprised of diked embankments on all sides which direct stormwater away from the impoundment and limit runoff to that which falls directly on the water surface. Therefore, the areas surrounding the impoundments do not contribute any runoff. The watershed for the ponds is equal to the surface areas of the ponds and is approximately 61 acres.

The bottom ash ponds are located within the Region 12 - Texas Gulf Region Watershed and are part of the sub group HUC = 12010002 Middle Sabine watershed area. The area is approximately 1770009.6 acres.

7.0 DESCRIPTION OF THE FOUNDATION AND ABUTMENT MATERIALS 275.73(c)(1)(v)

[A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is located.]

The foundaion materials for the East BAP are native soils which consist of stiff to very stiff sandy lean clay (CL) and sandy fat clay (CH) with intermittent layers of medium dense to dense silty sand (SM) and clayey sand (SC). Atterburg Plasticity Indices of tested soils ranged between a low of 16 to a high of 39.

The foundation materials for the West BAP are native soils which consist primarily of medium dense to very dense clayey sand (SC) with layers of of dense clayey gravel (GC) and very dense silty clayey sand (SC-SM). Atterburg Plasticity Indices of tested soils ranged between a low of 9 to a high of 46. The engineering properties of the foundation soils had a cohesion that ranged between 290 psf and 430 psf and a friction angle that ranged between 17 degrees and 28 degrees. Additioanl details on the engineering properties of the foundaiton soils is in the design reports presented in Attachment B.

8.0 DESCRIPTION OF EACH CONSTRUCTED ZONE OR STAGE OF THE CCR UNIT 275.73 (c)(1)(vi)

[A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.]

The East BAP is primarily incised into native soils with an embankment height of approximately 4 feet (AMEC, 20110). The East BAP embankments are constructed of compacted clay on a 3:1 slope (3 feet horizontal, 1 foot vertical) (Sargent & Lundy, 1983). The embankment soils are stiff to very stiff sandy lean clay (CL) and sandy fat clay (CH) with intermittent layers of medium dense to dense silty sand (SM) and clayey sand (SC). The elevation of the top of embankment around the perimeter of the East BAP is approximately 357 feet amsl, and the normal operating level is approximately 354 feet amsl (Johnson & Pace, May 2011). The interior bottom elevation of the East BAP is approximately 347 feet amsl (Sargent & Lundy, 1983; Johnson & Pace, June 2011. A copy of the referenced design documents and design drawings are presented in attachment B & C.

The West BAP embankments have maximum height of approximately 25 feet and are constructed of compacted clay on a slope ranging from 2.5:1 (2.5 feet horizontal, 1 foot vertical) to 3:1 (Sargent & Lundy). The elevation at the top of the embankment around the perimeter of the West BAP is approximately 357 feet amsl, and the normal operating level is approximately 354 feet amsl (Johnson & Pace, 2011). The embankment fill materials are stiff to very stiff lean clay (CL) and/or fat clay (CH), overlying native soils consisting of dense to very dense clayey sand (SC) with intermittent layers of dense gravel (GC) and very dense silty clayey sand (SC-SM). The interior bottom elevation of the West BAP is approximately 347 feet amsl (Sargent & Lundy, 1983; Akron Consulting, 2012). The engineering properties of embankment soils had a cohesion of 590 psf and a friction angle of 16 degrees. Additioanl details on the engineering properties of the foundaiton soils is in the design reports presented in Attachment B.

A copy of the referenced design documents and design drawings are presented in attachment B & C.

9.0 ENGINEERING STRUCTURES AND APPURTENANCES, 275.73 (c)(1)(vii)

[At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection…]

The bottom ash from the plant is sluiced to the Ash Ponds using sluice pumps that convey the ash slurry through a pipeline which discharges the slurry into the middle of the pond. The slurry is sluiced at the rate of 3,000 gallons per minute (GPM) per pump. During normal operations only one pump is used at a time. The bottom ash settles, and the decant water is discharged from the Ash Ponds using either a portable pump or by overflowing into the Secondary Pond through a vertical box weir structure that contains a 36-inch diameter corrugated metal pipe (CMP) and manually operated gate valve. Additional discharge outlets convey relatively minor quantities into the ponds, including the boiler blowdown outlet which conveys about 35 GPM to the Secondary Pond. None of the ponds have a designated emergency spillway. The decant water from the Secondary Pond is re-used by pumping it out of the pond using the ash recirculation pumps (housed in a pump 4 house structure). Of the four recirculation pumps, only three are normally operated and convey average flows of about 2,000 GPM each. Flow to and from the ponds is balanced by conveying the water from the recirculation pumps to a suction tank that is used by the sluice pumps to remove the ash from the boiler and then return it to the Ash Ponds. A permitted outfall valve is located near the southwest corner of the Secondary Pond and discharges into a runoff ditch on the south side of the pond that eventually conveys water to Hatley Creek. The gate valve is typically closed.

For location and details of all appurtenances see design drawings presented in Attachment C and for a map of the instrumentation locations see Attachment D.

10.0 SUMMARY OF POOL SURFACE ELEVATIONS, AND MAXIMUM DEPTH OF CCR, 275.73 (c)(1)(vii)

[…in addition to the normal operating pool surface elevation and the maximum pool elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment.]

The table below describes the normal pool elevations and maximum pool elevations as well as maximum depth of CCR within the impoundment. The Inflow Design Flood is the 100-year storm event.

	West Bottom Ash Pond	East Bottom Ash Pond
Normal Pool Elevation	354.0	354.0
Maximum Pool Elevation following peak discharge from inflow design flood	355.01	354.99
Expected Maximum depth of CCR within impoundment	7.5 ft	7.5 ft

11.0 FEATURES THAT COULD ADVERSELY AFFECT OPERATION DUE TO MALFUNCTION OR MIS-OPERATION (275.73 (c)(1)(vii))

[…and any identifiable natural or manmade features that could adversely affect operations of the CCR unit due to malfunction or mis-operation]

In the event of malfunction or mis-operation of any of the pond's appurtenances the ponds operations could be adversely affected. These structures include weir structures and piping between pond cells, low water discharge gated structures, gated weir structures, effluent return piping and pump structures and influent sluicing piping and structures. See design drawings in Attachment C for location and details of all appurtenances.

12.0 DESCRIPTION OF THE TYPE, PURPOSE AND LOCATION OF EXISTING INSTRUMENTATION 275.73 (c)(1)(viii)

[A description of the type, purpose, and location of existing instrumentation.]

The East BAP has no instrumentation.

The West BAP has 2 piezometers located within the structure of the dam. These piezometers are read every 30 days for the purpose of determining the phreatic water level within the dike. A location map is provided in Attachment D.

13.0 AREA – CAPACITY CURVES FOR THE CCR UNIT 275.73 (c)(1)(ix)

[Area-capacity curves for the CCR unit.]

The area capacity curves for the Bottom Ash Pond Complex are included in the Hydrology and Hydraulic Analysis Report by Aukland, 2015 in Attachment E.

14.0 275.73 (c)(1)(x) DESCRIPTION OF EACH SPILLWAY AND DIVERSION

[A description of each spillway and diversion design features and capacities and calculations used in their determination.]

Complete details of each spillway structure are included with the design drawings in Attachment C. Hydrology and Hydraulic Analysis which include calculations for each spillway structure are included in Attachment E.

The surface water elevation in the East BAP is controlled by a weir box and a manually operated gate valve on a 36-inch diameter discharge pipe at the southwest corner of the pond. Clear water overflow from the East BAP discharges through the 36-inch diameter pipe into a 2.7 acre Clearwater Pond located directly south of the East BAP. Water in the Clearwater Pond is either pumped (re-circulated) back into the boiler ash hopper, or gravity discharged through a pipe at the southwest corner of the Clearwater Pond into an unnamed intermittent tributary of Hatley Creek via outfall 006 in accordance with Texas Pollutant discharge Elimination system (TPDES) Permit no. WQ0002496000.

The surface water elevation in the West BAP is controlled by a weir box and a manually operated gate valve on a 36-inch-diameter discharge pipe at the southeast corner of the pond. Clear water overflow from the West BAP discharges through the 36-inch diameter pipe into a 2.7 acre Clearwater Pond located southeast of the West BAP. Water in the Clearwater Pond is either pumped (re-circulated) back into the boiler ash hopper, or gravity discharged through a pipe at the southwest corner of the Clearwater Pond into an unnamed intermittent tributary of Hatley Creek via outfall 006 in accordance with Texas Pollutant discharge Elimination system (TPDES) Permit no. WQ0002496000.

15.0 SUMMARY CONSTRUCTION SPECIFICATIONS AND PROVISIONS FOR SURVEILLANCE, MAINTENANCE AND REPAIR 275.73 (c)(1)(xi)

[The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.]

Readily available portions of the original construction specifications are included in Appendix B.

As required by the CCR rules the East and West Bottom Ash Ponds are inspected at least every 7 days by a qualified person. Instrumentation data is collected at least every 30 days and reviewed by AEP Engineering Services. Also as a requirement of the CCR rules the impoundment is also inspected annual by a professional engineer.

If repairs are found to be necessary during any inspection they will be completed as needed.

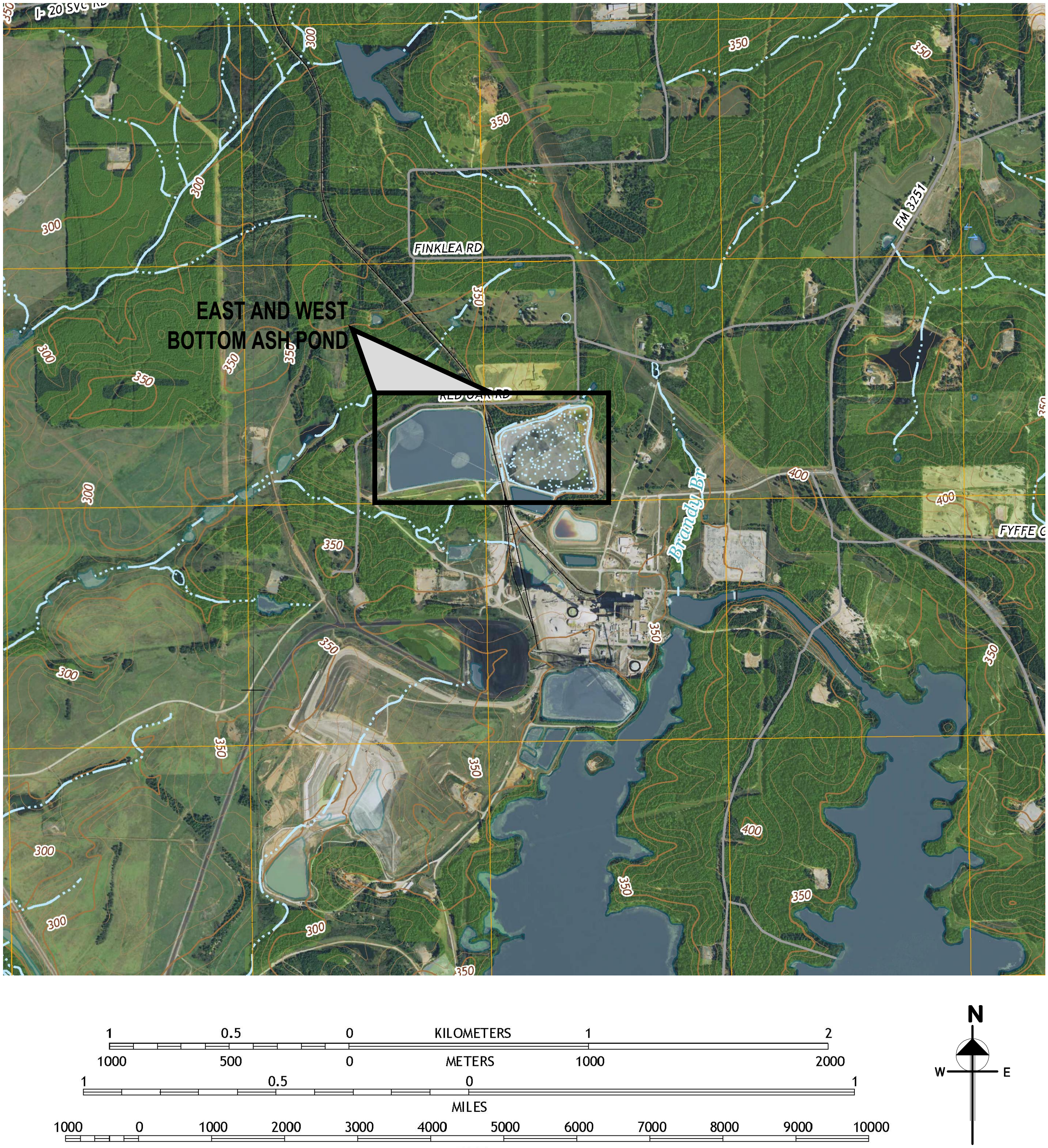
16.0 RECORD OR KNOWLEDGE OF STRUCTURAL INSTABILITY 275.73 (c)(1)(xii)

[Any record or knowledge of the structural instability of the CCR unit.]

To date there has been no known record of knowledge of the structural instability of the CCR unit.

ATTACHMENT A

LOCATION MAP



THIS DRAWING IS CLASSIFIED AS: **AEP PUBLIC** REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY	SOUTHWESTERN ELECTRIC POWER CO **HENRY W. PIRKEY** SOUTH HALLSVILLE TEXAS	UNIT: 1	DRAWING NUMBER: LOCATION MAP	REV: 1
		SCALE: 1"=2000'	CIVIL ENGINEERING	
		DR:		
		CH:		
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		ENG:		
		DATE: 10/12/16		
		AEP AMERICAN ELECTRIC POWER	*AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215*	

ATTACHMENT B

DESIGN REPORTS

HENRY W. PIRKEY POWER PLANT

DESIGN SUMMARY FOR LIGNITE STORAGE AREA AND WASTEWATER POND FACILITIES

REPORT PREPARED FOR

SOUTHWESTERN ELECTRIC POWER COMPANY

JANUARY 31, 1983

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LIST OF EXHIBITS

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DESIGN SUMMARY FOR LIGNITE STORAGE
AREA AND WASTEWATER POND FACILITIES

SOUTHWESTERN ELECTRIC POWER COMPANY

I INTRODUCTION

This report is prepared by Sargent & Lundy (S&L) at Southwestern Electric Power Company's (SWEPCO) request to summarize the design of the lignite storage area and the wastewater pond facilities with regard to technical guidelines and requirements of the Texas Department of Water Resources (TDWR). The technical guidelines referenced in this report are Technical Guide Nos. 4 and 6 titled Ponds and Lagoons, and Monitoring/Leachate Collection Systems respectively. Guide No. 4 was revised March 1, 1978 and Guide No. 6 March 21, 1980. We understand that the TDWR has the responsibility of preparing and issuing document approval for disposal of wastes. Requirements concerning waste storage and disposal and concerning the design, construction, and monitoring of wastewater pond facilities are discussed in this report.

The wastewater pond facilities discussed in this report and shown in Exhibit 1 are the lignite pile runoff basin, surge pond, two bottom ash storage basins, secondary settling pond, and the metal cleaning waste pond. Discussion of other waste treatment facilities such as the sanitary sewage treatment plant, the cooling pond, and the final treated Flue Gas Desulfurization (FGD) sludge disposal site are not within the scope of this report and, therefore, not included.

II SUMMARY AND CONCLUSIONS

Based on the evaluation of the site subsurface soil and water conditions, it is concluded that the design of the Henry W. Pirkey wastewater ponds conforms with the technical guidelines and requirements of the TDWR.

Nine groundwater monitoring wells will be located adjacent to the wastewater ponds. These wells will be designed and installed to requirements equal to or exceeding those suggested by the TDWR.

A summary of design guidelines and requirements suggested by the TDWR and those used for design of the Henry W. Pirkey wastewater ponds is given in Exhibit 2.

III DESIGN OF LIGNITE STORAGE AREA AND WASTEWATER POND FACILITIES

A. General

The general site layout is shown in Exhibit 1. The plant water usage and waste water scheme is shown on Exhibit 3. The lignite storage area, lignite pile runoff basin, metal cleaning waste pond, and surge pond have been sized to accommodate two units. Each bottom ash basin will accommodate storage of hydraulically placed ash for two units for 6 months. When one bottom ash basin is filled, storage will begin in the second basin while the first basin is being emptied and readied for reuse. The in-service bottom ash basin will also receive the discharge from the ash hopper pit sump pumps.

Effluent from the bottom ash basins will discharge to the secondary settling pond. Blowdown from the main and auxiliary boilers will also be routed to the secondary pond. Water collected in the secondary settling pond will be recirculated back to the plant to transport bottom ash. Excess water is pumped to the waste water treatment plant for treatment prior to release.

Drainage from the lignite and limestone storage areas and handling systems will be collected via ditches and routed to the lignite pile runoff basin. The contents of the lignite pile runoff basin will normally not require more treatment than sedimentation. Once the suspended solids are within acceptable limits, the basin contents will be discharged to the cooling pond by means of a sluice gate. If treatment other than gravity settling is required, the contents of the lignite pile runoff basin will be pumped to the wastewater treatment plant prior to release.

The surge pond is divided into two sections: the main surge pond and an auxiliary surge pond. The auxiliary surge pond is a collection and settling pond for scrubber waste slurry, either from the FGD system waste slurry pumps, thickener underflow pumps, or filtrate overflow sump pumps. These slurry flows will be routed to the auxiliary surge pond only under emergency conditions and allowed to thicken by gravity settling. The sludge formed when the slurry thickens will be removed by front end loader and conveyed to the sludge treatment system for stabilization. The water decanted from the thickened slurry, and not evaporated, will drain to the surge pond. In emergencies, the auxiliary surge pond overflows to the surge pond.

The main surge pond is a collection basin for various FGD waste streams. Drains, overflows, backwash, blowdown, and surface drainage from the FGD system will drain to the surge pond. The reclaim water sump will overflow to the surge pond.

Rainwater runoff from the sludge truck load out area, from under the sludge conveyors, and from the sludge reclaim area will drain to the surge pond by gravity. The water decanted from the auxiliary surge pond will drain to the surge pond. The collected water in the surge pond will be pumped to the thickeners for removal of sediment and used as make-up for the SO_2 scrubbers. Drainage entering the surge pond will not leave the plant except as makeup to the scrubbers, as water hydrated with the stabilized FGD sludge, or through evaporation.

Waste from air heater wash, precipitator wash and boiler chemical cleaning is discharged to the metal cleaning pond for storage. This pond is designed to accommodate all the wastewater containing heavy metals generated in 24 hours by cleaning all the three air heaters associated with one unit. Water collected in the metal cleaning waste pond will be pumped to the waste water treatment system for processing before being discharged to the cooling pond.

B. Lignite Storage Area and Runoff Basin Design

The location and layout of the lignite storage area and lignite pile runoff basin are shown on Exhibit 1. Five borings have been drilled in this area and their locations are shown on Exhibits 4 and 5. Copies of the boring logs are included in Appendix A. Based on the results of the boring data, the lignite storage area and lignite pile runoff basin are located over surface soil deposits of dense silty sand and sandy silt (SM and ML Unified Soil Classification). A summary of the laboratory test results on samples from these borings is given in Exhibit 6. All soil borings and soil laboratory test results given in this report, with the exception of Boring B14, have been drilled and tested by NFS/National Soil Services, Inc., Dallas, Texas. Boring B14 was drilled and tested by East Texas Testing Laboratory, Inc., Tyler, Texas. Complete laboratory index property and permeability test results for all samples from borings located in or near wastewater pond facilities are included in Exhibit 6. Also included for reference are index property and permeability values for various types of soils from other onsite borings.

The lignite pile runoff basin is an above and below ground pond designed to store lignite pile and limestone pile runoff. Plan and cross sections are shown in Exhibit 5. The lignite storage pile will be underlain by two feet of compacted cohesive fill (SC, CL, and CH Unified Soil Classification). The drainage ditches transporting runoff from the storage area to the basin will be lined with minimum 18 inches of compacted cohesive fill. The runoff basin will be lined on the bottom and side slopes with a minimum three feet of compacted cohesive fill. The dike fill, including lining, will be compacted as specified to a minimum 95 percent maximum density in accordance with ASTM D698. These requirements are in accordance with the guidelines suggested by the TDWR for wastewater ponds.

A summary of the parameters used for the lignite pile runoff basin design in comparison to those parameters and guidelines suggested by the TDWR is given in Exhibit 2. The runoff basin design parameters equal or exceed the minimum recommended values except for depth to the water table. Average or median parameter values are given where several individual tests or measurements were made. The only suggested parameter not obtainable is the TDWR recommendation that the bottom of the basin be 10 feet above the water table. The water table varies throughout the site, and with normal pool of the cooling pond at elevation 340.0 ft., it is possible that the static water table may be located within 3 feet of the bottom of the clay lining of any of the plant's wastewater ponds. Despite this, the presence of relatively homogeneous impermeable in situ and compacted clay layers should provide sufficient lining and protection of the groundwater.

Compacted clay linings are required on the bottom and side slopes of the lignite pile runoff basin and beneath the lignite storage pile. Project specifications require these compacted linings to be cohesive soils with minimum 40% passing the no. 200 sieve and having a minimum plasticity index of 15. The linings are to be compacted to minimum 95% maximum density in accordance with ASTM D698. The permeability of the compacted linings is estimated to be less permeable than or equal to 1.0×10^{-7} cm/sec. This will be verified by SWEPCO by testing field samples in the laboratory during or after construction.

C. Surge Pond Design

The location and layout of the surge pond are shown on Exhibit 1. Four borings have been drilled in this area and their locations are shown on Exhibits 4 and 7. Copies of the boring logs are included in Appendix A. Based on the results of the boring data, the surge pond is located within or above a thick surface deposit of silty and sandy clay (CL and CH Unified Soil Classification). The thickness of the in situ clay soils below the bottom of the pond (approximately elevation 350 ft) ranges from two and one half to 16 feet. A summary of the laboratory test results on samples from the surge pond borings is given in Exhibit 6.

The surge pond (including auxiliary surge pond) is an above and below ground pond. Dikes and excavated slopes are designed with three horizontal to one vertical side slopes. Dike fill will be cohesive soil compacted to a minimum 95 percent maximum density in accordance with ASTM D698. Typical surge pond cross sections are shown on Exhibit 7.

In situ cohesive soils will be used to function as the pond lining. Verification of the quality and thickness of the in situ lining will be made during or after construction by SWEPCO. As previously stated, the borings indicate that the thickness of the in situ lining ranges from approximately two and one half to 16 feet. Any compacted cohesive linings required will meet the density, index property, and permeability requirements as given for the lignite runoff basin.

Exhibit 2 summarizes the TDWR suggested parameters and guidelines and those parameters used for the surge pond design. Comparison of the design parameters obtained and those suggested indicate that in almost every case the obtained parameters equaled or exceeded the suggested value. The only suggested parameter not obtainable is the recommended 10 ft. depth to the groundwater table. It is possible that the groundwater table could eventually be located within 3 ft. of the bottom of the clay lining of the pond, as previously discussed.

Six laboratory permeability tests were performed on samples of undisturbed clay soil from the surge pond area. Results are given in Exhibit 8 and indicate a median permeability value of $5.1x10^{-8}$ cm/sec. The permeability test values ranged from $2.1x10^{-6}$ cm/sec. to $7.4x10^{-9}$ cm/sec.

D. Bottom Ash Basin and Secondary Pond Design

The location and layout of the bottom ash basins and secondary pond are shown on Exhibit 1. Plan and cross sections are shown in Exhibit 9. Nine borings have been drilled in this area. Their locations are given in Exhibits 4 and 9. Copies of the boring logs are included in Appendix A. Based on the results of the boring data, the secondary pond, bottom ash basin no. 1 and the east half of bottom ash basin no. 2 are located within or above a thick surface deposit of silty and sandy clay. These soils are classified as SC, CL, and CH material. A summary of the laboratory test results on samples from those borings is given in Exhibit 6. Results of approximately 23 tests on cohesive soils representing in situ lining indicate average fines content and plasticity index values of 78% and 36, respectively. These values significantly exceed the minimum values suggested by the TDWR.

Bottom ash basin no. 1 is an above and below ground pond located entirely in a cohesive soil deposit. The thickness of the cohesive soil below the bottom of the pond is greater than 5 feet. The plan and cross sections are given in Exhibit 9. A compacted clay lining is shown and will be used where required. In situ lining of acceptable quality and thickness exist in most of the area. This will be verified in the field during construction by SWEPCO. Shallow borings, test pits, and laboratory testing will be performed as necessary.

Bottom ash basin no. 2 is also an above and below ground pond.

A portion of this pond (west half) will require a minimum three feet thick compacted clay lining. The location where an acceptable in situ lining does not exist and where the compacted lining begins will be determined and verified in the field by SWEPCO.

The secondary pond has a bottom elevation of 344 feet. This is three feet or more below the lowest point in either bottom ash basin. During borrow excavation and construction of the embankment, the existing clay may be completely removed from areas within the pond. Where this occurs, a three foot thick compacted clay lining will be installed to the requirements of project specifications and the technical guidelines suggested by the TDWR. This will be verified in the field by SWEPCO.

Exhibit 2 summarizes the TDWR parameters and guidelines and those parameters used for the design of the bottom ash basins and the secondary pond. As indicated in Exhibit 2, the design parameters meet or exceed nearly all of the suggested values. The only suggested parameter not obtainable is the recommended depth to the groundwater table as previously discussed. The median permeability from ten laboratory tests on samples of in situ cohesive soils (generally CH classification) is approximately 7.5×10^{-9} cm/sec. The permeability of clay soils used for compacted cohesive linings (SC, CL, and CH classification) is estimated to be less than or equal to 1.0×10^{-7} cm/sec. The permeability of the compacted lining will be verified by

SWEPCO by testing field samples in the laboratory during and after construction.

E. Metal Cleaning Waste Pond

The location and layout of the metal cleaning waste pond are shown on Exhibit 1 and 10. The pond lies between the surge pond and the bottom ash basins. Borings located near the metal cleaning waste pond are shown in Exhibit 4. Review of the boring data indicates that the pond is located within or above a thick surface deposit of silty and sandy clay. Evaluation of the boring data is similar to that of the bottom ash basins.

The metal cleaning waste basin is an above and below ground pond. Plan and cross sections are given in Exhibit 10. The pond will require a minimum three feet thick clay lining where sufficient in situ clay does not exist at the design elevation. SWEPCO will verify the quality and acceptability of the lining, whether in situ or compacted.

IV GROUNDWATER MONITORING PROGRAM

Nine groundwater monitoring wells are to be installed at locations adjacent to the wastewater pond facilities. The wells will be installed after completion of pond construction. The approximate locations of these wells are given in Exhibit 12.

Four-inch diameter monitoring wells will be used because they permit use of a portable submersible pump for obtaining samples for water quality analysis. Each slotted screen for each well will be located in the most permeable soils occurring below the water table. A soil boring will be drilled at each well location to accurately define the soil strata adjacent to the well and to finalize the location and design of the well. The soils are very dense and range from a medium fine sand and silty sand to clayey sand and silty clay. The length of the screens have not yet been determined but are expected to range from 15 to 25 feet.

Technical Guide No. 6, published by the TDWR, presents guidelines for design and installation of monitoring wells. The H. W. Pirkey monitoring wells will equal or exceed these guidelines.

The groundwater monitoring program will consist of measuring and recording groundwater levels and obtaining samples for water quality analysis. The frequency for measuring levels and obtaining samples has not yet been determined. Measurements and samples will be obtained by SWEPCO and should begin at least two years before the power plant begins operation. This will allow for sufficient background data against which to compare all subsequent measurements and analyses of samples taken at the site.

Sargent & Lundy, by

D. G. Bodine

D. G. Bodine
Supervisor,
Geotechnical Division

Kenneth T. Kostal

EXHIBIT 2

SUMMARY OF PARAMETERS SUGGESTED AS GUIDELINES AND
PARAMETERS OBTAINED FOR DESIGN OF HENRY W. PIRKEY WASTEWATER PONDS

Parameter (1)	Suggested Guideline (1)	Parameter Values Used for Design of Pirkey Wastewater Ponds		
		Lignite Runoff Basin	Surge Pond	Bottom Ash Basins, Secondary Settling Pond and Metal Cleaning Waste Pond
Above Ground Dikes & Berms Fill Compaction Fill Classification (5) Fill Permeability Dike or Excavation Slopes	$C_r \geq$ 95% Standard Proctor CL, CH, and SC $K \leq 1x10^{-7}$ cm/sec 3H to 1V	Specified $C_r \geq$ 95% CL , CH, and SC $Km \leq 1.0x10^{-7}$ cm/sec (2) 3H to 1V	Specified $C_r \geq$ 95% CL & CH $Km \leq 1.0x10^{-7}$ cm/sec (2) 3H to 1V	Specified $C_r \geq$ 95% CL & CH (lined Slope) $Km \leq 1.0x10^{-7}$ cm/sec (2) 3H to 1V
Pond Compacted or Insitu Cohesive Lining Thickness Permeability, K Liquid Limit, LL Plasticity Index, PI Fines Content, FC Classification	3 ft. $K \leq 1x10^{-7}$ cm/sec $LL \geq 30\%$ $PI \geq 15$ $FC \geq 30\%$ CL, CH, OH, and SC	$\geq$ 3 ft. (compacted) $Km \leq 1.0x10^{-7}$ cm/sec (2) $LL > 30\%$ $PI > 15$ $FC \geq 40\%$ CL, CH, & SC	5 to 17 ft. (insitu) $Km \simeq 5.1x10^{-8}$ cm/sec (3) average LL = 54% average PI = 36 specified $FC \geq 40\%$ CL & CH	3 to 17 ft. (insitu & compacted) $Km \leq 1.0x10^{-7}$ cm/sec $Km \simeq 7.5x10^{-9}$ cm/sec (insitu) (4) average LL = 78% average PI = 36 average FC = 78% CL & CH
Below Ground Pond Permeability, K Liquid Limit, LL Plasticity Index, PI Fines Content, FC Classification	$K \leq 1x10^{-7}$ cm/sec $LL \geq 30\%$ $PI \geq 15$ $FC \geq 30\%$ CL, CH, OH, and SC	Below ground area of pond will be lined with 3 ft. of compacted cohesive material CL & CH material	Values given above are representative of insitu cohesive soils	Values given above are representative of insitu cohesive soils. Compacted lining 3 ft. in thickness will be placed where required
Groundwater Monitoring Well Depth to Water Table Below Pond	Yes, Required 10 ft. Recommended	Two 4 in. Diameter Gravel Pack Wells Approximately 3 ft., See Report Text	Two 4 in. Diameter Gravel Pack Wells Approximately 3 ft., See Report Text	Two and Five 4 in. Diameter Gravel Pack Wells for Metal Cleaning Waste Pond and Bottom Ash Basins, respectively. Approximately 3 ft., See Report Text

NOTES:

(1) Parameters and Guidelines given are suggestions stated in the Texas Department of Water Resources Technical Guides No. 4 revised March 1, 1978, and No. 6 revised March 21, 1980.

(2) Estimated. To be verified by SWEPCo during or after construction.

(3) Median permeability from six tests on undisturbed cohesive soil samples.

(4) Median permeability from ten tests on undisturbed soil cohesive soil samples.

(5) Classification symbols used in this Exhibit are in accordance with the Unified Soil Classification System and ASTM D2487.

(6) Standard Proctor Test performed in accordance with ASTM D698.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (°/o Passing) (2)				Atterberg Limits (3)			Unified Soil Classification Symbol	Field Water Content (°/o) (4)	Dry Density lbs/ft³	Laboratory Permeability cm/sec
		No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Liquid Limit (°/o)	Plastic Limit (°/o)	Plasticity Index				
B-14, J-2	3.0-4.5					38	18	20	CL	22.0		
T-4	9.5-11.0					56	26	30	CH	35.9	91.9	
J-5	13.0-14.5					51	22	29	CH	29.8		
J-6	18.0-19.5					28	22	6	SM-SC	26.6		
J-7A	23.0-24.0					25	21	4	SM-SC	29.6		
P-108, Bag 1	0-1.0					38	14	24	CL			
Bag 2	1.0-3.5								CL			
T-3	3.5-5.0					65	21	44	CH	26.9	98.8	$3.2x10^{-8}$ (5)
T-4	8.5-10.0					45	17	28	CH	21.7	101.7	$2.6x10^{-7}$ (5)
J-5	13.5-15.0					76	21	55	CH	35.7	87.9	
J-6	13.5-15.0								CH			
J-7	13.5-15.0								CH			
J-8	18.5-20.0								CH			
J-9	18.5-20.0					73	23	50	CH	32.0		
J-10	18.5-20.0								CH			
J-11	23.5-25.0					51	20	31	CH			
J-12	23.5-25.0								SC			
J-13	23.5-25.0								SC			
J-14	28.5-30.0								SC			
J-15	28.5-30.0				37				SC	30.2		
J-16	28.5-30.0								SC			
J-17	33.5-35.0								SC			
J-18	33.5-35.0				33				SC	25.6		

NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas Texas for OW and P-Series Borings. Laboratory testing performed by East Texas Testing Laboratory, Inc., Tyler, Texas for B-Series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.
(5) Laboratory Permeability Test performed on undisturbed Shelby tube sample. Sample tested in oedometer using Falling Head Test procedure in accordance with EM 1110-2-1906.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)
(continued)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (°/o Passing) (2)				Atterberg Limits (3)			Unified Soil Classification Symbol	Field Water Content (°/o) (4)	Dry Density lbs/ft^3	Laboratory Permeability cm/sec
		No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Liquid Limit (°/o)	Plastic Limit (°/o)	Plasticity Index				
P-108, J-20	38.0-39.5								SM	25.0		
J-21	43.5-45.0								SM			
J-23	43.5-45.0					30	11	19	SC	18.6		
J-24	48.5-50.0					34	18	16	SC	19.8		
J-25	53.0-54.5					19	12	7	SM-SC	20.3		
J-26	58.0-59.5								SC			
J-27	58.0-59.5					28	13	15	SC	22.2		
P-109, Bag 1	0-1.0								SC			
Bag 2	1.0-3.5								SC			
T-3	3.5-5.0					51	20	31	CH	20.9	105.7	$4.8x10^{-8}$ (5)
T-4	8.5-10.0					74	23	51	CH	33.1	89.3	$7.4x10^{-9}$ (5)
J-6	13.5-15.0								CH			
J-7	13.5-15.0					73	20	53	CH	29.8		
J-10	18.5-20.0					63	19	44	CH	27.7		
J-11	18.5-20.0											
J-12	23.5-25.0		87	84	38				SC	25.1		
J-13	23.5-25.0											
J-16	28.5-30.0		91	87	44				SC	27.7		
J-18	33.5-35.0								CH	37.0		
J-19	33.5-35.0											
J-20	38.5-40.0		100	98	23				SC	22.2		
J-21	38.5-40.0											

NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas, Texas for OW and P-Series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.
(5) Laboratory Permeability Test performed on undisturbed Shelby tube sample. Sample tested in oedometer using Falling Head Test Procedure in accordance with EM 1110-2-1906.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)
(continued)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (^{o}/o Passing) (2)				Atterberg Limits (3)			Unified Soil Classification Symbol	Field Water Content (^{o}/o)(4)	Dry Density lbs/ft^3	Laboratory Permeability cm/sec
		No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Liquid Limit (^{o}/o)	Plastic Limit (^{o}/o)	Plasticity Index				
OW-9, Bag 1	0-1.0								CL			
Bag 2	1.0-3.5								CL			
T-1	3.5-5.0								CL			
T-2	7.0-8.5		100	99	51	39	15	24	CL	13.2	110.9	
T-3	9.5-11.0								CL			
T-4	13.5-14.0		97	95	57	37	19	18	CL			2.07×10^{-6} (5)
J-5	15.5-16.5				15				SM	26.7		
J-6	18.5-19.5											
J-7	18.5-19.5					77	25	52	CH	33.6		
J-8	18.5-19.5											
J-9	23.5-25.0											
J-10	23.5-25.0		100	95	30				SC	22.3		
J-11	23.5-25.0											
J-12	28.5-30.0											
J-13	28.5-30.0		100	97	45				SC	18.9		
J-14	33.5-35.0											
J-15	38.5-40.0											
J-16	38.5-40.0		100	99	84				CL	20.8		
P-126, T-1	0-2.0		95	93	72	51	17	34	CH	13.0		
T-2	3.0-6.0		95	93	89	62	21	41	CH	25.3	101.6	5.84×10^{-9} (6)
										19.3		3.07×10^{-9} (5)
T-3	6.0-8.0											
T-4	9.0-12.0		98	98	89	63	23	39	CH			7.12×10^{-9} (5)
J-5	13.5-15.0					45	20	25	CL	27.0		

NOTES:

