Stantec Consulting Services Inc.
3052 Beaumont Centre Circle, Lexington, Kentucky 40513-1703

October 12, 2021
File: rpt_032_let_175568465
Revision 0

Tennessee Valley Authority
1101 Market Street
Chattanooga, Tennessee 37402

RE: Periodic Inflow Design Flood Control System Plan
Ash Pond 2
EPA CCR Rule
TVA Shawnee Fossil Plant
West Paducah, Kentucky

1.0 PURPOSE

This letter documents Stantec's certification that the inflow design flood control system plan for Ash Pond 2 at the Tennessee Valley Authority (TVA) Shawnee Fossil Plant is in compliance with 40 CFR 257.82 of the EPA CCR Final Rule. The EPA CCR Final Rule requires a certification to be performed on a 5-yr periodic interval. The initial certification of the inflow design flood control system plan was placed in the operating record on October 12, 2016.

2.0 INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

The initial inflow design flood control plan is attached. The 1000-year flood event was selected for the design storm based upon a hazard potential classification of "significant." The initial assessment found that Active Ash Pond 2 met the requirements of 40 CFR 257.82(a)&(b).

3.0 CURRENT INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Stantec reviewed the conditions and results of the initial inflow design plan and changes in conditions that have occurred in the past five years at the site. The following items summarize changes that have occurred:

1. Ash Pond 2 ceased receiving all CCR and non-CCR water flows from the plant in April 2021.

2. Ash Pond 2 operating pool level has decreased from El. 344.0 ft to El. 339.3 ft (main ash pond) and 337.5 ft (stilling pond), which improves the available storage capacity of the impoundment.

3. Cross-sectional geometry of the perimeter dike system has not changed.

4. Water levels within the Little Bayou Creek and the discharge channel, adjacent to Ash Pond 2, have remained unchanged.

Re: **Periodic Inflow Design Flood Control System Plan**
Ash Pond 2
EPA CCR Rule
TVA Shawnee Fossil Plant
West Paducah, Kentucky

5. Monthly and Annual inspections indicate that stability related conditions have not changed and phreatic conditions at the perimeter of Ash Pond 2 have decreased.

Based on our review, there are no conditions that have changed in the past five years that would cause the result of the inflow design assessment to have changed.

4.0 SUMMARY OF ASSESSMENT

Based on a review of the initial inflow design flood control plan and the items listed in Section 3.0, the result of this periodic inflow design flood control plan review is that the Ash Pond 2 at the Shawnee Fossil Plant continues to meet the requirements of §257.82(a)&(b) of the EPA CCR Rule.

5.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, C. Zachary Wilder, being a Professional Engineer in good standing in the Commonwealth of Kentucky, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;

2. that the information contained herein is accurate as of the date of my signature below; and

3. that the inflow design flood control system plan for the TVA Shawnee Fossil Plant's Ash Pond 2 meets the requirements specified in 40 CFR 257.82(a), (b), and (c)(1).

SIGNATURE _____ DATE 10/12/2021

ADDRESS: Stantec Consulting Services Inc.
3052 Beaumont Centre Circle
Lexington, Kentucky 40513-1703

TELEPHONE: (859) 422-3000

Re: **Periodic Inflow Design Flood Control System Plan**
Ash Pond 2
EPA CCR Rule
TVA Shawnee Fossil Plant
West Paducah, Kentucky

ATTACHMENTS: Initial Inflow Design Flood Control System Plan

INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM ASSESSMENT

Stantec Consulting Services Inc.
1409 North Forbes Road, Lexington KY 40511-2024

October 5, 2016
File: rpt_001_let_175555010
Revision 0

Tennessee Valley Authority
1101 Market Street
Chattanooga, Tennessee 37402

RE: Initial Inflow Design Flood Control System Plan
Ash Pond 2
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Shawnee Fossil Plant
West Paducah, Kentucky

1.0 PURPOSE

This letter documents Stantec's certification of the initial inflow design flood control system plan for the TVA Shawnee Fossil Plant's Ash Pond 2. Based on the assessment, the Ash Pond 2 complies with the inflow design flood control requirements in the EPA Final CCR Rule at 40 CFR 257.82.

2.0 INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

As described in 40 CFR 257.82(c), an inflow design flood control system plan must be prepared to document how the inflow design flood control system has been designed and constructed to manage the design storm required by the hazard classification. Stantec has assigned the Ash Pond 2 a significant hazard potential classification rating. Thus, the inflow design storm event was selected from §257.82(a)(3) as the 1000-year flood event based upon a hazard potential classification of "significant".

3.0 SUMMARY OF FINDINGS

The attached plan presents the analysis of the inflow design flood control system for Ash Pond 2. The resulting water surface elevations are shown in the following table. The plan and results show that the impoundment meets the requirements set forth in 40 CFR 257.82(a) and (b).

Plant	Facility	Inflow Design Storm	Water Surface Elevation (feet)	Minimum Embankment Elevation (feet)
SHF	Ash Pond 2	1000-year storm	348.8	351.5

Re: **Initial Inflow Design Flood Control System Plan**
Ash Pond 2
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Shawnee Fossil Plant
West Paducah, Kentucky

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Don W. Fuller II, being a Professional Engineer in good standing in the Commonwealth of Kentucky, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;

2. that the information contained herein is accurate as of the date of my signature below; and

3. that the inflow design flood control system plan for the TVA Shawnee Fossil Plant's Ash Pond 2 meets the requirements specified in 40 CFR 257.82(a), (b), and (c)(1).

SIGNATURE Don W. Fuller II DATE 10/5/2016

ADDRESS: Stantec Consulting Services Inc.
1409 North Forbes Road
Lexington, Kentucky 40511-2024

TELEPHONE: (859) 422-3000

ATTACHMENTS: Inflow Design Flood Control System Plan

STATE OF KENTUCKY
DON W. FULLER, II
18142
LICENSED PROFESSIONAL ENGINEER

Initial Inflow Design Flood Control System Plan

Shawnee – Ash Pond 2
West Paducah, Kentucky

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:
Stantec Consulting Services Inc.
Lexington, Kentucky

October 5, 2016
Revision 0

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1.0 BACKGROUND

On April 17, 2015 the Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (RIN-2050AE81; FRL-9149-4) (EPA Final CCR Rule) was published in the Federal Register. Stantec Consulting Services, Inc. (Stantec) was contracted by the Tennessee Valley Authority (TVA) to analyze the inflow design flood for Shawnee Fossil Plant's (SHF) Ash Pond 2 CCR surface impoundment (SI) and evaluate compliance with section §257.82 of the EPA Final CCR Rule.

SHF is a coal-fired, electric generating plant located in McCracken County, Kentucky. SHF is approximately 10 miles northwest from Paducah. The plant is located near the south bank of Ohio River. Little Bayou Creek flows around the southwest perimeter of SHF. A map showing the location of SHF in relation to the surrounding hydrologic features is included as Appendix A. Ash Pond 2 SI is an Existing CCR SI as defined by the EPA Final CCR Rule. Ash Pond 2 SI is subject to the EPA Final CCR Rule and consists of the approximate boundary area denoted in Figure 1.

Figure 1 Shawnee Fossil Plant

2.0 EXISTING CONDITIONS

Ash Pond 2 conveys stormwater run-off and process water from SHF. Ash Pond 2 has a surface area of approximately 45-acres at the normal pool elevation of 344.4-feet and an approximate storage capacity of 473-acre-feet (not including the sluice channel) at an elevation of 351-feet. There is approximately 10,000-feet of perimeter dike. The lowest dike crest elevation is 351.5-feet and the top of coal combustion residual elevation of Ash Pond 2 is 331.3-feet. Elevations and storage capacities were determined from existing topographic data (dated February, 2014) provided by TVA. SHF contributing run-off areas include the Consolidated Waste Dry Stack (116-acres), Special Waste Landfill Expansion (72-acres), Coal Yard Area (95-acres) and Ash Pond 2 (103-acres).

The perimeter embankment surrounding Ash Pond 2 consists of a gravel road and grass-covered slopes. The northern portion of Ash Pond 2 consists mainly of the pool along with an interior gravel access road. The remaining portion of Ash Pond 2 is ponding water in the sluice channel with phragmites, grass, and ash adjacent to the sluice channel.

SHF stormwater run-off and process water conveyed and detained in Ash Pond 2 is discharged through the Ash Pond 2 Spillway that consists of a concrete inlet structure with six (6) boxes and sets of removable fiberglass stoplogs which are used to control the normal pool elevation. The stoplogs are set at an elevation of 343.9-feet and are 7-feet in length. Each box discharges through a 30-inch nominal diameter high density polyethylene (HDPE) outlet pipe into the spillway discharge channel. The spillway discharge channel flows clockwise around Ash Pond 2 into the plant discharge channel and ultimately the Ohio River. Flow through Ash Pond 2 spillway is subject to an active KPDES permit (permit number: KY0004219).

Note that elevations included in this document and appendices are referenced to the National Geodetic Vertical Datum of 1929 (NGVD29) except where otherwise noted.

Figure 2 shows the location of the hydraulic structures in Ash Pond 2.

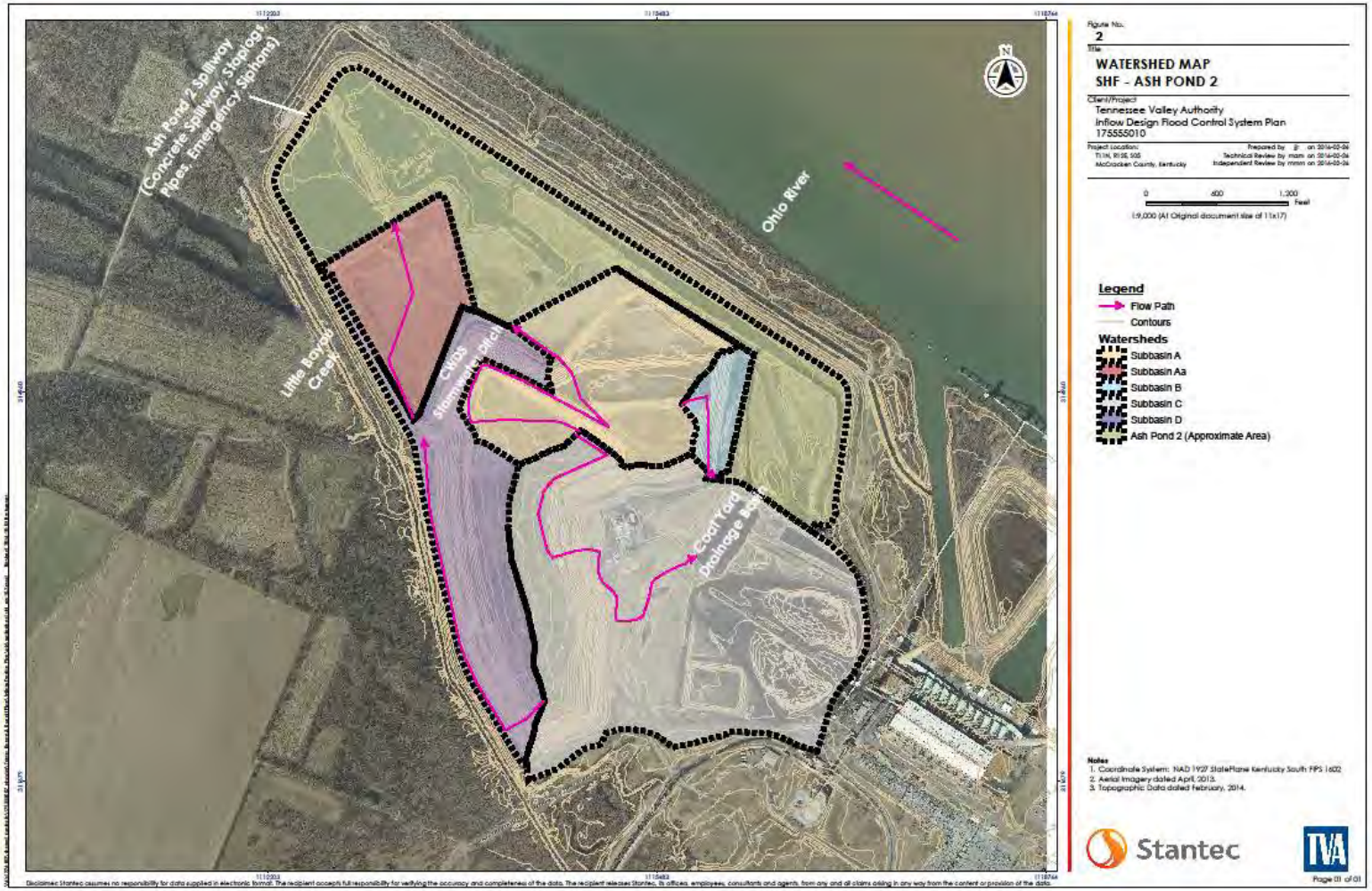


Figure 2 Hydraulic Structures

3.0 METHODS / DESIGN CRITERIA

This Inflow Design Flood Control System Plan has been developed to document how the inflow design flood control system has been designed and constructed to meet the requirements of §257.82. Ash Pond 2 was classified as a Significant Hazard structure in September, 2013 and was confirmed to be a Significant Hazard structure based on the report from Stantec to TVA dated September 30, 2016. This plan has been developed based on that classification and the following EPA Final CCR Rule criteria apply:

1. The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood. (Ref. §257.82(a)(1)),
2. The inflow design flood control system must collect and control flow from the CCR unit during and following the peak discharge of the inflow design flood. (Ref. §257.82(a)(2)),
3. The inflow design flood for a significant hazard potential CCR surface impoundment is the 1,000-year flood. (Ref. §257.82(a)(3)(ii)),
4. Discharge from the CCR Unit must be handled in accordance with the surface water requirements under 257.3-3.
5. The owner or operator must prepare an initial inflow design flood control system plan for its existing surface impoundments by October 17, 2016. (Ref. §257.82(c)(3)(i)),
6. The plan must be revised every 5 years, and amendments must be made whenever there is a change in condition(s) that would substantially affect the written plan in effect. (Ref. §257.82)(c)(4) & (2)),
7. This plan will be considered complete upon its placement in the facility's operating record. (Ref. §257.82(c)(1)),
8. The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and periodic inflow design flood control system plans meet the requirements of §257.82.

Hydrological calculations were performed based on Soil Conservation Service Technical Release 55 (TR-55) methods in U.S. Army Corps of Engineers' Hydrologic Engineering Center-Hydrological Modeling System (HEC-HMS) software to analyze the performance of the impoundments for the 1000-year storm. EPA's Final CCR Rule does not specify the storm duration for the inflow design flood; therefore, a 6-hour storm duration was used.

The following sections describe the modeling assumptions and hydrologic parameter inputs to the HEC-HMS model, including curve number and lag times.

3.1 MODELING ASSUMPTIONS

1. The model represents existing conditions as of March, 2016.
2. The storage capacity of the Coal Yard Drainage Basin, located to the southeast of the Consolidated Waste Dry Stack was not considered in the analysis. Flow that is conveyed to the Coal Yard Drainage Basin is discharged into Ash Pond 2.
3. The storage capacity of the CWDS Stormwater Ditch located on the north toe of the Consolidated Waste Dry Stack was not considered in the analysis. Flow that is conveyed to the CWDS Stormwater Ditch is discharged into Ash Pond 2.
4. The storage capacity of Ash Pond 2 sluice channel was not considered in the analysis.
5. For this analysis, the tailwater elevation was assumed to be equal to elevation 337-feet which is the approximate 100-year peak elevation of Ohio River from the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) dated November 2, 2011 for McCracken County, Kentucky (converted from NAVD88 to NGVD29).
6. Ash Pond 2 receives a constant plant process flow of 26.5 million gallons per day. The flow was obtained from the "Spillway Replacement Project Pond B (Ash Stilling Pond) Ash Disposal Area No. 2 Shawnee Fossil Plant" Design Report and Supporting Calculations dated May, 2010.
7. Pipes are assumed to be flowing freely and not clogged or leaking.

3.2 HYDROLOGY INPUTS

3.2.1 Watershed Parameters

Subwatersheds were delineated in AutoCAD 2015. The watershed delineations were based on topographic data provided by TVA dated February, 2014. The estimated watershed parameters are summarized in Table 1. A figure showing the watershed delineations is included in Appendix B.

Table 1 Watershed Parameters

Watershed	Drainage Area (acres)	Composite Curve Number	Lag Time (minutes)
Subbasin A	52.9	87	19.0
Subbasin Aa	28.4	80	26.3
Subbasin B	8.8	85	8.4
Subbasin C	140.6	88	13.7
Subbasin D	52.6	81	7.8
Ash Pond 2	102.5	92	3.5

3.2.1.1 Curve Number (CN)

The land use cover on Ash Pond 2 and contributing watersheds outside Ash Pond 2 CCR Unit limits includes water, vegetated clay, fly and bottom ash (ash), phragmites, gravel, coal and pavement.

The cover type for vegetated clay soil areas was judged to be best represented by "Open Space (lawns, parks, etc.)" per NRCS TR-55, Table 2-2a. Grass vegetated clay soil areas with vegetation cover more than 75 percent were assumed "Good" cover type per NRCS TR-55, Table 2-2a. The clay soil was classified as hydrologic soil group (HSG) D and assigned a CN of 80.

The cover type for ash was judged to be best-represented by "Fallow: Bare soil" per NRCS TR-55, Table 2-2b. The ash was classified as HSG C and a CN of 91 was assigned. The cover type for phragmites in areas with ash was judged to be best-represented by "Meadow" per Table 2-2c. The phragmite was classified as HSG C and a CN of 71 was assigned.

Ash Pond 2 areas surfaced with gravel and pavement were judged to be best represented by "impervious areas" per NRCS TR-55, Table 2-2a. The gravel and pavement areas were classified HSG D and a CN 91 and CN 98 were assigned, respectively per NRCS Table 2-2a. Coal and ponded water surfaced areas were assigned a CN of 98 and 99, respectively.

A summary of curve number calculations and a map showing the curve numbers for each sub-area is included in Appendix C.

3.2.1.2 Lag Time

The time of concentration for each subwatershed was calculated using the NRCS segmental approach described in TR-55. The longest hydraulic flow path in each subwatershed was delineated using topographic data and aerial imagery data (dated February 2014 and April 2013, respectively). The flowpaths were subdivided into sheet, shallow-concentrated and open-channel flow components. The following methods were used to calculate flow velocities (time of concentration was then found by dividing flow length by velocity) for each flow component:

- Sheet Flow: Sheet flow velocity was computed based on methodology presented in TR-55. This equation calculates time of concentration based on Manning's roughness coefficient for sheet flow, flow length (up to a maximum distance of 100-feet) slope, and the 2-year, 24-hour rainfall depth.
- Shallow Concentrated Flow: Shallow concentrated flow velocity was calculated based on methodology presented in TR-55. This equation calculates average velocity based on the slope and surface of the watercourse.
- Open Channel Flow: Open channel flow velocities were calculated based on an assumed depth and channel geometry.

Lag time calculations are included in Appendix D.

3.2.2 Spillway Data

Flow from Ash Pond 2 is conveyed to a drainage channel that flows into the Ohio River through a spillway structure. As described in Section 2, Ash Pond 2 has a concrete inlet structure which is divided into six (6) boxes. Each box has sets of removable fiberglass stoplogs and each box discharges through a 30-inch nominal diameter HDPE pipe that flows into an energy dissipater structure before flowing into the spillway discharge channel that flows into the Ohio River. The box is 4-feet deep, 8-feet wide, and 6-feet tall with 8-inch thick walls. The stoplog is 7-feet in length. The outlet pipe consists of three pipe sections. Section 1 is 34-feet in length with a slope of 2.5% and penetrates the embankment. Section 2 is 44-feet in length with a slope of 38.4% and is located over the downstream slope. Section 3 is 8-feet in length with a slope of -1.5% and it discharges to an energy dissipater structure into the spillway discharge channel. Dimensions and elevations for the spillway structure were obtained from "Spillway Replacement Project Ash Disposal Area No.2 Pond B (Ash Stilling Pond) Work Plan 5 Shawnee Fossil Plant" record drawings dated 2012. These drawings are included in Appendix E.

A schematic showing the geometry of the outlet pipes is shown in Figure 3. Geometry data for Ash Pond 2 spillway structures is summarized in Table 2.