(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas Texas for OW and P-series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.
(5) Laboratory Permeability Test performed on undisturbed Shelby tube sample. Sample tested in oedometer using Falling Head Test Procedure in accordance with EM 1110-2-1906.
(6) Laboratory Permeability determined using remolded sample. Sample tested in oedometer using Falling Head Test Procedure in accordance with EM 1110-2-1906.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)
(continued)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (°/o Passing) (2) No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Atterberg Limits (3) Liquid Limit (°/o)	Plastic Limit (°/o)	Plasticity Index	Unified Soil Classification Symbol	Field Water Content (°/o)(4)	Dry Density lbs/ft³	Laboratory Permeability cm/sec
P-126, J-7	13.5-15.0											
J-8	18.5-20.0				59	41	22	19	CL	29.8		
J-10	18.5-20.0											
J-11	23.5-24.0				40				SM	28.5		
J-12	28.5-29.5				7				SM	26.7		
J-13	33.0-34.0					34	19	15	SC	22.7		
J-15	34.0-35.0		99	94	24				SC			
J-16	38.5-40.5								SC	19.4		
J-19	43.5-44.5				19				SC	26.6		
P-130, T-1	0-2.0								SM			
T-2	3.0-6.0		99	99	55	40	20	20	CL			$5.1x10^{-8}$ (5)
T-3	6.0-9.0								CL			
T-4	9.0-12.0		98	97	96	68	27	41	CH	33.2		$1.4x10^{-8}$ (5)
J-5	13.5-15.0								CH	31.6		
J-7	13.5-15.0											
J-8	18.5-20.0				34	37	21	16	SC	26.7		
J-10	18.5-20.0											
J-11	23.5-25.0				64	54	25	29	CH	25.4		
J-13	23.5-25.0											
J-14	28.5-30.0								SM	27.6		
J-16	33.5-40.0				29				SM	24.1		
J-18	43.5-45.0				25				SM	24.1		
J-22	48.5-50.0								SM	23.6		

NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas Texas for OW and P-series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.
(5) Laboratory Permeability Test performed on undisturbed Shelby tube sample. Sample tested in oedometer using Falling Head Test Procedure in accordance with EM 110-2-1906.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)
(continued)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (°/o Passing) (2) No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Atterberg Limits (3) Liquid Limit (°/o)	Plastic Limit (°/o)	Plasticity Index	Unified Soil Classification Symbol	Field Water Content (°/o)(4)	Dry Density lbs/ft^3	Laboratory Permeability cm/sec
P-141, T-1	3.0-6.0		99	99	98	94	35	69	CH			$9.5x10^{-10}$ (5)
T-2	9.0-12.0								SM			
T-3	15.0-18.0				98	74	25	49	CH			$1.3x10^{-8}$ (5)
J-4	18.0-19.0					73	25	48	CH	33.0		
J-6	19.0-20.0		100	96	93				CH			
J-7	23.5-25.0				87	64	25	39	CH	16.6		
J-9	23.5-25.0											
J-10	28.5-30.0				77	56	28	28	CH	37.5		
J-12	28.5-30.0											
J-13	33.5-35.0				22				SM	28.7		
J-14	44.0-45.0								SC	22.3		
P-143, T-1	0-1.5									20.4		
T-2	1.5-3.0				75	59	19	40	CH	18.6		
T-3	3.0-5.5				89	72	23	49	CH	22.9	104.4	
T-4	5.5-8.0				97	49	18	31	CL	23.8	100.6	$6.6x10^{-9}$ (5)
T-5	8.0-11.0				94	71	21	50	CH	22.6	104.4	$7.79x10^{-9}$ (5)
T-6	11.0-12.5				37	30	15	15	SC	19.4		
J-8	13.5-15.0											
J-9	13.5-15.0				61				CH	23.9		
J-11	13.5-15.0											
J-12	18.5-20.0				19				SM	25.2		
J-14	23.5-25.0			99	26				SM	24.5		
J-17	28.5-30.0								SM	21.9		
J-20	33.5-35.0				25	35	16	19	SC	19.2		
J-22	33.5-35.0											
J-23	38.5-40.0			100	92				ML	24.0		

NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas, Texas for OW and P-Series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.
(5) Laboratory Permeability Test performed on undisturbed Shelby tube sample. Sample tested in oedometer using Falling Head Test Procedure in accordance with EM 1110-2-1906.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)
(continued)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (°/o Passing) (2) No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Atterberg Limits (3) Liquid Limit (°/o)	Plastic Limit (°/o)	Plasticity Index	Unified Soil Classification Symbol	Field Water Content (°/o)(4)	Dry Density lbs/ft³	Laboratory Permeability cm/sec
P-124, T1	3.0-6.0		99	98	77	44	17	27	CL	16.6		
T2	9.0-12.0											
J3	13.5-15.0		100	99	77	53	17	36	CH	24.8		
J5	18.5-20.0											
J7	18.5-20.0				22	26	12	14	SC	25.5		
J8	23.5-25.0									26.9		
J10	23.5-25.0											
J11	28.5-30.0									21.4		
J13	28.5-30.0											
J14	33.5-35.0				47	30	14	16	SC	20.6		
J16	33.5-35.0											
J17	38.5-40.0									24.3		
J19	43.5-45.0				39				SM	19.4		
P-138, T1	0-2.0								SM			
T2	3.0-6.0		94	90	30				SM	12.4		
T3	9.0-12.0					20			SM		110.7	
J4	13.5-15.0				29	33	12	21	SC	21.1		
J6	13.5-15.0											
J7	18.5-20.0									22.8		
J9	18.5-20.0											
J10	23.5-25.0				25				SM	23.9		
J12	28.5-29.5									20.4		
J13	33.5-35.0									18.7		
J14	43.5-45.0				98	77	40	37	CH	32.8		
J16	43.5-45.0											

NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas Texas for OW and P-Series Borings. Laboratory testing performed by East Texas Testing Laboratory, Inc., Tyler, Texas for B-Series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D422.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.

SUMMARY OF LABORATORY TEST RESULTS ON SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE AREA AND WASTEWATER POND DESIGN (1) (continued)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (^{o}/o Passing) (2)				Atterberg Limits (3)			Unified Soil Classification Symbol	Field Water Content (^{o}/o)(4)	Dry Density lbs/ft^3	Laboratory Permeability cm/sec
		No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Liquid Limit (^{o}/o)	Plastic Limit (^{o}/o)	Plasticity Index				
OW-10, Bag 1	0-1.5											
Bag 2	1.5-3.0											
Bag 2A	3.0-3.5											
J-3	3.5-5.0				40	43	17	26	SC	23.0		
J-4	8.5-9.5	87	75	67	35	52	19	33	SC	26.6		
J-6	13.5-15.0				36				SC	31.1		
J-8	18.5-20.0									21.4		
J-10	18.5-20.0									26.6		
J-11	23.5-25.0		100	99	28				SM	22.8		
J-13	23.5-25.0											
J-14	28.5-29.5		99	99	45				SM	18.1		
J-16	33.5-35.0		100	100	97				ML	17.9		
J-18	33.5-35.0											
J-19	38.5-39.5	99	98	97	32				SM	25.3		
P-139, Bag 1	0-2.0											
Bag 2	2.0-3.5											
J-3	3.5-5.0											
J-4	3.5-5.0	96	92	89	35				SM	15.0		
J-5	3.5-5.0											
J-6	8.5-10.0											
J-7	8.5-10.0											
J-8	8.5-10.0				80	29	14	15	CL	23.6		
J-9	13.5-15.0											
J-10	13.5-15.0											
J-11	13.5-15.0		100	100	99	48	20	28	CL	21.5		

NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas, Texas for OW and P-Series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)
(continued)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (°/o Passing) (2)				Atterberg Limits (3)			Unified Soil Classification Symbol	Field Water Content (°/o) (4)	Dry Density lbs/ft³	Laboratory Permeability cm/sec
		No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Liquid Limit (°/o)	Plastic Limit (°/o)	Plasticity Index				
P-139, J-12	18.5-20.0		100	100	68				ML	19.2		
J-13	18.5-20.0											
J-14	23.5-25.0											
J-15	23.5-25.0											
J-16	23.5-25.0				50				ML	16.3		
J-17	28.5-29.0	100	99	99	11				SP	23.1		
J-18	34.0-35.0											
J-19	34.0-35.0		100	100	46				SM	23.4		
J-20	38.5-39.0											
J-21	38.5-39.0		100	100	21				SM	21.8		
J-22	48.5-49.0				21				SM	25.8		
J-23	53.5-54.0				15				SM	22.4		
J-24	58.5-59.0									23.1		
J-25	63.5-64.0									24.6		
J-26	73.5-74.0											
J-27	73.5-74.0				30				SM	24.7		
J-28	78.5-79.0				83				ML	19.1		
J-29	88.5-90.0											
J-30	88.5-90.0											
J-31	88.5-90.0				100	44	20	24	CL	19.8		
J-32	93.5-95.0									24.8		
J-33	98.5-100.0											
J-34	98.5-100.0											
J-35	98.5-100.0				100	71	24	47	CH	24.8		
J-36	108.5-110.0									33.3		
J-37	118.0-119.0									33.5		
J-38	128.0-129.0											
J-39	128.0-129.0											
J-40	128.0-129.0				82	53	20	33	CH	21.4		
J-41	138.5-139.0											
J-42	138.5-139.0									69.1		
J-44	148.0-149.0									21.5		

NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas, Texas for OW and P-Series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)
(continued)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (°/o Passing) (2)				Atterberg Limits (3)			Unified Soil Classification Symbol	Field Water Content (°/o) (4)	Dry Density lbs/ft^3	Laboratory Permeability cm/sec
		No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Liquid Limit (°/o)	Plastic Limit (°/o)	Plasticity Index				
P-139, J-45	158.0-159.0											
J-46	158.0-159.0					58	23	35	CH	19.4		
J-47	168.0-169.0				80				CH	23.3		
J-48	168.0-169.0											
J-49	178.5-179.0									25.7		
J-50	188.5-190.0				99				CL	24.2		
J-52	198.0-199.0									25.9		
P-140, Bag 1	0-2.0											
Bag 2	2.0-4.0											
T-3	4.0-5.0				50	32	15	17	CL	13.7	110.0	3.7×10^{-8} (5)
J-4	8.5-10.0											
J-6	8.5-10.0		98	96	61				CL	17.8		
J-7	14.0-15.0											
J-8	14.0-15.0		100	99	55				CL	18.4		
J-10	19.0-20.0		100	100	27				SM	20.1		
J-12	23.5-25.0				58				CL	23.0		
J-13	23.5-25.0											
J-14	28.0-29.0				30				SM	22.0		
J-15	33.5-34.0	99	99	98	17				SM	24.6		
J-16	38.5-39.5											
J-17	38.5-39.5	97	96	96	19				SM	27.0		
J-18	43.5-44.5	98	97	97	16				SM	25.9		
J-19	49.0-50.0				21				SM	28.2		
J-20	58.0-59.0				27				SM	23.9		
J-22	79.0-80.0											
J-23	79.0-80.0									24.5		
J-24	79.0-80.0								CH			

NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas, Texas for OW and P-Series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.
(5) Laboratory Permeability Test performed on undisturbed Shelby tube sample. Sample tested in oedometer using Falling Head Test Procedure in accordance with EM 110-2-1906.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)
(continued)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (°/o Passing) (2)				Atterberg Limits (3)			Unified Soil Classification Symbol	Field Water Content (°/o)(4)	Dry Density lbs/ft^3	Laboratory Permeability cm/sec
		No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Liquid Limit (°/o)	Plastic Limit (°/o)	Plasticity Index				
P-144, Bag 1	0-2.0											
Bag 2	2.0-3.0		94	91	56	32	14	18	CL	12.2		
J- 3	4.0-5.0											
J- 4	4.0-5.0		100	99	72				ML	12.1		
J- 5	9.0-10.0											
J- 6	10.0-11.0			100	46				SM	13.4		
J- 7	14.0-15.0											
J- 8	14.0-15.0		100	99	29				SM	22.7		
J- 9	19.0-20.0											
J-10	19.0-20.0				20				SM	19.5		
J-11	23.5-24.5											
J-12	23.5-24.5		100	99	24				SM	23.2		
J-13	29.0-30.0											
J-14	29.0-30.0				16				SM	23.7		
J-15	34.0-35.0									32.6		
J-16	34.0-35.0											
J-17	39.0-40.0											
J-18	39.0-40.0									21.5		
J-19	44.0-45.0									25.7		
J-20	44.0-45.0											
J-21	49.0-50.0									27.3		
J-22	49.0-50.0											
P-148, Bag 1	0-2.0				37				SM	0.7		
J- 2	3.5-5.0											
J- 3	3.5-5.0		99	99	21				SM	7.9		
J- 4	8.5-10.0		100	99	41				SM	15.3		
J- 5	8.5-10.0											
J- 6	13.5-15.0		100	99	31				SM	21.5		
J- 7	18.5-20.0											

NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas, Texas for OW and P-Series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)
(continued)

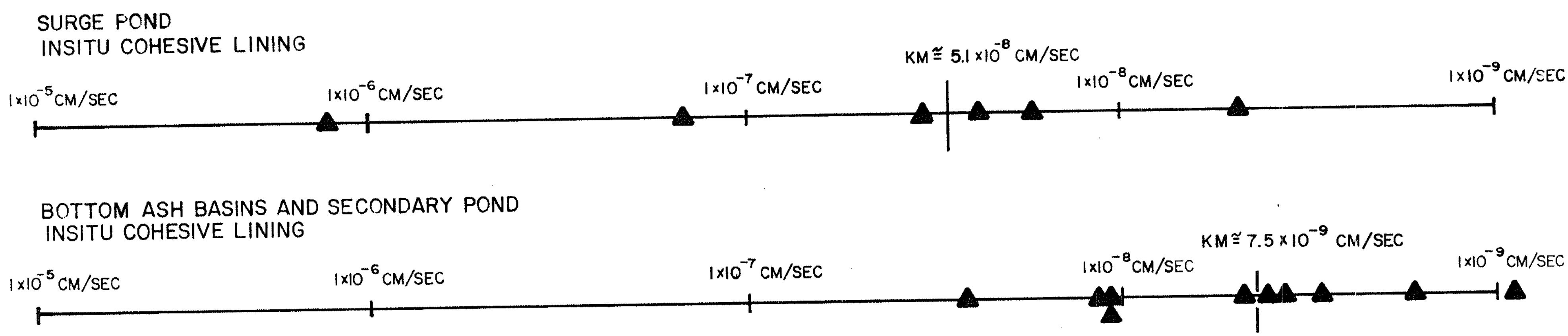
Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (°/o Passing) (2) No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Atterberg Limits (3) Liquid Limit (°/o)	Plastic Limit (°/o)	Plasticity Index	Unified Soil Classification Symbol	Field Water Content (°/o) (4)	Dry Density lbs/ft^3	Laboratory Permeability cm/sec
P-148, J-8	18.5-20.0		99	98	40				SM	21.5		
J-9	23.5-24.0											
J-10	23.5-24.0									21.7		
J-11	33.5-34.0									23.3		
J-12	33.5-34.0											
J-15	39.0-40.0											
J-16	39.0-40.0									20.1		
T-6	13.5-15.0		100	99	31				SM			
OW-5, Bag 1	0-1.5											
Bag 2	1.5-3.5											
J-3	3.5-4.5				36				SM	13.1		
J-4	8.5-10.0				31				SM	22.1		
J-5	13.5-15.0				41				SM	14.6		
J-7	18.5-20.0				79				ML	22.6		
J-9	18.5-20.0											
J-10	23.5-24.5		92	90	69				ML			
J-11	28.5-30.0		100	100	98				ML	27.2		
J-13	28.5-30.0											
J-14	33.5-35.0	100	100	99	93				ML	18.8		
J-16	33.5-35.0											
J-17	38.5-40.0				24.1				SM	19.4		
P-119, Bag 8	10.0-11.0		99	99	35				SC	15.1	114.3	2.88×10^{-7} (6)
Bag 8a	10.0-11.0		99	99	35				SC	15.1	118.1	3.07×10^{-8} (7)
Bag 12	16.0-18.0		100	99	58				ML	16.3	116.4	7.58×10^{-8} (7)
Bag 16	22.0-24.0				40				SM	11.9	116.2	2.35×10^{-7} (7)

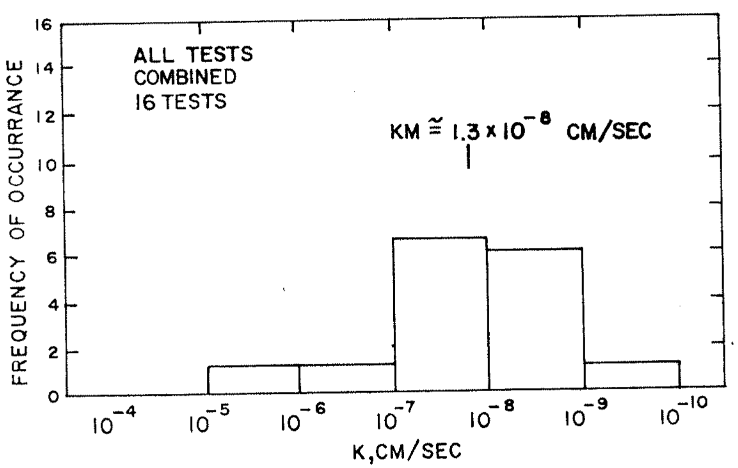
NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas, Texas for OW and P-Series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and ASTM D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.
(6) Laboratory Permeability Test performed on remolded sample using Back Pressure Method in Triaxial Test.
(7) Laboratory Permeability Test performed on sample recompacted to approximately 95 percent standard compaction.

SUMMARY OF LABORATORY TEST RESULTS ON
SOIL BORING SAMPLES RELATED TO LIGNITE STORAGE
AREA AND WASTEWATER POND DESIGN (1)
(continued)

Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (°/o Passing) (2)				Atterberg Limits (3)			Unified Soil Classification Symbol	Field Water Content (°/o)(4)	Dry Density lbs/ft^3	Laboratory Permeability cm/sec
		No. 4 Sieve	No. 10 Sieve	No. 40 Sieve	No. 200 Sieve	Liquid Limit (°/o)	Plastic Limit (°/o)	Plasticity Index				
P-119, Bag 20	28.0-30.0				47				SM	16.6	114.7	2.12×10^{-7} (7)
Bag 24	34.0-36.0				35				SM	9.9	117.0	2.11×10^{-7} (7)
P-120, T-4	8.5-10.0				89	25	11	14	CL	19.7	110.3	2.3×10^{-8} (5)
J-8	18.5-20.0		100	100	29				SM	25.2		
P-125, J-5	13.5-15.0				63	41	17	24	CL	24.9	106.1	2.36×10^{-8} (6)
J-7	13.5-15.0											
P-129, T-3	3.0-5.0								SM	15.8	118.2	5.7×10^{-8} (8)
P-137, T-3	3.5-5.5					37	16	21	SC	18.7	107.5	1.1×10^{-7} (5)
P-137A, T-4	9.5-10.5		100	99	26	31	15	16	SC	10.5		2.75×10^{-6} (5)
OW-7, J-3	3.5-5.0					51	17	34	CH	28.2 27.2	97.6	
J-4	9.5-10.0					25	14	11	CL	23.2 20.8	96.3	
OW-11 J-6	13.5-15.0		99	97	85	68	23	45	CH	30.7		
J-8	18.5-20.0		89	84	79	61	21	40	CH	27.5	95.5	1.34×10^{-8} (6)
J-10	18.5-20.0								CH	34.3		

NOTES:
(1) Laboratory testing performed by NFS/National Soil Services, Inc., Dallas, Texas for OW and P-Series Borings.
(2) Laboratory Particle Size Analysis Tests performed in accordance with ASTM D422 and ASTM D1140.
(3) Laboratory Atterberg Limit Tests performed in accordance with ASTM D423 and D424.
(4) Moisture Content of Soils performed in accordance with ASTM D2216.
(5) Laboratory Permeability Test performed on undisturbed Shelby tube sample. Sample tested in oedometer using Falling Head Test Procedure in accordance with EM 1110-2-1906.
(7) Laboratory Permeability Test performed on sample recompacted to approximately 95 percent standard compaction.
(8) Laboratory Permeability Test performed on undisturbed sample using back pressure in Triaxial Test.





NOTES:

(1) KM = MEDIAN PERMEABILITY IN CM/SEC

(2) SEE EXHIBIT 5 FOR DESCRIPTION OF PERMEABILITY TEST PERFORMED

(3) ALL LABORATORY PERMEABILITY TESTING PERFORMED BY NFS/ NATIONAL SOILS SERVICE, INC., DALLAS, TEXAS

EXHIBIT 8

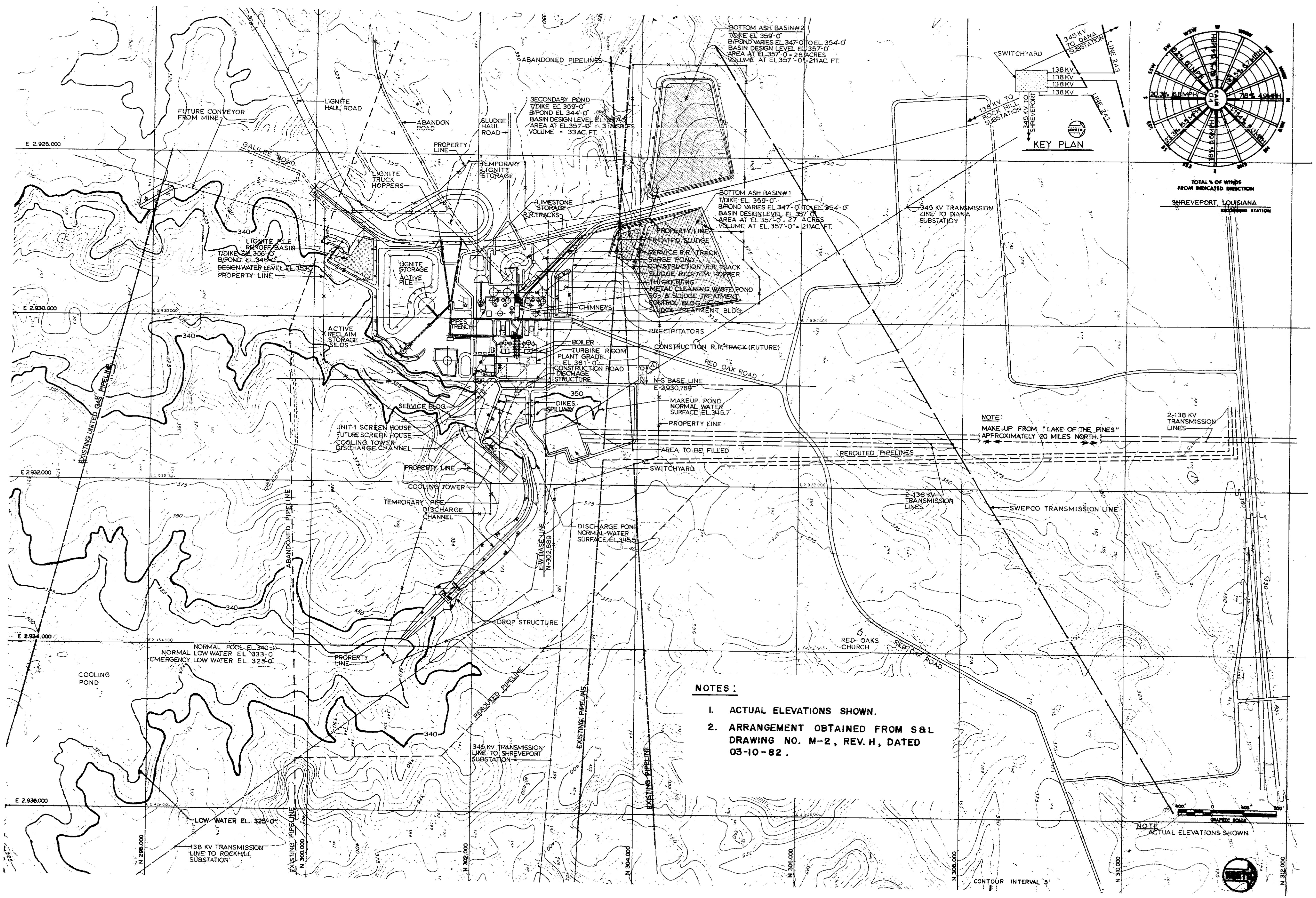
SUMMARY OF LABORATORY PERMEABILITY TEST RESULTS ON COHESIVE SOILS INTENDED FOR USE AS INSITU
CLAY LININGS

SUMMARY OF WASTEWATER POND SIZING DATA

Pond	Top of Dike Elevation, Ft.	Pond Design Level Ft.	Bottom Level, Ft.	Volume @ NOL or PDL Acre Ft.	NOL or PDL Acres	Sizing Basis
Bottom Ash Basin #1	357.0	354.6	347.0	188 (1)	31.0 (2)	541 TPH burn rate, 70% load factor, 20% average ash, 65 pcf ash density, 1 year storage for 1 unit plus 1.5 ft. freeboard over one in 100 year rainfall
Bottom Ash Basin #2	357.0	354.6	347.0	188 (1)	30.8 (2)	
Secondary Pond	359-357	352.0	344.0	12	2.6	
Surge Pond	358-359	355.0	347 - 352	21	4.0	Waste slurry flow from one unit's scrubber at full load for 4 days; 657,148 lb/hr slurry discharge
Lignite Pile Runoff Basin	356.0	353.0	346.0	28.6	45.0	To store 10 year - 24 hour runoff from lignite and limestone piles, material handling structures and limestone preparation area.
Metal Cleaning Waste Pond	360.0	356.5	348.0	12.0	1.9	To store a volume of 12.0 acre-ft plus the runoff from a once-in-ten-year 24-hour rainfall event

NOTES: (1) Maximum ash capacity.
(2) Surface area at maximum pool.

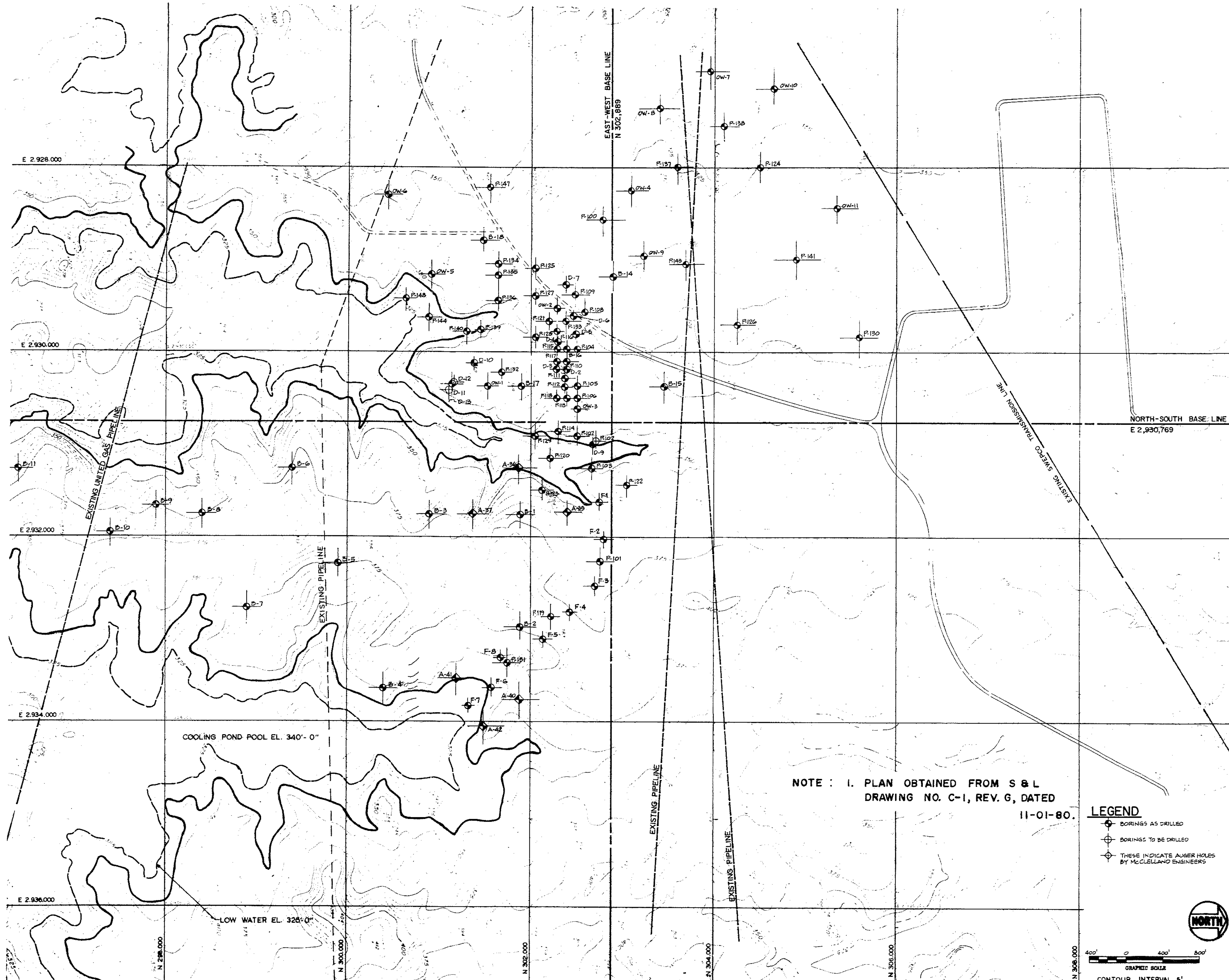
EXHIBIT I



GENERAL SITE LAYOUT

SARGENT & LUNDY
ENGINEERS

EXHIBIT 4

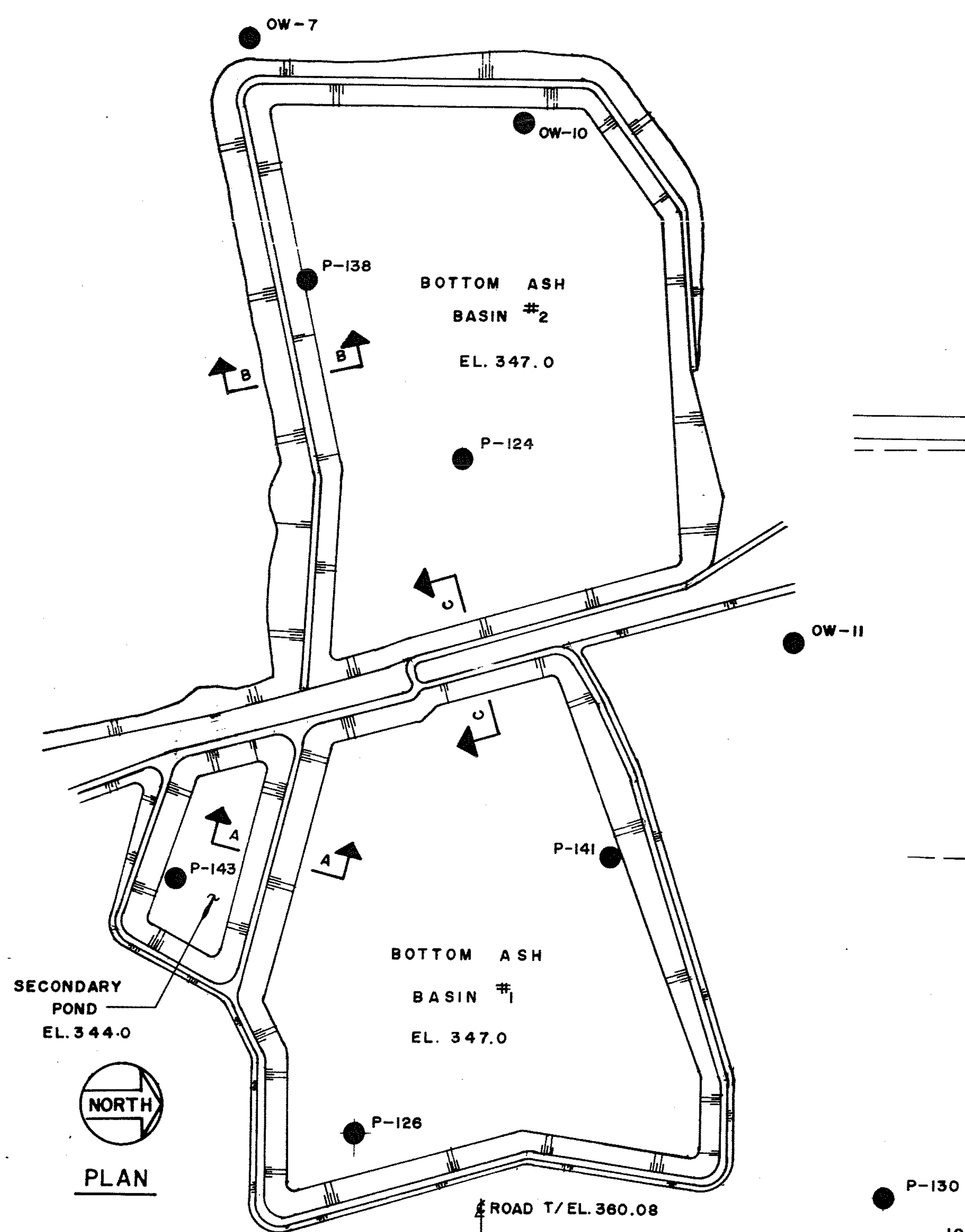


BORING Nº	LOCATION NORTH	LOCATION EAST	DEPTH IN FEET	REMARKS
B-1	301,889	2,931,769		COMPLETED OCT. 1977
B-2	301,889	[illegible]		
B-3	300,889	[illegible]		
B-4	300,389	2,933,269		
B-5	299,889	2,931,269		
B-6	299,389	2,931,269		
B-7	298,839	[illegible]		
B-8	298,389	2,931,769		
B-9	297,889	2,931,269		
B-10	297,389	2,931,969		
B-11	296,389	2,931,269		COMPLETED OCT. 1977
B-12	299,989	2,938,269		NOT DRILLED
B-13	297,889	2,937,769		COMPLETED OCT. 1977
B-14	302,889	2,929,169		COMPLETED JAN. 1978
B-15	303,449	2,930,369		
B-16	302,399	2,929,969		
B-17	301,889	2,930,369		
B-18	301,469	2,928,769		COMPLETED JAN. 1978
P-100	302,789	2,928,569	40	
P-101	302,769	2,932,269	40	
P-102	302,719	2,930,969	50	
P-103	302,669	2,931,269	50	
P-104	302,509	2,929,969	100	
P-105	302,509	2,930,379	79	COMPLETED AUG. 1978
P-106	302,509	2,930,509	79	COMPLETED AUG. 1978
P-107	302,509	2,930,919	40	
P-108	302,589	2,929,579	60	
P-109	302,489	2,929,359	40	
P-110	302,389	2,930,109	80	
P-111	302,374	2,930,289	80	
P-112	302,374	2,930,379	100	
P-113	302,389	2,930,509	79	COMPLETED AUG. 1978
P-114	302,309	2,930,869	80	
P-115	302,289	2,929,969	200	CHIMNEY
P-116	302,289	2,929,789	80	
P-117	302,289	2,930,109	80	
P-118	302,289	2,930,509	100	
P-119	302,229	2,932,859	40	
P-120	302,219	2,931,149	80	
P-121	302,209	2,929,669	80	
P-122	303,050	2,931,450	60	
P-123	302,129	2,931,499	80	
P-124	304,500	[illegible]8,000	50	PERCOLATION TEST @ 5', 7' & 10'
P-125	302,049	2,929,089	50	
P-126	[illegible]	2,929,700	50	PERCOLATION TEST @ 5', 7' & 10'
P-127	302,049	2,929,389	80	
P-128	302,049	2,929,839	80	
P-129	302,049	2,930,919	80	
P-130	305,[illegible]	2,929,350	50	PERCOLATION TEST @ 6' & 10'
P-131	301,759	2,933,369	60	
P-132	301,689	2,930,219	80	
P-133	302,389	2,929,669	100	
P-134	301,649	2,929,044	50	
P-135	301,649	2,929,169	50	
P-136	301,649	2,929,444	50	
P-137	303,600	2,927,[illegible]0	50	REGULAR SAMPLING
P-138	304,100	2,927,550	50	PERCOLATION TEST @ 5', 7' & 10'
P-139	301,459	2,929,759	200	LIGNITE ZONE
P-140	301,309	2,929,779	80	
P-141	304,900	2,929,000	50	PERCOLATION TEST @ 0' & 15'
P-143	303,700	2,929,050	40	PERCOLATION TEST @ 3', 7' & 10'
P-144	300,889	2,929,629	50	
P-147	301,559	2,928,219	40	
P-148	300,629	2,929,429	40	
OW-1	301,539	2,930,369	15' BELOW WATER TABLE	1¼" DIA. OBSERVATION WELL
OW-2	302,289	2,929,529	15' BELOW WATER TABLE	1¼" DIA. OBSERVATION WELL
OW-3	302,509	2,930,619	15' BELOW WATER TABLE	1¼" DIA. OBSERVATION WELL
OW-4	303,000	2,928,250	15' BELOW WATER TABLE	4" DIA. OBSERVATION WELL FOR WATER QUALITY
OW-5	300,919	2,929,169	15' BELOW WATER TABLE	
OW-6	300,430	2,928,300	15' BELOW WATER TABLE	
OW-7	303,950	2,926,950	15' BELOW WATER TABLE	
OW-8	305,410	2,927,350	15' BELOW WATER TABLE	
OW-9	303,239	2,928,969	15' BELOW WATER TABLE	
OW-10	304,650	2,927,150	15' BELOW WATER TABLE	
OW-11	305,350	2,928,450	15' BELOW WATER TABLE	4" DIA. OBSERVATION WELL FOR WATER QUALITY
A-35	302,400	2,931,750		
A-36	301,880	2,931,260		
A-37	301,380	2,931,750		
A-40	301,890	2,933,780		
A-41	301,200	2,933,540		
A-42	301,500	2,934,050		
D-2	302,394	2,930,189	35	COMPLETE JUNE 1979
D-3	302,284	2,930,189	35	
D-4	302,300	[illegible]	35	
D-5	302,499	[illegible]	38	
D-6	302,464	[illegible]	35	
D-7	302,389	2,929,23[illegible]	40	
D-9	[illegible]	[illegible]	30	
D-10	302,359	2,930,119	40	
D-11	301,[illegible]	[illegible]	50	COMPLETE JUNE 1979
D-12	301,159	2,930,339	120	
D-13	301,104	2,930,414	120	
F-1	302,752.92	2,931,638.42	75	
F-2	302,806.67	2,932,046.23	75	
F-3	302,705.54	2,932,549.30	75	
F-4	302,432.26	2,932,830.85	75	
F-5	302,158.55	2,933,125.12	70	
F-6	301,968.05	2,933,659.32	45	
F-7	301,316.63	2,933,851.59	45	
F-8	301,673.63	2,933,330.89	45	

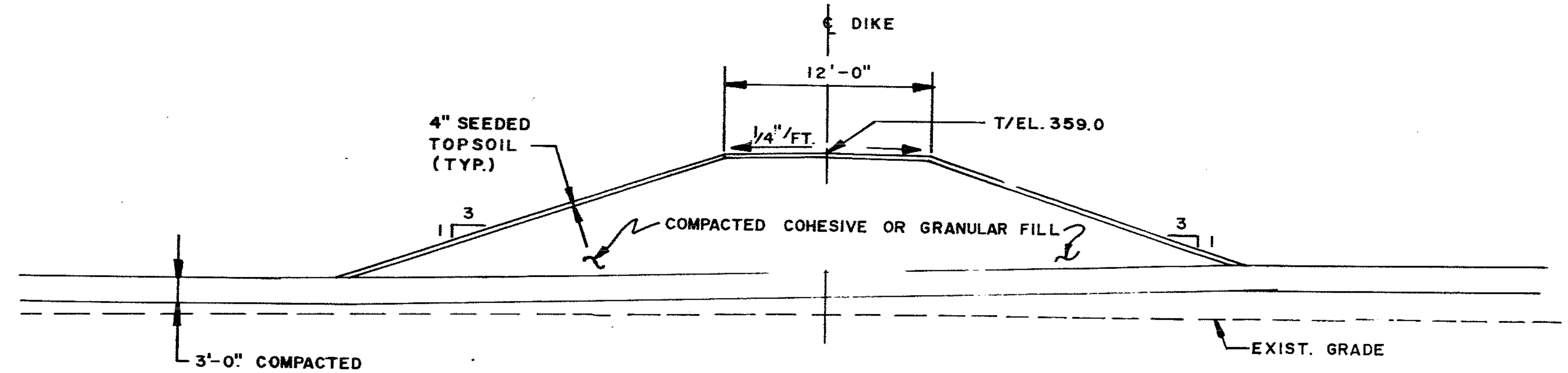
BORING LOCATION PLAN

SARGENT & LUNDY ENGINEERS

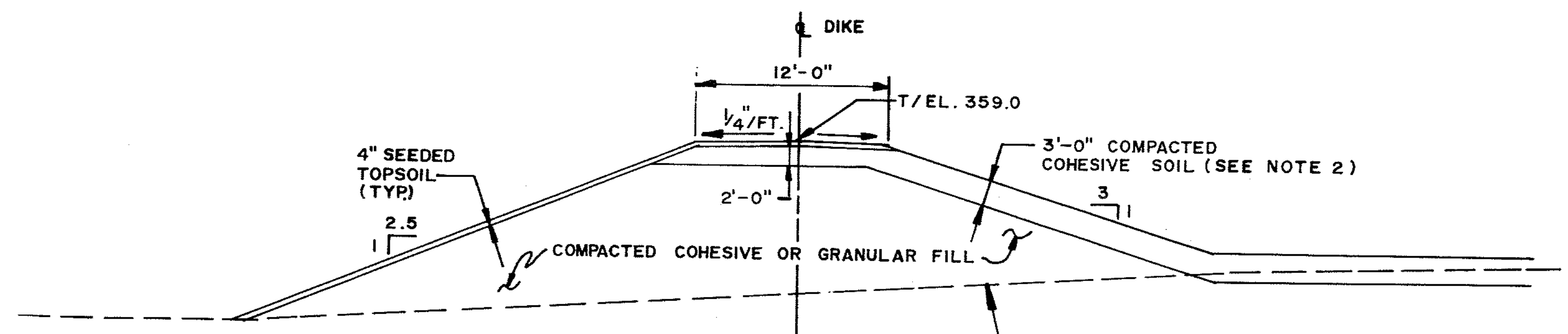
EXHIBIT 9



PLAN

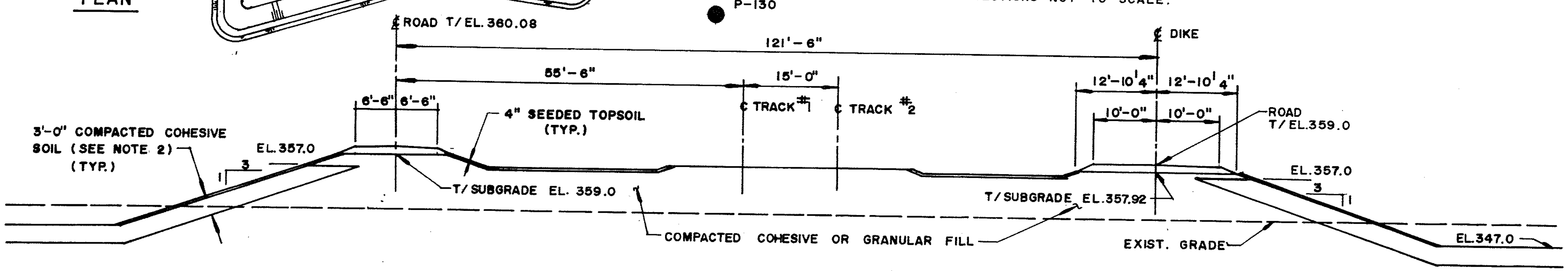


SECTION A



SECTION B

NOTES:
1. PLAN AND SECTIONS OBTAINED FROM S&L DRAWING NOS. & REVISIONS, C-19-D, C-20-G, C-21-D, AND C-22-F, DATED 08-25-81.
2. COMPACTED COHESIVE LINING REQUIRED ONLY IN AREAS WHERE DIKE FILL IS GRANULAR OR WHERE POND BOTTOM IS NON-COHESIVE. SOIL BORINGS INDICATE THAT BASIN #1 AND EAST SIDE OF BASIN #2 ARE LOCATED IN NATURAL COHESIVE DEPOSITS (CL AND CH MATERIAL).
3. SOIL BORING LOCATIONS ARE APPROXIMATE, SEE EXHIBIT 4 FOR EXACT LOCATIONS.
4. PLAN AND SECTIONS NOT TO SCALE.

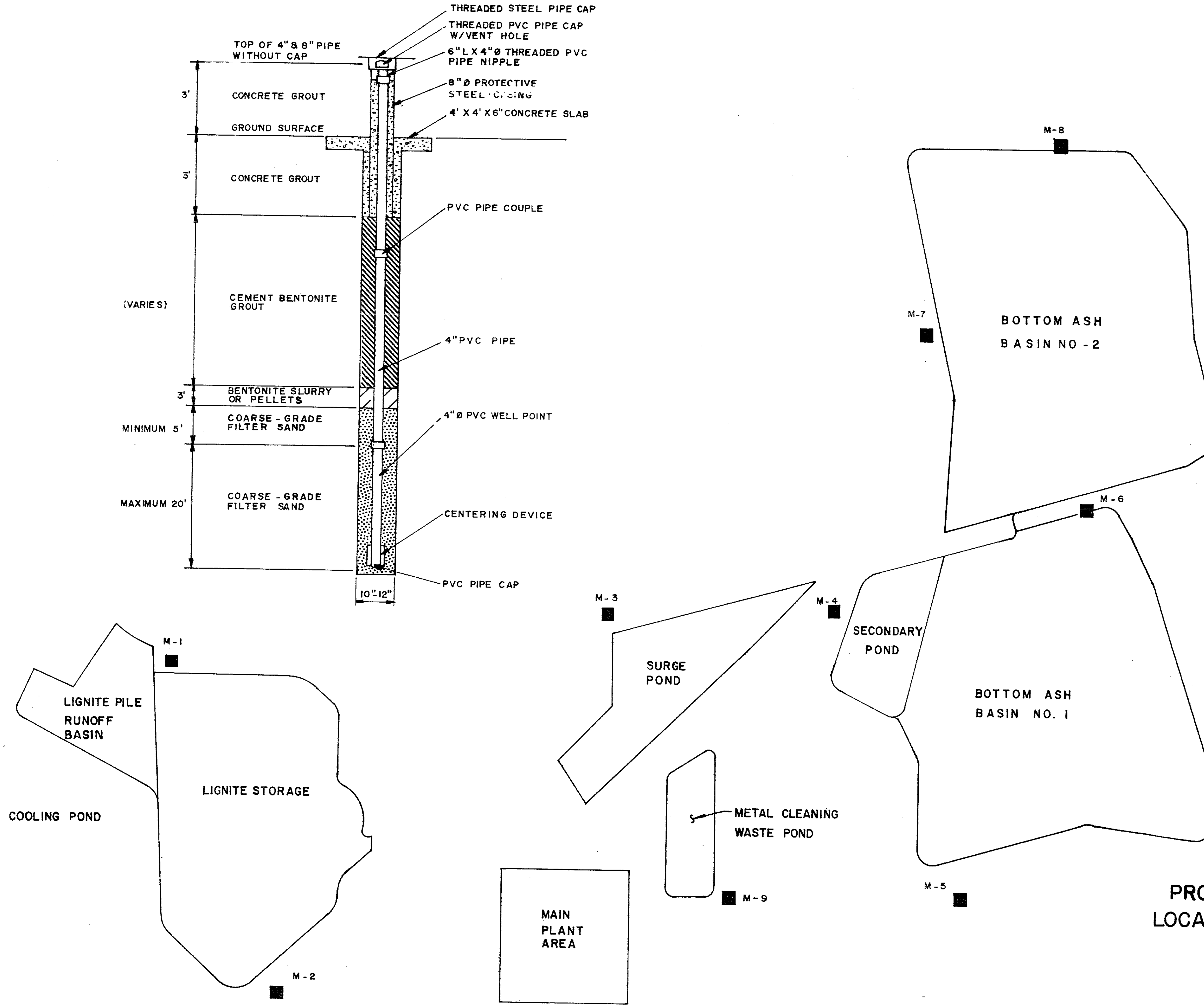


SECTION C

BOTTOM ASH BASINS AND SECONDARY POND PLAN AND CROSS SECTIONS

SARGENT & LUNDY
ENGINEERS

EXHIBIT 12



LEGEND

■ LOCATION OF PROPOSED MONITORING WELLS

NOTES:

1. LOCATION OF WELLS ARE APPROXIMATE.
2. DRAWING NOT TO SCALE.

PROPOSED MONITORING WELLS
LOCATIONS AND TYPICAL DETAILS

SARGENT & LUNDY ENGINEERS

Southwestern Electric Power Company
Henry W. Pirkey Power Plant

COHESIVE LINING CONSTRUCTION VERIFICATION PROGRAM FOR LIGNITE STORAGE AREA AND WASTEWATER POND FACILITIES

I. INTRODUCTION

Southwestern Electric Power Company (SWEPCo) has committed to providing verification that their insitu and compacted cohesive linings for the lignite storage area and wastewater pond facilities have been constructed in accordance with project specifications and guidelines suggested by the Texas Department of Water Resources (TDWR). The wastewater pond facilities requiring verification are the lignite pile runoff basin, surge pond, two bottom ash storage basins, secondary settling pond, and the metal cleaning waste pond. Also requiring verification is the compacted cohesive lining placed beneath the lignite storage pile and for ditches transporting runoff from the pile to the runoff basin.

A summary of the design of the lignite storage area and wastewater pond facilities with respect to the guidelines suggested by the TDWR was presented in a report for SWEPCo dated January 31, 1983. In this report, which may have been submitted to the TDWR, SWEPCo has committed to the verification. This report should be reviewed concerning the applicable guidelines suggested by the TDWR and the lining and dike requirements specified. The wastewater pond facilities and lignite storage area earthwork construction is included in the scope of project specification H-4533.

II. SCOPE

The cohesive lining construction verification program will include the following for each of the wastewater pond facilities and lignite storage area.

a. A listing of all the field density tests performed on cohesive lining material during construction. A statistical summary of field dry density, field water content, and percent compaction.

b. Results of any laboratory testing performed on samples representing cohesive lining material during construction.

c. Results of laboratory testing on continuous undisturbed samples obtained from the in-place (compacted or insitu) cohesive lining after construction. The laboratory testing will consist of sample classification, grain size, atterberg limit, and falling or constant head permeability tests. If construction of the lining has not been completed at the time this program begins, as is the case with the Metal Cleaning Waste Pond, samples should be obtained during construction.

Results of the laboratory testing and field density test summary will be compared to project specifications and TDWR guidelines to document compliance. Details of the laboratory test program are given in Section III of this report.

III. LABORATORY TEST PROGRAM FOR COHESIVE LINING SAMPLES

Twenty-two undisturbed shelby tube samples shall be obtained from the cohesive lining of the six wastewater ponds and lignite storage area. The thin-walled shelby tube samples shall be in accordance with ASTM D1587. The tube shall be 3 inches outside diameter and having a length such that a minimum 24-inch sample can be obtained. Tubes may be field extruded, unless otherwise directed by the purchaser. If extruded, the entire sample shall be placed in approved containers, properly labeled and transported to the laboratory. A field log shall be prepared for all extruded samples.

Dwg. HP-56 shows the approximate location of all test samples. These locations will be staked and surveyed by the purchaser prior to beginning field work. Any pond containing water will have to be pumped dry. Most samples are located within the bottom lining of the pond or area. Some samples are located in the lining of the dike slope. Drilling or other suitable equipment shall be used to obtain the samples.

The testing contractor shall inspect the site prior to beginning the sampling, but after the locations are staked to ensure that the proper equipment is brought to the site.

After sampling each or a group of locations, each borehole shall be filled with CH clay obtained on site and compacted in 6-inch layers with suitable heavy hand tampers. Testing contractor shall make with purchaser all necessary arrangements to assure that all holes are properly filled and compacted to prevent any future pond leakage due to sampling.

The required laboratory testing is given in Table 1. All samples shall be properly classified and test results reported as required in standards.

TABLE I - LABORATORY TEST REQUIREMENTS

Sample Number	Laboratory Classification ASTM D 2487	Atterberg Limits ASTM D 423 & D 424	Grain Size Analysis ASTM D 422 Hydrometer	Grain Size Analysis ASTM D 1140 Fines Content	Laboratory Permeability (2) EM 1110-2-1906
S-1	X	X	X		X
S-2	X	X		X	X
S-3	X	X		X	X
S-4	X	X	X		X
S-5	X	X		X	X
S-6	X	X		X	X
S-7	X	X		X	X
S-8	X	X	X		X
S-9	X	X		X	X
S-10	X	X		X	X
S-11	X	X		X	X
S-12	X	X	X		X
S-13	X	X		X	X
S-14	X	X		X	X
S-15	X	X	X		X
S-16	X	X		X	X
S-17	X	X		X	X
S-18	X	X	X		X
S-19	X	X		X	X
S-20	X	X		X	X
S-21	X	X	X		X
S-22	X	X		X	X

Southwestern Electric Power Company
Henry W. Pirkey Power Plant

Ground Water Monitoring Program for Lignite Storage Area and Wastewater Pond Facilities

I. INTRODUCTION

The Lignite Storage Area and Wastewater Pond Facilities at the H. W. Pirkey Station are situated generally west of the main plant area. The original topography ranges in elevation from 325 feet to 375 feet, mean sea level. The ponds are underlain by a series of stiff clay strata and dense silty sand strata. Pond and basin linings consist of in-situ cohesive soils, where available, or compacted cohesive fill where the in-situ lining thickness is less than 3 feet.

Groundwater occurs under water table conditions between elevations varying from 320 ft. in the low lying areas to 350 feet in the higher elevations. Recharge of the water table is primarily from infiltration of precipitation. Groundwater discharge is to Brandy Branch Creek, which drains the site south and east of the lignite storage area, and to Hatleys Creek, which drains the area north and west of the lignite storage area. Brandy Branch Creek will be dammed to provide a cooling pond.

The proposed ground water monitoring program consists of two phases:

1) A pre-operational phase during which baseline data are established and interpreted.

2) An operational phase during which ground water levels and ground water quality are monitored in order to identify the impact of the various ponds and drainage basins.

The proposed ground water monitoring program includes periodic measurement of groundwater levels and groundwater quality in monitoring wells installed specifically for these purposes within the area. Additional data collected for the groundwater monitoring program should include daily cooling pond level and precipitation measurements.

II. OBJECTIVES

The objectives of the proposed groundwater monitoring program are:

1) Identification of the potentiometric surface, general direction of groundwater movement, and hydraulic gradient for the aquifer(s), including seasonal fluctuations, in the vicinity of the ponds;

2) Establishment of baseline groundwater quality data prior to operation of the plant;

3) Monitoring of changes in groundwater levels that may result from infiltration from the various ponds and drainage basins;

4) Monitoring of groundwater quality during plant operation;

5) Early detection and determination of the level of contamination and general direction of movement away from the source.

III. PHYSICAL ARRANGEMENT

Single-level groundwater monitoring wells are proposed at ten locations. The locations of these monitoring wells are indicated on Dwg. HP-56. Construction details for the single-level monitoring wells are shown on Exhibit 2.

The single-level monitoring wells are screened in the upper portions of the water table or confined aquifers where the concentration of contaminants should be highest. In addition, the concentration of contaminants should decrease through the saturated thickness of the aquifer as a result of hydrodynamic dispersion.

The well locations have been chosen so that one well is located hydraulically upgradient from the active portion of the facilities and at least one monitoring well is installed hydraulically downgradient of the active area. The upgradient well will yield samples representative of the background quality of the groundwater which flows under the facility. The down-gradient well is located as close as possible to the facility where it will provide the greatest opportunity for interception of migrating leachate and provide an early warning of ground-water contamination..

The proposed single-level monitoring well, shown on Exhibit 2, is a 10-inch by 4-inch, sand-pack installation. The 4-inch diameter CPVC casing is preferable to a 2-inch diameter casing because the larger diameter will facilitate collecting ground-water samples using a portable submersible pump rather than by bailing of the well. The upper portion of the annular space will be backfilled with an impermeable material to prevent surface water from entering the well bore.

IV. INSTALLATION OF GROUNDWATER MONITORING WELLS

A. Contractor shall drill a 10-inch minimum diameter borehole as indicated on the attached exhibits. The borehole shall be fully cased during drilling with a temporary 10-inch minimum diameter steel casing. Larger diameter borehole and casing may be used only if approved in advance by the Consulting Engineers and the Purchaser. The use of bentonite drilling mud to hold the borehole open will not be permitted. Once the designated depth has been reached, Contractor shall flush the casing with clear water until clear water returns to the surface. The use of biodegradable drilling mud (revert) in lieu of a fully cased borehole to hold the hole open will be permitted if Contractor can show to the satisfaction of the Purchaser and the Consulting Engineers that he can satisfactorily install and disinfect the monitoring well.

B. Contractor shall collect representative split-spoon soil samples at five foot intervals and at changes in strata during drilling. Contractor shall prepare a boring log showing the stratigraphy and groundwater level during drilling.

C. Option: Contractor may drill an initial borehole of diameter less than 10-inches to collect samples and then ream to a large diameter for the installation of the well screen, casing, and sand pack.

D. Once the soil stratigraphy and groundwater level have been determined, Purchaser's representative shall confirm the intended installation details for the groundwater monitoring well as indicated in Exhibit 2. These details shall include stratigraphy, total depth, screened interval, length and depth of granular backfill, thickness and depth of the bentonite seal, and length of grout seal. Purchaser shall approve the installation details prior to the installation.

E. Contractor shall construct the groundwater monitoring well from 4-inch diameter CPVC 4120, Schedule 40 casing as specified in ASTM F441 attached to a 20-foot length of 4-inch diameter PVC well screen with a bottom cap. Solvent cement and pipe cleaner for joining sections of CPVC pipe, fittings, and the PVC well screen shall be a type specifically intended for its use. The slot size of the well screen shall be 0.010 inch. A 9-inch diameter perforated PVC disk or equivalent device shall be attached to the bottom of the well point to permit centering of the well point in the borehole.

F. Upon placement of the CPVC casing and well screen in the borehole, Contractor shall fill the annular space between the CPVC casing-well screen assembly and 10-inch temporary casing with clean concrete sand (graded per ASTM C-33) to 5 feet above the top of the PVC well screen. The backfill material may be allowed to settle through the water in the steel casing. The 10-inch diameter casing shall be pulled back to 3 feet above the well screen while backfilling with the clean, concrete sand. During the sand backfilling the casing shall not be pulled back above the top of the sand.

G. After placement of the sand backfill, Contractor shall settle the backfill around the well point by pumping water from the PVC well screen. Sufficient sand shall be added to the annular space to maintain the level of sand backfill at 5 feet above the top of the well screen. Pumping shall continue intermittently until the discharge water is clear and soil free or until pumping is stopped by Purchaser's representative. Disposal of water discharged from the monitoring well during pumping shall be as directed by Purchaser.

H. After settlement of the sand backfill, place two feet of bentonite in the annular space between the CPVC casing and the outer casing to prevent any movement of the cement grout into the granular backfill. If granular bentonite is used, it shall be placed through a conductor pipe using the tremie or other method as approved by the Purchaser. If bentonite pellets are used, they may be allowed to settle through the water around the CPVC casing. If the water table is below the bentonite seal, add clear water during this process to hydrate the bentonite. When bentonite pellets are used, sufficient length of time shall be allowed for the bentonite to form a seal over the sand backfill before placing grout. After placement and hydration of the bentonite seal, the outer casing shall be pulled to one foot below the top of the bentonite seal.

I. After placement of the bentonite seal, Contractor shall fill the remaining annular space between the CPVC casing and borehole with cement-bentonite grout, placed by the tremie method from the bottom upward or by an alternative method approved by Purchaser. The 10-inch steel casing shall be pulled simultaneously with placement of the grout. A positive head of grout shall be maintained in the temporary casing at all times during the placement. The grout mix shall be approximately 7 gallons of water with 3 pounds of powdered bentonite per 94-pound sack of Portland cement. The bentonite and water shall be mixed first to provide a smooth slurry, then the cement shall be added to the slurry and blended to a smooth consistency.

J. Contractor shall terminate the CPVC casing 3 feet above grade and shall install a vented, removable PVC cap such that the CPVC casing is not restricted by the cap or coupling. Contractor shall cut a small notch in the rim of the CPVC casing to mark the point from which all level measurements are to be made. This point shall be clearly marked on the CPVC casing with an indelible marking.

K. Contractor shall install a 6-foot length of 8-inch diameter protective steel casing 3 feet into the cement-bentonite grout. Contractor shall fill the annular space between casings with cement-bentonite grout to within 6 inches of the top of the CPVC casing. A threaded steel cap with ventilation hole shall be provided for the protective casing. An 18-inch long rebar shall be welded to the top of the steel cap to facilitate its removal during groundwater sampling. Contractor shall paint the protective casing and its cap with florescent type paint. Contractor shall clearly and permanently mark the protective casing with the appropriate alphanumeric designation.

L. Contractor shall construct a concrete apron at the ground surface to provide drainage away from the monitoring well, to prevent movement of water down the side of the steel casing, to prevent erosion, and to provide permanence to the monitoring well. The concrete apron shall be at least 2 feet in diameter and 6 inches in thickness.

M. After the monitoring wells are installed, Contractor shall survey the locations and the elevations of the measuring points on the well casings.

V. DISINFECTION OF WELLS

A. Immediately after completion of well, disinfect it by circulating a chlorine solution through the well, let set for the period specified, then pump the solution from the well, and discharge it as directed.

B. Disinfecting Agent:

a. The disinfecting agentt shall be liquid sodium hypochlorite, NaOCl, or granular calcium hypochlorite, $Ca(ClO)_2$. Calcium hypochlorite shall not be used where the concentration of calcium in the groundwater will exceed 300 ppm after addition of the disinfecting solution. The choice of disinfecting agent is subject to approval by the Consulting Engineer.

b. The disinfecting agent used in the solution shall be delivered to the Project Site in the original, unopened dated containers. Prior to use, the disinfecting agent shall not be exposed to air or direct sunlight.

C. Disinfection Procedure:

a. Determine depth to water and depth to the bottom of the well from a common measuring point. Calculate the height of the water column in the well (depth to bottom of well minus depth to water, in feet).

b. Calculate the total volume of water ($V=V_1+V_2$) in both the well (V_1 in gallons) and sand pack (V_2 in gallons) where V (in gallons) equals the height of the water column times 1.5.

c. With the pump intake located as near the water level as possible, pump the well to remove at least 5 volumes of water, 5x(V). Pump until discharge water is clear. Then, lower the pump intake to the bottom of the well. Pump at least 1.5 volumes of water, 1.5x(V), until discharge water is clear. Additional pumping levels may be required at the discretion of the Consulting Engineer. This step may be deleted if disinfection is performed immediately after well installation.

d. Mix a solution of disinfectant by adding a measured amount of calcium or sodium hypochlorite to a known volume of clear water to provide at least a 200 ppm chlorine solution when mixed with the total volume, V, of water in the well. The amount of disinfecting agent to be added to clear water depends on the initial concentration of hypochlorite. The volume of clear water added shall be no less than the total volume of water, V.

e. After approval of the disinfection solution mix by the Consulting Engineer, place the solution in the well in such a manner that it is thoroughly distributed throughout the entire column of water in the well. Add an extra dosage to the bottom of the well. Make certain that the dry portion of the well casing above the water level is also wetted. This may be accomplished by tremie or by pumping the solution through a hose moved through the well from the bottom up, or by another acceptable method as approved by the Consulting Engineer. Well disinfection by pouring the solution from the top of the well is not acceptable.

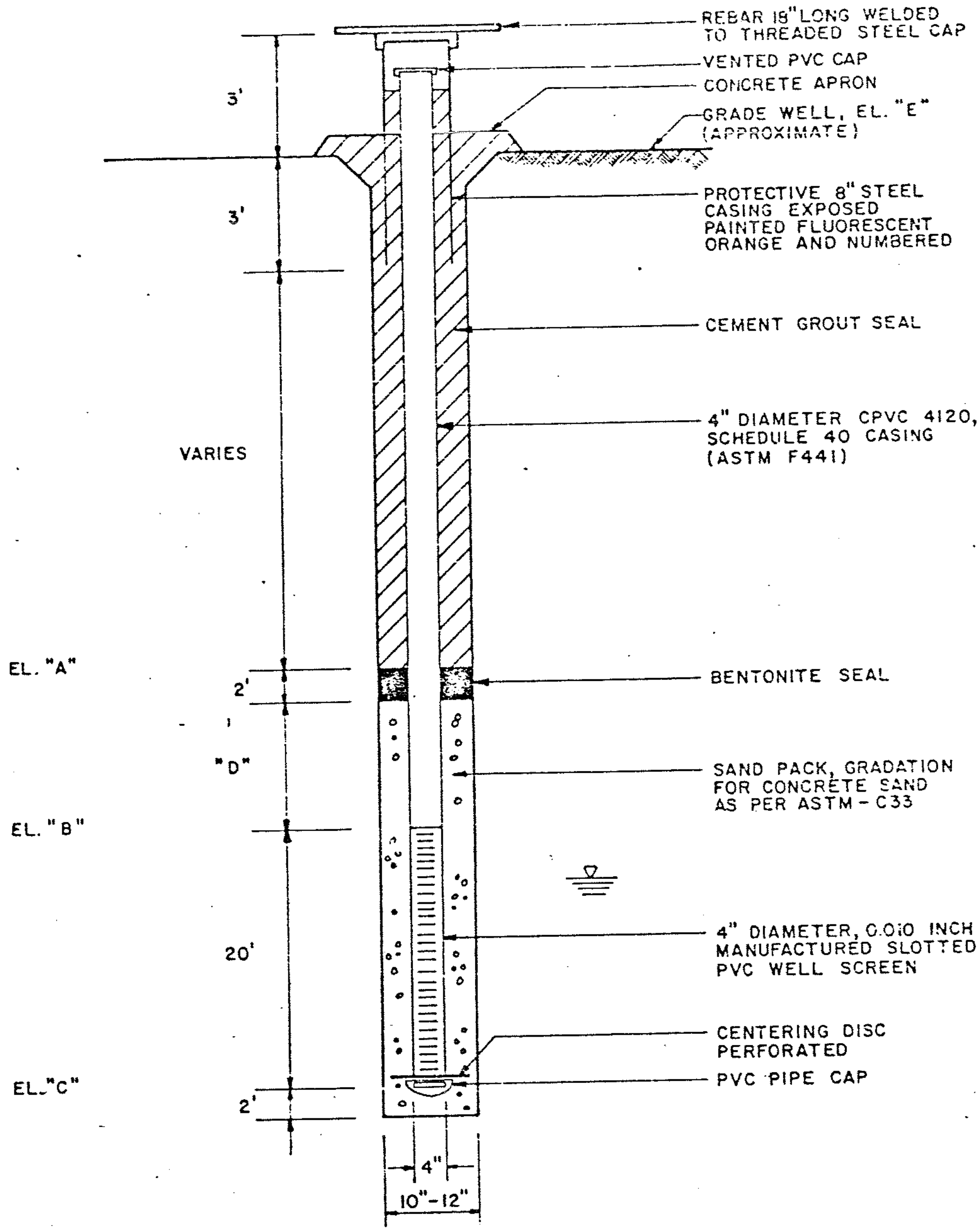
f. Recirculate the solution in the well by pumping from the bottom of the well and reintroducing the discharged solution into the top of the well. During recirculation, the portion of the well casing above the water table shall be maintained in a wet condition with the solution. The length of the recirculation period will be determined by the Consulting Engineer, but will not be less than 30 minutes nor more than two hours. Measure the residual free chlorine concentration at the end of the recirculation period.

g. After recirculation, the solution shall remain in the well for a minimum of eight hours. Replace the well caps for this period.

h. After the eight hour or longer period, the well shall be pumped to clean it of solution. Purchaser will determine the residual free chlorine concentration at the beginning of pumping to assure that complete disinfection has occurred. The method of determining the concentration shall be approved by the Consulting Engineer.

i. If the residual free chlorine concentration is greater than or equal to 1.0 ppm, the disinfection of the well will be assumed to be complete. The well shall then be pumped for at least two hours, but not more than four hours, to remove the solution from the well and surrounding aquifer. Vary the depth of the pump intake in the well while pumping, from the top of the water column to the bottom of the well, and back to the top again. Dispose of the water pumped from the well as directed by Purchaser.

j. If the residual free chlorine concentration is less than 1.0 ppm, pump the solution from the well as indicated in step "c." above and repeat the disinfection procedure.



WELL No.	EL. "A"	EL. "B"	EL. "C"	"D"	EL. "E"
MW-1	330	323	303	5'	334
MW-2	327	320	300	5'	339
MW-3	342	335	315	5'	370
MW-4	347	340	320	5'	364
MW-5	347	340	320	5'	362.5
MW-6	347	340	320	5'	361
MW-7	347	340	320	5'	358.3
MW-8	351	344	324	5'	356.3
MW-9	348	344	324	2'	353.1
MW-10	347	340	320	5'	357.6

NOTES

1. DRAWING NOT TO SCALE.
2. WELL SHALL BE DISINFECTED UPON COMPLETION.
3. LOCATION OF GROUNDWATER QUALITY MONITORING WELLS IS SHOWN ON EXHIBIT 1.

EXHIBIT 2
GROUNDWATER QUALITY MONITORING
WELL DETAIL
HENRY W. PIRKEY POWER PLANT
SOUTHWESTERN ELECTRIC POWER CO.

SARGENT & LUNDY
ENGINEERS
FOUNDED 1891
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603
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April 25, 1984
Project No. 5555-02
File No. 5.8.1

Southwestern Electric Power Company
Henry W. Pirkey Power Plant
Unit 1

Wastewater Ponds Permit
Data Report - Revisions

Mr. M. J. Scott
Southwestern Electric Power Company
P. O. Box 21106
Shreveport, Louisiana 71156

Dear Mr. Scott:

Enclosed are two copies of the Wastewater Ponds Permit Data Report which has been revised per your letter, dated December 20, to Mr. F. J. Emmett. The revisions address overflows from the ponds which are not bounded by the permit. The revisions have been indicated in the righthand margin with an "R". Please review the revisions and return any comments you have to us so that we can reissue the appropriate number of copies for your use.

Yours very truly,

Charles J. Nelson
Charles J. Nelson
Structural Project Engineer

CJN:jg
Enclosure
Copies:
W. H. Holley (1/1)
A. I. Melson (1/1)
R. J. Pruett (1/1)
F. J. Emmett (1/1)
E. R. Weaver (1/1)
D. G. Bodine (1/1)
J. A. Wilson (1/1)

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APR 30 1984
OFFICE OF
W. H. HOLLEY

HENRY W. PIRKEY POWER PLANT

DESIGN SUMMARY FOR LIGNITE STORAGE AREA AND WASTEWATER POND FACILITIES

REPORT PREPARED FOR

SOUTHWESTERN ELECTRIC POWER COMPANY

JANUARY 31, 1983

REVISED: APRIL 25, 1984

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LIST OF EXHIBITS

HENRY W. PIRKEY POWER PLANT
DESIGN SUMMARY FOR LIGNITE STORAGE AREA AND WASTEWATER POND FACILITIES

SOUTHWESTERN ELECTRIC POWER COMPANY

I INTRODUCTION

This report is prepared by Sargent & Lundy (S&L) at Southwestern Electric Power Company's (SWEPCO) request to summarize the design of the lignite storage area and the wastewater pond facilities with regard to technical guidelines and requirements of the Texas Department of Water Resources (TDWR). The technical guidelines referenced in this report are Technical Guide Nos. 4 and 6 titled Ponds and Lagoons, and Monitoring/Leachate Collection Systems respectively. Guide No. 4 was revised March 1, 1978 and Guide No. 6 March 21, 1980. We understand that the TDWR has the responsibility of preparing and issuing document approval for disposal of wastes. Requirements concerning waste storage and disposal and concerning the design, construction, and monitoring of wastewater pond facilities are discussed in this report.

The wastewater pond facilities discussed in this report and shown in Exhibit 1 are the lignite pile runoff basin, surge pond, two bottom ash storage basins, secondary settling pond, and the metal cleaning waste pond. Discussion of other waste treatment facilities such as the sanitary sewage treatment plant, the cooling pond, and the final treated Flue Gas Desulfurization (FGD) sludge disposal site are not within the scope of this report and, therefore, not included.

II SUMMARY AND CONCLUSIONS

Based on the evaluation of the site subsurface soil and water conditions, it is concluded that the design of the Henry W. Pirkey wastewater ponds conforms with the technical guidelines and requirements of the TDWR.

Nine groundwater monitoring wells will be located adjacent to the wastewater ponds. These wells will be designed and installed to requirements equal to or exceeding those suggested by the TDWR.

A summary of design guidelines and requirements suggested by the TDWR and those used for design of the Henry W. Pirkey wastewater ponds is given in Exhibit 2.

III DESIGN OF LIGNITE STORAGE AREA AND WASTEWATER POND FACILITIES

A. General

The general site layout is shown in Exhibit 1. The plant water usage and waste water scheme is shown on Exhibit 3. The lignite storage area, lignite pile runoff basin, metal cleaning waste pond, and the surge pond have been sized to accommodate two units. Each bottom ash basin will accommodate storage of hydraulically placed ash for two units for 6 months. When one bottom ash basin is filled, storage will begin in the second basin while the first basin is being emptied and readied for reuse. The in-service bottom ash basin will also receive the discharge from the ash hopper pit sump pumps.