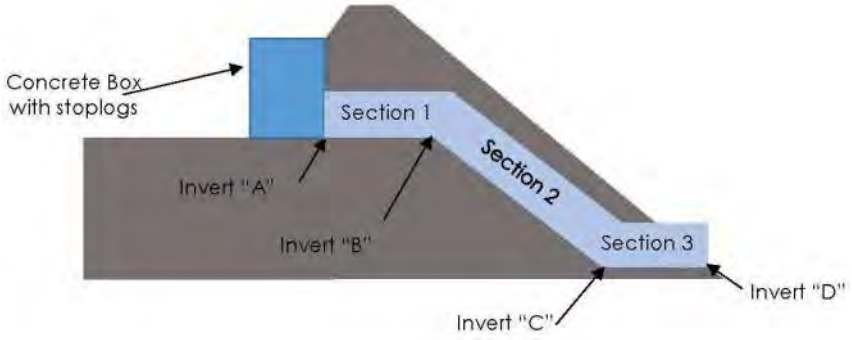


Figure 3 Spillway Schematic

Table 2 Ash Pond 2 Spillway Data

Inlet Structure	Stoplog Length (feet)	Stoplog Elevation (feet)	Pipe Inside Diameter[1] (inches)	Pipe Inlet Invert Elevation "A" (feet)	Pipe Inlet Invert Elevation "B" (feet)	Pipe Inlet Invert Elevation "C" (feet)	Pipe Inlet Invert Elevation[2] "D" (feet)
Box 1 (Stoplog 1)	7	343.9	26.25	342.00	341.14	325.20	325.32
Box 2 (Stoplog 2)	7	343.9	26.25	342.00	341.14	325.20	325.32
Box 3 (Stoplog 3)	7	343.9	26.25	342.00	341.14	325.20	325.32
Box 4 (Stoplog 4)	7	343.9	26.25	342.00	341.14	325.20	325.32
Box 5 (Stoplog 5)	7	343.9	26.25	342.00	341.14	325.20	325.32
Box 6 (Stoplog 6)	7	343.9	26.25	342.00	341.14	325.20	325.32

1. Pipe material is HDPE (DR 17) and was assumed to have an inside pipe diameter of 26.25-inches as manufactured by JM Eagle.
2. Record drawings show design invert elevation 325.00-feet was modified to 325.32-feet.

Depending on the headwater elevation, the stoplogs and pipes are controlled by weir flow through the stoplog, or by pipe orifice flow, open-channel flow, or pipe flow through the outlet pipe. In developing a hydraulic rating curve for these structures, these four flow conditions are computed for a range of headwater elevations and the limiting flow is used. The methods used to estimate the discharge for each of these components are described below:

Riser – Weir flow

Flow just above the stoplog behaves as sharp-crest weir flow and was computed using:

$$Q = C_w(L\text{-}0.2H)H^{1.5} \qquad \textbf{Eqn. 1}$$

Where: Q = discharge (cubic feet per second); $C_w = 3.27+0.4(H/H_c)$ and is the weir coefficient (to account for losses due to contraction); L = weir length (feet); H = head above the riser crest (feet); and H_c = height of weir crest above the structure base (3.58-feet).

Pipe Orifice flow

Orifice flow in the pipe was computed for the range of hydraulic conditions using:

$$Q = C_0 A[2g(H_C)]^{0.5} \qquad \textbf{Eqn. 2}$$

Where H_c = head above the outlet pipe springline (at upstream end), A = cross sectional area of the outlet pipe.

Outlet Pipe – Open-channel

Open-channel and submerged inlet flow in the outlet pipe was computed using the HY-8 Culvert Hydraulic Analysis Program developed by the US Department of Transportation Federal Highway Administration (FHWA).

Computed rating curves for the structures are included in Appendix F.

3.2.3 Precipitation Data

The rainfall depth for the 1000-yr, 6-hour storm is 7.32-inches based on NOAA Atlas 14 at SHF. "Early", "Middle" and "Late Peak" hyetographs were obtained from HydroCAD for a 6-hr storm duration assuming an SCS Type II shape. The modeled distributions are included in Appendix G.

3.2.4 Stage-Storage Data

Storage volumes were computed at 1-foot increments for Ash Pond 2 using AutoCAD Civil3D. These volumes are included as Appendix H. A surface was created to represent the bottom of the impoundment using existing topographic data (dated February, 2014) provided by TVA.

The elevation of the top of embankment for Ash Pond 2 is approximately 351.5-feet based on the existing topographic data.

3.2.5 Plant Process Flow

The average daily process flows into Ash Pond 2 was assumed to be 26.5 million gallons per day. The average daily process flow was provided by TVA during the development of the "Spillway Replacement Project Pond B (Ash Stilling Pond) Ash Disposal Area No 2. Shawnee Fossil Plant" design report and supporting calculations, dated May 2010.

3.2.6 Starting Water Surface Elevations

The starting water surface elevation for Ash Pond 2 was set to an elevation of 344.4-feet which is based on the normal pool elevation of Ash Pond 2 per the "Spillway Replacement Project Ash Disposal Area No. 2 Pond B (Ash Stilling Pond) Work Plan 5 (SHF-100504-WP-5) Shawnee Fossil Plant" record drawings, dated January, 2012.

3.3 HYDROLOGIC AND HYDRAULIC MODELING

Hydrologic and hydraulic modeling was performed using HEC-HMS 4.0 based on the model inputs summarized in Section 3.2. A model schematic is included in Figure 4. This schematic shows the watersheds and plant process flow that discharge into Ash Pond 2.

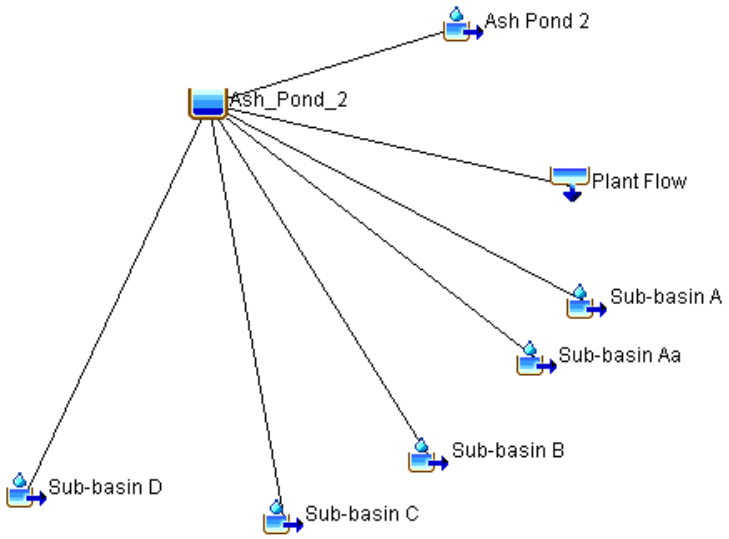


Figure 4 HEC-HMS Model Schematic

4.0 CALCULATION RESULTS

The hydrologic modeling results were used to determine the performance of Ash Pond 2 for the 1000-year, 6-hour storm for the three precipitation events described in Section 3.2.3.

4.1 CAPACITY AND FREEBOARD RESULTS

The peak pool elevation, inflow and outflow for each pond scenario is summarized in Table 3. The results showed that Ash Pond 2 can safely pass the flow from the 1000-year 6-hour storm without overtopping.

Table 3 Hydrologic and Hydraulic Modeling Results

Scenario	Storm	Peak Water Surface Elevation (feet)	Peak Inflow (cubic feet per second)	Peak Outflow (cubic feet per second)	Minimum Embankment Crest Elevation (feet)	Freeboard (feet)
1	SCS Type II "Early Peak"	346.7	1,149	205	351.5	5.1
2	SCS Type II "Middle Peak"	348.5	2,954	253	351.5	3.2
3	SCS Type II "Late Peak"	348.8	3,277	261	351.5	2.7

5.0 CONCLUSIONS

The calculations included in this report demonstrate that the inflow design flood control system adequately manages flow into and from the CCR Unit during and following the peak discharge of the inflow design flood (1,000-year flood). In addition the CCR Unit discharges through a KPDES permitted outfall, and is therefore handled in accordance with the surface water requirements under §257.3-3. Therefore the Ash Pond 2 meets the requirements of Section §257.82 of the EPA Final CCR Rule.

6.0 REFERENCES

1. Stantec (2010). "Spillway Replacement Project Pond B (Ash Stilling Pond) Ash Disposal Area No. 2. Shawnee Fossil Plant." Prepared for Tennessee Valley Authority, May, 2010.

2. "75555007_01_sitex_eg01_current.dwg, Topographic data." Provided by Tennessee Valley Authority, February-August 2014.

3. KYAPED Kentucky From Above! Program (2013). "Site aerial imagery." Prepared for Tennessee Valley Authority, March-April.

4. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (RIN-2050-AE81; FRL-9149-4) (EPA Final CCR Rule) April, 2015.

5. United States Department of Agriculture (1986). "Urban Hydrology for Small Watersheds, TR-55."June, 1986.

6. JM Eagle (2013). High-Density Polyethylene Water and Sewer, Polyethylene Water and Sewer Pipe for Municipal & Industrial Applications, April, 2013.

7. Brater, E.F. and H.W. King (1976), Handbook of Hydraulics, McGraw-Hill, New York.

8. Chow, V.T. (1959), Open-Channel Hydraulics, McGraw-Hill, 680 p.

9. United States Army Corps of Engineers, Hydrologic Modeling System (HEC-HMS), Version 4.0, December 31, 2013.

10. Federal Highway Administration, HY-8 Culvert Hydraulic Analysis Program, Version 7.3, August 18, 2014.

11. Stantec Consulting Services Inc., "Initial, Hazard Potential Classification Assessment – Ash Pond 2 (Main Ash Pond/Stilling Pond)", September 30, 2016.

12. Stantec Consulting Services Inc., "Dam Safety Hazard Classification Assessment", Project Summary Report for Tennessee Valley Authority, September 30, 2013.

13. NOAA Atlas 14, Precipitation Frequency Atlas of the United States, Volume 2, Version 3, 2006.

APPENDIX A
HYDROLOGIC OVERVIEW MAP

Figure No.
1

Title
HYDROLOGIC OVERVIEW MAP
SHF - ASH POND 2

Client/Project
Tennessee Valley Authority
Inflow Design Flood Control System Plan
175555010

Project Location:
T11N, R12E, S05
McCracken County, Kentucky

Prepared by jjr on 2016-02-26
Technical Review by mam on 2016-02-26
Independent Review by mmm on 2016-02-26

0 2,000 4,000 Feet
1:24,000 (At Original document size of 11x17)

Legend
Ash Pond 2
Flow Arrows

APPENDIX B
WATERSHED MAP

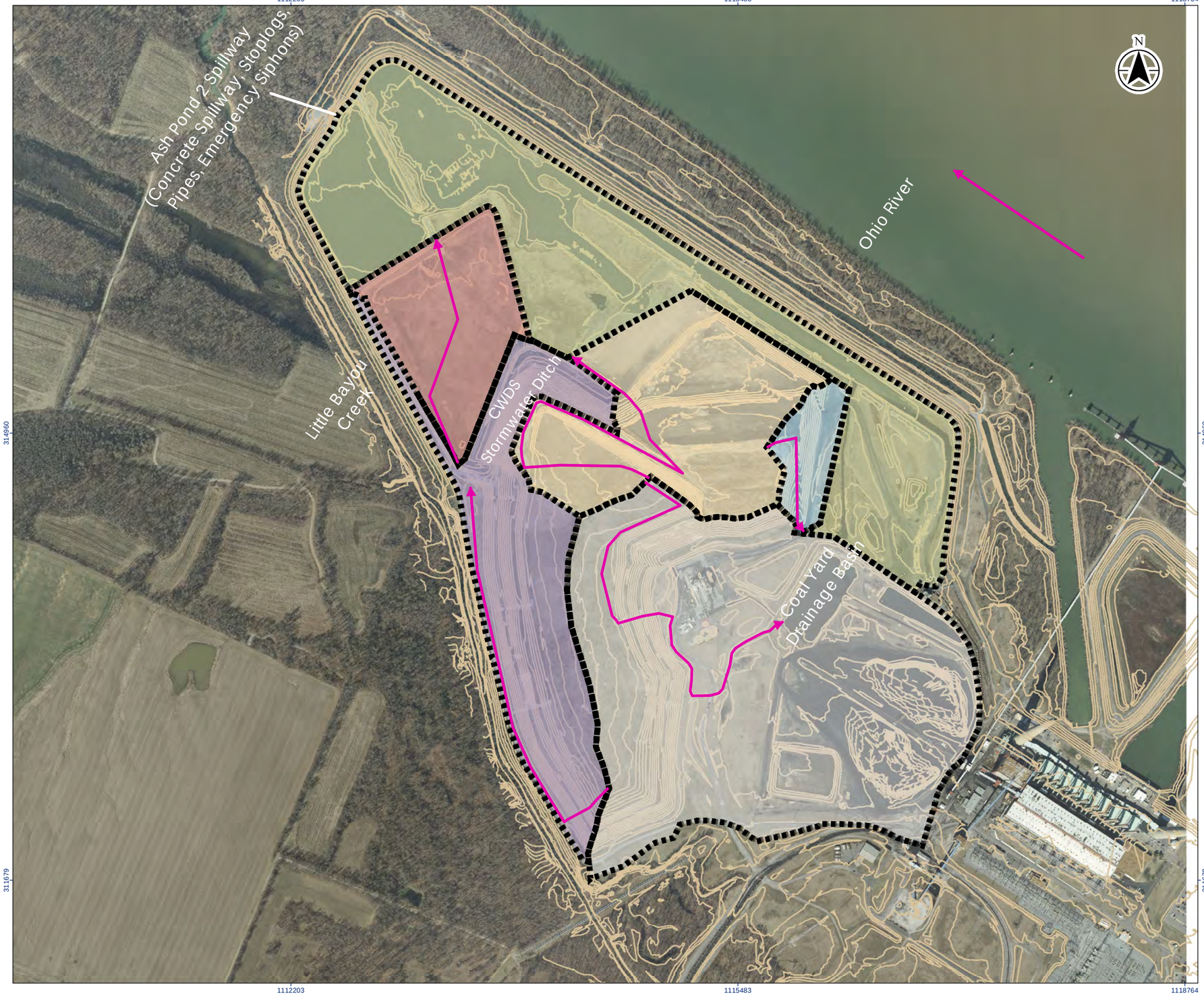


Figure No.
2

Title
WATERSHED MAP
SHF - ASH POND 2

Client/Project
Tennessee Valley Authority
Inflow Design Flood Control System Plan
175555010

Project Location:
T11N, R12E, S05
McCracken County, Kentucky

Prepared by jjr on 2016-02-26
Technical Review by mam on 2016-02-26
Independent Review by mmm on 2016-02-26

0 600 1,200
Feet

1:9,000 (At Original document size of 11x17)

Legend
- Flow Path
- Contours

Watersheds
- Subbasin A
- Subbasin Aa
- Subbasin B
- Subbasin C
- Subbasin D
- Ash Pond 2 (Approximate Area)

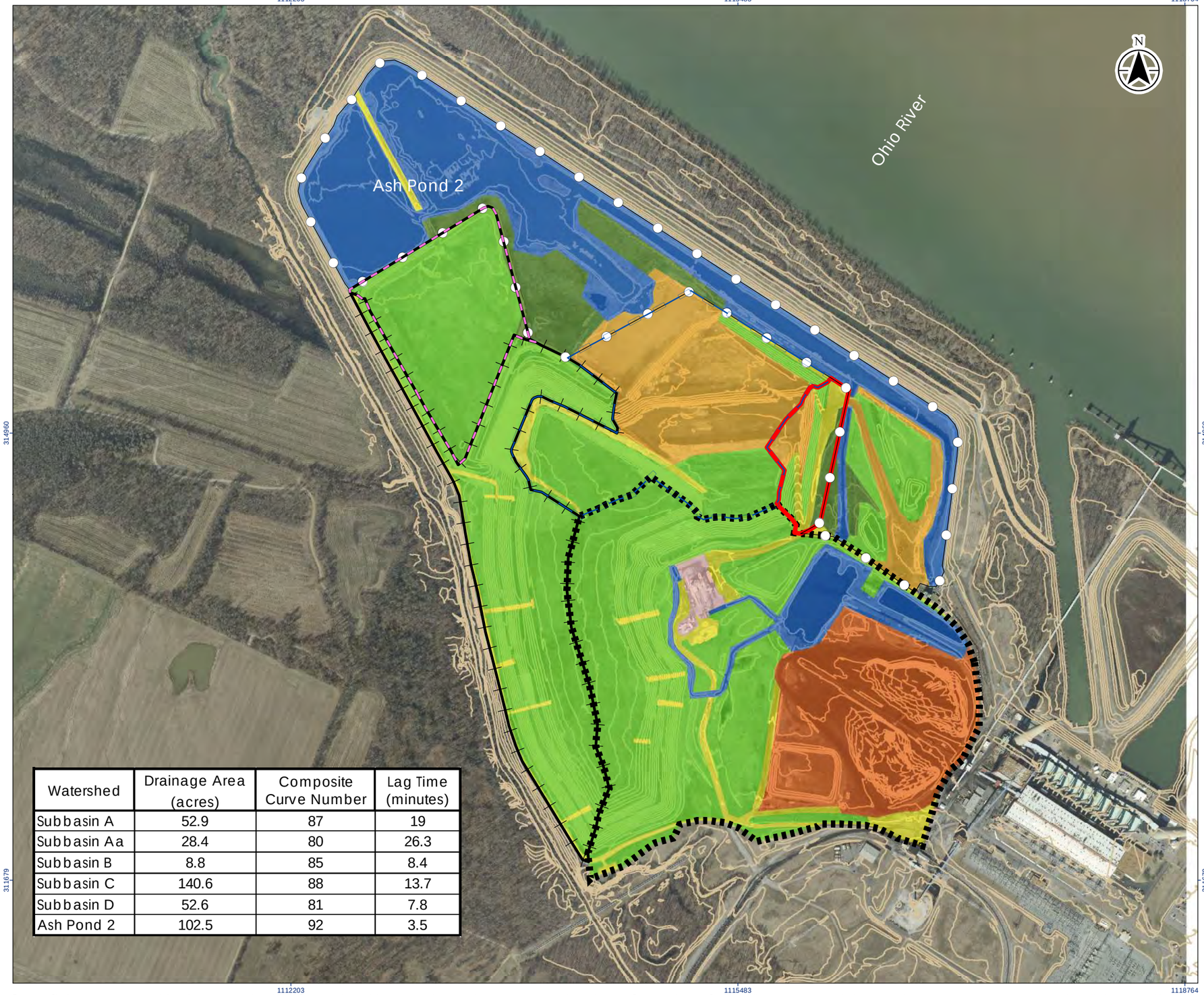
Notes
1. Coordinate System: NAD 1927 StatePlane Kentucky South FIPS 1602
2. Aerial Imagery dated April, 2013.
3. Topographic Data dated February, 2014.

Stantec

TVA

L:\Uv1276-f02\shared_projects\175555007_nbaden\temp_Runon & Runoff Plan\Inflow Design Plan\gis\watershed_shf_rev02.mxd Revised: 2016-02-26 By: jjreyes

APPENDIX C
CURVE NUMBER MAP AND COMPUTATIONS



Watershed	Drainage Area (acres)	Composite Curve Number	Lag Time (minutes)
Subbasin A	52.9	87	19
Subbasin Aa	28.4	80	26.3
Subbasin B	8.8	85	8.4
Subbasin C	140.6	88	13.7
Subbasin D	52.6	81	7.8
Ash Pond 2	102.5	92	3.5

Figure No.
3

Title
CURVE NUMBER MAP
SHF - ASH POND 2

Client/Project
Tennessee Valley Authority
Inflow Design Flood Control System Plan
175555010

Project Location:
T11N, R12E, S05
McCracken County, Kentucky

Prepared by jjr on 2016-02-26
Technical Review by mam on 2016-02-26
Independent Review by mmm on 2016-02-26

0 600 1,200 Feet
1:9,000 (At Original document size of 11x17)

Legend
Contours
Curve Number (CN)
Ash
Coal
Fragmites
Grass
Gravel
Pavement
Water
Watershed
Subbasin A
Subbasin Aa
Subbasin B
Subbasin C
Subbasin D
Ash Pond 2

Notes
1. Coordinate System: NAD 1927 StatePlane Kentucky South FIPS 1602
2. Aerial Imagery dated April, 2013.
3. Topographic Data dated February, 2014.