Effluent from the bottom ash basins will discharge to the secondary settling pond. Blowdown from the main and auxiliary boilers will also be routed to the secondary pond. Water collected in the secondary settling pond will be recirculated back to the plant to transport bottom ash. R

The ash basins and secondary pond, acting as a system, have been provided with additional capacity above the normal operating level to capture and hold the 10 year-24 hour runoff from the basin and pond drainage areas. A spillway has been R provided for the secondary pond to discharge inflows in excess of the 10 year-24 hour runoff in conformance with the NPDES permit. The quality of those overflows is not subject to permit limitations. To protect the basin and pond dikes from damage, the spillway has been designed to discharge excess runoff from the 100 year-24 hour runoff and freeboard has been provided above the maximum water level resulting from the 100 year-24 hour runoff. Excess water accumulated in the secondary pond due to rainfall runoff will be pumped to the wastewater treatment plant for treatment prior to discharge. R

Drainage from the lignite and limestone storage areas and handling systems will be collected via ditches and routed to the lignite pile runoff basin.

The lignite pile runoff basin has been designed to capture and hold the entire 10 year-24 hour runoff from the basin drainage area with no outflow. An auxiliary spillway has been provided to discharge inflows in excess of the 10 year-24 hour runoff in conformance with the NPDES permit. The quality of these overflows is not subject to permit limitations. To protect basin dikes from damage due to overflow, the spillway has been designed to discharge excess runoff from the 100 year-24 hour runoff and freeboard has been provided above the maximum water level due to the 100 year-24 hour runoff. R

Water captured in the lignite pile runoff basin will not R normally require more treatment than sedimentation to lower the total suspended solids content prior to release. Once the suspended solids are within acceptable limits, the basin contents will be discharged to the cooling pond by gravity in a normally closed pipe outlet. However, if treatment other than gravity settling is required, the contents of the lignite pile runoff basin will be pumped to the wastewater treatment plant prior to release.

The surge pond is divided into two sections: the main surge pond and the auxiliary surge pond. The auxiliary surge pond is a collection and settling pond for scrubber waste slurry, from the FGD system waste slurry pumps, thickener underflow pumps, and filtrate overflow sump pumps. These slurry flows will be routed to the auxiliary surge pond only under emergency conditions and allowed to thicken by gravity settling. The sludge formed when the slurry thickens will be removed by front end loader and conveyed to the sludge treatment system for stabilization. The water decanted from the thickened slurry, and not evaporated, will overflow to the surge pond.

The main surge pond is a collection basin for overflows from the auxiliary surge pond and several additional waste streams. Surface drainage from the FGD system and the reclaim water sump overflow will also drain into the surge pond. Rainwater runoff from the sludge truck load out area, from under the sludge conveyors, and from the sludge reclaim area will drain to the surge pond by gravity. The water decanted from the auxiliary surge pond will drain to the surge pond. The collected water in the surge pond will be pumped to the thickeners for removal of sediment and used as make-up for the SO_2 scrubbers. Drainage entering the surge pond will not leave the plant except as makeup to the scrubbers, as water hydrated with the stabilized FGD sludge, or through evaporation.

Waste from air heater wash, precipitator wash and boiler chemical cleaning is discharged to the metal cleaning pond for storage. This pond is designed to accommodate all the waste-water containing heavy metals generated in 24 hours by cleaning all the three air heaters associated with one unit. Water collected in the metal cleaning waste pond will be pumped to the waste water treatment system for processing before being discharged to the cooling pond.

B. Lignite Storage Area and Runoff Basin Design

The location and layout of the lignite storage area and lignite pile runoff basin are shown on Exhibit 1. Five borings have been drilled in this area and their locations are shown on Exhibits 4 and 5. Copies of the boring logs are included in Appendix A. Based on the results of the boring data, the lignite storage area and lignite pile runoff basin are located over surface soil deposits of dense silty sand and sandy silt (SM and ML Unified Soil Classification). A summary of the laboratory test results on samples from these borings is given in Exhibit 6. All soil borings and soil laboratory test results given in this report, with the exception of Boring B14, have been drilled and tested by NFS/National Soil Services, Inc., Dallas, Texas. Boring B14 was drilled and tested by East Texas Testing Laboratory, Inc., Tyler, Texas. Complete laboratory index property and permeability test results for all samples from borings located in or near waste-water pond facilities are included in Exhibit 6. Also included for reference are index property and permeability values for various types of soils from other onsite borings.

The lignite pile runoff basin is an above and below ground pond designed to store lignite pile and limestone pile runoff. Plan and cross sections are shown in Exhibit 5. The lignite storage pile will be underlain by two feet of compacted cohesive fill (SC, CL, and CH Unified Soil Classification). The drainage ditches transporting runoff from the storage area to the basin will be lined with minimum 18 inches of compacted cohesive fill. The runoff basin will be lined on the bottom and side slopes with a minimum three feet of compacted cohesive fill. The dike fill, including lining, will be compacted as specified to a minimum 95 percent maximum density in accordance with ASTM D698. These requirements are in accordance with the guidelines suggested by the TDWR for wastewater ponds.

A summary of the parameters used for the lignite pile runoff basin design in comparison to those parameters and guidelines suggested by the TDWR is given in Exhibit 2. The runoff basin design parameters equal or exceed the minimum recommended values except for depth to the water table. Average or median parameter values are given where several individual tests or measurements were made. The only suggested parameter not obtainable is the TDWR recommendation that the bottom of the basin be 10 feet above the water table. The water table varies throughout the site, and with normal pool of the cooling pond at elevation 340.0 ft., it is possible that the static water table may be located within 3 feet of the bottom of the clay lining of any of the plant's wastewater ponds. Despite this, the presence of relatively homogeneous impermeable in situ and compacted clay layers should provide sufficient lining and protection of the groundwater.

Compacted clay linings are required on the bottom and side slopes of the lignite pile runoff basin and beneath the lignite storage pile. Project specifications require these compacted linings to be cohesive soils with minimum 40% passing the no. 200 sieve and having a minimum plasticity index of 15. The linings are to be compacted to minimum 95% maximum density in accordance with ASTM D698. The permeability of the compacted linings is estimated to be less permeable than or equal to 1.0×10^{-7} cm/sec. This will be verified by SWEPCO by testing field samples in the laboratory during or after construction.

C. Surge Pond Design

The location and layout of the surge pond are shown on Exhibit 1. Four borings have been drilled in this area and their locations are shown on Exhibits 4 and 7. Copies of the boring logs are included in Appendix A. Based on the results of the boring data, the surge pond is located within or above a thick surface deposit of silty and sandy clay (CL and CH Unified Soil Classification). The thickness of the in situ clay soils below the bottom of the pond (approximately elevation 350 ft) ranges from two and one half to 16 feet. A summary of the laboratory test results on samples from the surge pond borings is given in Exhibit 6.

The surge pond (including auxiliary surge pond) is an above and below ground pond. Dikes and excavated slopes are designed with three horizontal to one vertical side slopes. Dike fill will be cohesive soil compacted to a minimum 95 percent maximum density in accordance with ASTM D698. Typical surge pond cross sections are shown on Exhibit 7.

In situ cohesive soils will be used to function as the pond lining. Verification of the quality and thickness of the in situ lining will be made during or after construction by SWEPCO. As previously stated, the borings indicate that the thickness of the in situ lining ranges from approximately two and one half to 16 feet. Any compacted cohesive linings required will meet the density, index property, and permeability requirements as given for the lignite runoff basin.

Exhibit 2 summarizes the TDWR suggested parameters and guidelines and those parameters used for the surge pond design. Comparison of the design parameters obtained and those suggested indicate that in almost every case the obtained parameters equaled or exceeded the suggested value. The only suggested parameter not obtainable is the recommended 10 ft. depth to the groundwater table. It is possible that the groundwater table could eventually be located within 3 ft. of the bottom of the clay lining of the pond, as previously discussed.

Six laboratory permeability tests were performed on samples of undisturbed clay soil from the surge pond area. Results are given in Exhibit 8 and indicate a median permeability value of $5.1x10^{-8}$ cm/sec. The permeability test values ranged from $2.1x10^{-6}$ cm/sec. to $7.4x10^{-9}$ cm/sec.

D. Bottom Ash Basin and Secondary Pond Design

The location and layout of the bottom ash basins and secondary pond are shown on Exhibit 1. Plan and cross sections are shown in Exhibit 9. Nine borings have been drilled in this area. Their locations are given in Exhibits 4 and 9. Copies of the boring logs are included in Appendix A. Based on the results of the boring data, the secondary pond, bottom ash basin no. 1 and the east half of bottom ash basin no. 2 are located within or above a thick surface deposit of silty and sandy clay. These soils are classified as SC, CL, and CH material. A summary of the laboratory test results on samples from those borings is given in Exhibit 6. Results of approximately 23 tests on cohesive soils representing in situ lining indicate average fines content and plasticity index values of 78% and 36, respectively. These values significantly exceed the minimum values suggested by the TDWR.

Bottom ash basin no. 1 is an above and below ground pond located entirely in a cohesive soil deposit. The thickness of the cohesive soil below the bottom of the pond is greater than 5 feet. The plan and cross sections are given in Exhibit 9. A compacted clay lining is shown and will be used where required. In situ lining of acceptable quality and thickness exist in most of the area. This will be verified in the field during construction by SWEPCO. Shallow borings, test pits, and laboratory testing will be performed as necessary.

Bottom ash basin no. 2 is also an above and below ground pond. A portion of this pond (west half) will require a minimum three feet thick compacted clay lining. The location where an acceptable in situ lining does not exist and where the compacted lining begins will be determined and verified in the field by SWEPCO.

The secondary pond has a bottom elevation of 344 feet. This is three feet or more below the lowest point in either bottom ash basin. During borrow excavation and construction of the embankment, the existing clay may be completely removed from areas within the pond. Where this occurs, a three foot thick compacted clay lining will be installed to the requirements of project specifications and the technical guidelines suggested by the TDWR. This will be verified in the field by SWEPCO.

Exhibit 2 summarizes the TDWR parameters and guidelines and those parameters used for the design of the bottom ash basins and the secondary pond. As indicated in Exhibit 2, the design parameters meet or exceed nearly all of the suggested values. The only suggested parameter not obtainable is the recommended depth to the groundwater table as previously discussed. The median permeability from ten laboratory tests on samples of in situ cohesive soils (generally CH classification) is approximately 7.5×10^{-9} cm/sec. The permeability of clay soils used for compacted cohesive linings (SC, CL, and CH classification) is estimated to be less than or equal to 1.0×10^{-7} cm/sec. The permeability of the compacted lining will be verified by SWEPCO by testing field samples in the laboratory during and after construction.

E. Metal Cleaning Waste Pond

The location and layout of the metal cleaning waste pond are shown on Exhibit 1 and 10. The pond lies between the surge pond and the bottom ash basins. Borings located near the metal cleaning waste pond are shown in Exhibit 4. Review of the boring data indicates that the pond is located within or above a thick surface deposit of silty and sandy clay. Evaluation of the boring data is similar to that of the bottom ash basins.

The metal cleaning waste basin is an above and below ground pond. Plan and cross sections are given in Exhibit 10. The pond will require a minimum three feet thick clay lining where sufficient in situ clay does not exist at the design elevation. SWEPCO will verify the quality and acceptability of the lining, whether in situ or compacted.

IV GROUNDWATER MONITORING PROGRAM

Nine groundwater monitoring wells are to be installed at locations adjacent to the wastewater pond facilities. The wells will be installed after completion of pond construction. The approximate locations of these wells are given in Exhibit 12.

Four-inch diameter monitoring wells will be used because they permit use of a portable submersible pump for obtaining samples for water quality analysis. Each slotted screen for each well will be located in the most permeable soils occurring below the water table. A soil boring will be drilled at each well location to accurately define the soil strata adjacent to the well and to finalize the location and design of the well. The soils are very dense and range from a medium fine sand and silty sand to clayey sand and silty clay. The length of the screens have not yet been determined but are expected to range from 15 to 25 feet.

Technical Guide No. 6, published by the TDWR, presents guidelines for design and installation of monitoring wells. The H. W. Pirkey monitoring wells will equal or exceed these guidelines.

The groundwater monitoring program will consist of measuring and recording groundwater levels and obtaining samples for water quality analysis. The frequency for measuring levels and obtaining samples has not yet been determined. Measurements and samples will be obtained by SWEPCO and should begin at least two years before the power plant begins operation. This will allow for sufficient background data against which to compare all subsequent measurements and analyses of samples taken at the site.

Sargent & Lundy, by

D. G. Bodine

D. G. Bodine
Supervisor,
Geotechnical Division

Kenneth J. Kostal

SARGENT & LUNDY
ENGINEERS
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603
(312) 269-2000
TWX 910-221-2807

SEP 20 1984
OFFICE OF
R. A. NEAL

September 14, 1984
Project No. 5555-02
File No. 5.8.1

Southwestern Electric Power Company
Henry W. Pirkey Power Plant
Unit 1

Wastewater Ponds - Liner
Verification & Monitoring Wells

HP-56

Mr. M. J. Scott
Southwestern Electric Power Company
P. O. Box 21106
Shreveport, Louisiana 71156

Dear Mr. Scott:

We have completed our review of the boring logs and results of the laboratory tests made on samples from the borings which you transmitted to us. This work was performed as part of the liner verification program transmitted to Mr. R. A. Neal with a letter, dated February 25, 1983.

Enclosed is a copy of Table #1 which was developed by combining the information contained on the field logs and the results of the laboratory test data. From the information contained in Table #1, Table #2 was prepared and summarizes our analysis of the test results for each individual pond or lined area.

Our analysis indicates that the cohesive linings for the surge pond, metal cleaning waste pond, bottom ash basins No. 1 and No. 2 and beneath the lignite storage pile are in general accordance with the guidelines suggested by the Texas Department of Water Resources. The average permeability reported for bottom ash basin No. 1 is 2.4×10^{-6} cm/sec. This value is higher than desired because it is significantly influenced by one out of the eight tests run. This one test yielded a 1.1×10^{-5} cm/sec flow rate for a CH clay sample which leads one to believe that the test may be in error due to a leak in the testing apparatus or a miscalculation. You may want to run this by the laboratory for a check. SWL & SL

COPY

Mr. M. J. Scott
Southwestern Electric Power Company

The cohesive lining for the secondary pond appears to be very sandy or contains sand pockets more so on the east side of the pond. The area should be inspected and repaired if necessary to improve its cohesive lining.

done

The borings and testing for the lignite pile runoff basin was not yet completed when you transmitted the data. Please forward this data to us as soon as it becomes available so that the tables can be completed. Also boring S-17 in the Metal Cleaning Pond was not yet drilled.

done
S-15
wk of 10/8

Part of this verification program was also to consist of a review of the field density test records for the lining made during construction so that a statistical summary could be performed. This data was included in your previous transmittal. Please forward us this data at your convenience.

SWEPCO

We have also enclosed a marked up copy of the boring logs correcting the soil classification based on our review of the laboratory test data. Please have the laboratory make the indicated corrections and re-issue the logs.

SWL

We also received the boring logs for the ten monitoring wells. A review of these logs indicates that if the wells are installed per the detail proposed in the monitoring well program, they will encounter pervious sandy soils. Well MW-9 may, however, need to be installed approximately five feet deeper than proposed to intersect a thicker layer of sands.

SWL & S&L

After you review the data being transmitted to you and with your concurrence we will formalize the data into an Appendix which can be added to the Wastewater Pond Data Report.

Yours very truly,

CHARLES J. NELSON

Charles J. Nelson
Structural Project Engineer

Check elev. of S-16

Add Ground elev. to Logs.

CJN:jg
Enclosure
Copies:
R. A. Neal (1/1)
W. H. Holley (1/1)
J. A. Pruett (1/1)
F. J. Emmett (1/1)
E. R. Weaver (1/1)
D. G. Bodine (1/1)
J. A. Wilson (1/1)

HP.56

COPY

SUMMARY OF LABORATORY TEST RESULTS FOR
COHESIVE LINING VERIFICATION PROGRAM (1)

Facility	Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (%) Passing) (2) No. 4 Sieve	No.10 Sieve	No.40 Sieve	No.200 Sieve	Atterberg Limits (3) Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Unified Soil Classification Symbol	Field Water Content (%)(4)	Dry Density lbs/ft^3	Laboratory Permeabilit cm/sec
Secondary Pond	S-1	0-2	95	91	88	60	32	18	14	CL-Silty Clay	18.9	-	$2.2x10^{-8}$
		2-4	91	88	85	63	28	18	10	CL-Silty Clay	18.3	-	$8.5x10^{-8}$
		4-6	-	-	-	-	28	18	10	CL-Sandy Clay	20.3	-	-
		6.5-8	-	-	-	26	28	18	10	SC-Clayey Sand	22.2	-	-
		8.5-10	-	-	-	-	-	-	-	CL-Sandy Clay	27.1	-	-
	S-2	0-2	-	-	-	-	29	17	12	CL-Sandy Clay	19.0	-	$7.2x10^{-8}$
		2-4	-	-	-	-	35	18	17	CL-Sandy Clay	23.0	-	$7.6x10^{-8}$
		4.5-6	-	-	-	-	42	21	21	CL-Sandy Clay	23.1	-	-
		6.5-8	-	-	-	-	33	18	15	CL-Silty Clay	24.1	-	-
		8.5-10	-	-	-	-	35	18	17	CL-Sandy Clay	23.4	-	-
	S-3	0-2	-	-	-	32	28	18	10	SC-Clayey Sand	20.4	-	$8.7x10^{-6}$
		2-4	-	-	-	-	31	19	12	SC-Clayey Sand	23.7	-	$1.1x10^{-5}$
		4-6	-	-	-	37	31	18	13	SC-Clayey Sand	23.9	-	-
		6.5-8	-	-	-	-	-	-	-	CL-Sandy Clay	26.9	-	-
		8.5-10	-	-	-	-	-	-	-	CL-Sandy Clay	30.0	-	-
BA-B#1	S-4	0-2	100	100	100	75	36	19	17	CL-Silty Clay	21.2	-	$6.8x10^{-9}$
		2-4	100	100	100	76	34	18	16	CL-Silty Clay	19.4	-	$1.8x10^{-8}$
		4-6	-	-	-	-	-	-	-	CL-Silty Clay	19.3	-	-

Notes: 1. Laboratory Testing Performed by Southwestern Laboratories, Shreveport, LA.
2. Laboratory Particle Size Analysis Tests - ASTM D422 or D1140.
3. Laboratory Atterberg Limit Tests - ASTM D423 and D424.
4. Laboratory Moisture Content of Soils - ASTM D2216.

TABLE 1

NEW

SUMMARY OF LABORATORY TEST RESULTS FOR
COHESIVE LINING VERIFICATION PROGRAM (1)

Facility	Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (%) Passing) (2) No. 4 Sieve	No.10 Sieve	No.40 Sieve	No.200 Sieve	Atterberg Limits (3) Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Unified Soil Classification Symbol	Field Water Content (%)(4)	Dry Density lbs/ft^3	Laboratory Permeability cm/sec
Surge Pond	S-12	0-2	-	-	99	92	39	19	20	CL-Silty Clay	23.7	-	$1.4x10^{-8}$
		2-4	-	-	98	95	52	22	30	CH-Silty Clay	26.3	-	$1.1x10^{-8}$
		4-6	-	-	-	-	61	23	38	CH-Silty Clay	23.2	-	-
	S-13	0-2	-	-	-	76	38	20	18	CL-Sandy Clay	21.3	-	$3.6x10^{-8}$
		2-4	-	-	-	69	32	17	15	CL-Sandy Clay	19.1	-	$6.6x10^{-8}$
		4-6	-	-	-	-	-	-	-	CL-Sandy Clay	17.7	-	-
	S-14	0-2	-	-	-	99	51	20	31	CH-Silty Clay	31.4	-	$9.2x10^{-8}$
		2-4	-	-	-	98	48	20	28	CL-Silty Clay	29.8	-	$1.3x10^{-8}$
		4-6	-	-	-	-	-	-	-	CL-Silty Clay	29.2	-	-
Metal Cleaning Pond	S-15	Not Drilled Yet											
	S-16	0-2	-	-	-	59	44	21	23	CL-Sandy Clay	23.6	-	$2.7x10^{-8}$
		2-4	-	-	-	80	45	20	25	CL-Sandy Clay	23.1	-	$1.3x10^{-8}$
		4-6	-	-	-	-	29	19	10	SC-Clayey Sand	23.5	-	-
	S-17	0-2	-	-	-	89	48	20	28	CL-Silty Clay	27.8	-	$6.1x10^{-8}$
		2-4	-	-	-	93	49	20	29	CL-Silty Clay	27.2	-	$4.3x10^{-8}$
		4-6	-	-	-	-	23	17	6	SC-Clayey Sand	18.1	-	-

Notes:
1. Laboratory Testing Performed by Southwestern Laboratories, Shreveport, LA.
2. Laboratory Particle Size Analysis Tests - ASTM D422 or D1140.
3. Laboratory Atterberg Limist Tests - ASTM D423 and D424.
4. Laboratory Moisture Content of Soils - ASTM D2216.

TABLE 1 (Continued)

SUMMARY OF LABORATORY TEST RESULTS FOR COHESIVE LINING VERIFICATION PROGRAM (1)

Facility	Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (%) Passing) (2) No. 4 Sieve	No.10 Sieve	No.40 Sieve	No.200 Sieve	Atterberg Limits (3) Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Unified Soil Classification Symbol	Field Water Content (%)(4)	Dry Density lbs/ft^3	Laboratory Permeabilit cm/sec
Bottom Ash Basin #1	S-5	0-2	–	–	–	81	38	19	19	CL-Sandy Clay	20.9	–	4.9×10^{-7}
		2-4	–	–	–	75	36	18	18	CL-Sandy Clay	21.5	–	8.1×10^{-8}
		4.5-6	–	–	–	–	–	–	–	CL-Sandy Clay	24.3	–	–
	S-6	0-2	–	–	–	–	32	17	15	CL-Silty Clay	22.4	–	7.4×10^{-6}
		2-4	–	–	–	55	43	20	23	CL-Sandy Clay	22.2	–	7.1×10^{-8}
		4-6	–	–	–	–	54	21	33	CH-Silty Clay	25.2	–	–
	S-7	0-2	–	–	–	97	46	20	26	CL-Silty Clay	30.4	–	2.0×10^{-8}
		2-4	–	–	–	90	51	20	31	CH-Silty Clay	30.4	–	1.1×10^{-5}
		4-6	–	–	–	–	–	–	–	CL-Sandy Clay	27.7	–	–
Bottom Ash Basin #2	S-8	0-2	99	98	97	65	49	20	29	CL-Silty Clay	15.3	–	4.3×10^{-8}
		2-4	–	–	98	92	53	20	33	CH-Silty Clay	31.4	–	7.5×10^{-9}
		4-6	–	–	–	–	33	18	15	CL-Sandy Clay	18.3	–	–
	S-9	0-2	–	–	–	90	51	20	31	CH-Silty Clay	28.8	–	6.1×10^{-8}
		2-4	–	–	–	80	38	19	19	CL-Sandy Clay	21.6	–	3.2×10^{-8}
		4-6	–	–	–	–	29	18	11	CL-Sandy Clay	19.1	–	–
	S-10	0-2	–	–	–	80	34	18	16	CL-Silty Clay	18.2	112	6.5×10^{-8}
		2-4	–	–	–	74	38	19	19	CL-Silty Clay	18.9	115	1.2×10^{-8}
		4-6	–	–	–	–	30	18	12	CL-Silty Clay	19.1	112	–
	S-11	0-2	–	–	–	81	41	20	21	CL-Silty Clay	28.8	96	1.5×10^{-7}
		2-4	–	–	–	94	43	20	23	CL-Silty Clay	31.4	91	1.8×10^{-8}
		4-6	–	–	–	–	–	–	–	CL-Silty Clay	28.8	95	–

Notes:
1. Laboratory Testing Performed by Southwestern Laboratories, Shreveport, LA.
2. Laboratory Particle Size Analysis Tests - ASTM D422 or D1140.
3. Laboratory Atterberg Limit Tests - ASTM D423 and D424.
4. Laboratory Moisture Content of Soils - ASTM D2216.

TABLE 1 (Continued)

SUMMARY OF LABORATORY TEST RESULTS FOR
COHESIVE LINING VERIFICATION PROGRAM (1)

Facility	Boring No. Sample No.	Sample Depth, Ft	Particle Size Analysis (%) Passing) (2) No. 4 Sieve	No.10 Sieve	No.40 Sieve	No.200 Sieve	Atterberg Limits (3) Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Unified Soil Classification Symbol	Field Water Content (%)(4)	Dry Density lbs/ft^3	Laboratory Permeabilit cm/sec
Lignite Storage Pile	S-18	0-2	91	90	89	48	33	18	15	SC-Clayey Sand	13.4	–	$1.3x10^{-6}$
		2-4	–	99	97	78	35	18	17	CL-Silty Clay	20.4	–	$7.2x10^{-8}$
		4-6	–	–	–	–	–	–	–	CL-Sandy Clay	17.9	–	–
	S-19	0-2	–	–	–	–	37	17	20	CL-Sandy Clay	20.5	–	$8.7x10^{-8}$
		2-4	–	–	–	–	24	17	7	SC-Clayey Sand	11.6	–	$2.4x10^{-7}$
		4.5-6	–	–	–	–	33	18	15	CL-Sandy Clay	13.3	–	–
	S-20	0-2	–	–	–	–	33	18	15	CL-Sandy Clay	16.3	–	$3.7x10^{-8}$
		2-4	–	–	–	–	25	18	7	ML-CL Clayey Silt	14.9	–	$3.8x10^{-7}$
		4-6	–	–	–	–	33	18	15	CL-Sandy Clay	17.7	–	–
Lignite Run-off Pond	S-21	Not Drilled Yet											
	S-22	Not Drilled Yet											

Notes:
1. Laboratory Testing Performed by Southwestern Laboratories, Shreveport. LA.
2. Laboratory Particle Size Analysis Tests - ASTM D422 or D1140.
3. Laboratory Atterberg Limit Tests - ASTM D423 and D424.
4. Laboratory Moisture Content of Soils - ASTM D2216.

TABLE 1 (Continued)

SUMMARY OF ANALYSIS OF LABORATORY TEST
RESULTS FOR COHESIVE LINING VERIFICATION PROGRAM

Facility	Lining Soil Type	Lining Thickness Ft	Average Permeability k, cm/sec	Average Fines Content FC, %	Average Liquid Limit LL, %	Average Plasticity Index PI
Surge Pond	CL&CH	≥ 4	3.8×10^{-8}	88	43	24
Secondary Pond	SC&CL	≥ 4	3.8×10^{-6}	52	30	12
Bottom Ash Basin #1	CL&CH	≥ 4	2.4×10^{-6}	92	40	21
Bottom Ash Basin #2	CL&CH	≥ 4	4.8×10^{-8}	82	43	24
Metal Cleaning Waste Pond	CL&CH	≥ 4	3.8×10^{-8}	80	46	26
Lignite Runoff Pond		Boring	Not	Drilled	Yet	
Lignite Storage Pile	SC, CL ML&CL	≥ 4	3.5×10^{-7}	63	31	14
Suggested Guideline (TDWR)	CL, CH & SC	≥ 3	$\leq 1 \times 10^{-7}$	≥ 30	≥ 30	≥ 15

TABLE 2

Southwestern Electric Power Company

FOR COMPANY BUSINESS ONLY

SUBJECT: Waste Water Ponds Lining Verification and Monitoring Wells

DATE: February 6, 1984

LOCATION: Henry W. Pirkey Power Plant, Unit #1

Mr. Jay Pruett

Attached please find one copy of the "Waste Water Ponds Lining Verification and Monitoring Wells" report of work performed to date. In order to complete this project, the following must be accomplished:

A. perform borings S-21 and S-22 in lignite pile run-off basin

B. perform boring S-15 in metal waste cleaning pond

C. re-drill borings S-1, S-2 and S-3 in secondary pond.

This work will be performed during the summer of 1984.

Please advise if you have any comments regarding this report.

W.H. Holley

W. H. Holley

WHH/bs

Attachment

cc: C. J. Nelson (S&L) w/attachment

SwL

SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

P. O. Box 37577 • 7222 Greenwood Rd. • Shreveport, LA 71103 • 318/636-3673

September 7, 1984

Southwestern Electric Power Company
P.O. Box 21106
Shreveport, Louisiana 71156

Attention: Mr. Winston Holley

Reference: Subsurface Exploration
Waste Water Ponds
Pirkey Power Plant
Hallsville, Texas

Gentlemen:

Attached is our Subsurface Exploration Report for the above referenced project.

It has been a pleasure to perform this work for you. If, during the course of this project, we can be of any further assistance, please do not hesitate to call on us.

Very truly yours,

SOUTHWESTERN LABORATORIES

Gene Gardner

Gene Gardner, P.E.

GG:awd
Attachment
3 cc: Southwestern Electric Power Company

RECEIVED

SEP 13 1984

OFFICE OF
W. H. HOLLEY

SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

P.O. Box 37577 • 7222 Greenwood Rd. • Shreveport, LA 71103 • 318/636-3673

August 20, 1984

File No. 832964

Southwestern Electric Power Company
P. O. Box 21106
Shreveport, LA 71156

Attention: Mr. Winston Holley

Reference: Subsurface Exploration
Waste Water Ponds
Pirkey Power Plant
Hallsville, Texas

Gentlemen:

Enclosed is our Subsurface Exploration Report on Borings S-1, S-2 and S-3. These are redrilled for verification of the lining for the pond. The locations of the borings are shown on your drawing number HP-56A.

It has been a pleasure to perform this work for you. If, during the course of this project, we can be of any further assistance, please do not hesitate to call on us.

Very truly yours,

SOUTHWESTERN LABORATORIES

Gene Gardner

Gene Gardner, P.E.

GG:kw
Enclosure
3 cc: Southwestern Electric Power Company

RECEIVED
AUG 29 1984
OFFICE OF
W. H. HOLLEY

Bill Porter

SwL

SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

P.O. Box 37577 • 7222 Greenwood Rd. • Shreveport, LA 71103 • 318/636-3673

December 27, 1983

File No. 832964

Southwestern Electric Power Company
P. O. Box 21106
Shreveport, LA 71156

Attention: Mr. Winston Holley

Reference: Waste Water Ponds
Pirkey Power Plant
Hallsville, Texas

Gentlemen:

The above referenced report was dated October 5, 1983. In accordance with Bill Porter's request dated December 22, I have revised the boring schedule for this report.

These revisions are based on the revised survey by Hart Engineering which was reported to you on October 11, 1983, by Mr. Nealy of Hart Engineering.

Data on the following borings was revised: S-10, S-11, MW-2, MW-4 and MW-10.

Very truly yours,

SOUTHWESTERN LABORATORIES

Gene Gardner

Gene Gardner, P.E.

GG:kw

Enclosure

RECEIVED

DEC 29 1983

OLLEY

SwL

SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

P.O. Box 37577 • 7222 Greenwood Rd. • Shreveport, LA 71103 • 318/636-3673

December 19, 1983

File No. 832964

Southwestern Electric Power Company
P.O. Box 21106
Shreveport, Louisiana 71156

Attention: Mr. Winston Holley

Reference: Subsurface Exploration
Waste Water Ponds
Pirkey Power Plant
Hallsville, Texas

Gentlemen:

Enclosed is our Summary of Laboratory Test Data and Log of Boring for Boring MW-3 of the above referenced project.

To summarize, all borings for this project have been completed, with the exception of S-15, S-21, and S-22, and the re-drills of S-1, S-2, and S-3. These borings are on indefinite hold at you request.

The ten (10) monitor wells have been installed. However, the steel protective caps have not been installed.

It has been a pleasure to perform this work for you. If we can be of any further assistance, please do not hesitate to call on us.

Very truly yours,

SOUTHWESTERN LABORATORIES

Gene Gardner

Gene Gardner, P.E.

GG:jwe
Enclosure
3 cc: Southwestern Electric Power Company

RECEIVED

DEC 20 1983

OFFICE OF
W. H. HOLLEY

SwL

SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

P.O. Box 37577 • 7222 Greenwood Rd. • Shreveport, LA 71103 • 318/636-3673

October 21, 1983

File No. 832964

Southwestern Electric Power Company
P.O. Box 21106
Shreveport, Louisiana 71156

Attention: Mr. Winston Holley

Reference: Subsurface Exploration
Waste Water Ponds
Pirkey Power Plant
Hallsville, Texas

Gentlemen:

Enclosed is our Subsurface Exploration Report for the above referenced project. Monitor well MW-3 has not yet been installed. It will be installed soon. At that time, we will also re-drill Borings S-1, S-2 and S-3. Borings S-15, S-21 and S-22 have not been drilled and are on hold at your request.

It has been a pleasure to perform this work for you. If we can be of any further assistance, please do not hesitate to call on us.

Very truly yours,

SOUTHWESTERN LABORATORIES

Roy D. Jones, P.E.
Geotechnical Manager

Gene Gardner

Gene Gardner, P.E.

RDJ;GG:jwe
Enclosure
3 cc: Southwestern Electric Power Company

RECEIVED

OCT 2 6 1983

OFFICE OF
W. H. HOLLEY

SwL

SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

P.O. Box 37577 • 7222 Greenwood Rd. • Shreveport, LA 71103 • 318/636-3673

October 5, 1983

File No. 832964

Southwestern Electric Power Company
P.O. Box 21106
Shreveport, Louisiana 71156

Attention: Mr. Winston Holley

Reference: Waste Water Ponds
Pirkey Power Plant
Hallsville, Texas

Gentlemen:

Enclosed is our Subsurface Exploration Report for the above referenced project. Borings S-10, S-11, S-15, S-21 and S-22 have not yet been drilled at this time. Results from those borings will be sent to you at a later date. Boring Logs and Summaries of Laboratory Test Data for the monitor well installations (MW-1 through MW-10) will also be sent to you at a later date.

It has been a pleasure to perform this work for you. If, during the course of this project, we can be of any further assistance, please do not hesitate to call on us.

Very truly yours,

SOUTHWESTERN LABORATORIES

Roy D. Jones, P.E.
Geotechnical Manager

Gene Gardner

Gene Gardner, P.E.

RECEIVED

OCT 10 1983

OFFICE OF
W. H. HOLLEY

RDJ;GG:jwe
Enclosure
3 cc: Southwestern Electric Power Company

BORING SCHEDULE

Boring No.	Location*		Depth	Surface Elevation
S-1	N9+69.8	W18+99.5	10	343.6
S-2	N10+20	W17+30.8	10	343.9
S-3	N9+12.6	W16+13.6	10	343.8
S-4	N14+99.3	W17+01	6	347.3
S-5	N15+ 00.8	W11+30.6	6	347.1
S-6	N19+99.9	W16+99.9	6	353.6
S-7	N20+00.2	W11+29.9	6	346.9
S-8	N14+88.3	W32+91	6	347.1
S-9	N20+11.4	W32+74.9	6	348.1
S-10	N15+00	W26+00	6	347.4
S-11	N20+00	W26+00	6	347.0
S-12	N0+00.2	W16+99.9	6	348.3
S-13	N3+00.3	W17+91.5	6	348.9
S-14	S1+38.2	W13+70.5	6	352.9
S-15	N2+00	W8+80	6	
S-16	N1+36	W11+52.9	6	357.0
S-17	N2+12.6	W12+86.2	6	348.1
S-18	S15+27	W8+89.3	6	357.2
S-19	S19+01.1	W6+05.3	6	356.7
S-20	S18+01.7	W13+55.4	6	357.6
S-21	S23+20	W16+20	6	
S-22	S23+20	W13+50	6	
MW-1	N18+55.2	W38+59.8	33	334.0
MW-2	N9+88.5	W25+85.4	41	341.0
MW-3	N19+99.7	W22+75	57	370.0
MW-4	N13+76.4	W8+34.4	46	363.4
MW-5	N2+61.5	W7+82.2	44.5	362.5
MW-6	S1+84.6	W10+60.5	43	361.0
MW-7	S2+23.9	W17+24.45	40.5	358.3
MW-8	S21+04.6	W16+11.9	34.5	356.3
MW-9	S15+48	W1+88.5	31	353.1
MW-10	N6+56.9	W18+31.3	39.5	358.6

* Locations are based on the power plant grid coordinate system.

832964 **SUMMARY OF LABORATORY TEST DATA**

PROJECT Waste Water Ponds Pirkey Power Plant

DATE 9-29-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS			COMPRESSION TEST				REMARKS
					LL	PL	PI	COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	
S-1	0 - 2	Silty sandy clay w/iron ore	18.9		32	18	14					* **
	2 - 4	Silty sandy clay w/iron ore	18.3		28	18	10					* **
	4½- 6	Very silty sandy clay	20.3		28	18	10					28 B/F
	6½- 8	Clayey silty sand	22.2		28	18	10					26% Finer 50 B/10"
	8½-10	Silty sandy clay w/gravel	27.1									50 B/3½"
S-2	0 - 2	Silty sandy clay	19.0		29	17	12					**
	2 - 4	Silty sandy clay w/iron ore	23.0		35	18	17					* **
	4½- 6	Silty sandy clay	23.1		42	21	21					23 B/F
	6½ - 8	Sandy silt clay	24.1		33	18	15					50 B/11"
	8½-10	Silty sandy clay w/gravel	23.4		35	18	17					24 B/F

* Hydrometer analysis results attached.