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Curve Numbers - H&H
Ash Pond 2 - Shawnee Fossil Plant
2/11/2016

Sub basin	Weighted CN (2)	Grass (Grass 1) (sf)(1)	Grass (Grass 2) (sf)(1)	Ash (sf)(1)	Phragmites (sf)(1)	Gravel (sf)(1)	Coal (sf)(1)	Pavement (sf)(1)	Water (sf)(1)
Sub-basin A	87	877,034		1,278,323		150,619			
Sub-basin Aa	80	1,211,399			23,036				
Sub-basin B	85		97,504	106,239	63,351	116,573			
Sub-basin C	88	2,098,302	1,011,351			481,741	1,804,545	111,165	617,416
Sub-basin D	81	2,174,661				119,340			
Ash Pond 2	92	413,416		389,896	710,706	56,881			2,897,436

Notes:

1 Areas retrieved from topographic data dated February, 2014 and aerial imagery dated April, 2013

2 Below are CN used in calculating weighted CN:

Land Use Cover	Notes	CN
Grass (Grass 1)	Clay Capped Ash	80
Grass (Grass 2)	Clay	80
Ash	Use Fly Ash CN=91, Bottom Ash CN = 86	91
Phragmites		71
Gravel		91
Coal		98
Pavement		98
Water		99

APPENDIX D
LAG TIME COMPUTATIONS

Lag Time Summary
SHF - Ash Pond 2

Subbasin ID	T_L(hr)	T_L(min)	T_L(min) Used*
Sub-basin A	0.32	19.0	19.0
Sub-basin Aa	0.44	26.3	26.3
Sub-basin B	0.14	8.4	8.4
Sub-basin C	0.23	13.7	13.7
Sub-basin D	0.13	7.8	7.8
Ash Pond 2**			3.5

*HEC-HMS model uses minimum lag time of 3.5 minutes. Therefore, any time less than 3.5 minutes will be modified to 3.5 minutes.
**Ash Pond 2 lag time assumed 3.5 minutes

WORKSHEET: Time of Concentration (Tc)

Project: SHF - 175555010 By: JJR Date:2/11/16
Watershed ID: Sub-basin Aa Checked: MAM Date:2/19/16

Sheet Flow		Segment ID				
1. Surface description			Grass, short prairie			
2. Manning's roughness coef., n			0.15			
3. Flow length, L (Total L less than 300/100 ft)	ft		100			
4. Two-year, 24-hour Rainfall, P2	in		3.72			
5a. Upstream elevation	ft		362			
5b. Downstream elevation	ft		361.56			
5. Land slope, S	ft / ft		0.004			
6. Tt = [0.007(nL)$^{0.8}$]/[sqrt(P2) S$^{0.4}$]	hr		0.28		=	0.28 hr

Shallow Concentrated Flow		Segment ID				
7. Surface description (paved or unpaved)			Unpaved			
8. Flow length, L	ft		1660.62			
9a. Upstream elevation	ft		361.56			
9b. Downstream elevation	ft		354.93			
9. Watercourse slope, S	ft / ft		0.003992485			
10. Average velocity, V	ft / s		1.0			
11. Tt = L / 3600V	hr		0.45		=	0.45 hr

25. Watershed Tc (sum Tt from 6, 11, 24)	0.73 hr
26. Watershed lag time, TL (=0.6 x Tc)	0.438 hr

WORKSHEET: Time of Concentration (Tc)

Project: SHF - 175555010 By: JJR Date:2/11/16
Watershed ID: Sub-basin B Checked: MAM Date:2/19/16

Sheet Flow		Segment ID				
1. Surface description			Grass, short prairie			
2. Manning's roughness coef., n			0.15			
3. Flow length, L (Total L less than 300/100 ft)		ft	75.01			
4. Two-year, 24-hour Rainfall, P2		in	3.72			
5a. Upstream elevation		ft	402.53			
5b. Downstream elevation		ft	401.91			
5. Land slope, S		ft / ft	0.008			
6. Tt = $[0.007(nL)^{0.8}]/[\text{sqrt}(P2)\ S^{0.4}]$		hr	0.17		=	0.17 hr

Shallow Concentrated Flow		Segment ID				
7. Surface description (paved or unpaved)			Unpaved			
8. Flow length, L		ft	854.91			
9a. Upstream elevation		ft	401.91			
9b. Downstream elevation		ft	353.44			
9. Watercourse slope, S		ft / ft	0.056696026			
10. Average velocity, V		ft / s	3.8			
11. Tt = L / 3600V		hr	0.06		=	0.06 hr

25. Watershed Tc (sum Tt from 6, 11, 24)	0.23	hr
26. Watershed lag time, TL (=0.6 x Tc)	0.14	hr

WORKSHEET: Time of Concentration (Tc)

Project: SHF - 175555010 By: JJR Date:2/11/16
Watershed ID: Sub-basin C Checked: MAM Date:2/19/16

Sheet Flow		Segment ID				
1. Surface description			Grass, short prairie			
2. Manning's roughness coef., n			0.15			
3. Flow length, L (Total L less than 300/100 ft)		ft	100			
4. Two-year, 24-hour Rainfall, P2		in	3.72			
5a. Upstream elevation		ft	454.76			
5b. Downstream elevation		ft	453.92			
5. Land slope, S		ft / ft	0.008			
6. Tt = $[0.007(nL)^{0.8}]/[sqrt(P2)\ S^{0.4}]$		hr	0.21		=	0.21 hr

Shallow Concentrated Flow	Segment ID				
7. Surface description (paved or unpaved)			Unpaved		
8. Flow length, L		ft	211.8		
9a. Upstream elevation		ft	453.92		
9b. Downstream elevation		ft	445.88		
9. Watercourse slope, S		ft / ft	0.03796034		
10. Average velocity, V		ft / s	3.1		
11. Tt = L / 3600V		hr	0.02		=	0.02 hr

Open Channel Flow	Segment ID				
12. Pipe or Open Channel			Open-channel		
13. Diam (pipe) or depth (open)		ft	0.8		
14. Base width (open)		ft	0		
15. Channel side slope		XH:1V	17.5		
16. Cross sectional flow area		ft2	11.20		
17. Wetted perimeter, Pw		ft	28.05		
18. Hydraulic radius, r = a/Pw		ft	0.40		
19a. Upstream elevation		ft	446		
19b. Downstream elevation		ft	432		
19. Channel slope, S		ft / ft	0.011		
20. Runoff surface / pipe material			bare soil		
21. Manning's roughness coef., n			0.02		
22. V= (1.49 r2/3 S1/2 / n)		ft / s	4.31		
23. Flow length, L		ft	1216.79		
24. Tt = L / 3600V		hr	0.08		=	0.08 hr

Open Channel Flow	Segment ID				
12. Pipe or Open Channel			Open-channel		
13. Diam (pipe) or depth (open)		ft	0.5		
14. Base width (open)		ft	13.7		
15. Channel side slope		XH:1V	2		
16. Cross sectional flow area		ft2	7.35		
17. Wetted perimeter, Pw		ft	15.94		
18. Hydraulic radius, r = a/Pw		ft	0.46		
19a. Upstream elevation		ft	432		
19b. Downstream elevation		ft	354		
19. Channel slope, S		ft / ft	0.254		
20. Runoff surface / pipe material			riprap		
21. Manning's roughness coef., n			0.04		
22. V= (1.49 r2/3 S1/2 / n)		ft / s	11.21		
23. Flow length, L		ft	307.05		
24. Tt = L / 3600V		hr	0.01		=	0.01 hr

Open Channel Flow	Segment ID				
12. Pipe or Open Channel			Open-channel		
13. Diam (pipe) or depth (open)		ft	4.32		
14. Base width (open)		ft	9		
15. Channel side slope		XH:1V	1.5		
16. Cross sectional flow area		ft2	66.87		
17. Wetted perimeter, Pw		ft	24.58		
18. Hydraulic radius, r = a/Pw		ft	2.72		
19a. Upstream elevation		ft	344		
19b. Downstream elevation		ft	335		
19. Channel slope, S		ft / ft	0.006		
20. Runoff surface / pipe material			earth, winding, grass weeds		
21. Manning's roughness coef., n			0.03		
22. V= (1.49 r2/3 S1/2 / n)		ft / s	7.36		
23. Flow length, L		ft	1605.46		
24. Tt = L / 3600V		hr	0.06		=	0.06 hr

25. Watershed Tc (sum Tt from 6, 11, 24) = 0.38 hr

26. Watershed lag time, TL (=0.6 x Tc) = 0.228 hr

WORKSHEET: Time of Concentration (Tc)

Project: SHF - 175555010 By: JJR Date:2/11/16
Watershed ID: Sub-basin D Checked: MAM Date:2/19/16

Sheet Flow	Segment ID				
1. Surface description		Grass, short prairie			
2. Manning's roughness coef., n		0.15			
3. Flow length, L (Total L less than 300/100 ft)	ft	100			
4. Two-year, 24-hour Rainfall, P2	in	3.72			
5a. Upstream elevation	ft	438.19			
5b. Downstream elevation	ft	429.53			
5. Land slope, S	ft / ft	0.087			
6. Tt = $[0.007(nL)^{0.8}]/[\text{sqrt}(P2)\ S^{0.4}]$	hr	0.08		=	0.08 hr

Shallow Concentrated Flow	Segment ID				
7. Surface description (paved or unpaved)		Unpaved			
8. Flow length, L	ft	101.61			
9a. Upstream elevation	ft	429.53			
9b. Downstream elevation	ft	405.23			
9. Watercourse slope, S	ft / ft	0.23914969			
10. Average velocity, V	ft / s	7.9			
11. Tt = L / 3600V	hr	0.00		=	0.00 hr

Open Channel Flow	Segment ID				
12. Pipe or Open Channel		Open-channel			
13. Diam (pipe) or depth (open)	ft	0.5			
14. Base width (open)	ft	14			
15. Channel side slope	XH:1V	4			
16. Cross sectional flow area	ft2	8.00			
17. Wetted perimeter, Pw	ft	18.12			
18. Hydraulic radius, r = a/Pw	ft	0.44			
19a. Upstream elevation	ft	405			
19b. Downstream elevation	ft	350			
19. Channel slope, S	ft / ft	0.261			
20. Runoff surface / pipe material		riprap			
21. Manning's roughness coef., n		0.04			
22. V= (1.49 r2/3 S1/2 / n)	ft / s	11.04			
23. Flow length, L	ft	213.32			
24. Tt = L / 3600V	hr	0.01		=	0.01 hr

Open Channel Flow	Segment ID				
12. Pipe or Open Channel		Open-channel			
13. Diam (pipe) or depth (open)	ft	2.5			
14. Base width (open)	ft	28			
15. Channel side slope	XH:1V	6.5			
16. Cross sectional flow area	ft2	110.63			
17. Wetted perimeter, Pw	ft	60.88			
18. Hydraulic radius, r = a/Pw	ft	1.82			
19a. Upstream elevation	ft	350			
19b. Downstream elevation	ft	342			
19. Channel slope, S	ft / ft	0.003			
20. Runoff surface / pipe material		bare soil			
21. Manning's roughness coef., n		0.02			
22. V= (1.49 r2/3 S1/2 / n)	ft / s	5.83			
23. Flow length, L	ft	2584.93			
24. Tt = L / 3600V	hr	0.12		=	0.12 hr

25. Watershed Tc (sum Tt from 6, 11, 24) 0.22 hr

26. Watershed lag time, TL (=0.6 x Tc) 0.13 hr

APPENDIX E
REFERENCE DRAWINGS

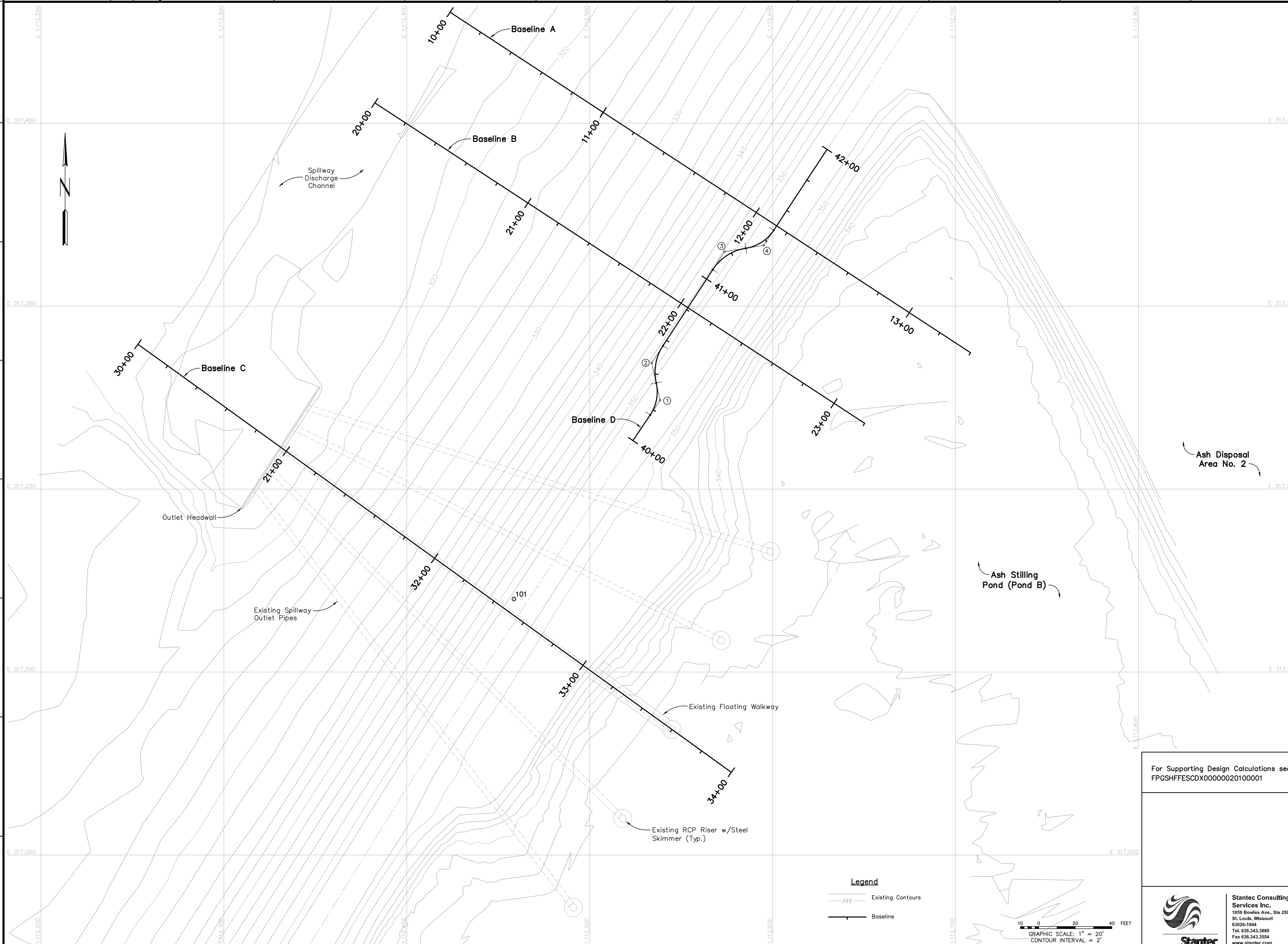

TABLE OF BASELINE COORDINATES

Station	Baseline	Northing	Easting
10+00	Baseline A	317,460.73	1,112,423.65
13+40	Baseline A	317,274.58	1,112,708.16
20+00	Baseline B	317,411.16	1,112,382.51
23+20	Baseline B	317,235.96	1,112,650.28
30+00	Baseline C	317,279.20	1,112,253.01
34+00	Baseline C	317,045.17	1,112,577.40
40+00	Baseline D	317,226.52	1,112,523.61
42+00	Baseline D	317,385.74	1,112,629.74

BASELINE CURVE DATA

①
P.I. Sta. = 40+26.60
Northing = 317,248.59
Easting = 1,112,538.46
Δ = 46°37'34"
D = 254°38'52"
T = 9.70'
L = 18.31'
R = 22.50'
E = 2.00'
P.C. Sta. = 40+16.90
P.T. Sta. = 40+35.22

②
P.I. Sta. = 40+46.44
Northing = 317,268.99
Easting = 1,112,533.87
Δ = 45°52'48"
D = 216°12'38"
T = 11.22'
L = 21.22'
R = 26.50'
E = 2.28'
P.C. Sta. = 40+35.22
P.T. Sta. = 40+56.44

③
P.I. Sta. = 41+17.96
Northing = 317,329.86
Easting = 1,112,573.69
Δ = 47°50'51"
D = 216°12'38"
T = 11.76'
L = 22.13'
R = 26.50'
E = 2.49'
P.C. Sta. = 41+06.20
P.T. Sta. = 41+28.33

④
P.I. Sta. = 41+38.27
Northing = 317,333.23
Easting = 1,112,595.13
Δ = 47°40'12"
D = 254°38'52"
T = 9.94'
L = 18.72'
R = 22.50'
E = 2.10'
P.C. Sta. = 41+28.33
P.T. Sta. = 41+47.05

TABLE OF SURVEY CONTROL POINTS

No.	Monument Type	Northing	Easting	Elev. (ft.)
101	Nail	317,139.92	1,112,458.55	351.84
SSP-141R	Angle Iron	316,698.14	1,112,252.52	350.77
SSP-143	Angle Iron	317,707.84	1,112,941.20	351.22

SSP-141R and SSP-143 are not shown on this drawing.

MAPPING NOTE:
Topographic mapping shown on this layout was generated from surveys dated December 2009 and January 2010 and supplied by Tennessee Valley Authority (TVA). Horizontal coordinates are referenced to Kentucky South State Plane Coordinate System (Lambert), NAD 27. Elevations are based on NGVD 29.

RECORD DRAWING NOTES:
1. These drawings have been prepared based on survey information performed by TVA Surveying in November and December, 2011 and provided to Stantec on December 7, 2011 and December 23, 2011 .
2. Items shown on the "record drawing"with clouded notation are items for which as-built information was available. All other items are shown for reference as they were in the "issued for construction" plan set.

RECORD DRAWING

PLOT DATE: 01/06/2012 USER: MYERS, TONY
V:\1756\ACTIVE\175669075\ENVIRONMENTAL\DRAWING\REV1_RECORD\DWG\10W505-04-R1.DWG

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 1	01/06/12	GJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–	–
RECORD DRAWING											
R 0	05/04/10	LJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–	–
ISSUED FOR CONSTRUCTION											

DISCIPLINE INTERFACE
1
2
3
4

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
EXISTING CONDITIONS
WORK PLAN 5 (SHF-100504-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L. WRIGHT	T. MYERS	M. HOY	M. HOY	S. BICKEL	J. MONTGOMERY	T. JOHNSON

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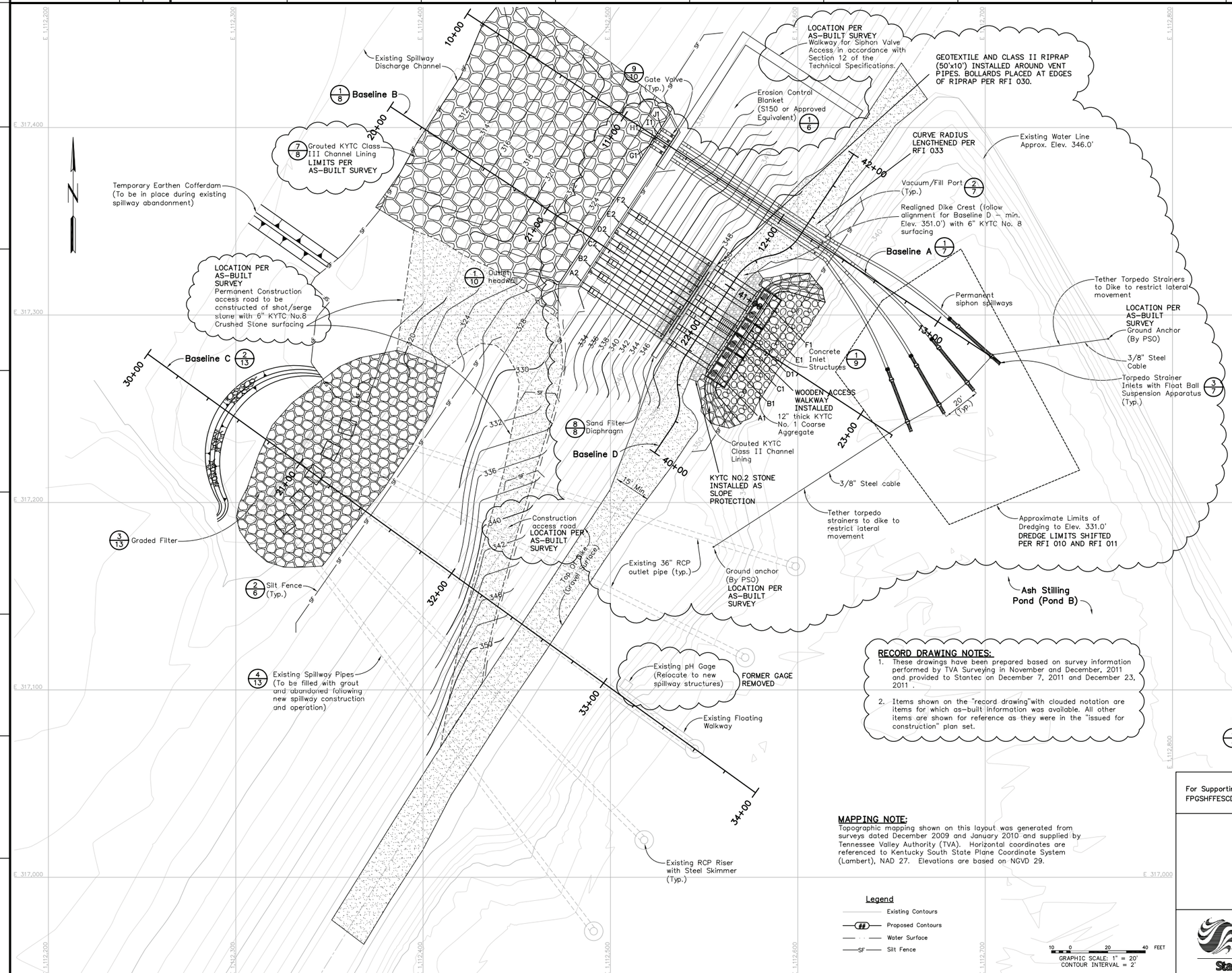
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

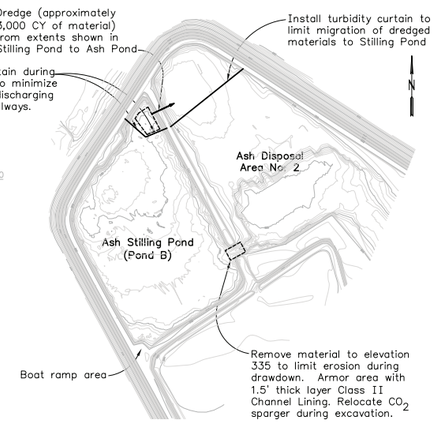
AUTOCAD R 2000 | DATE 01/06/12 | 35 | C | 10W505-04 | R 1

STANTEC	1
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:20
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY





MAPPING NOTE:
Below water topographic mapping in this detail only based on a hydrographic survey dated March 4, 2008 provided by TVA.

DREDGE SEQUENCING:

1. Install turbidity curtain in Stilling Pond to minimize disturbed material discharging through existing spillways. Turbidity curtain will be Elastic/American Marine Type 2 Fastwater Screen or approved equal. Curtain to be approximately 10 feet in height and extend to pond bottom.
2. Install turbidity curtain in Main Ash Pond to limit dredged materials from directly migrating back to Stilling Pond.
3. Dredge from Stilling Pond to Elev. 331 within extents shown. Dredged material to be deposited over divider dike into Ash Pond as indicated. Monitor turbidity in accordance with Section 2 of these Specifications.
4. Remove turbidity curtains prior to pool drawdown and no sooner than 2 days following end of dredging activities.

1/5 **DETAIL – DREDGING PLAN**
SCALE: 1" = 300'

AS-BUILT PIPE LOCATIONS

	Easting	Northing	PIPE INV.
A1	1112554.96	317270.42	341.98
A2	1112484.09	317318.51	325.25
B1	1112559.92	317278.12	342.03
B2	1112488.96	317326.18	325.21
C1	1112565.08	317285.93	342.02
C2	1112494.01	317334.02	325.14
D1	1112570.14	317293.83	342.04
D2	1112499.15	317341.78	325.40
E1	1112575.20	317301.39	342.02
E2	1112504.18	317349.82	325.18
F1	1112580.31	317309.41	342.01
F2	1112509.44	317357.35	325.28
G1	1112521.42	317390.98	326.91
H1	1112523.51	317394.02	326.79
I1	1112525.24	317397.02	326.88
J1	1112527.20	317399.86	326.90

RECORD DRAWING

RECORD DRAWING NOTES:

1. These drawings have been prepared based on survey information performed by TVA Surveying in November and December, 2011 and provided to Stantec on December 7, 2011 and December 23, 2011 .
2. Items shown on the "record drawing"with clouded notation are items for which as-built information was available. All other items are shown for reference as they were in the "issued for construction" plan set.

MAPPING NOTE:
Topographic mapping shown on this layout was generated from surveys dated December 2009 and January 2010 and supplied by Tennessee Valley Authority (TVA). Horizontal coordinates are referenced to Kentucky South State Plane Coordinate System (Lambert), NAD 27. Elevations are based on NGVD 29.

Legend
- Existing Contours
- Proposed Contours
- Water Surface
- SF — Silt Fence

GRAPHIC SCALE: 1" = 20'
CONTOUR INTERVAL = 2'

Section or Detail No.
Sheet Where Shown
REFERENCE KEY

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

REV NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV ID
R 1	01/06/12	GJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–	–
RECORD DRAWING											
R 0	05/04/10	LJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–	–
ISSUED FOR CONSTRUCTION											

DISCIPLINE INTERFACE
1
2
3
4

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
SIPHON & PRIMARY SPILLWAY
WORK PLAN 5 (SHF-100504-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L. WRIGHT	T. MYERS	M. HOY	M. HOY	S. BICKEL	J. MONTGOMERY	T. JOHNSON

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Fax 636.343.3554
www.stantec.com

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

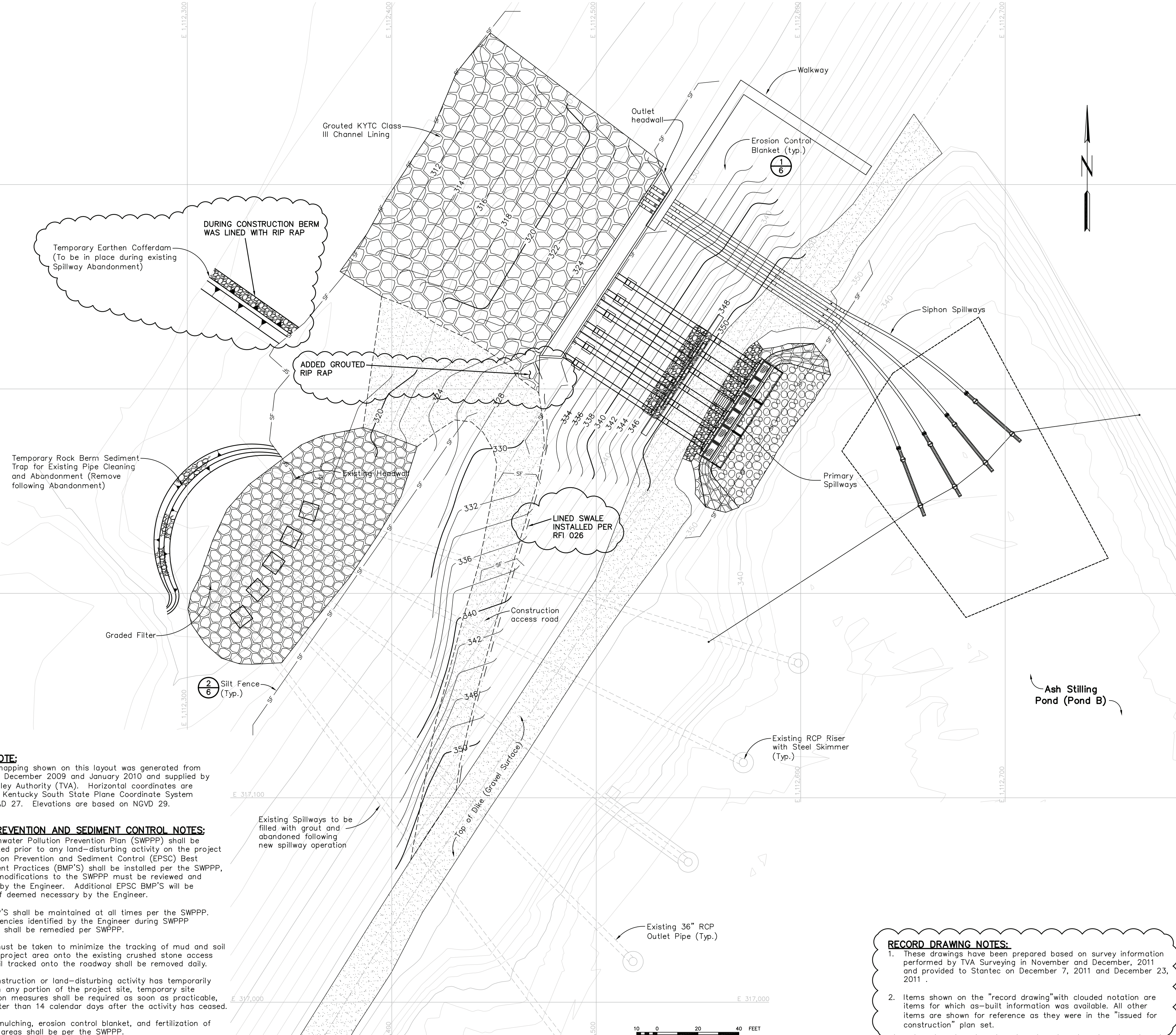
AUTOCAD R 2000	DATE 01/06/12	35	C	10W505-05	R 1

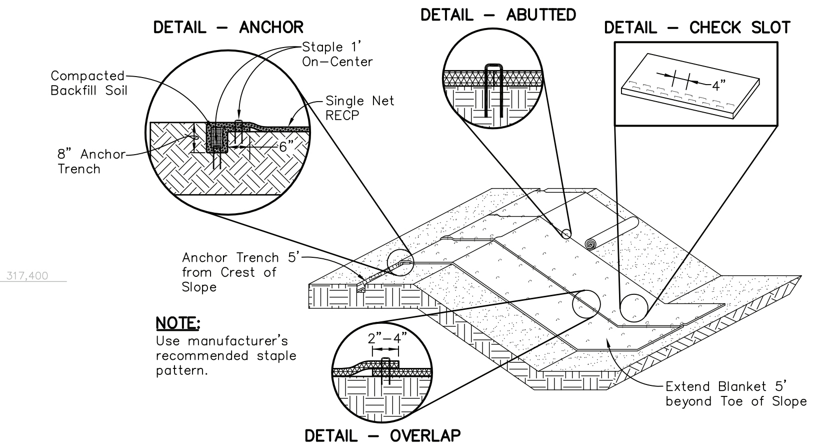
STANTEC	1
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:20
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

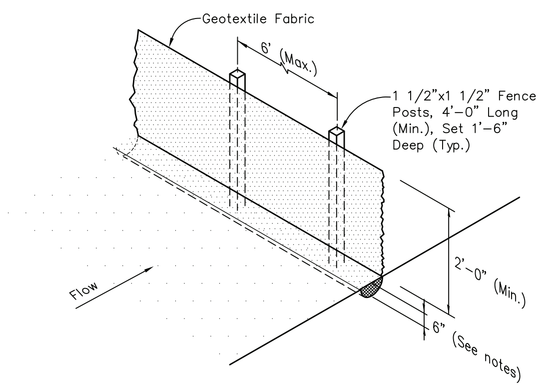
PLOT DATE: 01/06/2012 - USER: MYERS, TONY
L:\CAD\PWR\FOSSIL\SHF\DRAWING\REV_RECORD\10W505-05-R1.DWG





NOTE:
Use manufacturer's recommended staple pattern.

1/6 **DETAIL – EROSION CONTROL BLANKET INSTALLATION**
NOT TO SCALE



NOTES:
1. The bottom 12 inches of the fabric shall be buried in a 6-inch trench cut into the ground or covered by 6 inches of fill material to prevent sediment from escaping under the fence. All earthwork shall be on the upstream side of the fence.
2. Geotextile fabric used in silt fence shall meet the following specifications: Tensile strength (ASTM D-4632) – 100 lbs. (Min.), Width – 36" (Min.), Bursting strength (ASTM D-3786) – 175 psi. (Min.), Elongation of 4090 (Max.) (ASTM D-4632), apparent opening size (ASTM D-4751)–No. 30, Ultraviolet Stability (ASTM D-4355)–80% strength retained.

2/6 **DETAIL – SILT FENCE**
SCALE: 1/2"=1'-0"

Legend
- Existing Contours
- Proposed Contours
- Existing Water Surface
- Silt Fence

Section or Detail No.
Sheet Where Shown
REFERENCE KEY

MAPPING NOTE:
Topographic mapping shown on this layout was generated from surveys dated December 2009 and January 2010 and supplied by Tennessee Valley Authority (TVA). Horizontal coordinates are referenced to Kentucky South State Plane Coordinate System (Lambert), NAD 27. Elevations are based on NGVD 29.

EROSION PREVENTION AND SEDIMENT CONTROL NOTES:
1. The Stormwater Pollution Prevention Plan (SWPPP) shall be implemented prior to any land-disturbing activity on the project site. Erosion Prevention and Sediment Control (EPSC) Best Management Practices (BMP'S) shall be installed per the SWPPP, and any modifications to the SWPPP must be reviewed and approved by the Engineer. Additional EPSC BMP'S will be installed if deemed necessary by the Engineer.
2. EPSC BMP'S shall be maintained at all times per the SWPPP. Any deficiencies identified by the Engineer during SWPPP inspection shall be remedied per SWPPP.
3. Actions must be taken to minimize the tracking of mud and soil from the project area onto the existing crushed stone access road. Soil tracked onto the roadway shall be removed daily.
4. Where construction or land-disturbing activity has temporarily ceased on any portion of the project site, temporary site stabilization measures shall be required as soon as practicable, but no later than 14 calendar days after the activity has ceased.
5. Seeding, mulching, erosion control blanket, and fertilization of disturbed areas shall be per the SWPPP.

RECORD DRAWING NOTES:
1. These drawings have been prepared based on survey information performed by TVA Surveying in November and December, 2011 and provided to Stantec on December 7, 2011 and December 23, 2011 .
2. Items shown on the "record drawing"with clouded notation are items for which as-built information was available. All other items are shown for reference as they were in the "issued for construction" plan set.

RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 1	01/06/12	GJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–	–
RECORD DRAWING											
R 0	05/04/10	LJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–	–
ISSUED FOR CONSTRUCTION											

DISCIPLINE INTERFACE 1 2 3 4

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
SWPPP
WORK PLAN 5 (SHF-100504-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L. WRIGHT	T. MYERS	M. HOY	M. HOY	S. BICKEL	J. MONTGOMERY	T. JOHNSON

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SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

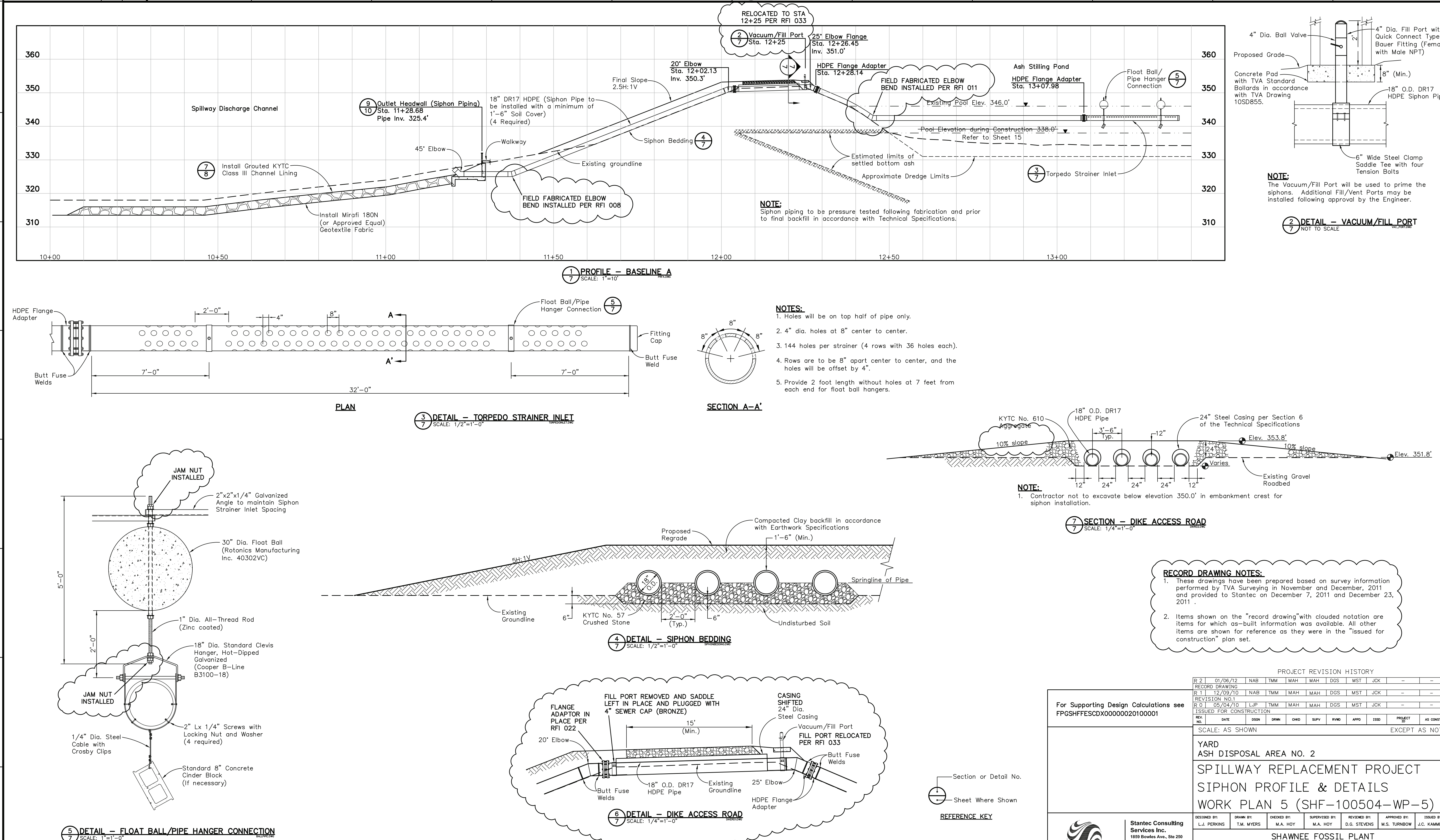
AUTOCAD R 2000 | DATE 01/06/12 | 35 | C | 10W505-06 | R 1

STANTEC | 1
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:20
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 01/06/2012