** Permeability results attached.

SOUTHWESTERN LABORATORIES

832964

SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds Pirkey Power Plant

DATE 9-29-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS			COMPRESSION TEST				REMARKS
					LL	PL	PI	COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	
S-3	0 - 2	Clayey silty sand w/iron ore	20.4		28	18	10					32% Finer **
	2 - 4	Sandy silty clay w/iron ore	23.7		31	19	12					
	4 - 6	Silty sandy clay w/iron ore	23.9		31	18	13					37% Finer **
	6½- 8	Silty sandy clay w/iron ore	26.9									50 B/F
	8½-10	Silty sandy clay	30.0									50 B/11"
S-4	0 - 2	Silty sandy clay	21.2		36	19	17					* **
	2 - 4	Silty sandy clay	19.4		34	18	16					* **
	4 - 6	Silty sandy clay w/iron ore	19.3									
S-5	0 - 2	Silty sandy clay w/iron ore	20.9		38	19	19					81% Finer **
	2 - 4	Silty sandy clay w/iron ore	21.5		36	18	18					75% Finer **
	4½- 6	Silty sandy clay	4.3									28 B/F

* Hydrometer analysis results attached.
** Permeability results attached.

SOUTHWESTERN LABORATORIES

832964

SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds Pirkey Power Plant

DATE 9-29-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS			COMPRESSION TEST				REMARKS
					LL	PL	PI	COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	
S-6	0 - 2	Sandy silty clay lenses w/iron ore	22.4		32	17	15					**
	2 - 4	Silty sandy clay w/iron ore	22.2		43	20	23					55% Finer **
	4 - 6	Clay	25.2		54	21	33					
S-7	0 - 2	Silty clay	30.4		46	20	26					97% Finer **
	2 - 4	Clay w/silt lenses and iron ore	30.4		51	20	31					90% Finer **
	4 - 6	Silty sandy clay	27.7									
S-8	0 - 2	Slightly silty sandy clay	15.3		49	20	29					* **
	2 - 4	Clay w/silt lenses	31.4		53	20	33					* **
	4 - 6	Silty sandy clay	18.3		33	18	15					
S-9	0 - 2	Clay w/silty sand	28.8		51	20	31					90% Finer **
	2 - 4	Silty sandy clay	21.6		38	19	19					80% Finer **
	4 - 6	Silty sandy clay	19.1		29	18	11					

* Hydrometer analysis results attached.
** Permeability results attached.

SOUTHWESTERN LABORATORIES

832964

SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds, Pirkey Power Plant

DATE 10-11-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS LL	PL	PI	COMPRESSION TEST: COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	REMARKS
S-10	0 - 2	Very stiff sandy silty clay	18.2	112	34	18	16	6056	3.3		Vert. Shear	80% Finer -8 k=6.5x10
	2 - 4	Very stiff sandy silty clay	18.9	115	38	19	19	7947	4.0		Yield	74% Finer -8 k=1.2x10
	4 - 6	Stiff sandy silty clay	19.1	112	30	18	12	3448	1.7		Vert. Shear	
S-11	0 - 2	Very stiff sandy silty clay lenses	28.8	96	41	20	21	5906	2.3		45° Shear	81% Finer k=1.5x10
	2 - 4	Very stiff silty clay lenses	31.4	91	43	20	23	5128	3.5		Vert. Shear	94% Finer -8 k=1.8x10
	4 - 6	Very stiff silty clay lenses	28.8	95				5418	3.5		45° Shear	

SOUTHWESTERN LABORATORIES

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SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds Pirkey Power Plant

DATE 9-29-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS			COMPRESSION TEST				REMARKS
					LL	PL	PI	COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	
S-12	0 - 2	Sandy silty clay	23.7		39	19	20					* **
	2 - 4	Clay w/silt lenses	26.3		52	22	30					* **
	4 - 6	Clay	23.2		61	23	38					
S-13	0 - 2	Silty sandy clay	21.3		38	20	18					76% Finer **
	2 - 4	Silty sandy clay	19.1		32	17	15					69% Finer **
	4 - 6	Silty sandy clay	17.7									
S-14	0 - 2	Clay w/silt lenses	31.4		51	20	31					99% Finer **
	2 - 4	Slightly silty clay	29.8		48	20	28					98% Finer **
	4 - 6	Sandy silty clay	29.2									
S-16	0 - 2	Silty sandy clay w/iron ore	23.6		44	21	23					59% Finer **
	2 - 4	Silty sandy clay	23.1		45	20	25					80% Finer **
	4 - 6	Clayey silty sand	23.5		29	19	10					

* Hydrometer analysis results attached.
** Permeability results attached.

SOUTHWESTERN LABORATORIES

832964 **SUMMARY OF LABORATORY TEST DATA**

PROJECT Waste Water Ponds Pirkey Power Plant

DATE 9-29-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	COMPRESSION TEST: COMPRESSION psf	COMPRESSION TEST: STRAIN %	COMPRESSION TEST: LATERAL PRESSURE psi	COMPRESSION TEST: TYPE FAILURE	REMARKS
S-17	0 - 2	Slightly silty clay w/iron ore	27.8		48	20	28					89% Finer **
	2 - 4	Slightly silty clay w/iron ore	27.2		49	20	29					93% Finer **
	4 - 6	Clayey silty sand	18.1		23	17	6					
S-18	0 - 2	Silty sandy clay w/iron ore	13.4		33	18	15					* **
	2 - 4	Sandy silty clay	20.4		35	18	17					* **
	4 - 6	Silty sandy clay w/gravel	17.9									
S-19	0 - 2	Silty sandy clay	20.5		37	17	20					75% Finer **
	2 - 4	Clayey silty sand	11.6		24	17	7					26% Finer **
	4½- 6	Silty sandy clay	13.3		33	18	15					37 B/F
S-20	0 - 2	Silty sandy clay w/gravel	16.3		33	18	15					53% Finer **
	2 - 4	Clayey sandy silt w/gravel	14.9		25	18	7					61% Finer **
	4 - 6	Silty sandy clay w/iron ore	17.7		33	18	15					

* Hydrometer analysis results attached.
** Permeability results attached.

SOUTHWESTERN LABORATORIES

SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds

DATE 8/20/84

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS LL	PL	PI	COMPRESSION TEST: COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	Permeability (cm/sec)
S1	0-2	Medium slightly silty clay	32.2	85	48	20	28	1762	5.0		Vert. Shear	
	2-4	Stiff silty sandy clay	17.7	105	30	18	12	2096	6.0		Vert. Shear	3.0×10^{-9}
	6-8	Clayey silty sand w/iron ore	22.8		24	18	6					
S2	0-2	Medium slightly silty clay	35.3	82				1030	5.0		Vert. Shear	5.9×10^{-9}
	2-4	Silty sandy clay w/iron ore	21.7		32	18	14					
	4-6	Stiff silty sandy clay w/iron ore	21.6	110	33	18	15	2825	5.0		Vert. Shear	
	6-8	Silty sandy clay w/iron ore	23.8									
S3	0-2	Medium slightly silty clay	34.6	82	49	20	29	1230	6.0		Vert. Shear	5.8×10^{-9}
	2-4	Medium silty sandy clay	22.8	101				1157	6.0		Vert. Shear	8.8×10^{-9}
	4-6	Medium silty sandy clay w/iron ore	29.4	92				1203	6.0		Vert. Shear	

SOUTHWESTERN LABORATORIES

SUMMARY OF LABORATORY TEST DATA

832964

PROJECT Waste Water Ponds Pirkey Power Plant

DATE 09-29-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	COMPRESSION TEST: COMPRESSION psf	COMPRESSION TEST: STRAIN %	COMPRESSION TEST: LATERAL PRESSURE psi	COMPRESSION TEST: TYPE FAILURE	k, Coefficient of Permeability cm/sec
S-4	0-2	Silty sandy clay										6.8×10^{-9}
	2-4	Silty sandy clay										1.8×10^{-8}
S-5	0-2	Silty sandy clay w/iron ore										4.9×10^{-7}
	2-4	Silty sandy clay w/iron ore										8.1×10^{-8}

SOUTHWESTERN LABORATORIES

832964

SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds Pirkey Power Plant

DATE 9-29-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	COMPRESSION TEST: COMPRESSION psf	COMPRESSION TEST: STRAIN %	COMPRESSION TEST: LATERAL PRESSURE psi	COMPRESSION TEST: TYPE FAILURE	k, Coefficient of Permeability cm/sec
S-6	0 - 2	Sandy silty clay lenses w/iron ore										7.4×10^{-6}
	2 - 4	Silty sandy clay w/iron ore										7.1×10^{-8}
S-7	0 - 2	Silty clay										2.0×10^{-8}
	2 - 4	Clay w/silt lenses and iron ore										1.1×10^{-5}
S-8	0 - 2	Slightly silty sandy clay										4.3×10^{-8}
	2 - 4	Clay w/silt lenses										7.5×10^{-9}
S-9	0 - 2	Clay w/silty sand										6.1×10^{-8}
	2 - 4	Silty sandy clay										3.2×10^{-8}
S-12	0 - 2	Sandy silty clay										1.4×10^{-8}
	2 - 4	Clay w/silt lenses										1.1×10^{-8}

832964 **SUMMARY OF LABORATORY TEST DATA**

PROJECT Waste Water Ponds Pirkey Power Plant

DATE 9-29-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS LL	PL	PI	COMPRESSION TEST: COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	k, Coefficient of Permeability cm/sec
S-13	0 - 2	Silty sandy clay										3.6×10^{-8}
	2 - 4	Silty sandy clay										6.6×10^{-8}
S-14	0 - 2	Clay w/silt lenses										9.2×10^{-8}
	2 - 4	Slightly silty clay										1.3×10^{-8}
S-16	0 - 2	Silty sandy clay w/iron ore										2.7×10^{-8}
	2 - 4	Silty sandy clay										1.3×10^{-8}
S-17	0 - 2	Slightly silty clay w/iron ore										6.1×10^{-8}
	2 - 4	Slightly silty clay w/iron ore										4.3×10^{-8}
S-18	0 - 2	Silty sandy clay w/iron ore										1.3×10^{-6}
	2 - 4	Sandy silty clay										7.2×10^{-8}

SOUTHWESTERN LABORATORIES

832964 **SUMMARY OF LABORATORY TEST DATA**

PROJECT Waste Water Ponds Pirkey Power Plant

DATE 9-29-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS			COMPRESSION TEST				k, Coefficient of Permeability cm/sec
					LL	PL	PI	COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	
S-19	0 - 2	Silty sandy clay										8.7×10^{-8}
	2 - 4	Clayey silty sand										2.4×10^{-7}
S-20	0 - 2	Silty sandy clay w/gravel										3.7×10^{-8}
	2 - 4	Clayey sandy silt w/gravel										3.8×10^{-7}

SOUTHWESTERN LABORATORIES

SUMMARY OF LABORATORY TEST DATA

PROJECT 832964

DATE 9-4-84

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS LL	PL	PI	COMPRESSION TEST: COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	Permeability,k (cm/sec)
S-21	0-2	Stiff silty clay with iron ore	26.6	95				2160	6.0		Vert. Shear	1.00×10^{-8}
	2-4	Stiff silty clay with iron ore	22.9	100	39	19	20	3222	4.0		Vert. Shear	
	4-6	Very stiff silty clay w/iron ore	21.3	81	38	19	19	4910	3.0		Vert. Shear	
S-22	0-2	Stiff clay with iron ore	26.7	93	51	21	30	3947	5.0		Vert. Shear	
	2-4	Stiff silty clay w/ iron ore	22.3	102	39	19	20	3153	6.0		Vert. Shear	4.3×10^{-9}
	4-5	Firm clayey sand w/iron ore	18.8	106	22	18	4	1785	3.0		Vert. Shear	
S-23	0-2	Stiff slightly sandy clay w/iron ore	28.6	92				2285	5.0		Vert. Shear	2.1×10^{-8}
	2-4	Stiff slightly sandy clay w/iron ore	27.5	88	48	20	28	3222	4.0		Vert. Shear	
	4-6	Stiff sandy clay with iron ore	19.5	104	35	19	16	2212	4.0		Vert. Shear	
S-24	0-2	Stiff silty sandy clay w/iron ore	27.5	100				2841	5.0		Vert. Shear	
	2-4	Stiff sandy clay with iron ore	20.4	105	37	19	18	3765	3.0		Vert. Shear	1.6×10^{-8}
	4-6	Firm very sandy clay w/iron ore	14.4		28	17	11					

SOUTHWESTERN LABORATORIES

832964

SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds, Pirkey Power Plant

DATE 10-11-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS			COMPRESSION TEST				REMARKS
					LL	PL	PI	COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	
MW-1	3½-5	Very dense clayey silty sand w/clay seam	13.5									50 B/7"
	8½-10	Very stiff very sandy clay w/iron ore	17.6									30 B/F
	13-15	Stiff silty sandy clay	21.2	113				2842	4.8		Vert. Shear	
	18-20	Loose clayey silty sand	22.5	102				694	2.0		Vert. Shear	
	23½-25	Hard silty sandy clay lenses	14.9									50 B/11"
	28½-30	Very dense clayey sandy silt	19.7									50 B/11½"
MW-2	3 - 5	Firm clayey silty sand	12.2									
	8 - 10	Medium very sandy silty clay	18.0	116				1726	3.0		Vert. Shear	
	13-15	Dense clayey silty sand	23.3									
	18½-20	Dense clayey silty sand	22.2									31 B/F
	23-25	Dense silty sand	19.2									
	28½-30	Very dense clayey silty sand	24.7									50 B/F
	33½-35	Very dense clayey silty sand	23.5									50 B/9"
	38½-40	Hard sandy silty clay	17.7									50 B/F

SOUTHWESTERN LABORATORIES

832964 **SUMMARY OF LABORATORY TEST DATA**

PROJECT Waste Water Ponds Pirkey Power Plant

DATE 11-15-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS LL	PL	PI	COMPRESSION TEST: COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	REMARKS
MW-3	3 - 5	Stiff sandy silty clay	21.0	107				2394	2.7		Vert. Shear	
	8 - 10	Stiff silty clay lenses w/iron ore	29.4	95				2981	3.0		Vert. Shear	
	13-15	Stiff sandy silty clay	25.7	103				1972	3.3		Vert. Shear	
	18-20	Firm sand w/clay lenses	30.2	95				800	2.3		Vert. Shear	
	23-25	Stiff clay	31.2	91				3485	3.0		45 Shear	Slickinsided
	28-30	Stiff clay w/silt lenses	28.3	95				3686	4.5		Vert. Shear	
	33-35	Firm clayey silty sand	20.5	103				1447	4.0		Vert. Shear	
	43½-45	Hard clay w/silty sand lenses	31.0									50 B/6"
	48½-50	Hard silty sandy clay	20.3									50 B/F
	53½-55	Hard silty sandy clay	20.4									50 B/10"

SOUTHWESTERN LABORATORIES

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SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds, Pirkey Power Plant

DATE 10-13-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS			COMPRESSION TEST				REMARKS
					LL	PL	PI	COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	
MW-4	3 - 5	Stiff silty sandy clay w/iron ore	27.0	98				3947	4.0		45° Shear	
	8 - 10	Very stiff clay	31.6	91				5143	2.0		45° Shear	
	13-15	Very stiff clay w/iron ore seam	32.0	91				5865	2.0		45° Shear	
	18-20	Stiff silty sandy clay lenses	30.5	96				2010	2.3		Vert. Shear	
	23-25	Firm silty sand	26.5	101				1234	1.3		Vert. Shear	
	28½-30	Very dense silty sand	25.5									50 B/F
	33½-35	Hard silty sandy clay	22.1									50 B/8"
	38½-40	Hard silty sandy clay	22.7									50 B/8"
	43½-45	Hard silty sandy clay	27.3									50 B/10½"

SOUTHWESTERN LABORATORIES

832964

SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds, Pirkey Power Plant

DATE 10-5-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS			COMPRESSION TEST				REMARKS
					LL	PL	PI	COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	
MW-5	3 - 5	Very stiff clay w/iron ore	29.0	96				4500	2.3		45° Shear	
	8 - 10	Very stiff clay	36.0	86				4583	1.0		45° Shear	Slickinsided
	13-15	Very stiff clay w/silty sand lenses	32.5	87				5469	3.3		45° Shear	
	18-20	Firm clayey silty sand	20.3	108				2031	1.7		Vert. Shear	
	23-25	Firm clayey silty sand	19.2									
	28½-30	Very dense silty sand w/clay pockets	28.7									50 B/7"
	33½-35	Very dense clayey silty sand	21.6									50 B/11"
	38½-40	Very dense clayey silty sand	21.9									50 B/9"
	43½-45	Very dense clayey silty sand	36.0									50 B/11½"

SOUTHWESTERN LABORATORIES

832964

SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds, Pirkey Power Plant

DATE 10-5-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS			COMPRESSION TEST				REMARKS
					LL	PL	PI	COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	
MW-6	3 - 5	Stiff clay w/silt lenses and iron ore	35.5	88				3500	1.0		45° Shear	Slickinsided
	8 - 10	Very stiff clay w/silt lenses and iron ore	27.7	97				4554	4.0		45° Shear	
	13-15	Firm clayey silty sand	26.8	100				2190	2.3		45° Shear	
	18-20	Loose clayey silty sand	22.4	102				746	3.4		Vert. Shear	
	23½-25	Very dense clayey silty sand	28.4									50 B/11½"
	28½-30	Firm clayey silty sand	23.6									24 B/F
	33½-35	Very dense clayey silty sand	23.3									50 B/9"
	38½-40	Very dense clayey silty sand	22.1									50 B/10½"

SOUTHWESTERN LABORATORIES

832964

SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds, Pirkey Power Plant

DATE 10-5-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	COMPRESSION TEST: COMPRESSION psf	COMPRESSION TEST: STRAIN %	COMPRESSION TEST: LATERAL PRESSURE psi	COMPRESSION TEST: TYPE FAILURE	REMARKS
MW-7	3 - 5	Stiff sandy silty clay w/iron ore	22.5	108				3151	3.0		Vert. Shear	
	8 - 10	Stiff clay w/iron ore	27.8	96				3657	1.7		Vert. Shear	
	13-15	Stiff silty sandy clay lenses w/iron ore	25.1	103				3953	1.7		Vert. Shear	
	18-20	Stiff very sandy silty clay	21.8	110				2192	2.8		Vert. Shear	
	23-25	Firm clayey silty sand	27.1	102				1477	5.6		Vert. Shear	
	28½-30	Very dense silty sand	28.3									50 B/F
	33½-35	Very dense clayey silty sand	21.4									50 B/F
	38½-40	Very dense clayey silty sand	21.6									50 B/10½"

SOUTHWESTERN LABORATORIES

832964

SUMMARY OF LABORATORY TEST DATA

PROJECT Waste Water Ponds, Pirkey Power Plant

DATE 10-11-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS			COMPRESSION TEST				REMARKS
					LL	PL	PI	COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	
MW-8	3 - 5	Stiff silty sandy clay w/iron ore	18.1	112				3183	2.7		Vert. Shear	
	8 - 10	Stiff silty sandy clay w/iron ore	13.3	118				3240	4.0		Vert. Shear	
	13-15	Firm clayey silty sand	20.6	103				1929	2.0		Vert. Shear	
	18-20	Medium very silty sandy clay w/iron ore	16.7	121				1385	3.0		Vert. Shear	
	23-25	Very stiff silty clay lenses	23.0	106				5468	5.0		Vert. Shear	
	33½-35	Very dense silty sand	18.5									50 B/5½"
MW-9	3 - 5	Stiff silty sandy clay w/iron ore	13.6									
	8½-10	Very stiff silty sandy clay	15.2									46 B/F
	13½-15	Medium very silty clay	20.2									15 B/F
	18-20	Stiff silty clay lenses	23.3	107				2153	5.0		Vert. Shear	
	23-25	Stiff very silty clay lenses	21.6									
	28½-30	Very dense silty sand	22.9									50 B/11"

SOUTHWESTERN LABORATORIES

832964 **SUMMARY OF LABORATORY TEST DATA**

PROJECT Waste Water Ponds, Pirkey Power Plant

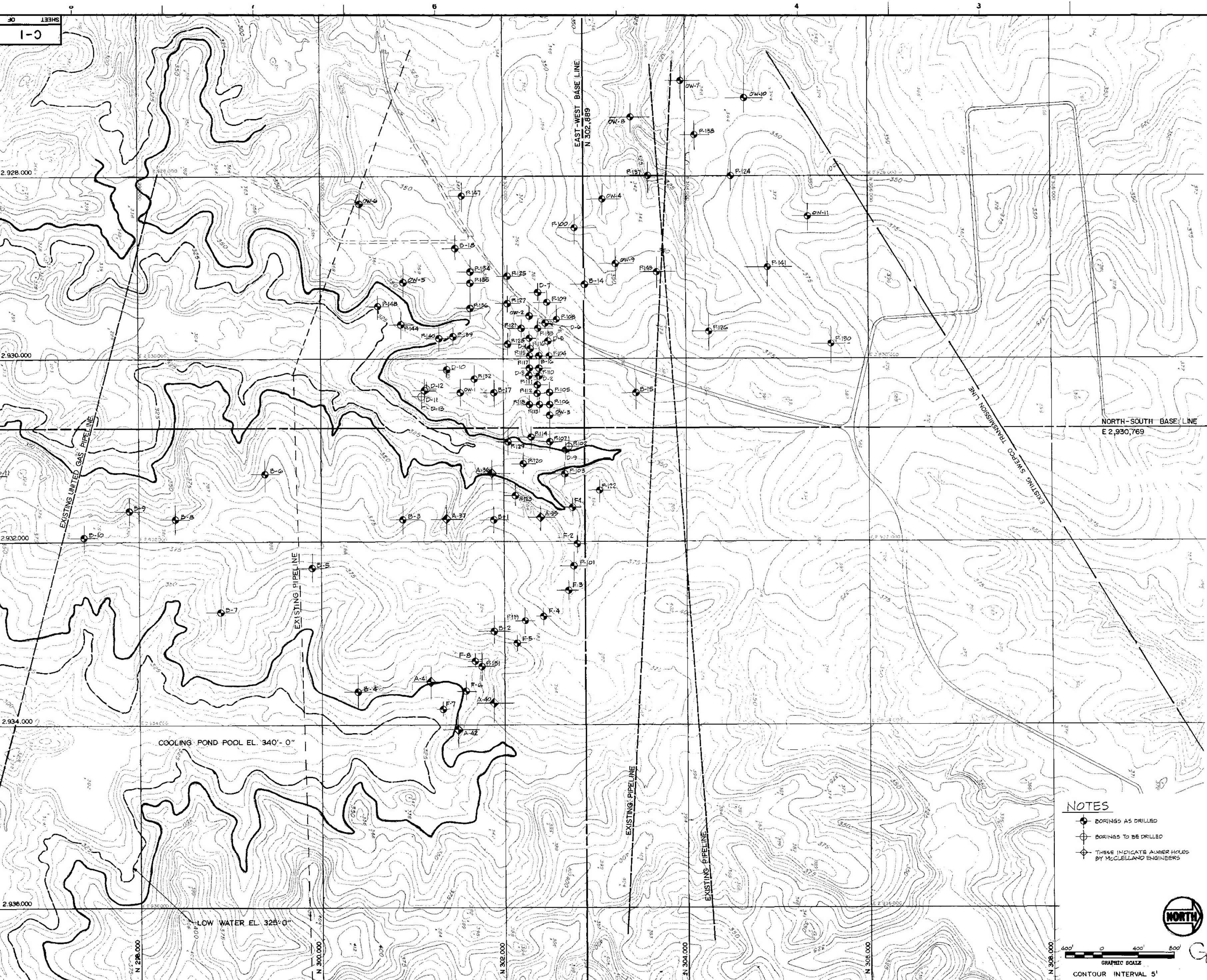
DATE 10-11-83

BORING NO	DEPTH IN FEET	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG LIMITS LL	PL	PI	COMPRESSION TEST: COMPRESSION psf	STRAIN %	LATERAL PRESSURE psi	TYPE FAILURE	REMARKS
MW-10	3 - 5	Stiff silty clay w/iron ore	23.6	102				3040	2.3		Vert. Shear	
	8 - 10	Hard silty clay	22.0	110				8319	3.3		Yield	
	13-15	Stiff silty clay w/iron ore	18.0	115				2925	3.0		Vert. Shear	
	18½-20	Dense silty sand w/iron ore	18.0									34 B/F
	23½-25	Firm clayey silty sand	20.9									22 B/F
	28½-30	Dense clayey silty sand	23.2									40 B/F
	33½-35	Very dense clayey silty sand	22.4									50 B/11"
	38½-40	Very dense clayey silty sand	19.2									50 B/10"

SOUTHWESTERN LABORATORIES

ATTACHMENT C

DESIGN DRAWINGS



NOTES

- BORINGS AS DRILLED
- BORINGS TO BE DRILLED
- THESE INDICATE AUGER HOLES BY McCLELLAND ENGINEERS

BORING SCHEDULE

BORING Nº	LOCATION NORTH	LOCATION EAST	DEPTH IN FEET	REM[ARKS]
B-1	301,889	2,931,769		COMPLETED
B-2	301,889	2,932,969		
B-3	300,889	2,931,769		
B-4	300,389	2,933,269		
B-5	299,889	2,932,269		
B-6	299,389	2,931,269		
B-7	298,889	2,932,769		
B-8	298,389	2,931,769		
B-9	297,889	2,931,669		
B-10	297,389	2,931,969		
B-11	296,389	2,931,269		COMPLETED
B-12	299,989	2,938,269		NOT DRI[LLED]
B-13	297,889	2,937,769		COMPLETED
B-14	302,889	2,929,169		COMPLETED
B-15	303,449	2,930,369		
B-16	302,389	2,929,969		
B-17	301,889	2,930,369		
B-18	301,469	2,928,769		COMPLETED
P-100	302,789	2,928,569	40	
P-101	302,769	2,932,269	40	
P-102	302,719	2,930,969	50	
P-103	302,669	2,931,269	50	
P-104	302,509	2,929,969	100	
P-105	302,509	2,930,379	79	COMPLETED
P-106	302,509	2,930,509	79	COMPLETED
P-107	302,509	2,930,919	40	
P-108	302,589	2,929,579	60	
P-109	302,489	2,929,389	40	
P-110	302,389	2,930,109	80	
P-111	302,374	2,930,289	80	
P-112	302,374	2,930,379	100	
P-113	302,389	2,930,509	79	COMPLETED
P-114	302,309	2,930,869	80	
P-115	302,289	2,929,969	200	CHIMN[EY]
P-116	302,289	2,929,789	80	
P-117	302,289	2,930,109	80	
P-118	302,289	2,930,509	100	
P-119	302,229	2,932,859	40	
P-120	302,219	2,931,149	80	
P-121	302,209	2,929,669	80	
P-122	303,050	2,931,450	60	
P-123	302,129	2,931,499	80	
P-124	304,500	2,928,000	50	PERCOLATI[ON] @ 5', 7' & 1[...]
P-125	302,049	2,929,089	30	
P-126	[illegible]	2,929,700	50	PERCOLATI[ON] @ 5', 7' & 1[...]
P-127	302,049	2,929,389	80	
P-128	302,049	2,929,889	80	
P-129	302,049	2,930,919	80	
P-130	305,600	2,929,850	50	PERCOLATI[ON] @ 6' & 10'
P-131	301,759	2,933,369	60	
P-132	301,689	2,930,219	80	
P-133	302,389	2,929.669	100	
P-134	301,649	2,929,044	80	
P-135	301,649	2,929,169	50	
P-136	301,649	2,929,444	50	
P-137	303,600	2,927,990	50	REGULAR [...]
P-138	304,100	2,927,550	50	PERCOLATI[ON] @ 5', 7' & 1[...]
P-139	301,459	2,929,759	200	LIGNITE
P-140	301,309	2,929,779	80	
P-141	304,900	2,929,000	50	PERCOLATI[ON] @ 10' & 15'
P-143	303,700	2,929,050	40	PERCOLATI[ON] @ 3', 7' & 1[...]
P-144	300,889	2,929,629	50	
P-147	301,559	2,928,219	40	
P-148	300,629	2,929,429	40	
OW-1	301,539	2,930,369	15' BELOW WATER TABLE	1¼" DIA. O[...] W[...]
OW-2	302,289	2,929,529	15' BELOW WATER TABLE	1¼" DIA. O[...] W[...]
OW-3	302,509	2,930,619	15' BELOW WATER TABLE	1¼" DIA. O[...] W[...]
OW-4	303,000	2,928,250	15' BELOW WATER TABLE	4" DIA. OBSE[RVATION] FOR WATE[R]
OW-5	300,919	2,929,169	15' BELOW WATER TABLE	
OW-6	300,430	2,928,300	15' BELOW WATER TABLE	
OW-7	303,950	2,926,950	15' BELOW WATER TABLE	
OW-8	303,410	2,927,350	15' BELOW WATER TABLE	
OW-9	303,239	2,928,969	15' BELOW WATER TABLE	
OW-10	304,650	2,927,150	15' BELOW WATER TABLE	
OW-11	305,350	2,928,450	15' BELOW WATER TABLE	4" DIA. OBSE[RVATION] FOR WATE[R]
A-35	302,400	2,931,750		
A-36	301,880	2,931,260		
A-37	301,380	2,931,750		
A-40	301,890	2,933,780		
A-41	301,200	2,933,540		
A-42	301,500	2,934,050		
D-2	302,394	2,930,189	35	COMPLETED
D-3	302,284	2,930,189	35	
D-4	302,300	2,929,904	33	
D-5	302,499	2,929,824	38	
D-6	302,464	2,929,629	35	
D-7	302,389	2,929,281	40	
D-9	302,692	2,930,995	30	
D-10	302,389	2,930,119	40	
D-11	301,139	2,930,359	50	COMPLETED
D-12	301,159	2,930,339	120	
D-13	301,104	2,930,414	120	
F-1	302,752.92	2,931,638.42	75	
F-2	302,806.67	2,932,046.23	75	
F-3	302,705.54	2,932,549.30	75	
F-4	302,432.26	2,932,830.88	75	
F-5	302,138.35	2,933,128.12	70	
F-6	301,568.05	2,933,689.32	45	
F-7	301,316.68	2,933,851.59	45	
F-8	301,673.63	2,933,330.89	45	

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
		Alex P. Odishoo Jr.			ADDED BORINGS F-1 THRU F-8.	

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
A	07-10-78	Al Slack	[signature]	[signature]	FOR DRILLING	X
B	09-14-78	Al Slack	[signature]	C. J. Nelson	REVISED BORING LOCATIONS , RELEASED HOLD	X
C	10-05-78	Al Slack	[signature]	C. J. Nelson	ADDED BORINGS; P.124, 126, 130, 141, AND OBSERVATION WELLS OW-9, 10 & 11	X
D	10-20-78	Al Slack	[signature]	C. J. Nelson	RELOCATED BORINGS P-137, P-138, P-143 & OBSERVATION WELLS OW-4, 7, 8, 9, 10 & 11, BECAUSE	X
					OF RELOCATED ASH PONDS	
E	11-01-79	Al Slack	J.W. Stanberg	C. J. Nelson	ADDED BORINGS; D-2 THRU D-7, D-9, D-10 & D-11; FOR BIDS, SPEC. H-4570	X
F	10-15-80	Al Slack	J. A. Edwards	C. J. Nelson	ADDED BORINGS; D-12 AND D-13	X
F	11-01-80	Al Slack			FOR BIDS, SPEC. H-4570	X

STATE OF TEXAS — J. M. McLAUGHLIN — 37586 — REGISTERED PROFESSIONAL ENGINEER

SCALE 1"=400'
PROJECT NUMBER 5555-03

BORING LOCATION PLAN

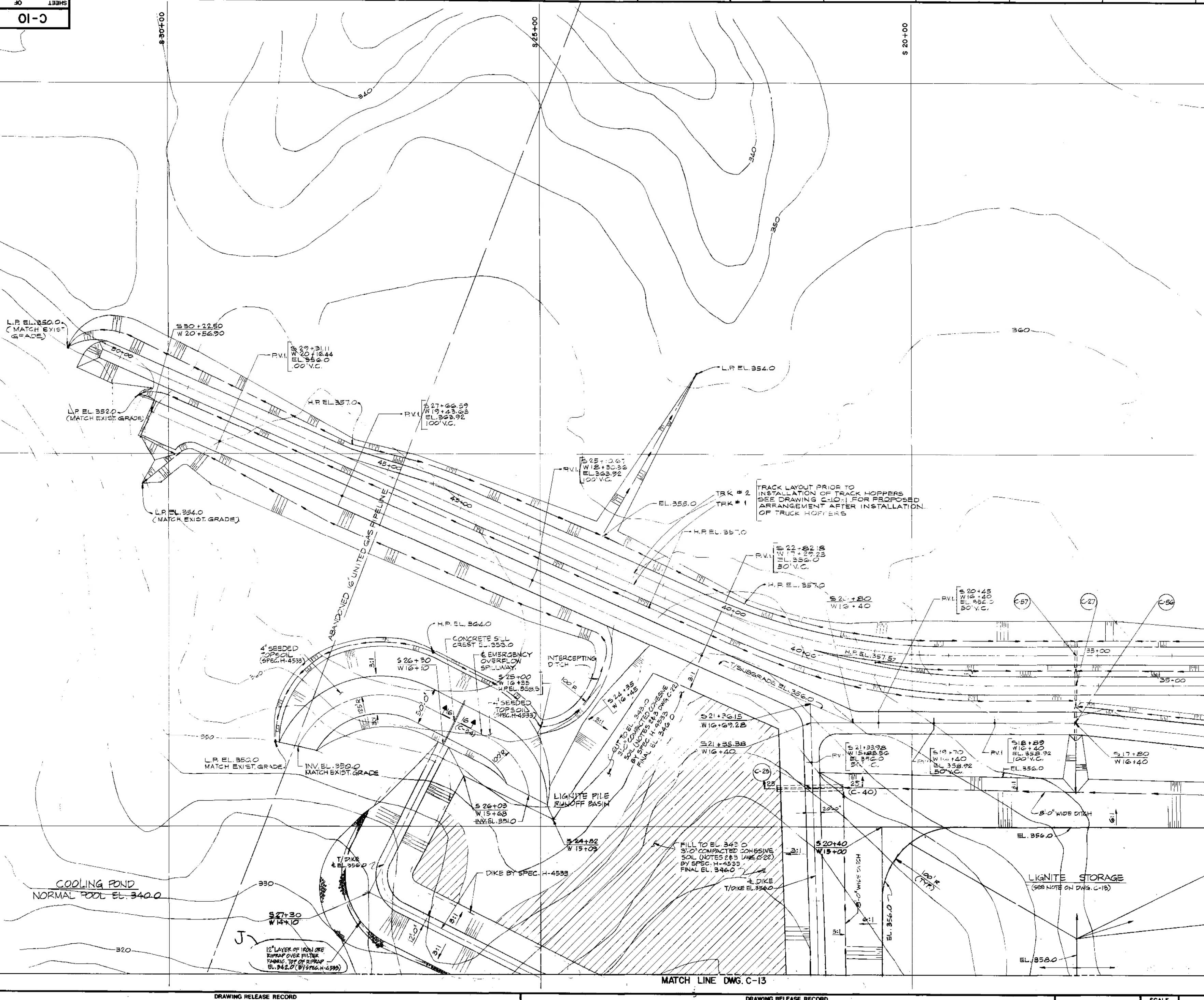
HENRY W. PIRKEY
POWER PLANT UNIT 1
SOUTHWESTERN ELECTRIC POWER CO.
SOUTH HALLSVILLE, TEXAS

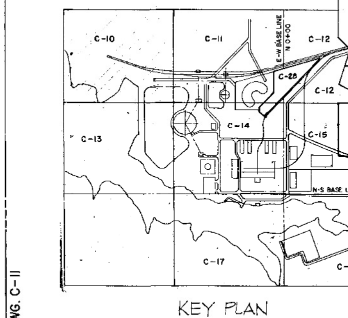
SARGENT & LU[NDY]
ENG[INEERS]
CHI[CAGO]

DRAWING NO. C-1

SHEET OF

COMPILED BY PHOTOGRAMMETRIC METHODS
TOBIN RESEARCH, INC. SAN ANTONIO, TEXA
DATE OF PHOTOGRAPHY 2-12-75
DATE OF COMPILATION 5-1-75
VERTICAL ACCURACY OF CONTOURS
90%-± 2.5' & 10%-± 5.0'
HORIZONTAL ACCURACY OF WELL DEFINED
90%-± 1"/5 & 10%-± 1"/2.5
GRID BASED ON TEXAS STATE-PLANE COORD
SYSTEM NORTH CENTRAL ZONE
ELEVATIONS ARE BASED ON 1929 MEAN SE
DATUM.