RELOCATED TO STA 12+25 PER RFI 033
2/7 Vacuum/Fill Port Sta. 12+25
25' Elbow Flange Sta. 12+26.45 Inv. 351.0'
20' Elbow Sta. 12+02.13 Inv. 350.3'
HDPE Flange Adapter Sta. 12+28.14
FIELD FABRICATED ELBOW BEND INSTALLED PER RFI 011
Ash Stilling Pond
HDPE Flange Adapter Sta. 13+07.98
Float Ball/ Pipe Hanger Connection 5/7
Final Slope 2.5H:1V
Spillway Discharge Channel
9/10 Outlet Headwall (Siphon Piping) Sta. 11+28.68 Pipe Inv. 325.4'
18" DR17 HDPE (Siphon Pipe to be installed with a minimum of 1'-6" Soil Cover) (4 Required)
Walkway
45' Elbow
Siphon Bedding 4/7
Existing groundline
7/8 Install Grouted KYTC Class III Channel Lining
FIELD FABRICATED ELBOW BEND INSTALLED PER RFI 008
Install Mirafi 180N (or Approved Equal) Geotextile Fabric
Existing Pool Elev. 346.0'
Pool Elevation during Construction 338.0' Refer to Sheet 15
Estimated limits of settled bottom ash
Approximate Dredge Limits
3/7 Torpedo Strainer Inlet
NOTE: Siphon piping to be pressure tested following fabrication and prior to final backfill in accordance with Technical Specifications.
360 350 340 330 320 310
10+00 10+50 11+00 11+50 12+00 12+50 13+00
1/7 PROFILE – BASELINE A SCALE: 1"=10'
4" Dia. Ball Valve
4" Dia. Fill Port with Quick Connect Type B Bauer Fitting (Female with Male NPT)
2'
Proposed Grade
Concrete Pad with TVA Standard Bollards in accordance with TVA Drawing 10SD855.
8" (Min.)
18" O.D. DR17 HDPE Siphon Pipe
6" Wide Steel Clamp Saddle Tee with four Tension Bolts
NOTE: The Vacuum/Fill Port will be used to prime the siphons. Additional Fill/Vent Ports may be installed following approval by the Engineer.
2/7 DETAIL – VACUUM/FILL PORT NOT TO SCALE
HDPE Flange Adapter
Butt Fuse Welds
2'-0" 4" 8"
A A'
Float Ball/Pipe Hanger Connection 5/7
Fitting Cap
Butt Fuse Weld
7'-0" 7'-0" 32'-0"
PLAN
3/7 DETAIL – TORPEDO STRAINER INLET SCALE: 1/2"=1'-0"
8" 8" 8"
SECTION A–A'
NOTES:
1. Holes will be on top half of pipe only.
2. 4" dia. holes at 8" center to center.
3. 144 holes per strainer (4 rows with 36 holes each).
4. Rows are to be 8" apart center to center, and the holes will be offset by 4".
5. Provide 2 foot length without holes at 7 feet from each end for float ball hangers.
KYTC No. 610 Aggregate
18" O.D. DR17 HDPE Pipe
3'-6" Typ.
12"
24" Steel Casing per Section 6 of the Technical Specifications
10% slope
Elev. 353.8'
Elev. 351.8'
24" Varies
12" 24" 24" 24" 12"
Existing Gravel Roadbed
NOTE:
1. Contractor not to excavate below elevation 350.0' in embankment crest for siphon installation.
7/7 SECTION – DIKE ACCESS ROAD SCALE: 1/4"=1'-0"
JAM NUT INSTALLED
2"x2"x1/4" Galvanized Angle to maintain Siphon Strainer Inlet Spacing
30" Dia. Float Ball (Rotonics Manufacturing Inc. 40302VC)
5'-0"
1" Dia. All-Thread Rod (Zinc coated)
2'-0"
18" Dia. Standard Clevis Hanger, Hot-Dipped Galvanized (Cooper B-Line B3100-18)
JAM NUT INSTALLED
2" Lx 1/4" Screws with Locking Nut and Washer (4 required)
1/4" Dia. Steel Cable with Crosby Clips
Standard 8" Concrete Cinder Block (If necessary)
5/7 DETAIL – FLOAT BALL/PIPE HANGER CONNECTION SCALE: 1"=1'-0"
Proposed Regrade
Compacted Clay backfill in accordance with Earthwork Specifications
1'-6" (Min.)
5H:1V
18" O.D.
Springline of Pipe
Existing Groundline
6" KYTC No. 57 Crushed Stone
2'-0" (Typ.)
6"
Undisturbed Soil
4/7 DETAIL – SIPHON BEDDING SCALE: 1/2"=1'-0"
FLANGE ADAPTOR IN PLACE PER RFI 022
FILL PORT REMOVED AND SADDLE LEFT IN PLACE AND PLUGGED WITH 4" SEWER CAP (BRONZE)
CASING SHIFTED 24" Dia. Steel Casing
15' (Min.)
Vacuum/Fill Port
FILL PORT RELOCATED PER RFI 033
20' Elbow
Butt Fuse Welds
18" O.D. DR17 HDPE Pipe
Existing Groundline
25' Elbow
HDPE Flange Adapter
Butt Fuse Welds
6/7 DETAIL – DIKE ACCESS ROAD SCALE: 1/4"=1'-0"
RECORD DRAWING NOTES:
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2. Items shown on the "record drawing" with clouded notation are items for which as-built information was available. All other items are shown for reference as they were in the "issued for construction" plan set.
Section or Detail No.
Sheet Where Shown
REFERENCE KEY

RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

PROJECT REVISION HISTORY

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 2 (RECORD DRAWING)	01/06/12	NAB	TMM	MAH	MAH	DGS	MST	JCK	–	–
R 1 (REVISION NO.1)	12/09/10	NAB	TMM	MAH	MAH	DGS	MST	JCK	–	–
R 0 (ISSUED FOR CONSTRUCTION)	05/04/10	LJP	TMM	MAH	MAH	DGS	MST	JCK	–	–

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
SIPHON PROFILE & DETAILS
WORK PLAN 5 (SHF-100504-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L.J. PERKINS	T.M. MYERS	M.A. HOY	M.A. HOY	D.G. STEVENS	M.S. TURNBOW	J.C. KAMMEYER

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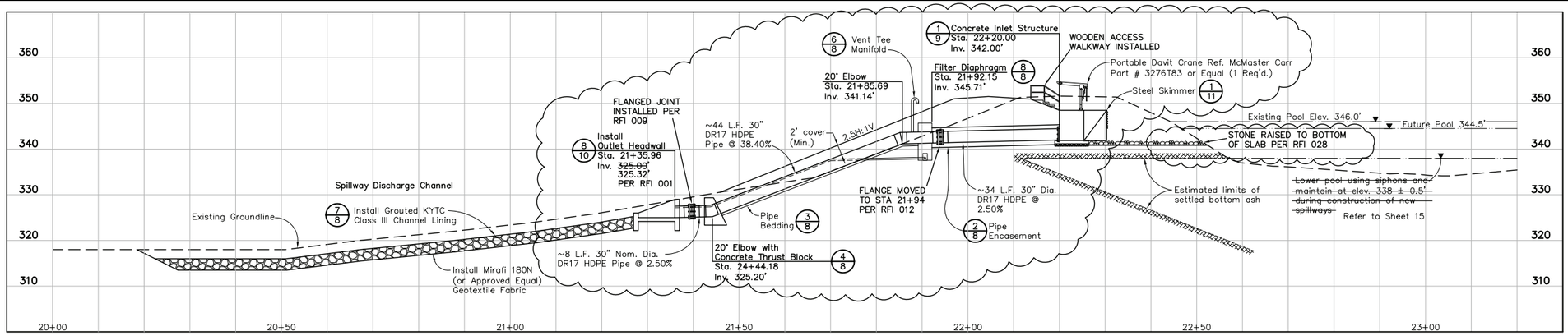
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 01/06/12 | 35 | C | 10W505-07 | R 2

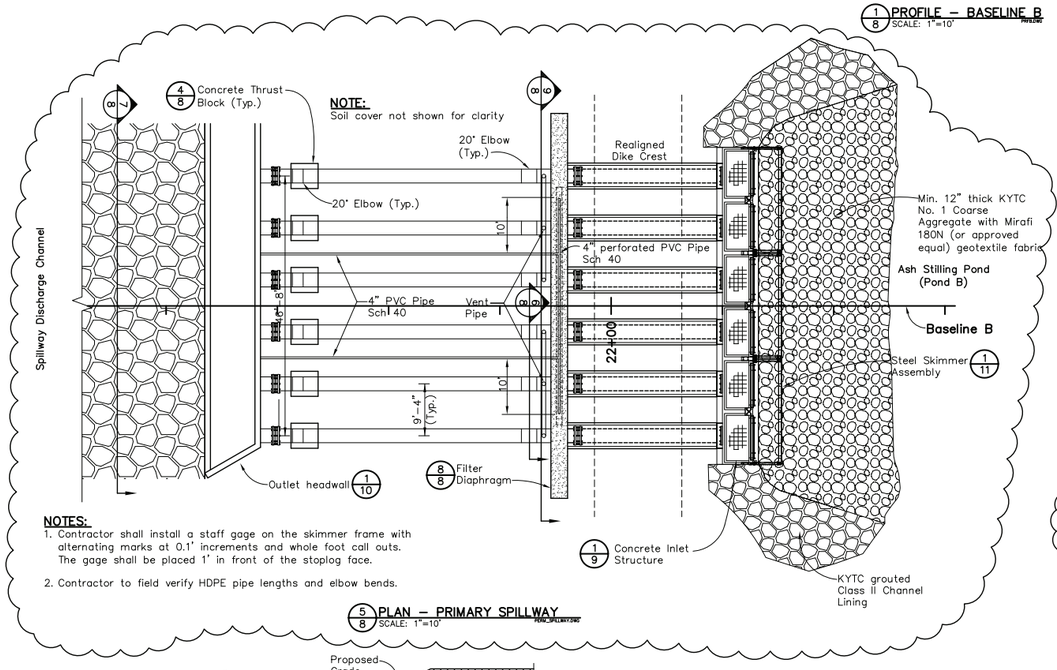
STANTEC | 2
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:1
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



1/8 PROFILE – BASELINE B
SCALE: 1"=10'

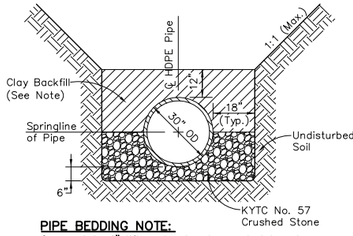


NOTES:
1. Contractor shall install a staff gage on the skimmer frame with alternating marks at 0.1' increments and whole foot call outs. The gage shall be placed 1' in front of the stoplog face.
2. Contractor to field verify HDPE pipe lengths and elbow bends.

5/8 PLAN – PRIMARY SPILLWAY
SCALE: 1"=10'

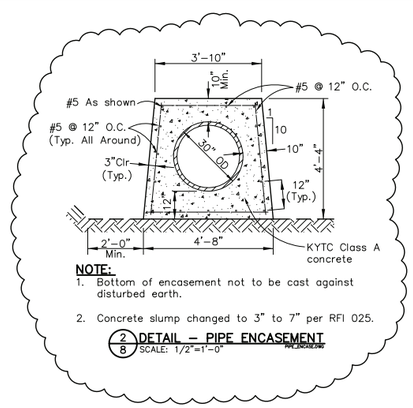
SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423.751.8416 OR 423.751.2571) SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.



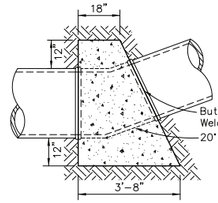
PIPE BEDDING NOTE:
Compact in 4" lifts using hand operated tamping compactor. Minimum required density shall be 98% Standard Proctor. At 36" above top of pipe Contractor may use a sheepsfoot or tamping wheel roller for compacting of backfill.

3/8 DETAIL – PIPE BEDDING WITH STONE CRADLE
SCALE: 1/2"=1'-0"



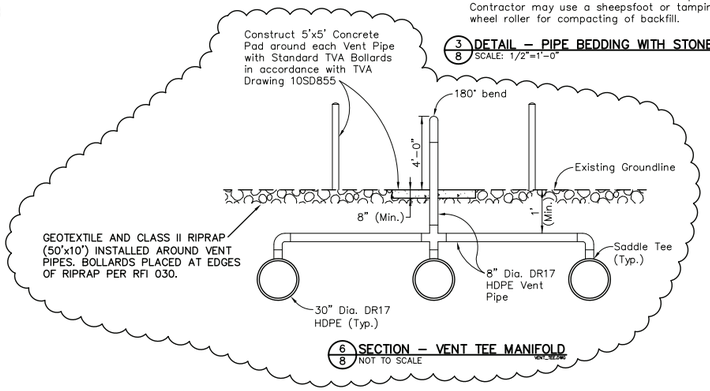
NOTE:
1. Bottom of encasement not to be cast against disturbed earth.
2. Concrete slump changed to 3" to 7" per RFI 025.

2/8 DETAIL – PIPE ENCASEMENT
SCALE: 1/2"=1'-0"

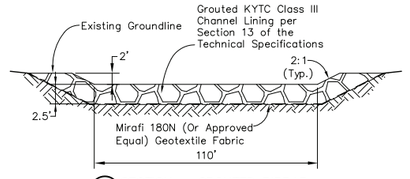


NOTE:
1. Thrust block not to be cast against disturbed earth.
2. Thrust block to be 4'-6" wide.

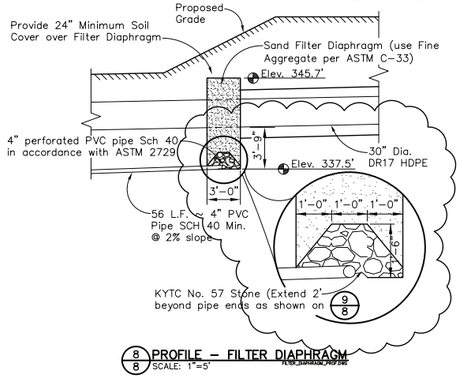
4/8 DETAIL – CONCRETE THRUST BLOCK
NOT TO SCALE



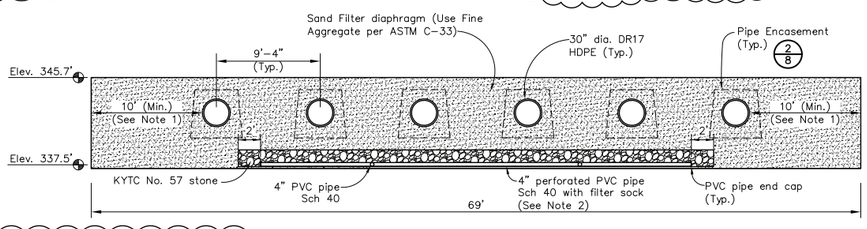
6/8 SECTION – VENT TEE MANIFOLD
NOT TO SCALE



7/8 SECTION – GROUTED RIPRAP
NOT TO SCALE



8/8 PROFILE – FILTER DIAPHRAGM
SCALE: 1"=5'



9/8 ELEVATION – FILTER DIAPHRAGM
SCALE: 1"=5'

RECORD DRAWING NOTES:
1. These drawings have been prepared based on survey information performed by TVA Surveying in November and December, 2011 and provided to Stantec on December 7, 2011 and December 23, 2011 .
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NOTE:
1. Filter diaphragm shall extend 2 feet beyond the limits of the excavation.
2. Sand filter diaphragm was compacted in 8-inch lifts with 2 passes of a vibratory plate compactor.

Section or Detail No. / Sheet Where Shown

REFERENCE KEY

RECORD DRAWING

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 2	01/06/12	GJW	TMM	MAH	MAH	DGS	JSM	JCK		
RECORD DRAWING										
R 1	12/09/10	NAB	TMM	MAH	MAH	DGS	JSM	JCK	–	–
REVISION NO.1										
R 0	05/04/10	LJP	TMM	MAH	MAH	DGS	MST	JCK	–	–
ISSUED FOR CONSTRUCTION										

DISCIPLINE INTERFACE: 1 2 3 4

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
PRIMARY SPILLWAY
WORK PLAN 5 (SHF-100504-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L.J. PERKINS	T.M. MYERS	M.A. HOY	M.A. HOY	D.G. STEVENS	M.S. TURNBOW	J.C.KAMMEYER

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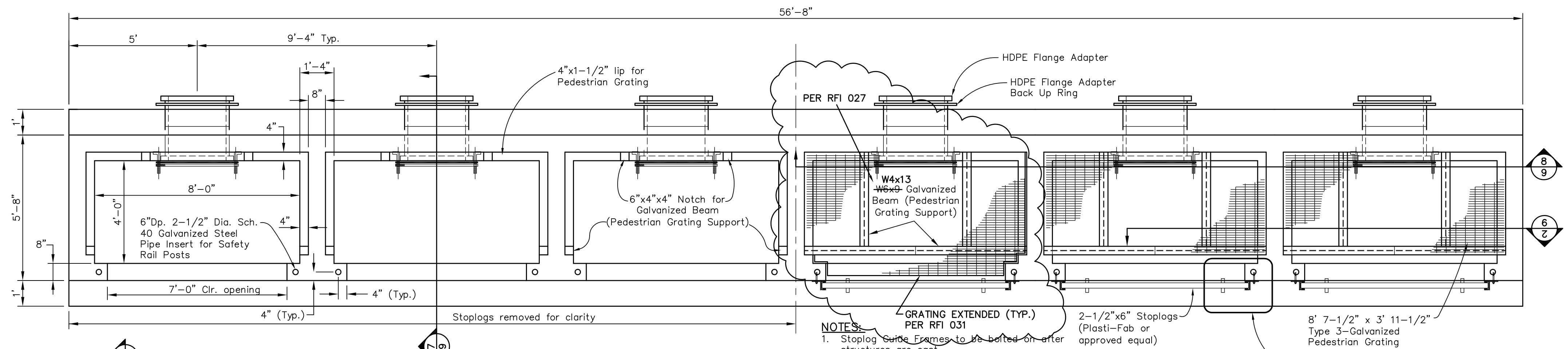
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 01/06/12 | 35 | C | 10W505-08 | R 2

STANTEC	2
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:1
W_TVA

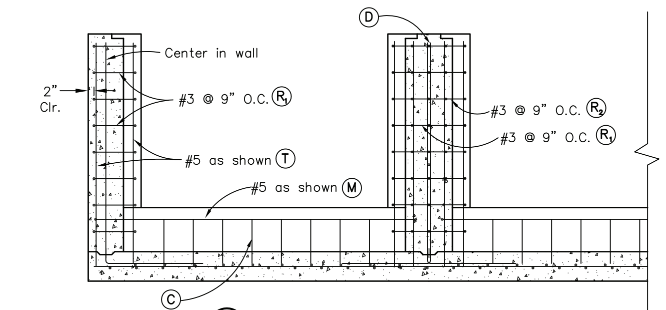
C.A.D. DRAWING DO NOT ALTER MANUALLY



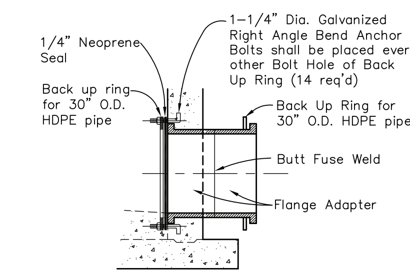
1/9 PLAN – CONCRETE INLET STRUCTURES
SCALE: 1/2"=1'-0"

NOTES:

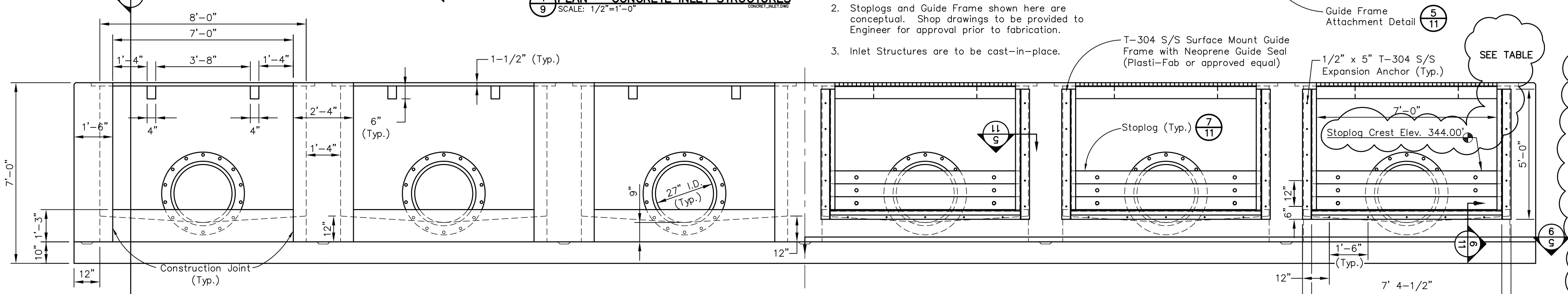
1. Stoplog Guide Frames to be bolted on after structures are cast.
2. Stoplogs and Guide Frame shown here are conceptual. Shop drawings to be provided to Engineer for approval prior to fabrication.
3. Inlet Structures are to be cast-in-place.



2/9 DETAIL – FRONT WALL REINFORCEMENT
SCALE: 1/2"=1'-0"



4/9 DETAIL – PIPE CONNECTION
SCALE: 1/2"=1'-0"



3/9 ELEVATION – CONCRETE INLET STRUCTURES
SCALE: 1/2"=1'-0"

AS-BUILT STOPLOG CREST ELEVATIONS

STRUCTURE	ELEVATION	STRUCTURE	ELEVATION
A1	343.90	D1	343.90
	343.90		343.90
	343.90		343.90
	343.90		343.89
	343.90		343.89
B1	343.89	E1	343.88
	343.89		343.88
	343.89		343.88
	343.88		343.87
	343.87		343.88
C1	343.90	F1	343.89
	343.90		343.90
	343.90		343.90
	343.89		343.90
	343.89		343.90

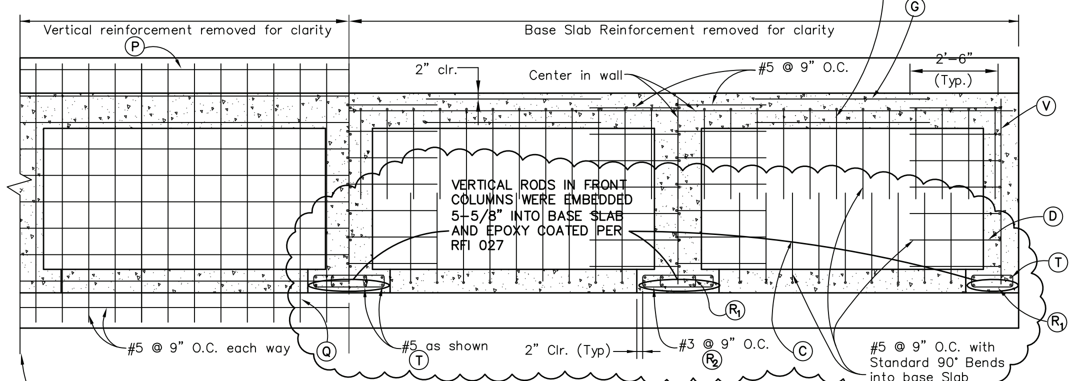
NOTE: STRUCTURES AND ELEVATIONS ARE FROM WEST TO EAST

Bill of Reinforcement - Inlet Structures

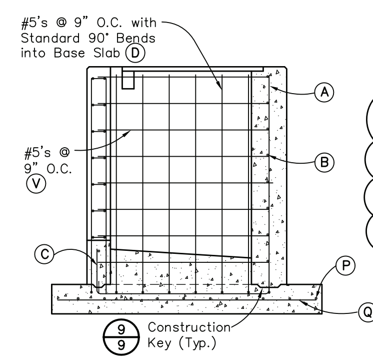
Mark	Bar No.	Qty.	Length Feet	Length Inches
A	5	72	8	8
B	5	8	56	0
C	5	54	3	9
D	5	84	8	8
G	5	48	4	0
H	5	12	4	0
M	5	6	9	0
P	5	10	56	0
Q	5	72	7	4
R_1	3	56	2	11
R_2	3	40	5	4
T	5	48	6	3
V	5	56	5	3

NOTE:

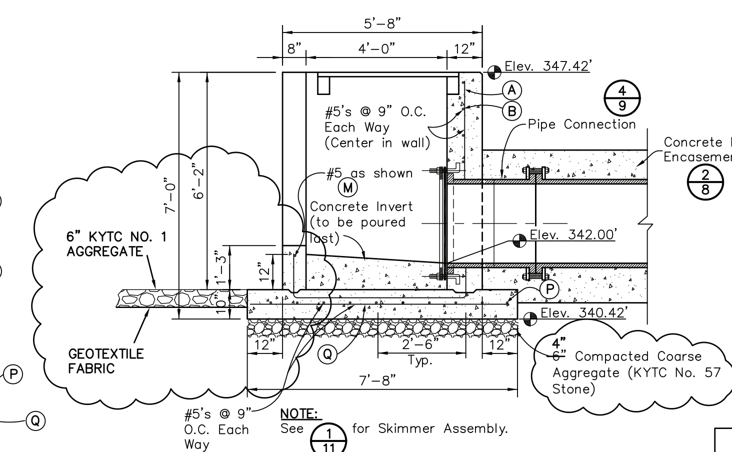
1. Total lengths shown for reference only; complete steel reinforcement and bent bar list to be provided by supplier prior to fabrication.



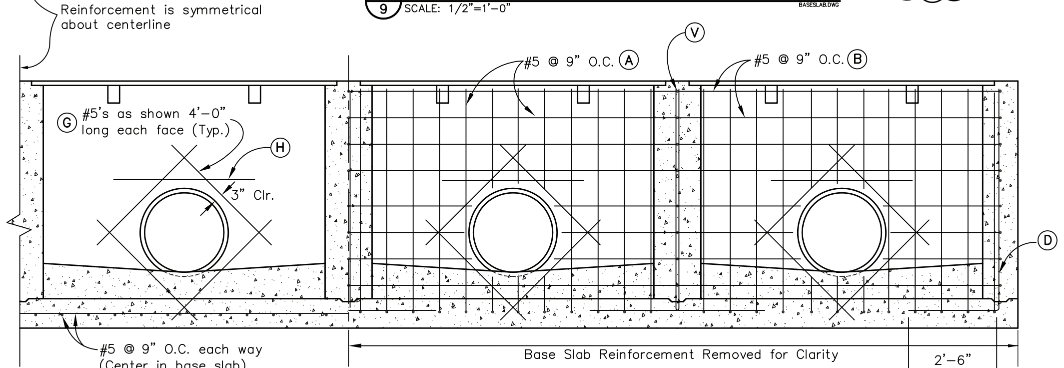
5/9 DETAIL – BASE SLAB AND VERTICAL REINFORCEMENT
SCALE: 1/2"=1'-0"



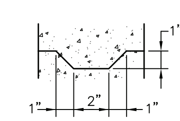
6/9 SECTION – END WALL
SCALE: 1/2"=1'-0"



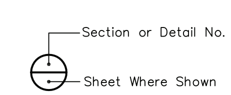
7/9 SECTION – CONCRETE INLET STRUCTURE
SCALE: 1/2"=1'-0"



8/9 DETAIL – REAR WALL REINFORCEMENT
SCALE: 1/2"=1'-0"



9/9 DETAIL – CONSTRUCTION KEY
SCALE: 3"=1'-0"



REFERENCE KEY

RECORD DRAWING NOTES:

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2. Items shown on the "record drawing" with clouded notation are items for which as-built information was available. All other items are shown for reference as they were in the "issued for construction" plan set.

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

RECORD DRAWING

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD
R 1	01/06/12	GJW	TMM	MAH	MAH	SHB	JSM	TJ
	RECORD DRAWING							
R 0	05/04/10	LJW	TMM	MAH	MAH	SHB	JSM	TJ
	ISSUED FOR CONSTRUCTION							

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
PRIMARY SPILLWAY DETAILS
WORK PLAN 5 (SHF-100504-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L. WRIGHT	T. MYERS	M. HOY	M. HOY	S. BICKEL	J. MONTGOMERY	T. JOHNSON

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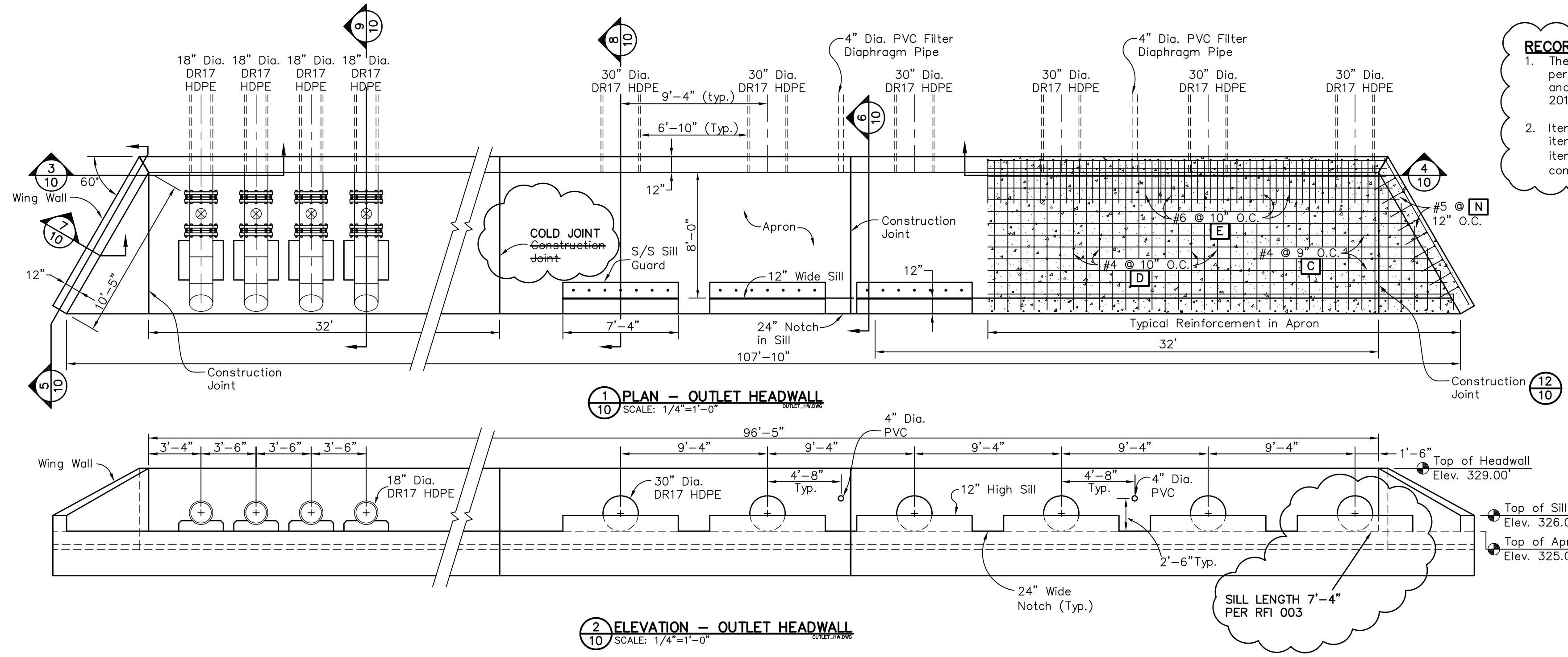
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 01/06/12 | 35 | C | 10W505-09 | R 1

STANTEC | 1
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

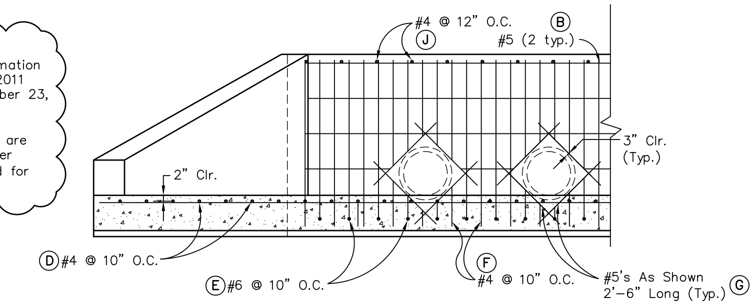


1 PLAN – OUTLET HEADWALL
SCALE: 1/4"=1'-0"

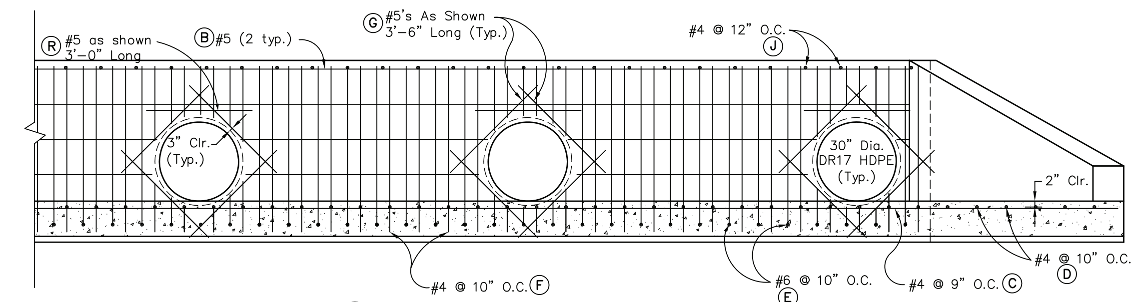
2 ELEVATION – OUTLET HEADWALL
SCALE: 1/4"=1'-0"

RECORD DRAWING NOTES:

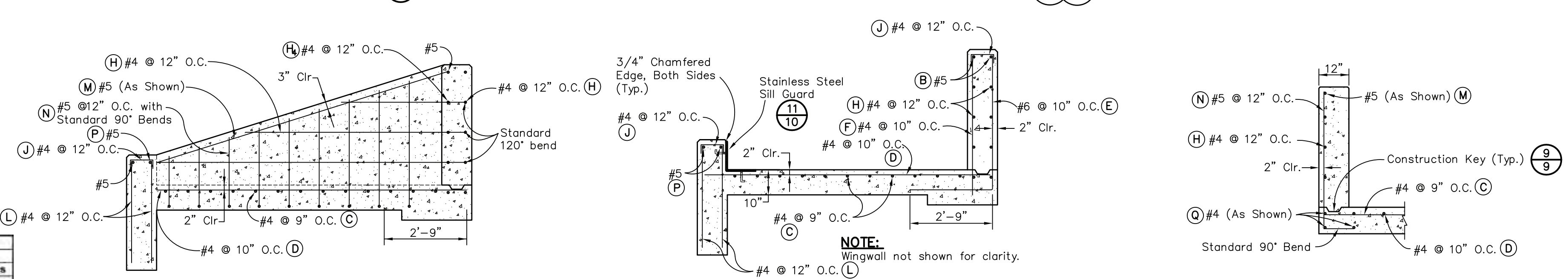
1. These drawings have been prepared based on survey information performed by TVA Surveying in November and December, 2011 and provided to Stantec on December 7, 2011 and December 23, 2011 .
2. Items shown on the "record drawing"with clouded notation are items for which as-built information was available. All other items are shown for reference as they were in the "issued for construction" plan set.



3 DETAIL – SECTION THROUGH SIPHON WALL
SCALE: 1/2"=1'-0"



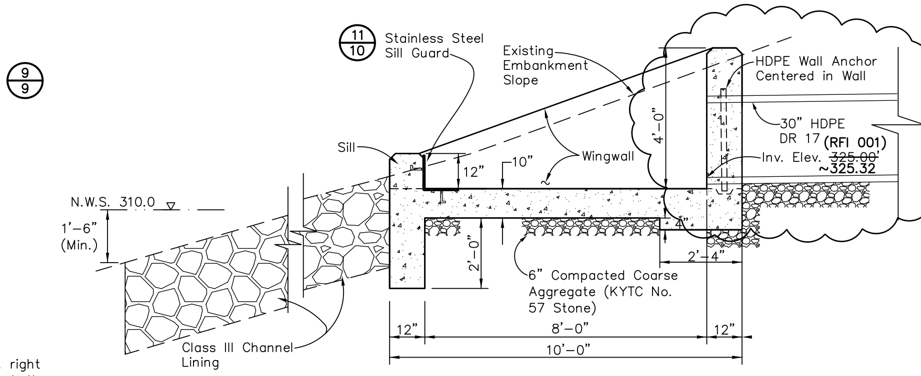
4 DETAIL – SECTION THROUGH SPILLWAY WALL
SCALE: 1/2"=1'-0"



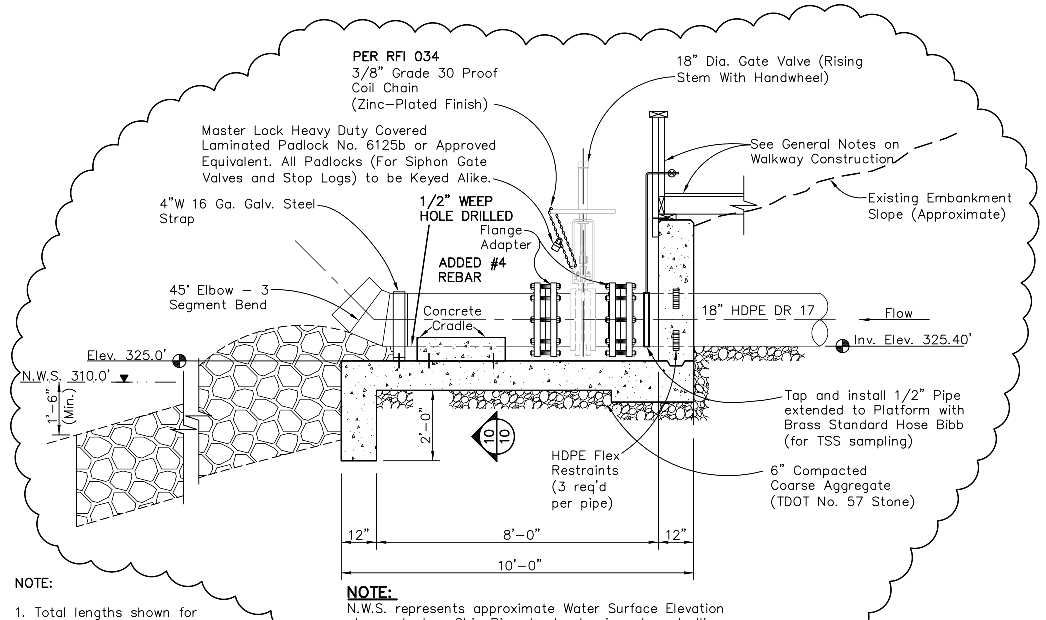
5 SECTION – WINGWALL REINFORCEMENT
SCALE: 1/2"=1'-0"

6 DETAIL – SECTION THROUGH OUTLET WALL
SCALE: 1/2"=1'-0"

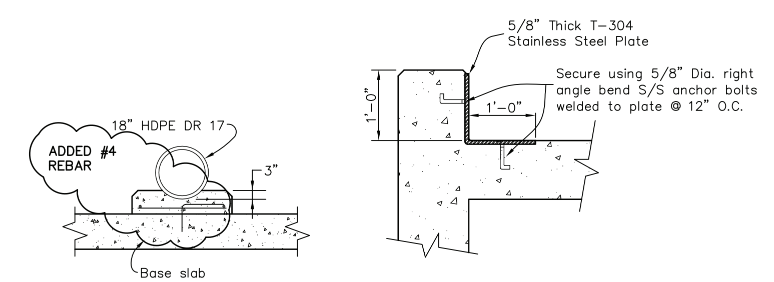
7 SECTION – WINGWALL REINFORCEMENT
SCALE: 1/2"=1'-0"



8 SECTION – OUTLET HEADWALL (PERMANENT SPILLWAYS)
SCALE: 1/2"=1'-0"



9 SECTON – OUTLET HEADWALL (SIPHON PIPING)
SCALE: 1/2"=1'-0"



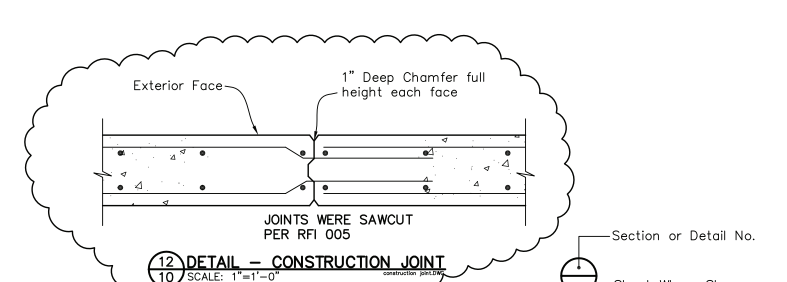
10 SECTION – CONCRETE CRADLE
SCALE: 1/2"=1'-0"

11 DETAIL – STAINLESS STEEL SILL GUARD
SCALE: 1"=1'-0"

Bill of Reinforcement - Outlet Headwall				
			Length	
Mark	Bar No.	Qty.	Feet	Inches
B	5	2	97	0
C_1	4	1	98	4
C_2	4	1	99	2
C_3	4	1	100	1
C_4	4	1	100	11
C_5	4	1	101	10
C_6	4	1	102	8
C_7	4	1	103	6
C_8	4	1	104	5
C_9	4	1	105	3
C_{10}	4	1	106	2
C_{11}	4	1	107	0
D_1	4	2	1	0
D_2	4	2	2	5
D_3	4	2	3	11
D_4	4	2	5	4
D_5	4	2	6	9
D_6	4	2	8	3
D_7	4	118	9	6
E	6	118	7	3
F	4	118	4	8
G	5	48	3	6
H_1	4	1	104	6
H_2	4	1	112	6
H_3	4	1	118	6
H_4	4	3	96	6
J	4	203	1	3
L	4	214	3	4
M	5	2	10	0
N_1	5	2	3	2
N_2	5	2	3	6
N_3	5	2	3	10
N_4	5	2	4	1
N_5	5	2	4	5
N_6	5	2	4	9
N_7	5	2	5	0
N_8	5	2	5	4
N_9	5	2	5	8
P	5	2	108	0
Q	4	6	10	5
R	5	12	3	0

NOTE:

1. Total lengths shown for reference only; complete steel reinforcement and bent bar list to be provided by supplier prior to fabrication.