KEY PLAN

50' 0 50' 100'
GRAPHIC SCALE

NOTES

1. FOR GENERAL NOTES, SPEC. H-4530, SEE DRAWING
2. FOR GENERAL NOTES, SPEC. H-4533, SEE DRAWING
3. FOR TRACKWORK GENERAL NOTES, SEE DRAWING
4. ALL WORK SHOWN ON THIS DRAWING SHALL BE DONE SITEWORK CONTRACTOR IN ACCORDANCE WITH SPEC. UNLESS NOTED OTHERWISE.

REFERENCE DRAWINGS

C-6	GENERAL ARRANGEMENT - SHEET 1
C-20	BOTTOM ASH BASIN PLAN - SHEET 2
C-34	GRADING SECTIONS - SHEET 4
C-35	TRACKWORK PLAN
C-37	TRACK & ROAD TYPICAL SECTIONS
C-40	CULVERT SCHEDULE
C-13	SITE DEVELOPMENT - GRADING & DRAINAGE PLAN -
C-22	BOTTOM ASH BASIN - SECTIONS & DETAILS

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
	8-25-81	(signature) Al Slack	(signature)	C.J. Nelson	REVISED ROADWAY AND CULVERTS C-27, 56 & 57, CONSTRUCTION SPEC. H-4570 CONSTR. REV. - ADDED IRON ORE RIPRAP, DELETED SOIL CEMENT, SPEC. H-4533	✓

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
A	09-01-78	(signature)			FOR BIDS, SPEC. H-4530	X
B	03-12-79	(signature)	R.P. Pahati	[redacted]	FOR CONSTRUCTION, SPEC. H-4530	X
C	04-16-79	Al Slack	R.P. Pahati		DECREASED PLANT GRADE BY 2'-0", PLACED HOLD ON LIGNITE STORAGE AREA, SPEC. H-4530	
D	05-01-79	Al Slack			FOR BIDS, SPEC. H-4533	X
E	08-01-79	(signature)	R.P. Pahati	C.J. Nelson	FOR CONSTRUCTION, SPEC. H-4533	X
F	12-14-79	Al Slack	R.P. Pahati	C.J. Nelson	REVISED CONCRETE RIPRAP TO STONE RIPRAP, SPECS. H-4530 & H-4533	X
G	11-01-80	(signature)			FOR BIDS, SPEC. H-4570	
G	02-09-81	(signature)	(signature)	C.J. Nelson	REVISED TRACKS, ROAD AND DRAINAGE, SPECS. H-4530 & H-4533	X

STATE OF TEXAS
J. M. McLAUGHLIN
37586
REGISTERED PROFESSIONAL ENGINEER

SEAL

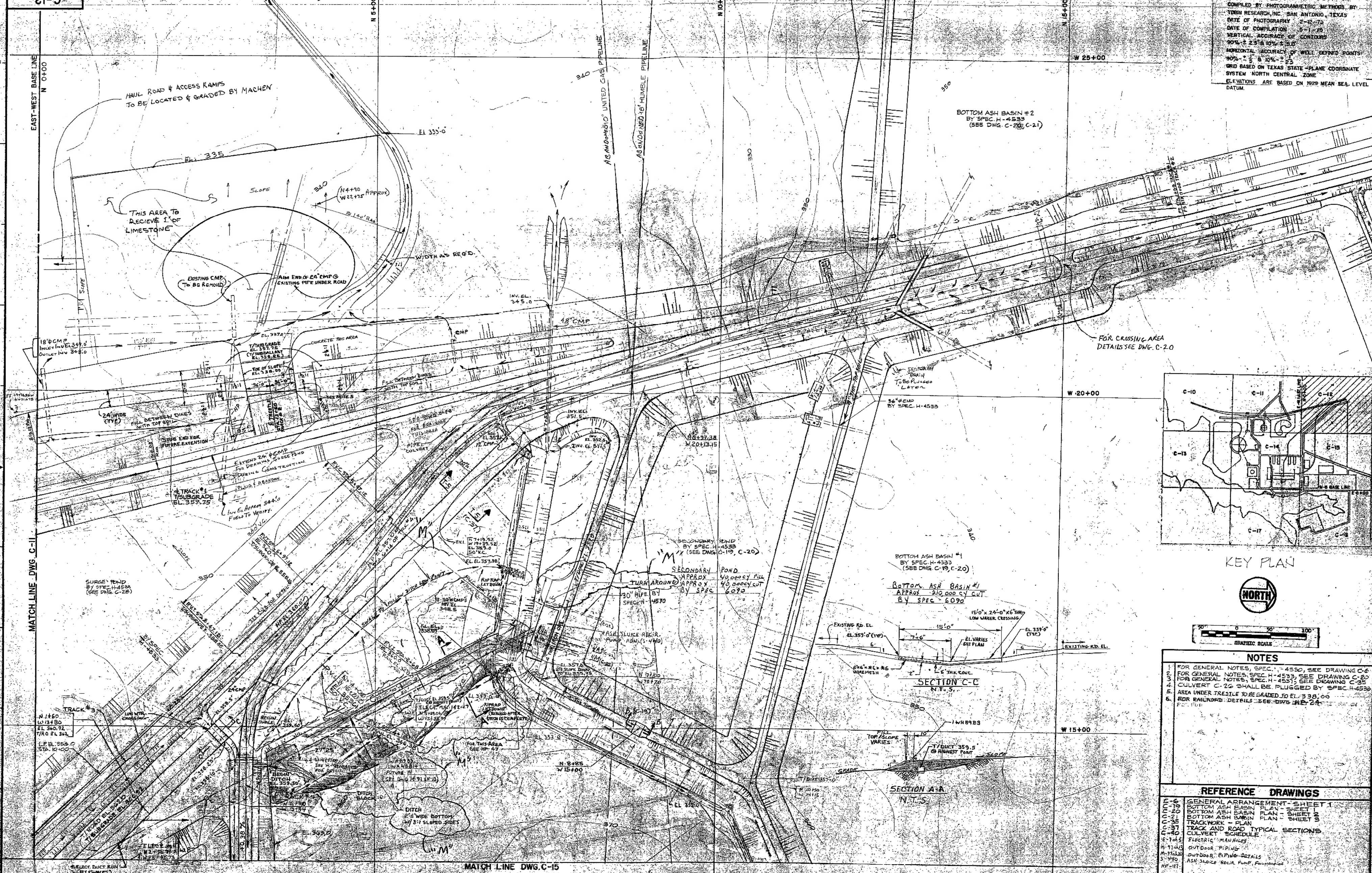
SCALE	1"=50'-0"
PROJECT NUMBER	5555-03

SITE DEVELOPMENT
GRADING & DRAINAGE PLAN - SHEET 1

HENRY W. PIRKEY
POWER PLANT UNIT 1
SOUTHWESTERN ELECTRIC POWER CO.
SOUTH HALLSVILLE, TEXAS

SARGENT & LU
ENG
CHI

DRAWING NO.
C-10
SHEET OF



COMPILED BY PHOTOGRAMMETRIC METHODS BY: TOBIN RESEARCH, INC. SAN ANTONIO, TEXAS
DATE OF PHOTOGRAPHY 2-12-75
DATE OF COMPILATION 5-1-75
VERTICAL ACCURACY OF CONTOURS 90% ± 2.5' & 10% ± 5.0'
HORIZONTAL ACCURACY OF WELL DEFINED POINTS: 90% ± 1"/5 & 10% ± 1/25
GRID BASED ON TEXAS STATE-PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE
ELEVATIONS ARE BASED ON 1929 MEAN SEA LEVEL DATUM.

NOTES

1. FOR GENERAL NOTES, SPEC. H-4530, SEE DRAWING C-6
2. FOR GENERAL NOTES, SPEC. H-4533, SEE DRAWING C-20
3. FOR GENERAL NOTES, SPEC. H-4537, SEE DRAWING C-35
4. CULVERT C-26 SHALL BE PLUGGED BY SPEC. H-4533
5. AREA UNDER TRESTLE TO BE GRADED TO EL. 338.00
6. FOR RAILROAD DETAILS SEE DWG RB-24

REFERENCE DRAWINGS

C-6	GENERAL ARRANGEMENT - SHEET 1
C-19	BOTTOM ASH BASIN PLAN - SHEET 1
C-20	BOTTOM ASH BASIN PLAN - SHEET 2
C-21	BOTTOM ASH BASIN PLAN - SHEET 3
C-35	TRACKWORK - PLAN
C-37	TRACK AND ROAD TYPICAL SECTIONS
C-40	CULVERT SCHEDULE
E-7 sh 5	ELECTRIC MANHOLES
M-97 sh 13	OUTDOOR PIPING
M-97 sh 20	OUTDOOR PIPING DETAILS
S-440	ASH SLUICE RECIR. PUMP, FOUNDATION
HP-47	

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
I	2-16-81				GEN REV FOR CONST	
J	3-30-83	R. A. GEDEON	[signature]	W H Holley	ADDED METAL CLEANING POND & REVISED DRAINAGE	
K	5-6-83	R. A. GEDEON			FOR SPEC 6090 EARTHWORK PHASE II FOR BIDS	
K	7-8-83	BP	[signature]	W H Holley	FOR CONST. 6090 - REVISED GRADING AT RECIRC. PUMP AREA	
L	12-1-83	BP	[signature]	W H Holley	REVISED DRAINAGE	
M	8-20-85		C. E. Smith	W H Holley	RELEASED FOR FINAL SITEWORK	

DRAWING RELEASE RECORD

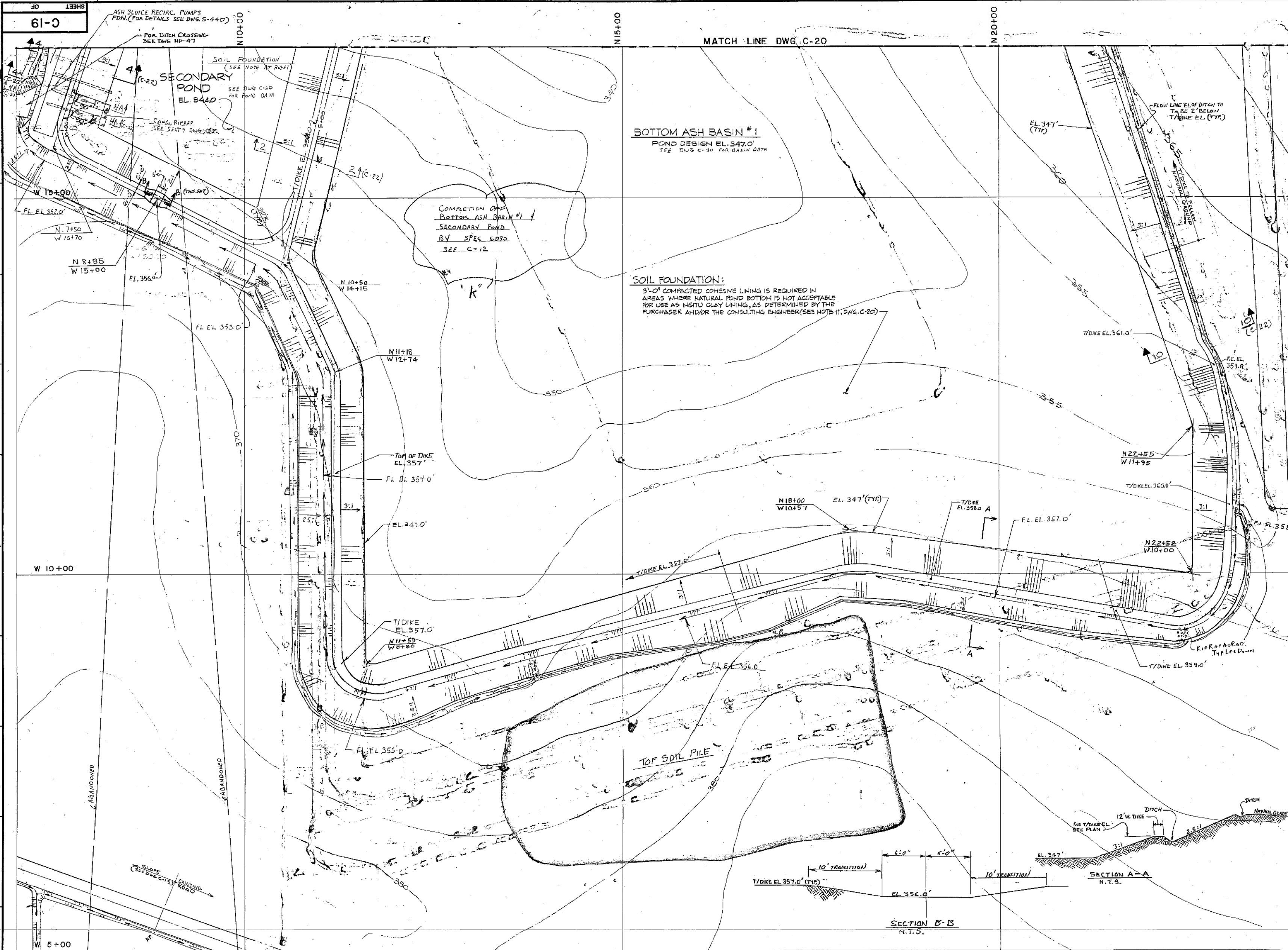
REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
A	09-01-78	[signature]			FOR BIDS, SPEC. H-4530	
B	03-12-79	[signature]	R. P. Pachal	[signature]	FOR CONSTRUCTION, SPEC. H-4530	
C	04-16-79	[signature]	R. P. Pachal	[signature]	DECREASED PLANT GRADE BY 2'-0", SPEC. H-4530	
D	05-01-79	Michael J. Dieter			FOR BIDS, SPEC. H-4533	
E	08-01-79	Michael J. Dieter	R. P. Pachal	C. J. Nelson	FOR CONSTRUCTION, SPEC. H-4533	
F	9-16-80				REL. FOR CONST. OF TRESTLE APPROACHES	
G	10-3-80				REL FOR RAILROAD GRADING (NOT FOR REMAINING PLANT SITE WORK)	
H	12-19-80				RELEASED LIMESTONE HANDLING AREA FOR CONSTRUCTION	

SCALE 1"=50'-0"
PROJECT NUMBER 5555-03

SITE DEVELOPMENT
GRADING & DRAINAGE PLAN - SHEET 3

HENRY W. PIRKEY
POWER PLANT UNIT 1
SOUTHWESTERN ELECTRIC POWER CO.
SOUTH HALLSVILLE, TEXAS

DRAWING NO. C-12 REV. M
SHEET OF



COMPILED BY PHOTOGRAMMETRIC METHODS BY TOBIN RESEARCH, INC. SAN ANTONIO, TEXAS
DATE OF PHOTOGRAPHY 2-12-75
DATE OF COMPILATION 5-1-75
VERTICAL ACCURACY OF CONTOURS 90% - ± 2.5' & 10% ± 5.0'
DASHED CONTOURS ARE OUTSIDE THE VERTICAL ACCURACY, BECAUSE OF TREES
HORIZONTAL ACCURACY OF WELL DEFINED POINTS: 90% - ± 1"/5 & 10% - ± 1"/25
GRID BASED ON TEXAS STATE-PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE
ELEVATIONS BASED ON 1929 MEAN SEA LEVEL DATUM

GRAPHIC SCALE: 50' 0 50' 100'

NOTES

1. FOR GENERAL NOTES, SPEC. H-4533, SEE DRAWING C-20

REFERENCE DRAWINGS

C-6	GENERAL ARRANGEMENT - SHEET 1
C-20	BOTTOM ASH BASIN PLAN - SHEET 2
C-22	BOTTOM ASH BASIN - SECTIONS & DETAILS
C-40	CULVERT SCHEDULE

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
H	2-16-81				GEN REV FOR CONST	
J	3-30-83	R. A. GEDEON	M. J. Sutton	W. H. Holley	REVISED DRAINAGE DITCH	
K	5-6-83	R. A. GEDEON			FOR SPEC 6090 EARTHWORK PHASE II FOR BIDS	
K1	6-30-83	BP			FOR CONST. 6090	
L	7-7-83	BP	M. J. Sutton	W. H. Holley	REVISED ASH SLUICE RECIRC. PUMPS FDN.	

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
A	05-01-79	Michael J. Ricarte		[illegible]	FOR BIDS, SPEC. H-4533	X
B	08-01-79	Al Slack	R. L. Pahutz	[illegible]	FOR CONSTRUCTION, SPEC. H-4533	X
C	12-14-79	Al Slack	R. L. Pahutz	C. J. Nelson	ADDED COORDINATES, SPECS. H-4530 & H-4533	X
D	12-01-80	F. Aquino			FOR CLIENTS COMMENTS	
D	12-15-80	F. Aquino	B. Ahrburn	C. J. Nelson	REVISED ASH POND & ADDED DITCH, SPEC. H-4533	
E	1-9-81	Bill Porter			Release Ash Basin For Construction	
F	1-12-81	Bill Porter			Add Corner Coordinates	
G	1-26-81	Bill Porter			Revised Ditch Location	

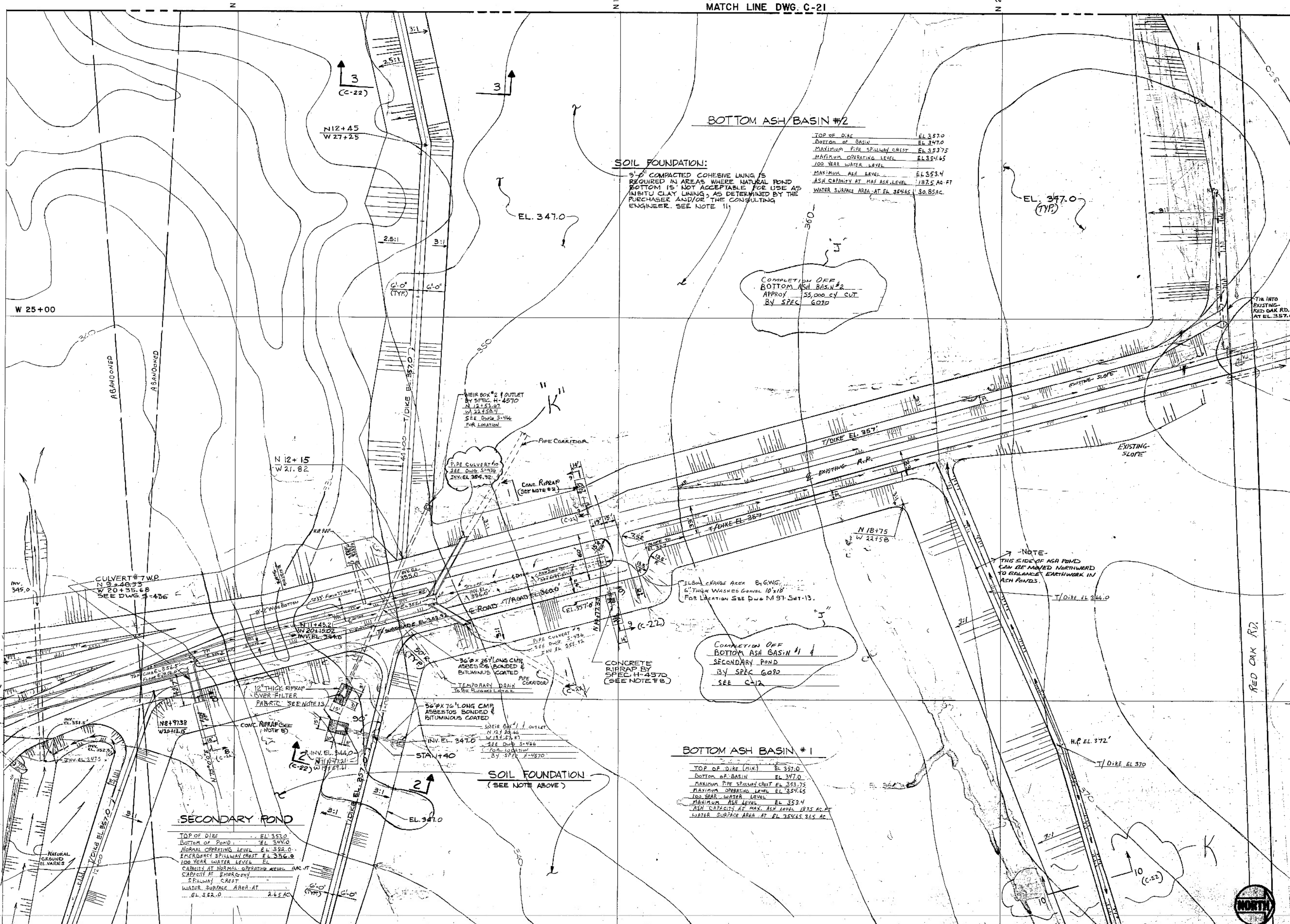
SCALE: 1" = 50'-0"
PROJECT NUMBER: 5555-03

BOTTOM ASH BASIN
PLAN - SHEET 1

HENRY W. PIRKEY
POWER PLANT UNIT 1
SOUTHWESTERN ELECTRIC POWER CO.
SOUTH HALLSVILLE, TEXAS

DRAWING NO.: C-19
REV.: L
SHEET OF

C-20



MATCH LINE DWG. C-19

COMPILED BY PHOTOGRAMMETRIC METHODS BY TOBIN RESEARCH, INC. SAN ANTONIO, TEXAS
DATE OF PHOTOGRAPHY 2-12-75
DATE OF COMPILATION 5-1-75
VERTICAL ACCURACY OF CONTOURS
90% - ± 2.5' & 10% ± 5.0'
DASHED CONTOURS ARE OUTSIDE THE VERTICAL ACCURACY, BECAUSE OF TREES.
HORIZONTAL ACCURACY OF WELL DEFINED POINTS:
90% - ± 1"/5 & 10% - ± 1"/25
GRID BASED ON TEXAS STATE-PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE
ELEVATIONS BASED ON 1929 MEAN SEA LEVEL DATUM

SPEC. H-4533

GENERAL NOTES

1. ALL WORK SHOWN ON THIS DRAWING AND ON DRAWINGS REFERRED TO THESE GENERAL NOTES SHALL BE DONE BY THE EARTHWORK CONTRACTOR IN ACCORDANCE WITH SPEC. H-4533 UNLESS NOTED OTHERWISE.
2. ALL FILL MATERIALS FOR DIKE WORK AND POND LINING SHALL BE OBTAINED FROM SITEWORK EXCAVATION. WHEN ENOUGH SUITABLE MATERIAL IS NOT AVAILABLE, BORROW MATERIALS SHALL BE OBTAINED FROM AREAS INDICATED ON THE DRAWINGS OR FROM AREAS APPROVED BY OWNER.
3. AREAS UNDER THE DIKES SHALL BE STRIPPED TO A MINIMUM OF ONE FOOT, OR AS REQUIRED BY OWNER.
4. TOPSOIL SHALL BE STOCKPILED IN AREAS APPROVED BY OWNER.
5. ALL SPOILS SHALL BE DISPOSED IN THE AREA SHOWN ON THE DRAWING OR IN OTHER AREAS APPROVED BY OWNER.
6. ALL ELEVATIONS SHOWN ON THE DRAWINGS ARE FINISHED GRADE ELEVATIONS UNLESS NOTED OTHERWISE.
7. ALL DRAINAGE DITCHES SHALL BE PROVIDED WITH 4 INCHES OF SEEDED TOPSOIL, UNLESS NOTED OTHERWISE.
8. ALL CONCRETE RIPRAP SHALL BE OF "CLASS B CONCRETE" AS SPECIFIED FOR "CONCRETE FOR STRUCTURES" IN ITEM 421 AND ITS REINFORCING SHALL BE 6"x6" x W2.1 x W2.1 WIRE MESH, AS SPECIFIED IN ARTICAL 432.9 OF ITEM 432 OF "TEXAS HIGHWAY DEPARTMENT" 1972 STANDARD SPECIFICATION FOR CONSTRUCTION OF HIGHWAYS, STREETS & BRIDGES.
9. ALL CULVERT PIPES SHALL BE BITUMINOUS COATED CORRUGATED METAL PIPE (C.M.P.) WITH 2⅔"x½" CORRUGATION, UNLESS NOTED.
10. FOR SOIL CEMENT DETAIL, SEE DRAWING C-34.
11. THE SURGE POND, ASH BASINS AND SECONDARY POND SHALL BE EXCAVATED TO THE FINISHED GRADE INDICATED. PURCHASER AND/OR CONSULTING ENGINEER SHALL VERIFY ACCEPTABILITY OF THE INSITU POND BOTTOM. IF THE INSITU MATERIAL IS ACCEPTABLE, NO FURTHER EXCAVATION WILL BE NECESSARY. IF THE INSITU MATERIAL IS NOT ACCEPTABLE EXCAVATE A SUFFICIENT AMOUNT OF MATERIAL SO THAT A 3'-0" THICK COMPACTED COHESIVE LINING CAN BE INSTALLED TO BRING THE BOTTOM OF THE POND UP TO THE FINISHED GRADE INDICATED ON THESE DRAWINGS.
12. ALL FILL SLOPES & CUT SLOPES SHALL BE PROVIDED WITH 4" SEEDED TOPSOIL UNLESS NOTED OTHERWISE.
13. TYPE OF FILTER FABRIC SHALL BE APPROVED BY PURCHASER AND INSTALLED PER MANUFACTURES REQUIREMENT.

REFERENCE DRAWINGS

C-6 GENERAL ARRANGEMENT - SHEET 1
C-22 BOTTOM ASH BASIN - SECTIONS & DETAILS
C-34 GRADING SECTIONS - SHEET 4

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
H	3-30-83	R.A. GEDEON	[illegible]	W.H. Holley	REVISED DRAINAGE, POND DATA	
I	4-22-83	MJS	[illegible]	W.H. Holley	REVISED GRADING AT PIPE CORRIDOR	
J	5-6-83	R. A. GEDEON	[illegible]		FOR SPEC 6090 EARTHWORK PHASE II For Bids	
J1	6-30-83	BP	[illegible]	WHH By MJS	FOR CONST. 6090	
K	12-1-83	BP	[illegible]	WHH By MJS	ADDED SECTION "10-10" & REVISED CULVERT ELEVATION	

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
A	05-01-79	Michael Dicente		[illegible]	FOR BIDS, SPEC. H-4533	X
B	08-01-79	Michael Dicente	R.P. Pohat		FOR CONSTRUCTION, SPEC. H-4533	X
C	11-01-79	Al Stark			FOR BIDS, SPEC. H-4570	X
D	12-14-79	D. Quiñono	R.P. Pohat	C.J. Nelson	ADDED NOTE, SPECS. H-4530 & H-4533	
	12-19-80				Revised Dikes @ R.R. For Construction	
E	1-9-81	Bill Porter			Release Ash Basin For Construction	
F	1-26-81	Bill Porter			Revised Ditch Location	
G	2-16-81				Gen Rev For Const.	

SCALE 1" = 50'-0"
PROJECT NUMBER 5555-03

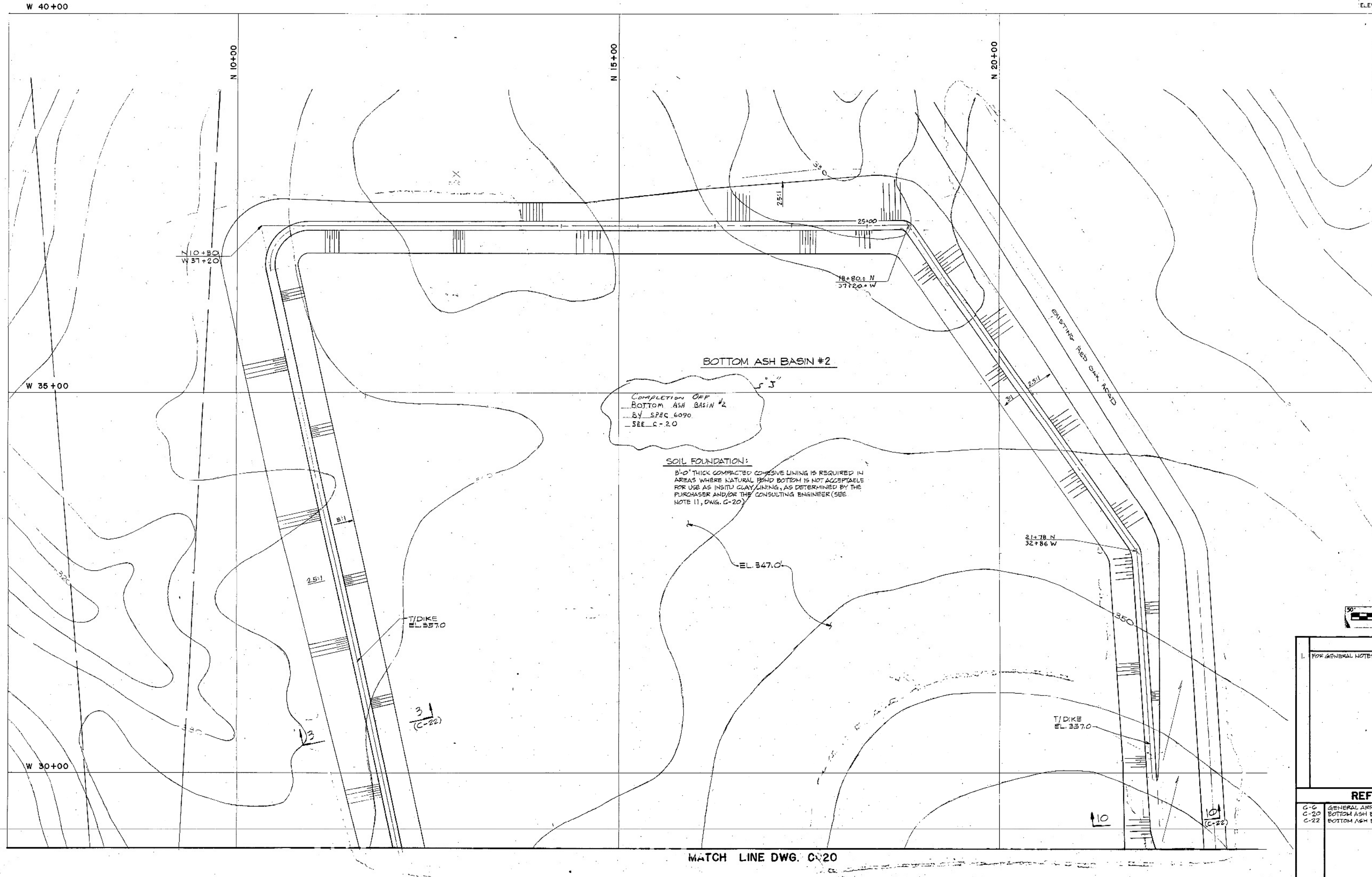
BOTTOM ASH BASIN
PLAN - SHEET 2

HENRY W. PIRKEY
POWER PLANT UNIT 1
SOUTHWESTERN ELECTRIC POWER CO.
SOUTH HALLSVILLE, TEXAS

DRAWING NO. C-20 REV. K
SHEET OF

C-21

COMPILED BY PHOTOGRAMMETRIC METHODS BY TOBIN RESEARCH, INC SAN ANTONIO, TEXAS
DATE OF PHOTOGRAPHY 2-12-75
DATE OF COMPILATION 5-1-75
VERTICAL ACCURACY OF CONTOURS
90% - ± 2.5' & 10% ± 5.0'
DASHED CONTOURS ARE OUTSIDE THE VERTICAL ACCURACY, BECAUSE OF TREES
HORIZONTAL ACCURACY OF WELL DEFINED POINTS:
90% - ± 1"/5 & 10% - ± 1"/2.5
GRID BASED ON TEXAS STATE-PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE
ELEVATIONS BASED ON 1929 MEAN SEA LEVEL DATUM



MATCH LINE DWG. C-20

NOTES

1. FOR GENERAL NOTES, SPEC. H-4533, SEE DRAWING C-20

REFERENCE DRAWINGS

C-6	GENERAL ARRANGEMENT - SHEET 1
C-20	BOTTOM ASH BASIN PLAN - SHEET 2
C-22	BOTTOM ASH BASIN - SECTIONS & DETAILS

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
H	3-30-83	[signature]	[signature]	W.H. Holley	UP-DATED	
J	5-6-83	R.A. GEDEON			FOR SPEC 6090 EARTHWORK PHASE II FOR BIDS	
J1	6-30-83	BP	[signature]	WHH By [signature]	FOR CONST. 6090	

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
A	05-01-79	Michael J. Dicente	—	[signature]	FOR BIDS, SPEC. H-4533	X
B	08-01-79	Michael J. Dicente	R.P. Pahel	[signature]	FOR CONSTRUCTION, SPEC. H-4533	X
C	12-14-79	[signature]	R.P. Pahel	C.J. Nelson	REVISED COORDINATES, SPECS. H-4530 & H-4533	X
D	12-01-80	[signature]	—	—	FOR CLIENTS COMMENTS	
D	12-15-80	[signature]	[signature]	C.J. Nelson	REVISED ASH POND, SPEC. H-4533	
E	1-9-81	Bill Porter			Release Ash Basin For Construction	
F	7-18-80				GEN REV FOR CONST.	
G	3-16-81	Bill Porter			Revised Dike Location as BUILT (Record Only)	

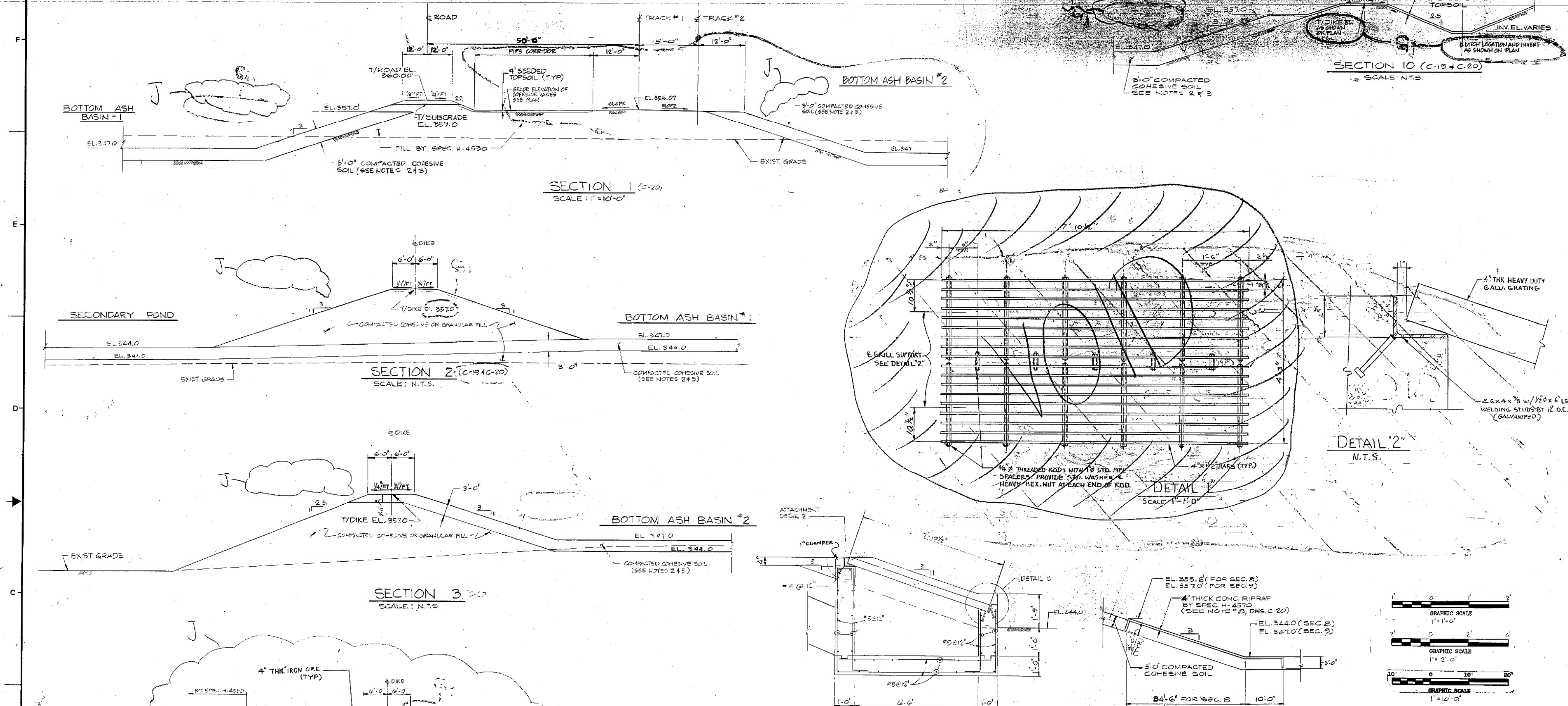
SCALE	1" = 50'-0"
PROJECT NUMBER	5555-03

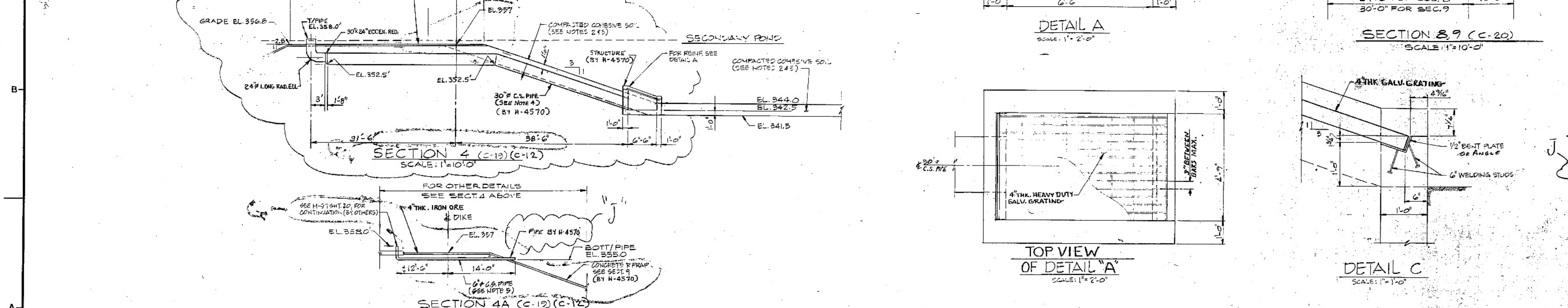
BOTTOM ASH BASIN
PLAN - SHEET 3

HENRY W. PIRKEY
POWER PLANT UNIT 1
SOUTHWESTERN ELECTRIC POWER CO.
SOUTH HALLSVILLE, TEXAS

DRAWING NO.	REV.
C-21	J

SHEET OF





NOTES

1. FOR GENERAL NOTES SPEC. H-4533, SEE DRAWING C-20.
2. COMPACTED COHESIVE LINING AT THE BOTTOM OF THE POND AND BASINS MAY BE OMITTED IF THE EXISTING SOIL IS SUITABLE AS AN INSITU COHESIVE LINING AS DETERMINED BY PURCHASER AND/OR THE CONSULTING ENGINEER. NO LINING SHALL BE OMITTED UNLESS IT IS APPROVED IN ADVANCE.
3. COMPACTED COHESIVE SOIL USED FOR IMPERVIOUS LINING SHALL HAVE A MINIMUM OF 40% PASSING Nº 200 U.S. STANDARD SIEVE AND A MINIMUM PLASTICITY INDEX (P.I.) OF 15%.
4. C.S. PIPE SHALL BE 3/8" WALL THICK NOM. (STD. WT.) PIPE PER S&L STD. PIPING DESIGN TABLE 100. OR 3/8"-A-53 STRAIGHT SEAM WELDED PLATE PIPE
5. 6"Ø SCHEDULE 80 C.S. PIPES PER S&L STD. PIPING DESIGN TABLE 103.
6. ALL BURIED PIPE SHALL BE COATED & WRAPPED

REFERENCE DRAWINGS

C-19	BOTTOM ASH BASIN PLAN – SHEET 1
C-20	BOTTOM ASH BASIN PLAN – SHEET 2
C-21	BOTTOM ASH BASIN PLAN – SHEET 3
C-40	CULVERT SCHEDULE

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
H	3-30-83	[signature]	[signature]	W.H. Holley	REVISED MISC. SECTIONS	
J	12-1-83	[signature]	[signature]	WHH By [signature]	REVISED 30"Ø SUCTION PIPE ROUTING & SLOPE TREATMENTS	

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
A	05-01-79	[signature]			FOR BIDS SPEC. H-4533	X
B	08-01-79	[signature]	R.P. Pelzel	[signature]	FOR CONSTRUCTION, SPEC. H-4533	X
C	12-14-79	[signature]	R.P. Pahat	C.J. Nelson	ADDED DETAILS ON PUMP INLET STRUCTURE, SPECS. H-4530 & H-4533	
D	12-15-80	[signature]	[signature]		REVISED ASH POND DIKES & ADDED SECTIONS 8, 9 & 10, SPEC. H-4533	
D	01-09-81	[signature]			FOR BIDS, SPEC. H-4570	
E	8-25-81	[signature]	[signature]	C.J. Nelson	REVISED SEC. 1, FOR CONSTRUCTION SPEC. H-4570	
F	10-20-81	[signature]	[signature]	C.J. Nelson	REVISIONS AS PER ASH PIPE CULVERTS, SPEC H-4533.	
G1	2-10-83	Al Slack	R.H. Cook		CONSTR. REV. - REVISED SECTS. 1,2,3,4,4A & 10, VOIDED SECTS. 5, 6 & 7, SPEC. H-4533	

SCALE: AS SHOWN
PROJECT NUMBER: 5555-03

BOTTOM ASH BASIN
SECTIONS & DETAILS
HENRY W. PIRKEY
POWER PLANT UNIT 1
SOUTHWESTERN ELECTRIC POWER CO.
SOUTH HALLSVILLE, TEXAS

DRAWING NO. C-22 REV. J
SHEET OF

R.C.L.-78

HORIZONTAL ACCURACY OF WELL SITES POINTS
GRID BASED ON TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE
ELEVATIONS ARE BASED ON 1929 MEAN SEA LEVEL DATUM.