12 DETAIL – CONSTRUCTION JOINT
SCALE: 1"=1'-0"

REFERENCE KEY

RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 1	01/06/12	GJW	TMM	MAH	MAH	SNB	JSM	TJ	–	–
	RECORD DRAWING									
R 0	05/04/10	LJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–
	ISSUED FOR CONSTRUCTION									

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
OUTLET HEADWALL DETAILS
WORK PLAN 5 (SHF–100504–WP–5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L. WRIGHT	T. MYERS	M. HOY	M. HOY	S. BICKEL	J. MONTGOMERY	T. JOHNSON

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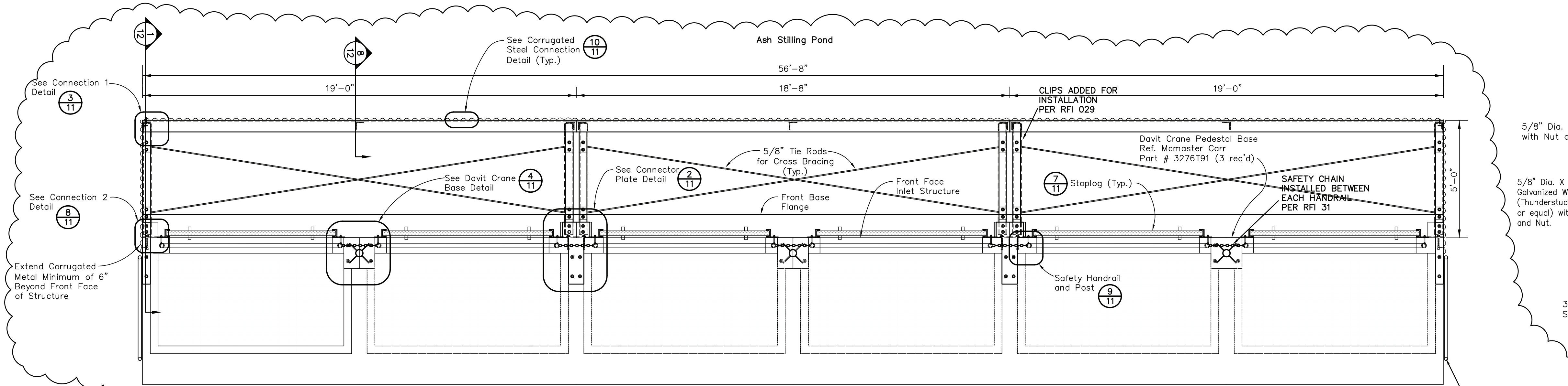
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 01/06/12 | 35 | C | 10W505–10 | R 1

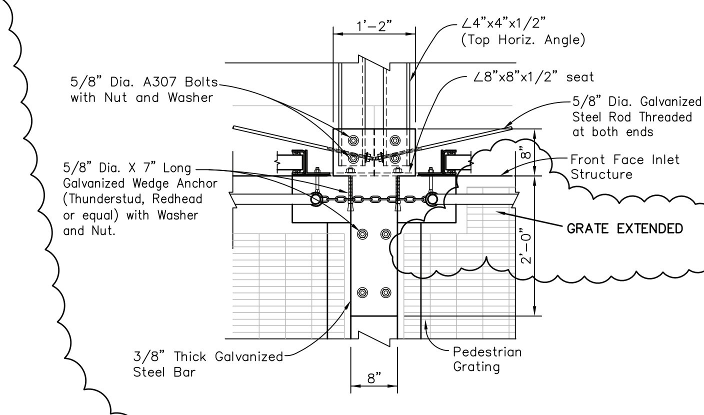
PLOT FACTOR:1
W_TVA

STANTEC 1
TASK COMPLETED BY: REV NO.

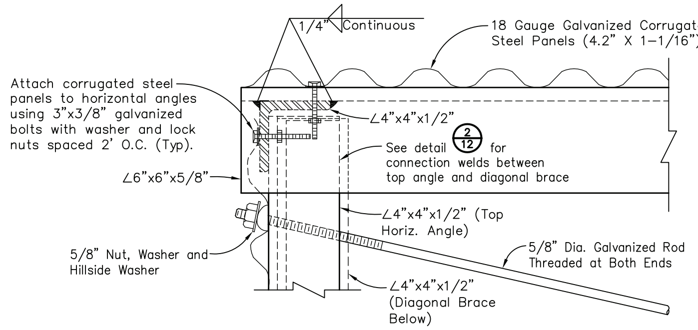
C.A.D. DRAWING
DO NOT ALTER MANUALLY



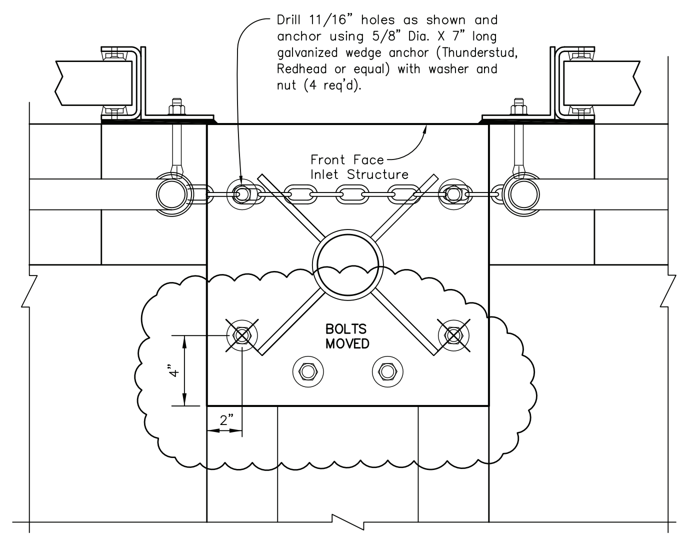
1 PLAN – STEEL SKIMMER ASSEMBLY
SCALE: 1/2"=1'-0"



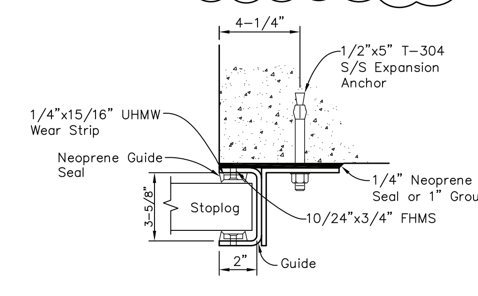
2 DETAIL – STEEL CONNECTOR PLATE
SCALE: 1"=1'-0"



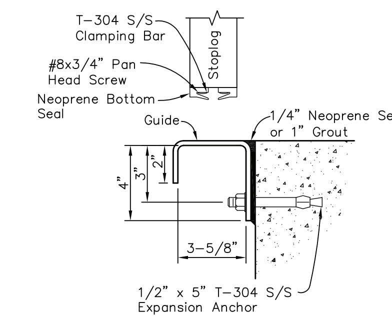
3 DETAIL – CONNECTION 1
SCALE: 3"=1'-0"



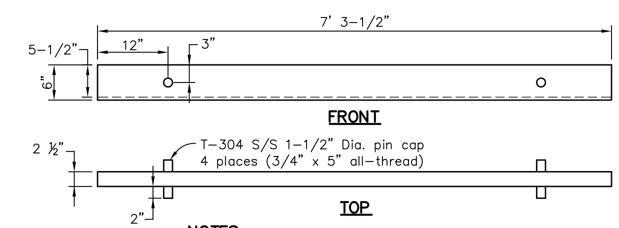
4 DETAIL – DAVIT CRANE BASE
SCALE: 3"=1'-0"



5 DETAIL – STOPLOG GUIDE FRAME SIDE MOUNT
NOT TO SCALE

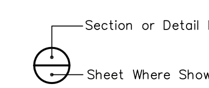


6 DETAIL – STOPLOG GUIDE FRAME BASE MOUNT
NOT TO SCALE



NOTES:
1. Guide frame material is formed and welded T-304 S/S or Engineer approved equivalent.
2. Stoplog is FRP (Fiberglass Reinforced Polyester) with internal steel reinforcing.
3. All hardware is T-304 S/S.
4. Details shown here are per Plasti-Fab, Inc.

7 DETAIL – STOPLOG
NOT TO SCALE



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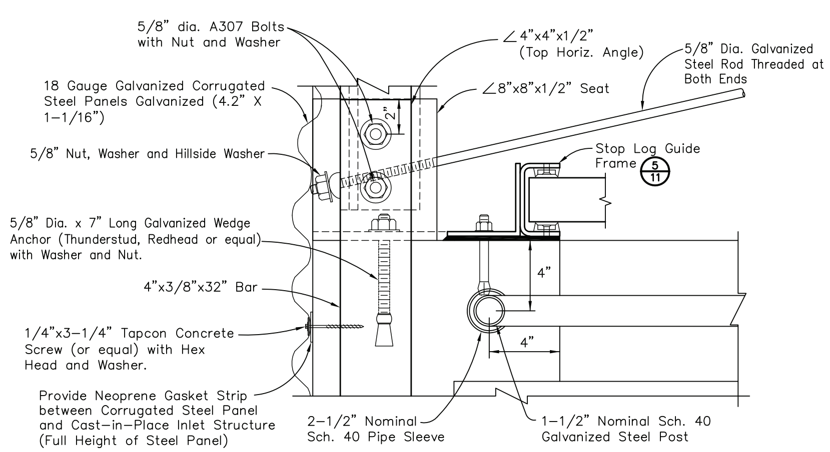
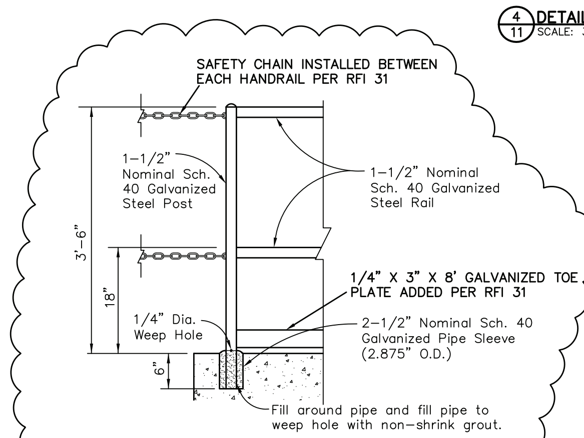
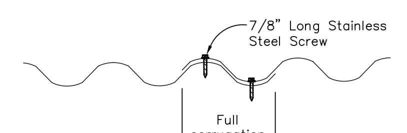


8 DETAIL – CONNECTION 2
SCALE: 3"=1'-0"



9 ELEVATION – SAFETY HANDRAIL AND POST
SCALE: 1"=1'-0"



NOTE:
Side laps should be fastened at 12" O.C. with 7/8" long self drilling, self tapping, needlepoint stainless steel stitch screw. Provide Neoprene gasket between all side laps and all connections to skimmer structure.

10 DETAIL – CORRUGATED STEEL CONNECTION
NOT TO SCALE

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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 1	01/06/12	GJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–
	RECORD DRAWING									
R 0	05/04/10	LJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–
	ISSUED FOR CONSTRUCTION									

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
STEEL SKIMMER DETAILS
WORK PLAN 5 (SHF-100504-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

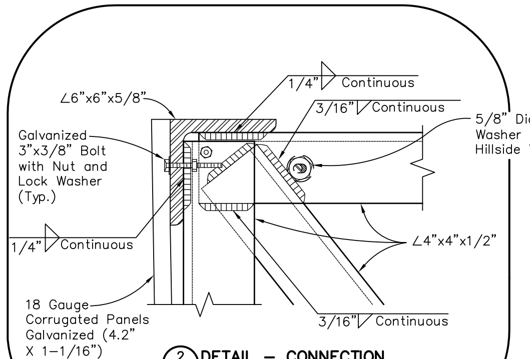
AUTOCAD R 2000 | DATE 01/06/12 | 35 | C | 10W505-11 | R 1

PLOT FACTOR:1
W_TVA

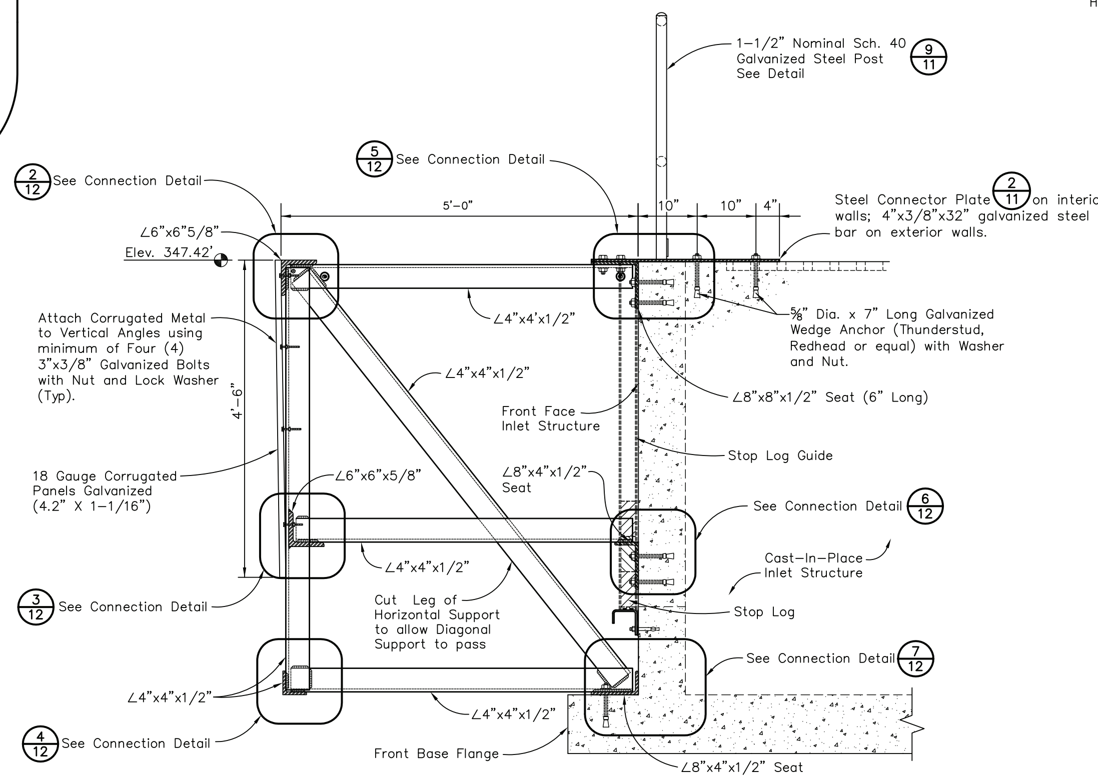
STANTEC | 1
TASK COMPLETED BY: | REV NO.

C.A.D. DRAWING DO NOT ALTER MANUALLY

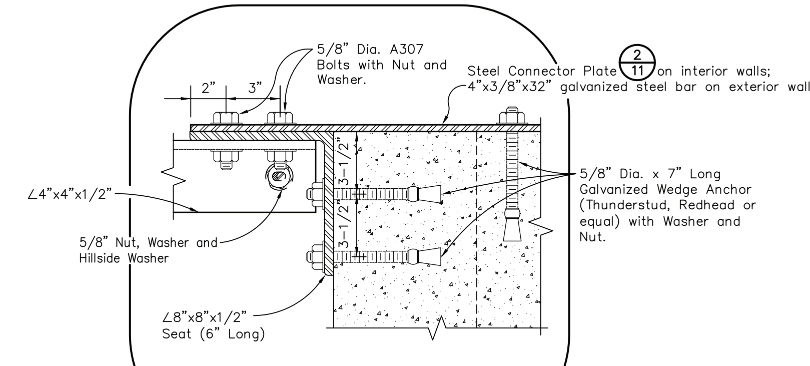
35	C
10W505-12	



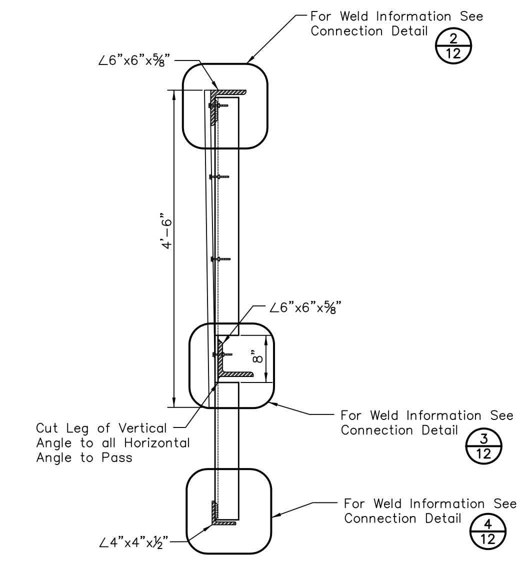
2/12 DETAIL – CONNECTION
SCALE: 1"=1'-0"



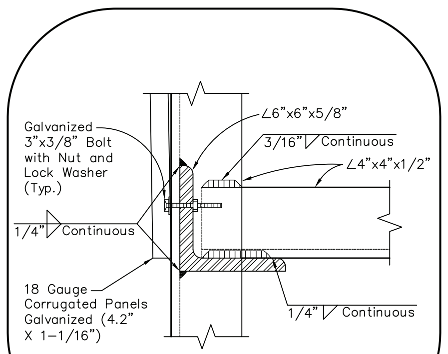
1/12 DETAIL – SKIMMER FRAME
SCALE: 1"=1'-0"



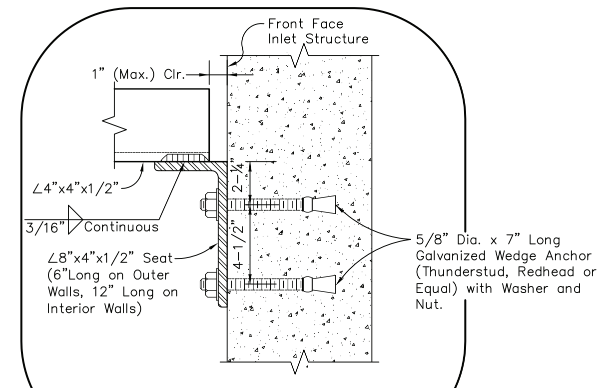
5/12 DETAIL – CONNECTION
SCALE: 3"=1'-0"



8/12 DETAIL – SKIMMER FRAME
SCALE: 1"=1'-0"



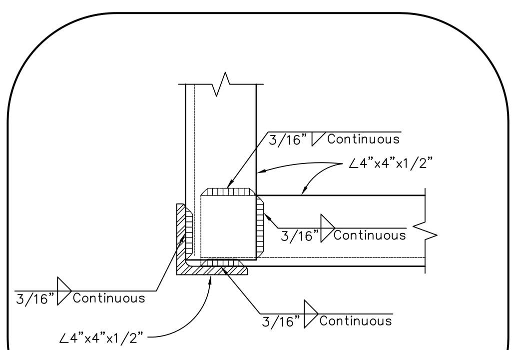
3/12 DETAIL – CONNECTION
SCALE: 1"=1'-0"



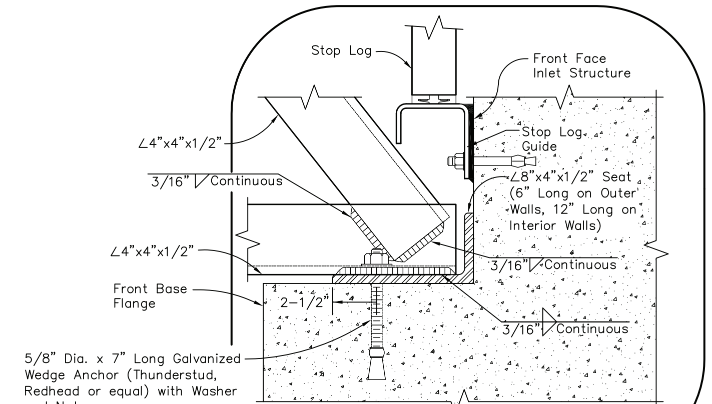
6/12 DETAIL – CONNECTION
SCALE: 3"=1'-0"

NOTES:

1. Preparation of Base Metal prior to Welding shall be performed in accordance with AWS D1.1.
2. All Welding shall be done by the Shielded Metal Arc Welding (SMAW) Process.
3. The Details shown shall be used to construct all parts of the Steel Skimmer Frame, but the Legs of the Angle Supports for alternating Frames shall oppose one another directionally (Mirror Image) as shown on the Plan View.