SPEC. H-4530

GENERAL NOTES

1. ALL COORDINATES SHOWN ON THE DESIGN DRAWINGS ARE BASED ON PLANT GRID COORDINATE SYSTEM WITH THE ORIGIN AT N 302,889 AND E 2,930,769 TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE
2. ALL ELEVATIONS ARE IN FEET AND BASED ON MEAN SEA LEVEL DATUM.
3. ALL WORK SHOWN ON THIS DRAWING AND ON OTHER DRAWINGS REFERENCED TO THESE GENERAL NOTES SHALL BE DONE BY SITE WORK CONTRACTOR IN ACCORDANCE WITH SPEC H-4530, UNLESS NOTED OTHERWISE.
4. SITE CLEARING, GRUBBING AND DEMOLITION OF EXISTING STRUCTURES AND FENCES SHALL BE DONE BY SITEWORK CONTRACTOR IN ACCORDANCE WITH SPEC H-4530 AND AS DIRECTED BY OWNER.
5. BENCH MARKS SHALL BE ESTABLISHED AT THE PLANT SITE AS DIRECTED BY OWNER. [illegible] BENCH MARK DETAILS
6. AREAS INCLUDING ROAD BED AND TRACK BED SHALL BE STRIPPED TO A MINIMUM OF ONE FOOT, OR AS REQUIRED BY OWNER. DEPTH OF STRIPPING IN OTHER AREAS SHALL BE DETERMINED IN THE FIELD AND APPROVED BY OWNER.
7. TOPSOIL SHALL BE STOCKPILED IN DESIGNATED AREAS SHOWN ON THE DRAWING, OR IN OTHER AREAS APPROVED BY OWNER.
8. ALL SPOILS SHALL BE DISPOSED IN THE AREA SHOWN ON THE DRAWING, OR IN OTHER AREAS APPROVED BY OWNER.
9. [illegible] MATERIAL SHALL BE OBTAINED FROM [illegible] APPROVED BY OWNER.
10. [illegible] SHALL HAVE A BOTTOM [illegible] SIDE SLOPES OF 2.5 H:1.0 V [illegible]
11. [illegible]
12. ROAD INTERSECTIONS SHALL HAVE A RADIUS OF [illegible] CENTERLINE OF ROAD UNLESS NOTED OTHERWISE. 75.
13. [illegible] SPEC. H-4530 SEE DRAWING [illegible]
14. [illegible] SPEC. H-4531 SEE DRAWING [illegible]
15. ROADWAYS DESIGNATED AS CONSTRUCTION ROADS WILL BE INSTALLED, ALONG WITH ANY REQUIRED DITCHES AND CULVERTS AT THE DIRECTION OF THE RESIDENT ENGINEER AND BY THE SITEWORK CONTRACTOR. THE CONSTRUCTION ROADS HAVE BEEN INDICATED ON THE PLAN VIEWS ONLY.

BORING SCHEDULE					
Date Installed	Boring	Plant Site Coordinates		Depth(Ft)	Surface Elevation
	S-1	N969.8	W1899.5	10	343.6
	S-2	N1020	W1730.8	10	343.9
	S-3	N912.6	W1613.6	10	343.8
	~~S-4~~	N1499.3	W1701	6	347.3
	S-5	N1500.6	W1130.6	6	347.1
	S-6	N1999.9	W1699.9	6	353.6
	S-7	N2000.2	W1129.9	6	346.9
	S-8	N1488.3	W3291	6	347.1
	S-9	N2011.4	W3274.9	6	348.1
	S-10	N1500	W2600	6	347.4
	S-11	N2000	W2600	6	347.0
	S-12	N000.2	W1699.9	6	348.3
	S-13	N300.3	W1791.5	6	348.9
	S-14	S138.2	W1370.5	6	352.9
HOLD-C	S-15	N200	W880	6	
	S-16	N135	1152.9	6	357.0
	S-17	N212.6	W1286.2	6	348.1
	S-18	S1327	W889.3	6	357.2
	S-19	S1901.1	W605.3	6	356.7
	S-20	S1801.7	W1355.4	6	357.6
	S-21	S2209.09	W1529.07	6	345.9
"D"	S-22	S2346.71	W1615.67	6	345.7
	S-23	S2416.52	W1477.93		345.8
	S-24	S2241.18	W1312.81		345.9
10/83	MW-1	N1855.2	W3859.8	30	334.0
	MW-2	N988.5	W2585.4	40	341.0
	MW-3	N1999.7	W2275	57	370.0
	MW-4	N1376.4	W834.4	46	363.4
	MW-5	N261.5	W782.2	45.5	362.5
	MW-6	S184.6	W1060.5	40	361.0
	MW-7	S223.9	W1724.45	40	358.3
	MW-8	S2104.6	W1611.9	35	356.3
	MW-9	S1548	W188.9	35	353.1
	MW-10	N656.9	W1831.3	40	358.6
1/86	MW-11	N 0+23.50	W 10+40.49	43	361.61
1/86	MW-12	N 4+13.25	W 6+50.36	51	378.41
2/88	MW-13	N 0+33.3	W 8+84.7	47.5	361.85
"	MW-14	N 0+36.3	W 12+34.2	42.5	361.81
"	MW-15	N 1+30.7	W 13+14.3	42.5	360.27
1/86	M-1	S 12+32.79	W 35+24.55	[illegible]	[illegible]
1/86	M-2	S 38+86.22	W 45+76.41	27	342.49
6/85	M-1A	S 33+79.30	W 24+59.76	35	357.20
6/85	M-2A	S 27+50.45	W 36+47.44	22 (CLOSED)	308.40
	M-3	S 50+09.57	W 52+17.21	20	275.40
		S 50+69.94	W 51+31.04		

REFERENCE DRAWINGS

C-4	CLEARING AND GRUBBING SHEET 1
C-5	CLEARING AND GRUBBING SHEET 2
C-7	GENERAL ARRANGEMENT SHEET 2
C-31	GRADING SECTIONS SHEET 1
C-32	GRADING SECTIONS SHEET 2
C-33	GRADING SECTIONS SHEET 3
C-35	TRACKWORK PLAN
C-45	SECTIONS AND DETAILS
C-46	DISCHARGE CHANNEL PROFILE SECTIONS & DETAILS
C-20	BOTTOM ASH BASIN PLAN SHEET
C-26	DISCHARGE STRUCTURE PLAN SECTIONS & DETAILS
S-457	MAKE-UP WATER PUMP FOUNDATION PLAN & SECTIONS
S-458	SURGE POND PUMP STRUCTURE PLAN SECTIONS & DETAILS
[illegible]	[illegible]

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
	8-5-81				RELEASED FOR RIPRAP WORK	
	9-27-82	Bill Porter			REVISED DISCHARGE CHANNEL	
	10-6-82				FOR BID SPEC. 6014	
	3-30-83	Bill Porter	[signature]	W.H. Holley	REVISE R.R. TRACK, ADDED TURNAROUND & MISC. UPDATE	
	9-12-83	Bill Porter		W.H. Holley	WASTE WATER PONDS LINING VERIFICATION & MONITORING WELLS FOR CONSTRUCTION	
A	9-16-83	Bill Porter		W.H. Holley	REVISED TO SHOW ACTUAL LOCATIONS OF BORINGS & WELLS	
B	10-13-83	Bill Porter		W.H. Holley	REMOVED HOLD ON S-10, S-11, REVISED LOCATIONS ON MW 2, MW4 & MW10	
C	8-30-84	Bill Porter		W.H. Holley	REMOVED HOLD ON S-21 & S-22, ADDED S-23 & S-24	

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
D	9-5-84	Bill Porter			REVISED LOCATION OF BORING S-22	
E	1-31-86	MJS			ADDED MW-11, M-1, [illegible]	
F	12-4-86	MJS			Rev MW11&12 (Was M-1&10), Add M-1,2,1A,2A, Add Surge Pond (North) & Sludge Area Info.	
G	4-7-88	MJS			Added MW-13, MW-14, MW-15	
					Added M-3, Closed M-2A	

SCALE 1"=200'

PROJECT NUMBER

WASTE WATER PONDS
LINING VERIFICATION AND MONITORING WELLS

HENRY W. PIRKEY
POWER PLANT UNIT 1
SOUTHWESTERN ELECTRIC POWER CO.
SOUTH HALLSVILLE, TEXAS

DRAWING NO. HP-56

REV. G

ATTACHMENT D

INSTRUMENTATION LOCATION MAP

Provided by Google Earth.

New Piezometer Location Map – West Bottom Ash Pond	
Scale: N/A	**Pirkey Power Generating Station** **New Piezometer Location – 2015** **Hallsville, Texas**
Auckland Project No. 2015-016	

ATTACHMENT E

HYDROLOGY AND HYDROLOGIC REPORT

December 17, 2015

Mr. Brett Dreger, P.E.
American Electric Power Company
1 Riverside Plaza
Columbus, Ohio 43215
Email: badreger@aep.com

RE: West Ash and East Ash Pond – Hydrology and Hydraulic Analysis
Pirkey Power Generating Station
Hallsville, Texas

Dear Mr. Dreger:

Auckland Consulting, LLC (Auckland) is pleased to provide the attached Hydrology and Hydraulic Report for both the West Ash and East Ash Ponds located at the Pirkey Power Generating Station near Hallsville, Texas. The analysis covers both the 25-year, 24-hour and 100-year, 24-hour storm events as required by 40 CFR §257.82(a). As indicated through various phone conversations and email correspondence, the West Ash and East Ash Ponds were identified as the only CCR impoundments requiring this demonstration.

Please do not hesitate to contact us with any questions or comments.

Best regards,

John J. Tayntor, P.E.
Auckland Consulting LLC
TBPE Firm Registration No. F-16721, Expires 2/29/2016

Attachments

HYDROLOGY & HYDRAULIC REPORT

EAST & WEST ASH PONDS

H.W. PIRKEY POWER PLANT – HALLSVILLE, TX

December 2015

Prepared for:

H.W. Pirkey Power Plant
2400 FM 3251
Hallsville, Texas 75650

Prepared by:

Akron Consulting, LLC
431 N. Center St.
Longview, Texas 75601
TBPE Firm # 14014

STATE OF TEXAS
LANDON COLE ALLEN
119170
LICENSED
PROFESSIONAL ENGINEER

12/15/15 e

TABLE OF CONTENTS

HYDROLOGY & HYDRAULIC REPORT

Page No.

LIST OF TABLES

LIST OF FIGURES

HYDROLOGIC & HYDRAULIC CALCULATIONS

APPENDIX - A

Introduction

H.W. Pirkey Power Plant which is located in Hallsville, Texas is a subsidiary of American Electric Power. Plant operation requires a series of water impoundments utilized in the process of power generation, including the bottom ash ponds. The purpose of this report is to analyze and document the Hydrologic & Hydraulic characteristics of the East and West Bottom Ash Ponds at Pirkey Power Plant.

Hydrologic Methodology

This section describes the general outline of the hydrologic methodologies used to evaluate the total runoff tributary to the ponds. Specific characteristics of each pond are discussed under individual subheadings later in this report.

The East & West Ash Ponds are total containment ponds. Watershed areas contributing to the flow into these ponds are the ponds and berms/access roads themselves; in other words, these ponds have no additional runoff areas tributary to them. Therefore, a conservative approach is to adopt a curve number 100 and to consider that every inch of rainfall will directly increase the water surface elevation.

According to Natural Resource Conservation Service (formerly SCS) Technical Release 55, the peak flow is calculated using the formula:

$Q = (P-0.2S)^2 / (P+0.8S)$

where,

Q = runoff (inches)

P = rainfall (inches)

S = potential maximum retention after runoff begins (inches) = (1000/curve number) – 10

Applying a curve number of 100 to the formula above will ultimately result in Q = P (because S=0); which implies that the total runoff contributing to the flow in each of the ponds is directly a function of the rainfall event.

Hydraulic Methodology

This section describes the general outline of the hydraulic methodologies used to analyze the storage capacity of the ponds. Specific characteristics of each pond are discussed under individual subheadings later in this report.

The plant’s CCR rules require that the ponds be able to accommodate the rainfall volume from a

100 year 24 hour storm without over topping. The normal operating level for each pond is established by other regulations, and it is set to 3 feet below the top of the embankment. Using actual field survey data, an elevation-area-storage table was developed for the ponds and is included in the tables section of this report. Hydraflow Hydrographs was utilized to evaluate storage capacity and the water surface elevations in each pond during the 100 year 24 hour rainfall event. The 25 year 24 hour rainfall event was analyzed as well.

Detailed Hydrologic & Hydraulic characteristics of the ponds are discussed below.

EAST ASH POND:

The East Ash Pond is located to the east of the rail road track and north of the Pirkey Power Plant. This is a coal combustion waste pond used to settle bottom ash that has been sluiced from the plant boiler. Field survey of the embankment around the impoundment indicates that the top of the embankment is at a minimum elevation of 357.0msl, which is consistent with original design drawings. Therefore, based on this top of embankment elevation, the normal operating level was established at 354.0msl. The watershed area contributing to the flow into this pond was estimated to be 29.63 acres.

The storage capacity for each pond was analyzed for a 100-yr, 24-hr rainfall event, which is 10.3 inches. Multiplying the acreage times the inches, the calculated volume of the rainfall event is 1,107,836 cf of water. When this rainfall event was modeled in Hydraflow Hydrographs, it generated a more conservative rainfall volume of 1,142,455 cf.

The storage capacity was also analyzed for a 25-yr, 24-hr rainfall event, which is 8.2 inches. The calculated volume of the rainfall event is 881,967 cf of water. When this rainfall event was modeled in Hydraflow Hydrographs, it generated a more conservative rainfall volume of 909,528 cf.

Water surface elevation was then calculated for the 100-yr, 24-hr rainfall event with a normal operating level (354.0msl) as the baseline elevation. Results from Hydraflow Hydrograph indicates that the water surface elevation during the 100-yr, 24-hr rainfall will be 354.99msl which is less than 357.0msl (embankment top). Results from the 25-yr, 24-hr rainfall event indicate the water surface elevation will be 354.79msl which is also less than 357.0msl (embankment top).

WEST ASH POND:

The West Ash Pond is located to the west of the rail road track and adjacent to the east ash pond. This is a coal combustion waste pond used to settle bottom ash that has been sluiced from the plant boiler. Field survey of the embankment around the impoundment indicates that the top of the embankment is at a minimum elevation of 357.0msl, which is consistent with original design drawings. Therefore, based on this top of embankment elevation, the normal operating level was established at 354.0msl. The watershed area contributing to the flow into this pond was estimated to be 33.44 acres.

As mentioned earlier the storage capacity for each pond was analyzed for a 100-yr, 24-hr rainfall event, which is 10.3 inches. Multiplying the acreage times the inches, the calculated volume of the rainfall event is 1,250,228 cf of water. When this rainfall event was modeled in Hydraflow Hydrographs, it generated a more conservative rainfall volume of 1,289,360 cf.

The storage capacity was also analyzed for a 25-yr, 24-hr rainfall event, which is 8.2 inches. The calculated volume of the rainfall event is 995,376 cf of water. When this rainfall event was modeled in Hydraflow Hydrographs, it generated a more conservative rainfall volume of 1,026,480 cf.

Water surface elevation was then calculated for the 100-yr, 24-hr rainfall event with a normal operating level (354.0msl) as the baseline elevation. Results from Hydraflow Hydrograph indicates that the water surface elevation during the 100-yr, 24-hr rainfall will be 355.01msl which is less than 357.0msl (embankment top). Results from the 25-yr, 24-hr rainfall event indicate the water surface elevation will be 354.81msl which is also less than 357.0msl (embankment top).

Summary

Water surface elevations calculated from Hydraflow Hydrographs are tabulated below:

SUMMARY OF POND HYDRAULIC CHARACTERISTICS				
	TOP OF EMBANKMENT	OPERATING LEVEL	100YR-24HR WSEL	25YR-24HR WSEL
EAST ASH POND	357.0	354.0	354.99	354.79
WEST ASH POND	357.0	354.0	355.01	354.81

As evident from the table above, it is the opinion of Akron Consulting that the East & West Ash Ponds will serve to adequately contain the calculated rainfall events.

TABLE 1

Runoff Curve Numbers for Hydrologic Soil-Cover Complexes
(Antecedent Moisture Condition II, and Ia= 0.2 S)
(Adapted from NRCS Technical Release 55)

Land Use	Treatment or Practice	Hydrologic Condition	Hydrologic Soil Group A	B	C	D
Fallow	Straight Row	----	77	86	91	94
Row Crops	Straight Row	Poor	72	81	88	91
	Straight Row	Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	Contoured	Good	65	75	82	86
	Contoured and Terraced	Poor	66	74	80	82
	Contoured and Terraced	Good	62	71	78	81
Small Grain	Straight Row	Poor	65	76	84	88
	Straight Row	Good	63	75	83	87
	Contoured	Poor	63	74	82	85
	Contoured	Good	61	73	81	84
	Contoured and Terraced	Poor	61	72	79	82
	Contoured and Terraced	Good	59	70	78	81
Close-Seeded, Legumes, Rotation Meadow	Straight Row	Poor	66	77	85	89
	Straight Row	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	Contoured	Good	55	69	78	83
	Contoured and Terraced	Poor	63	73	80	83
	Contoured and Terraced	Good	51	67	76	80
Pasture Or Range		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
Meadow		Good	30	58	71	78
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Farmsteads		----	59	74	82	86
Roads/Facilites		----	74	84	90	92

TABLE 2
EAST ASH POND ELEVATION-AREA-STORAGE TABLE
H.W. PIRKEY POWER PLANT
EXISTING CONDITION
NORMAL OPERATING POOL AT 354.0

ELEVATION (ft)	AREA (Acres)	STORAGE (Ac-Ft)	STORAGE (Cubic Feet)	STORAGE (Million Gallons)
352.00	25.70	na	na	na
353.00	25.99	na	na	na
354.00	26.29	0.00	0	0.00
355.00	26.59	26.44	1,151,730	232.61
356.00	26.88	53.18	2,316,300	467.82
357.00	27.19	80.21	3,493,950	705.67

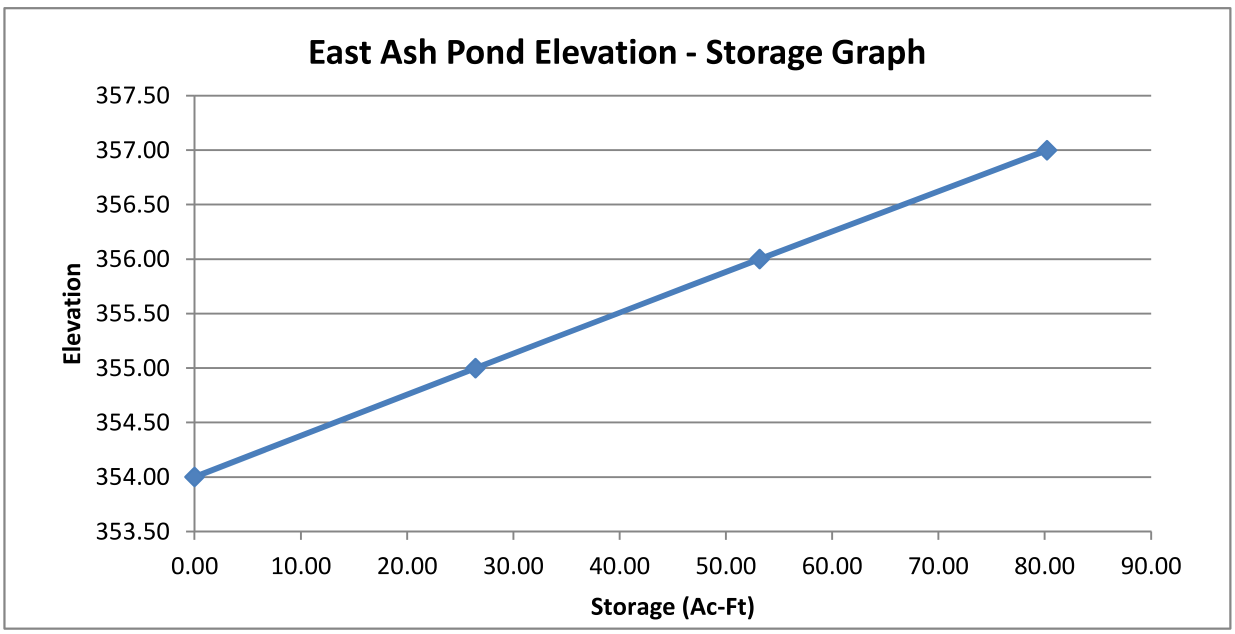
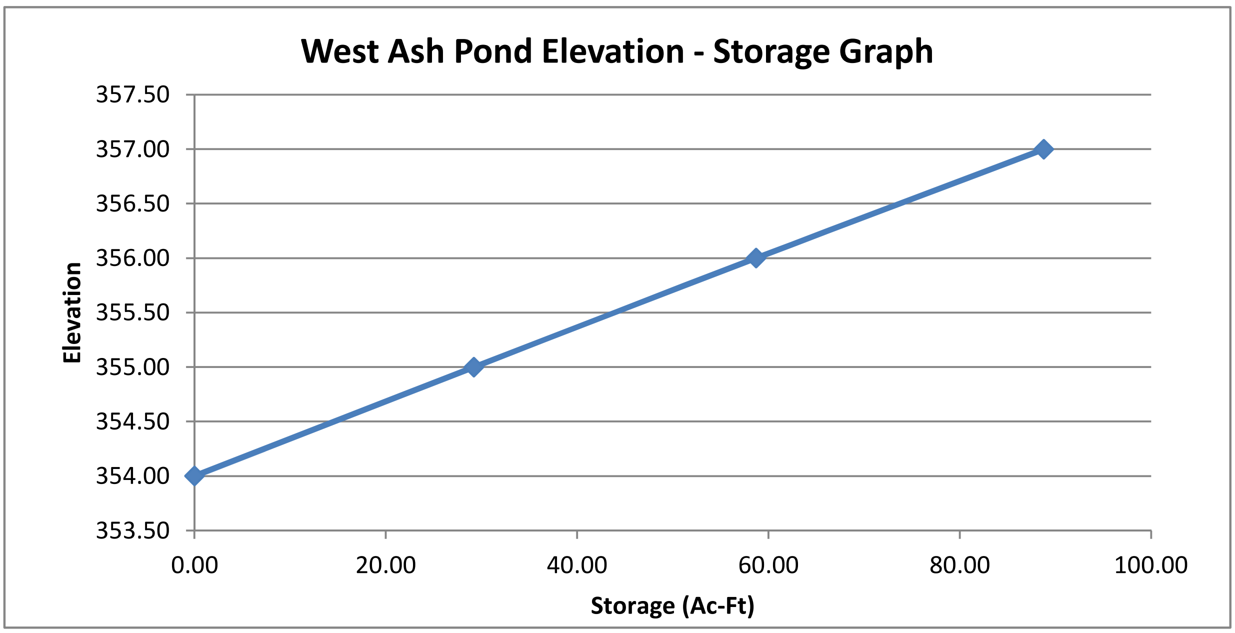
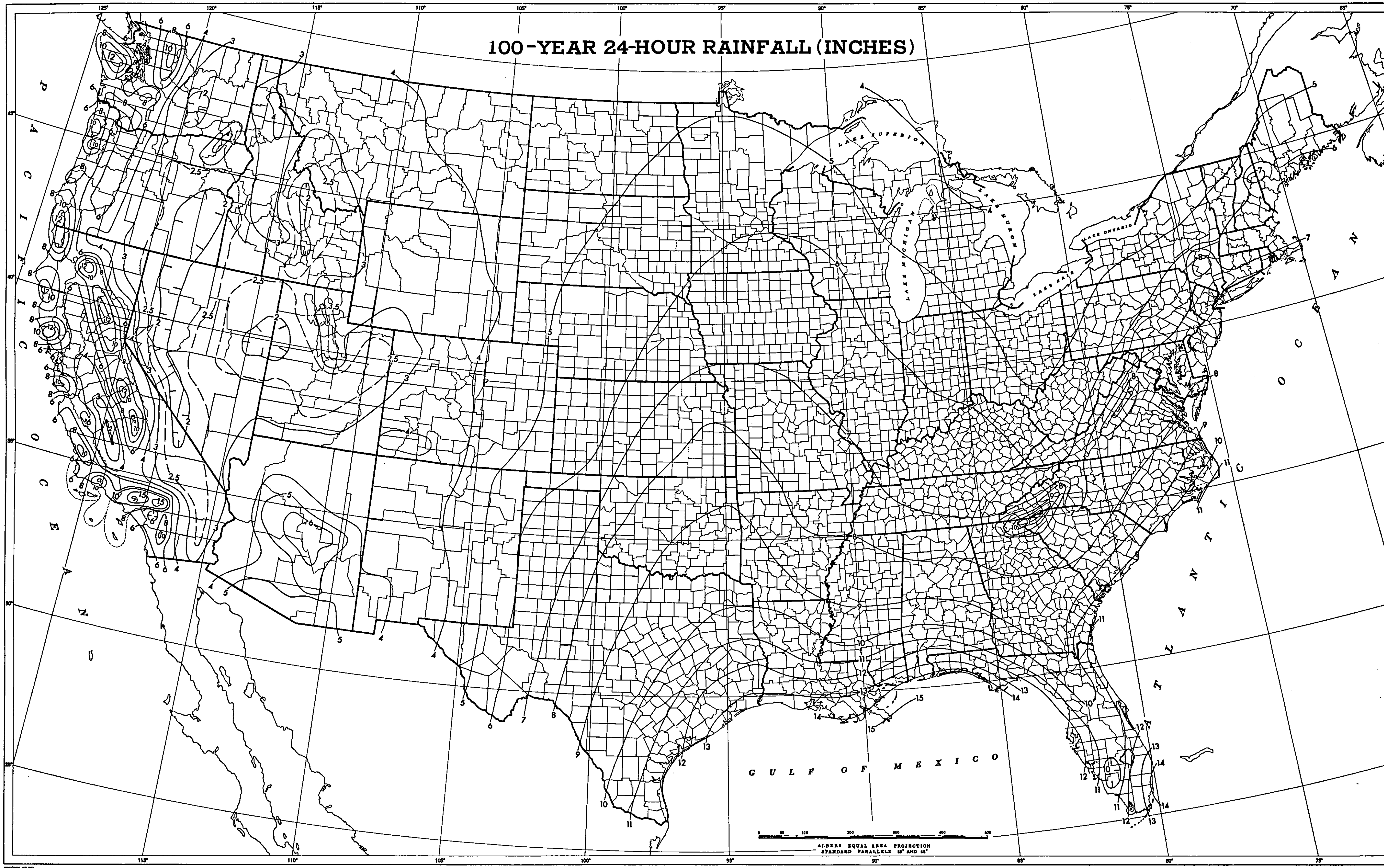
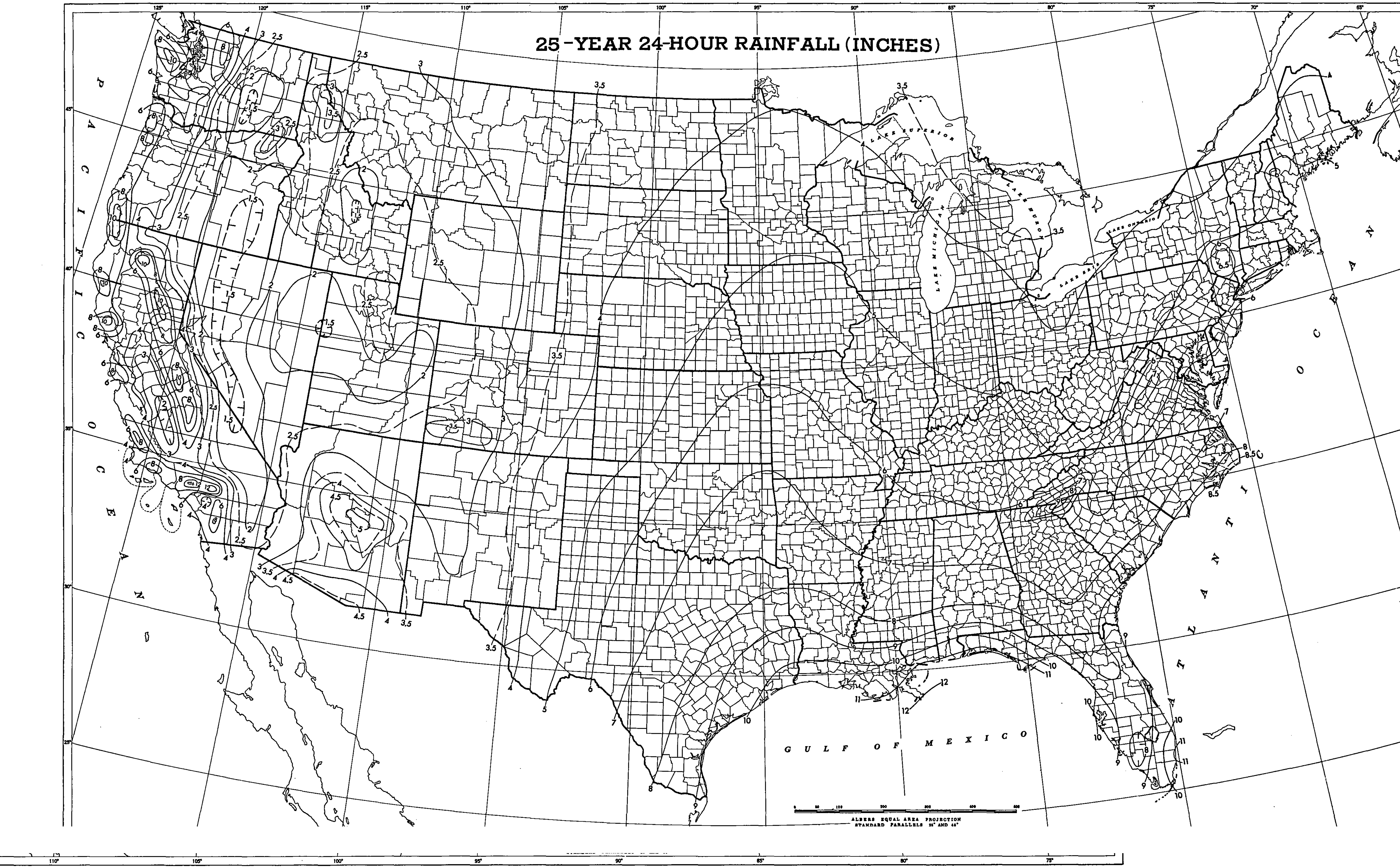


TABLE 3 WEST ASH POND ELEVATION-AREA-STORAGE TABLE H.W. PIRKEY POWER PLANT EXISTING CONDITION NORMAL OPERATING POOL AT 354.0				
ELEVATION (ft)	**AREA (Acres)**	**STORAGE (Ac-Ft)**	**STORAGE (Cubic Feet)**	**STORAGE (Million Gallons)**
352.00	28.43	na	na	na
353.00	28.74	na	na	na
354.00	29.05	0.00	0	0.00
355.00	29.36	29.21	1,272,170	256.94
356.00	29.67	58.72	2,557,840	516.61
357.00	30.47	88.79	3,867,690	781.16




100-YEAR 24-HOUR RAINFALL (INCHES)
P A C I F I C   O C E A N
A T L A N T I C   O C E A N
G U L F   O F   M E X I C O
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE
ALBERS EQUAL AREA PROJECTION
STANDARD PARALLELS 29° AND 45°

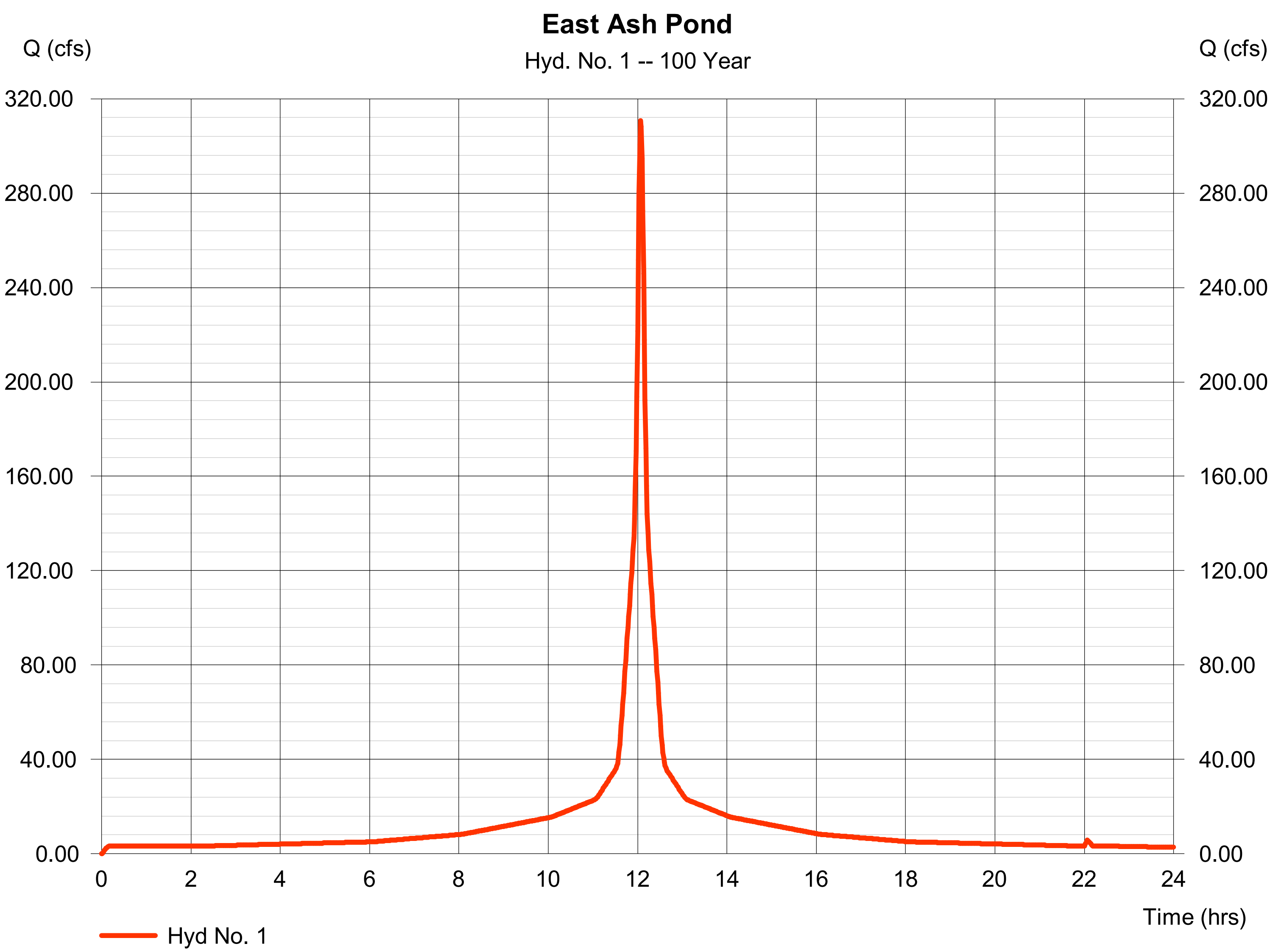

25-YEAR 24-HOUR RAINFALL (INCHES)
PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
ALBERS EQUAL AREA PROJECTION
STANDARD PARALLELS 29° AND 45°

Hydrograph Report

Hyd. No. 1

East Ash Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 310.73 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 1 min	Hyd. volume	= 1,142,455 cuft
Drainage area	= 29.630 ac	Curve number	= 100
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 10.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

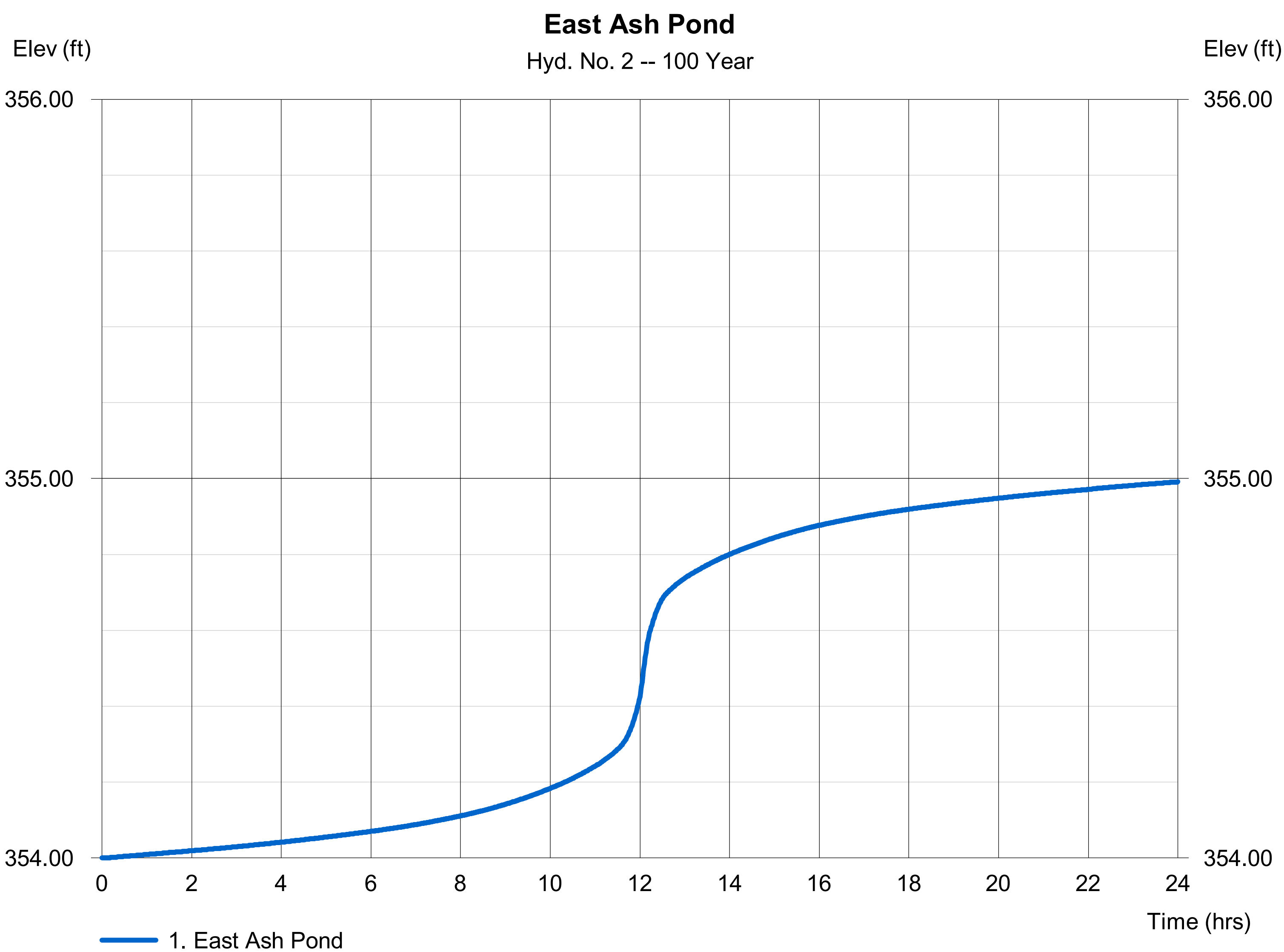
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 Tuesday, 00 3, 2015

Hyd. No. 2

East Ash Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 1 - East Ash Pond	Max. Elevation	= 354.99 ft
Reservoir name	= East Ash Pond		

Storage Indication method used. Wet pond routing start elevation = 354.00 ft.

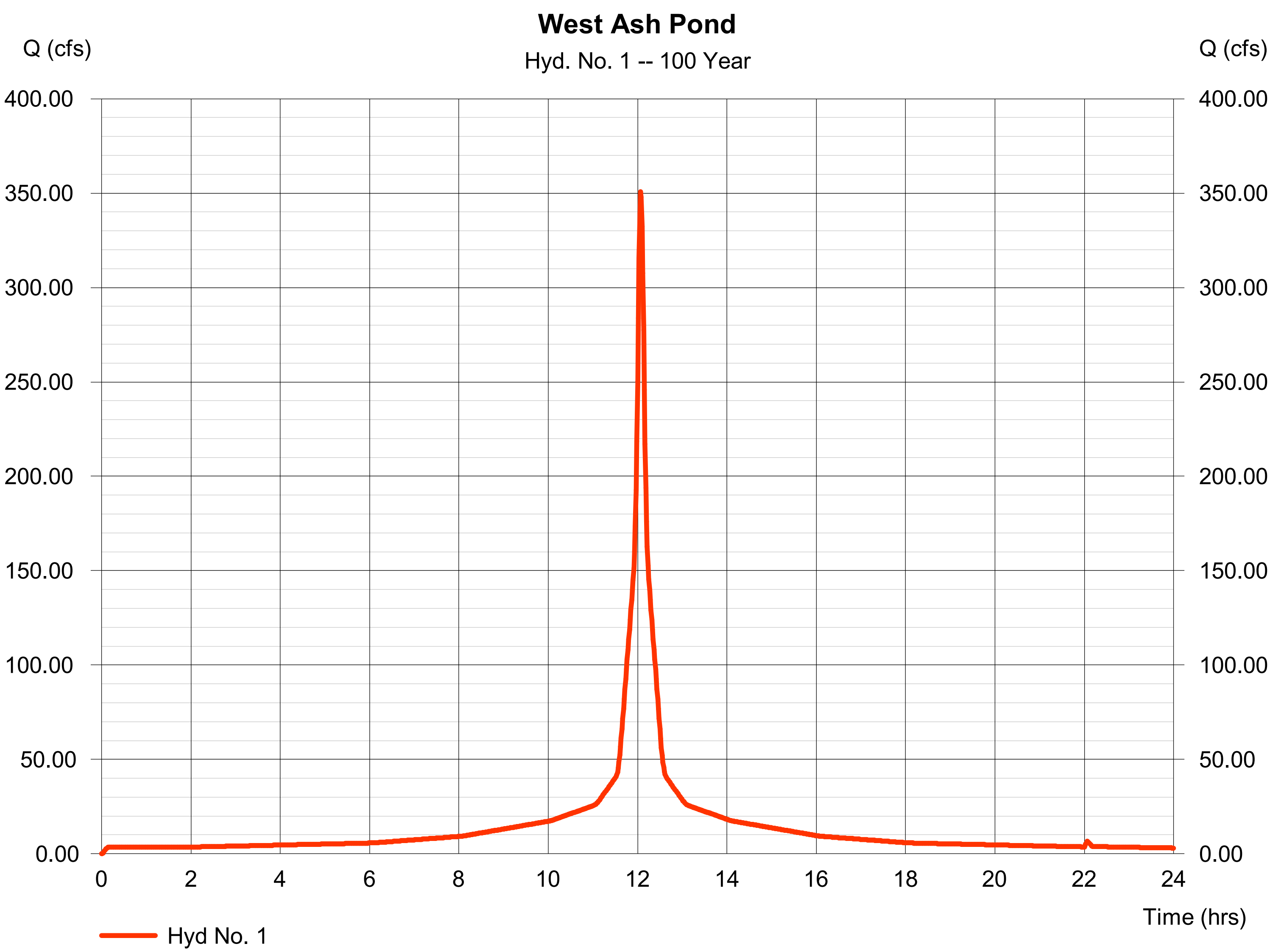


Hydrograph Report

Hyd. No. 1

West Ash Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 350.69 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 1 min	Hyd. volume	= 1,289,360 cuft
Drainage area	= 33.440 ac	Curve number	= 100
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 10.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

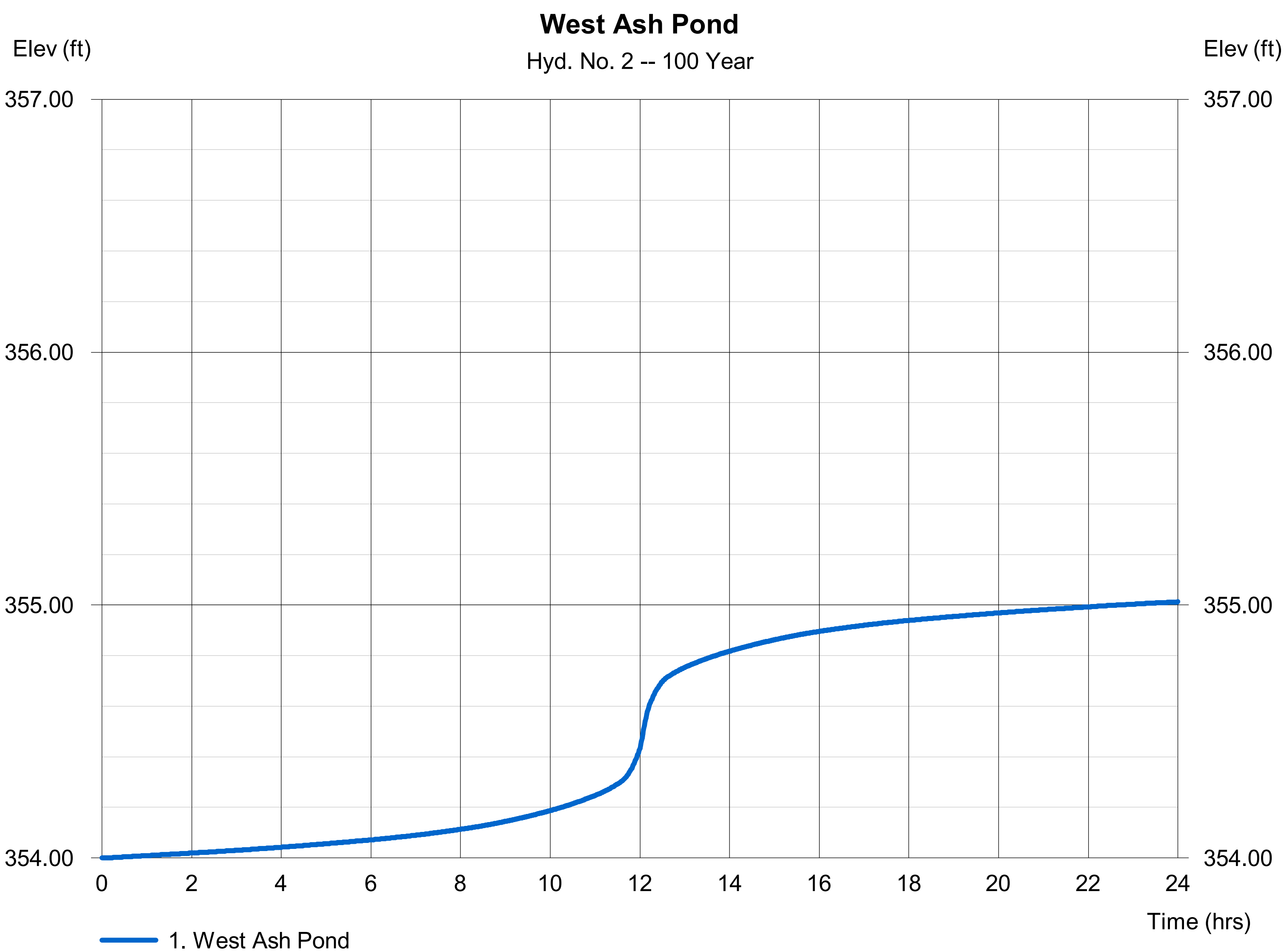
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 Tuesday, 00 3, 2015

Hyd. No. 2

West Ash Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 1 - West Ash Pond	Max. Elevation	= 355.01 ft
Reservoir name	= West Ash Pond		

Storage Indication method used. Wet pond routing start elevation = 354.00 ft.

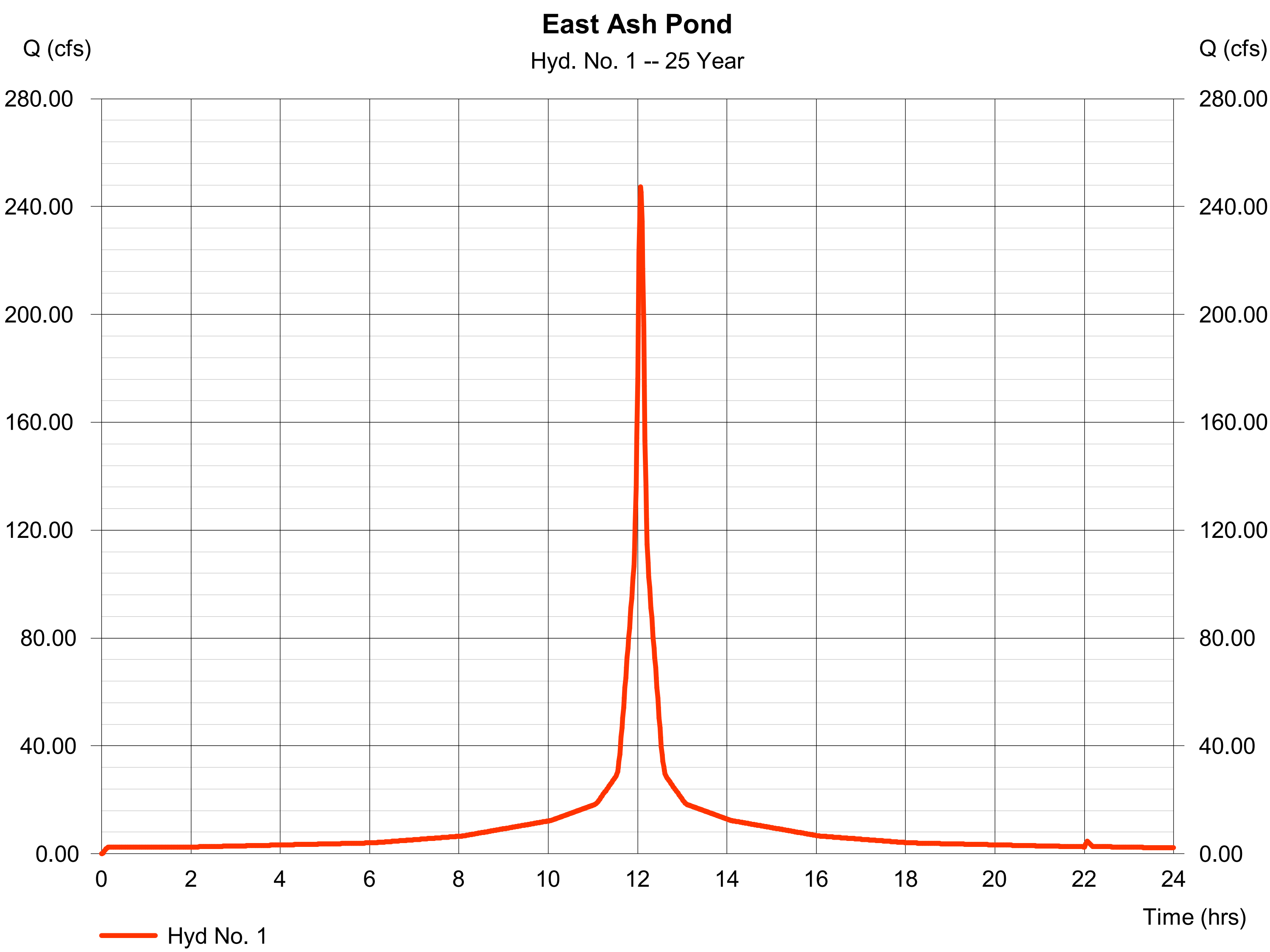


Hydrograph Report

Hyd. No. 1

East Ash Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 247.38 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 1 min	Hyd. volume	= 909,528 cuft
Drainage area	= 29.630 ac	Curve number	= 100
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

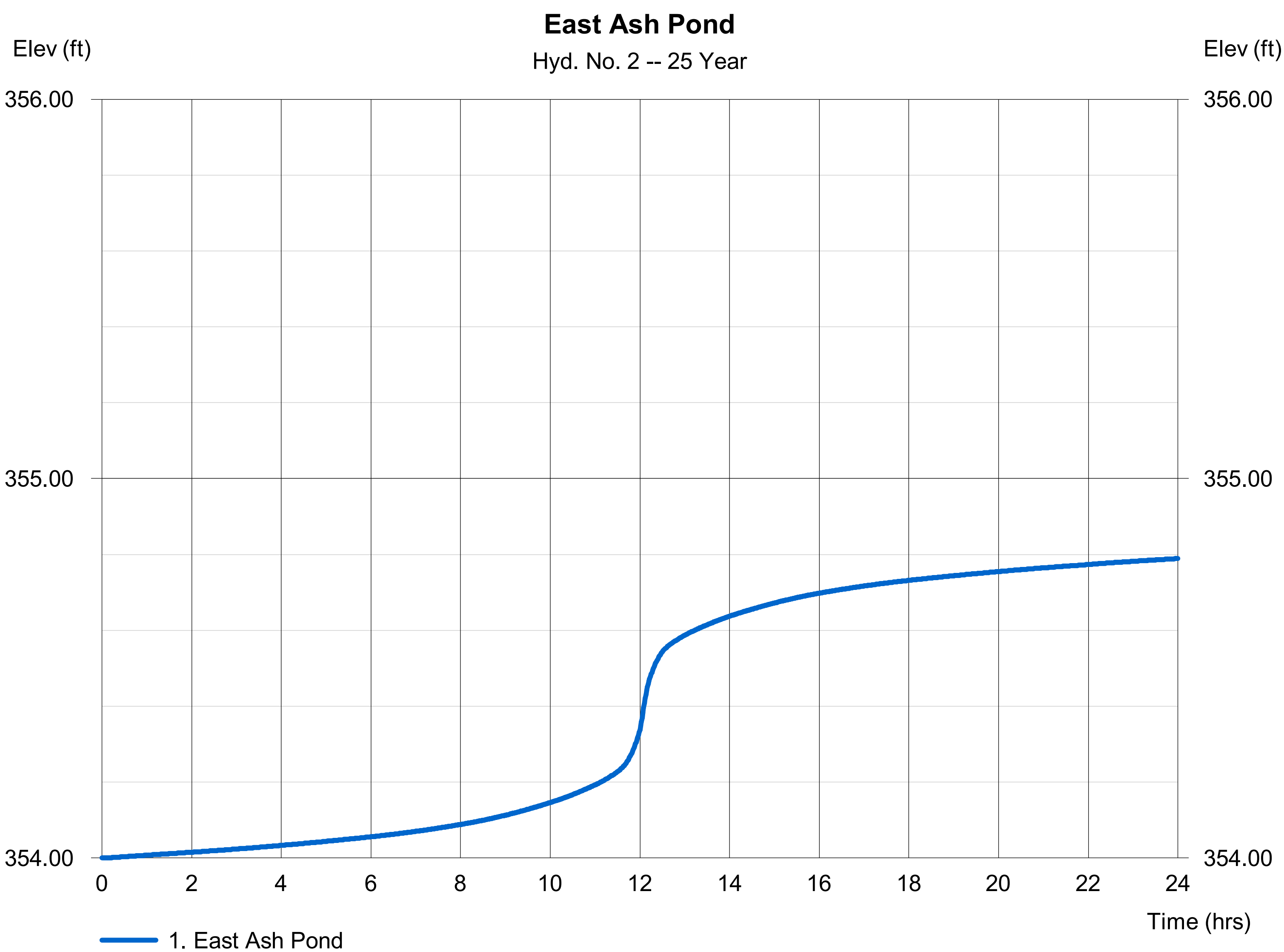
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 — Tuesday, 00 15, 2015

Hyd. No. 2

East Ash Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 1 - East Ash Pond	Max. Elevatioo	= 354.79 ft
Reservoir name	= East Ash Pond		

Storage Indication method used. Wet pond routing start elevation = 354.00 ft.

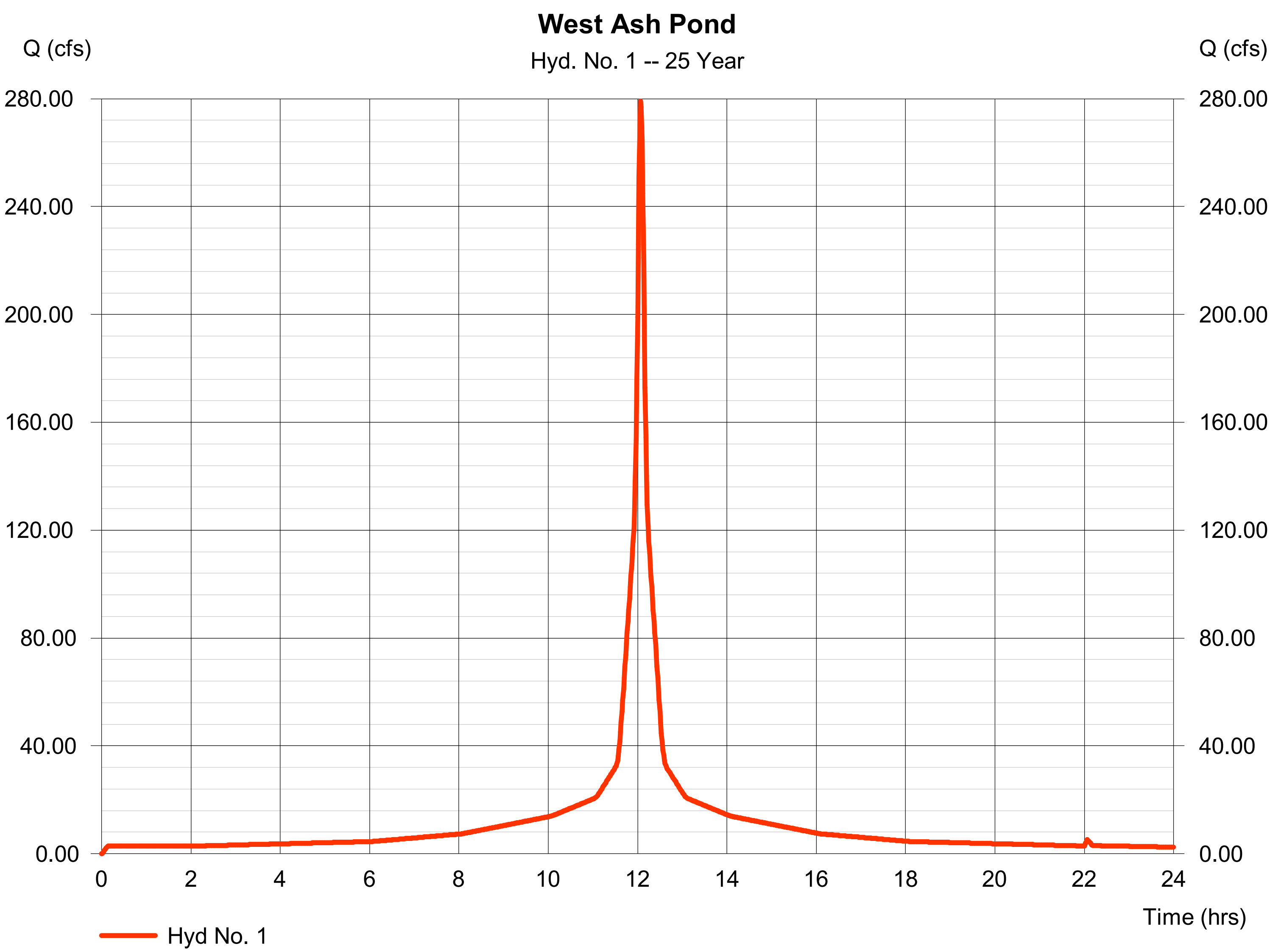


Hydrograph Report

Hyd. No. 1

West Ash Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 279.19 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 1 min	Hyd. volume	= 1,026,480 cuft
Drainage area	= 33.440 ac	Curve number	= 100
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



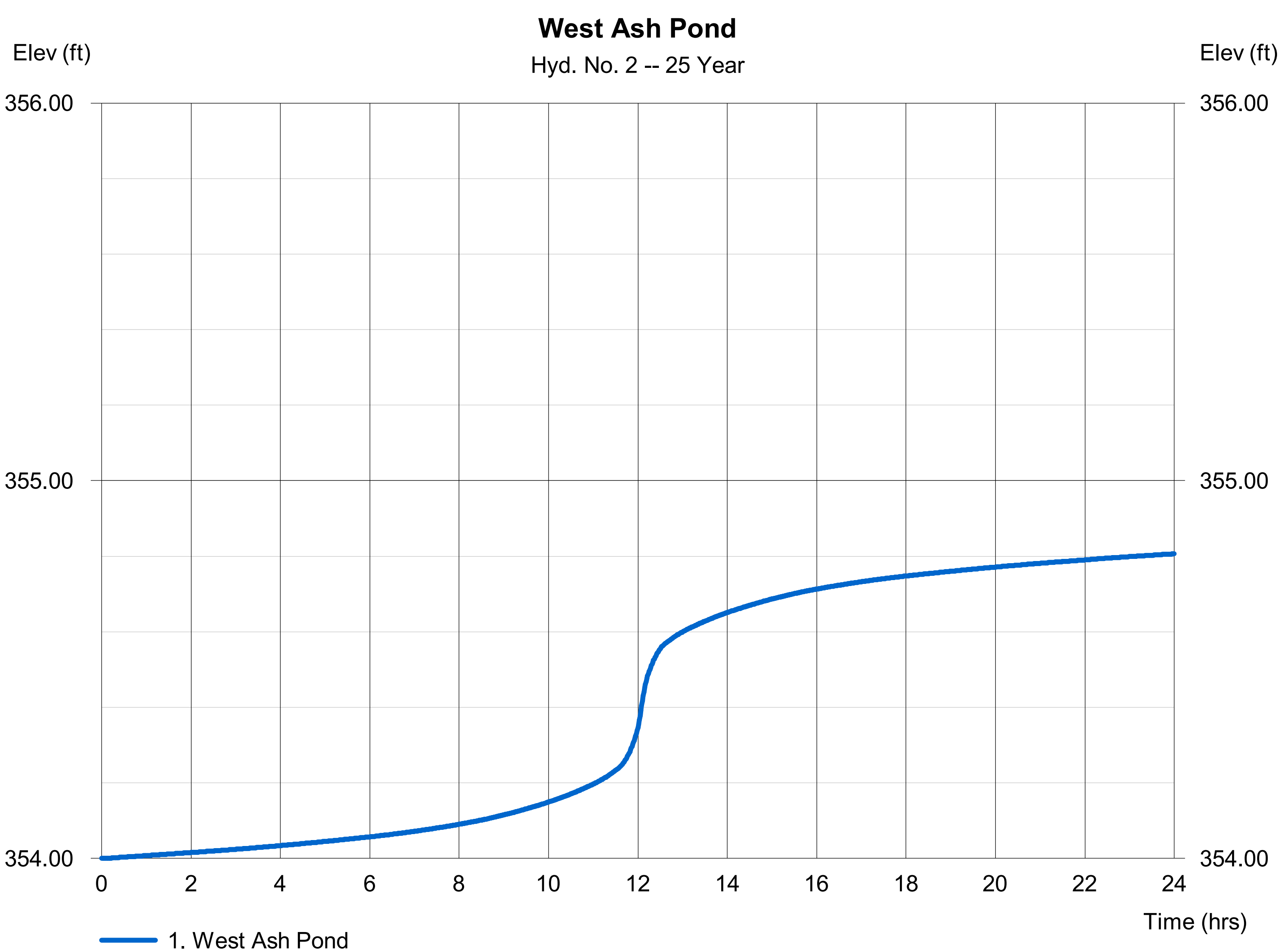
Hydrograph Report

Hyd. No. 2

West Ash Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 1 - West Ash Pond	Max. Elevation	= 354.81 ft
Reservoir name	= West Ash Pond		

Storage Indication method used. Wet pond routing start elevation = 354.00 ft.



0 300' 600'

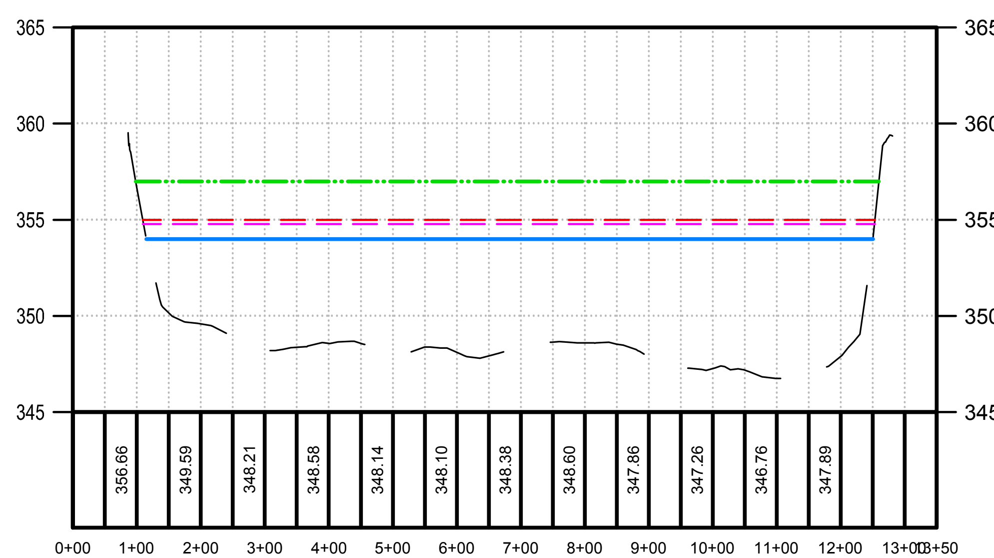
1"=300'

N

LEGEND

WATERSHED BOUNDARY

PLAN VIEW
SCALE: 1"=200'



SECTION A-A
HORIZ. SCALE: 1"=300'
VERT. SCALE: 1"=30'

LEGEND

TOP OF EMBANKMENT ELEV.= 357.00

100 YEAR 24 HOUR WSEL ELEV.= 354.99

25 YEAR 24 HOUR WSEL ELEV.= 354.79

NORMAL OPERATING LEVEL= 354.00

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EAST ASH POND WATER SURFACE EXHIBIT

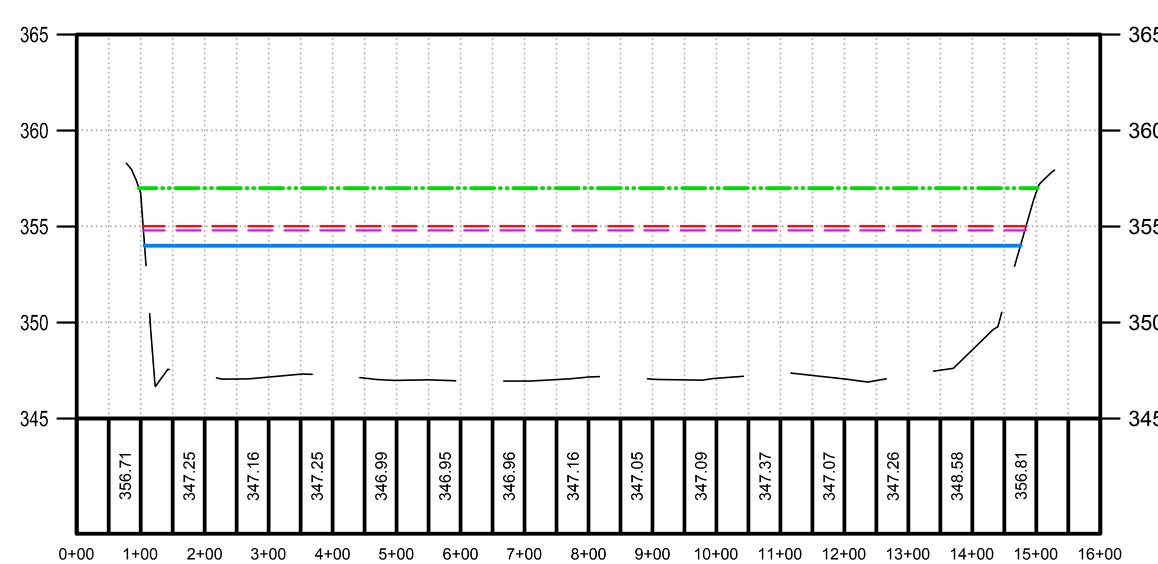
PLAN VIEW
SCALE: 1"=300'

0 300' 600'
1"=300'

N

LEGEND

WATERSHED BOUNDARY



SECTION B-B
HORIZ. SCALE: 1"=300'
VERT. SCALE: 1"=30'

LEGEND

TOP OF EMBANKMENT ELEV.= 357.00

100 YEAR 24 HOUR WSEL ELEV.= 355.01

25 YEAR 24 HOUR WSEL ELEV.= 354.81

NORMAL OPERATING LEVEL= 354.00

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WEST ASH POND WATER SURFACE EXHIBIT