4/12 DETAIL – CONNECTION
SCALE: 1"=1'-0"



7/12 DETAIL – CONNECTION
SCALE: 3"=1'-0"

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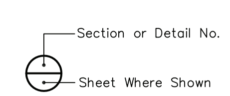

REFERENCE KEY

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
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RECORD DRAWING										
R 0	05/04/10	LJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–
ISSUED FOR CONSTRUCTION										

DISCIPLINE INTERFACE

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
STEEL SKIMMER DETAILS
WORK PLAN 5 (SHF-100504-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
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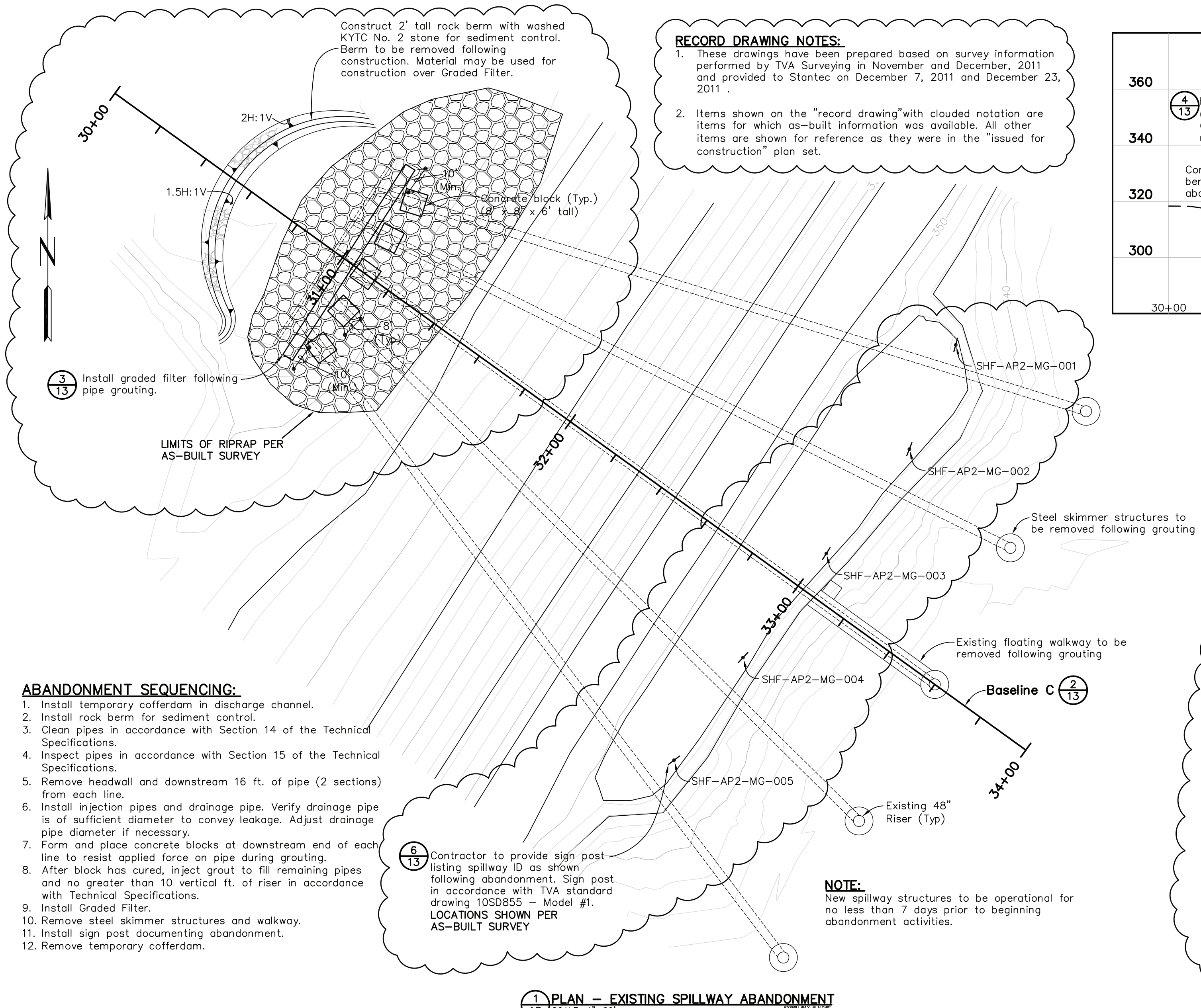
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 01/06/12	35	C	10W505-12	R 1

STANTEC	1
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



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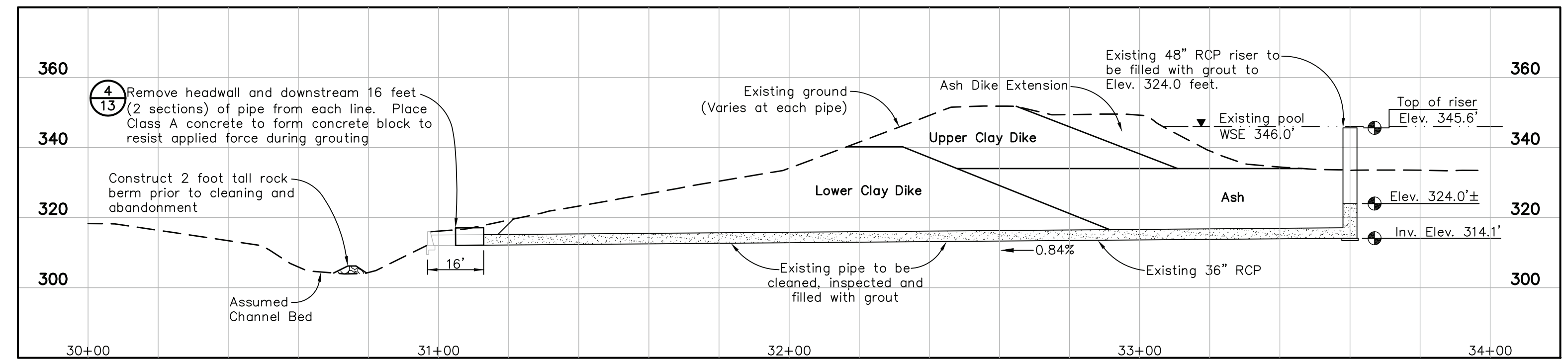
ABANDONMENT SEQUENCING:

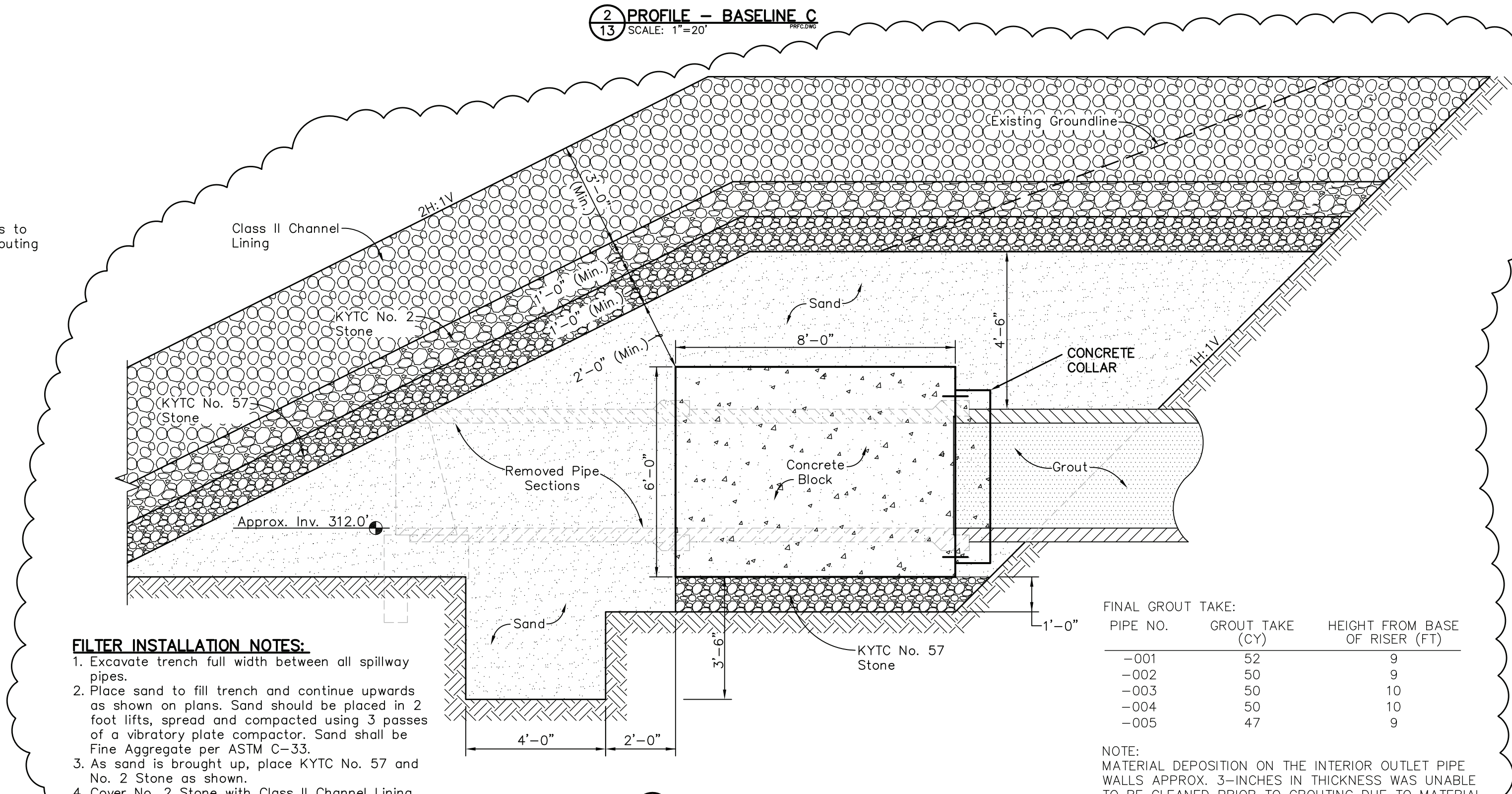
1. Install temporary cofferdam in discharge channel.
2. Install rock berm for sediment control.
3. Clean pipes in accordance with Section 14 of the Technical Specifications.
4. Inspect pipes in accordance with Section 15 of the Technical Specifications.
5. Remove headwall and downstream 16 ft. of pipe (2 sections) from each line.
6. Install injection pipes and drainage pipe. Verify drainage pipe is of sufficient diameter to convey leakage. Adjust drainage pipe diameter if necessary.
7. Form and place concrete blocks at downstream end of each line to resist applied force on pipe during grouting.
8. After block has cured, inject grout to fill remaining pipes and no greater than 10 vertical ft. of riser in accordance with Technical Specifications.
9. Install Graded Filter.
10. Remove steel skimmer structures and walkway.
11. Install sign post documenting abandonment.
12. Remove temporary cofferdam.

NOTE:
New spillway structures to be operational for no less than 7 days prior to beginning abandonment activities.

(1/13) PLAN – EXISTING SPILLWAY ABANDONMENT
SCALE: 1"=20'



(2/13) PROFILE – BASELINE C
SCALE: 1"=20'



FILTER INSTALLATION NOTES:

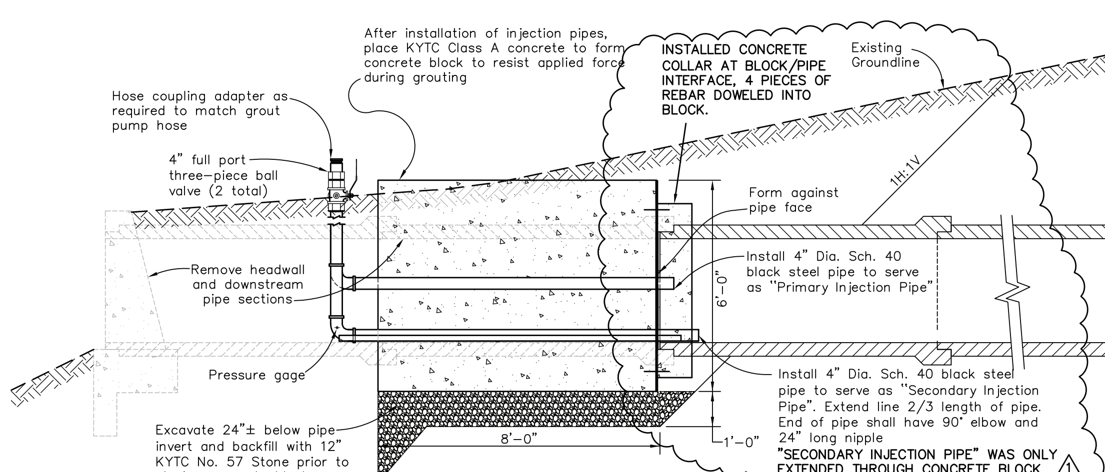
1. Excavate trench full width between all spillway pipes.
2. Place sand to fill trench and continue upwards as shown on plans. Sand should be placed in 2 foot lifts, spread and compacted using 3 passes of a vibratory plate compactor. Sand shall be Fine Aggregate per ASTM C-33.
3. As sand is brought up, place KYTC No. 57 and No. 2 Stone as shown.
4. Cover No. 2 Stone with Class II Channel Lining.

FINAL GROUT TAKE:

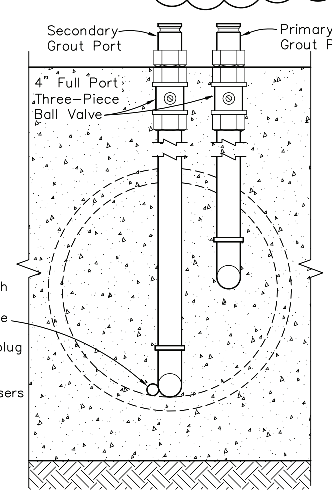
PIPE NO.	GROUT TAKE (CY)	HEIGHT FROM BASE OF RISER (FT)
-001	52	9
-002	50	9
-003	50	10
-004	50	10
-005	47	9

NOTE:
MATERIAL DEPOSITION ON THE INTERIOR OUTLET PIPE WALLS APPROX. 3-INCHES IN THICKNESS WAS UNABLE TO BE CLEANED PRIOR TO GROUTING DUE TO MATERIAL HARDNESS. DEPOSITION WAS THUS LEFT IN PLACE, THEREFORE REDUCING REQUIRED GROUT TAKE IN EACH PIPE.

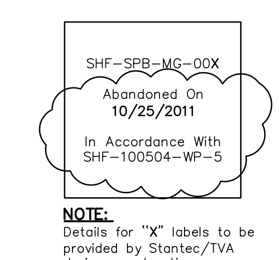
(3/13) DETAIL – GRADED FILTER
SCALE: 1/2"=1'-0"



(4/13) DETAIL – CONCRETE BLOCK AND PIPE GROUTING
SCALE: 1/2"=1'-0"



(5/13) DETAIL – GROUT PORT DETAIL
NOT TO SCALE



NOTE:
Details for "X" labels to be provided by Stantec/TVA during construction.

(6/13) DETAIL – SIGNAGE LAYOUT
NOT TO SCALE

Section or Detail No.
Sheet Where Shown
REFERENCE KEY

RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 1	01/06/12	GJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–
RECORD DRAWING										
R 0	05/04/10	LJW	TMM	MAH	MAH	SHB	JSM	TJ	–	–
ISSUED FOR CONSTRUCTION										

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
SPILLWAY ABANDONMENT DETAILS
WORK PLAN 5 (SHF-100504-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L. WRIGHT	T. MYERS	M. HOY	M. HOY	S. BICKEL	J. MONTGOMERY	T. JOHNSON

Stantec Consulting Services Inc.
1859 Bowles Ave., Ste 250
St. Louis, Missouri 63026-1944
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Fax 636.343.3554
www.stantec.com

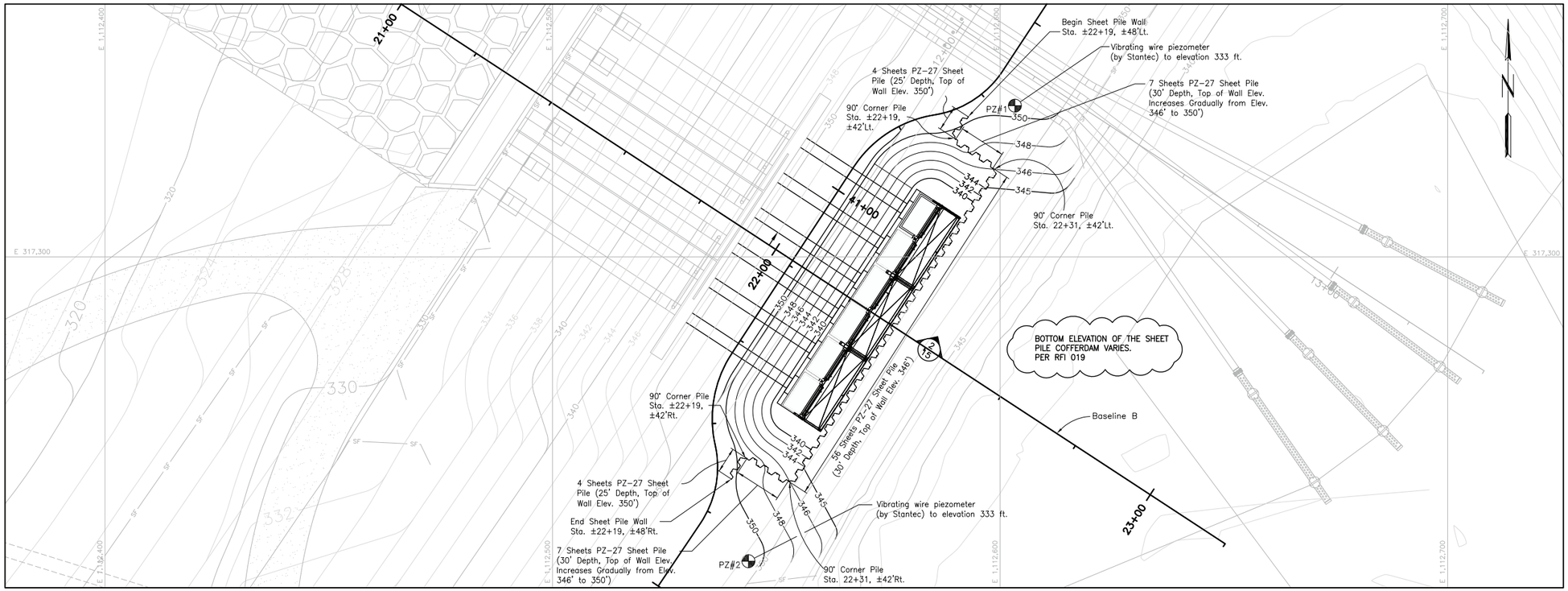
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 01/06/12 | 35 | C | 10W505-13 | R 1

PLOT FACTOR:1
W_TVA

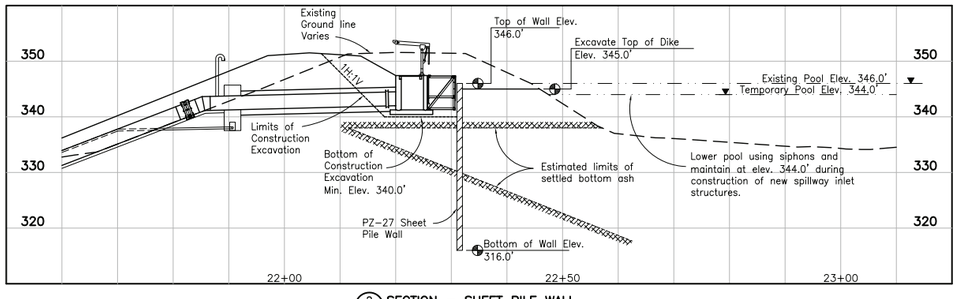
STANTEC | 1
TASK COMPLETED BY: | REV NO.

C.A.D. DRAWING
DO NOT ALTER MANUALLY

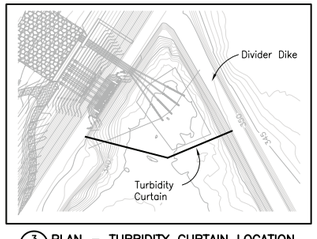


PZ #	COORDINATES	
	N	E
1	317,333.76	1,112,603.30
2	317,232.07	1,112,543.77

1/15 **PLAN – TEMPORARY SHEET PILE COFFERDAM**
SCALE: 1"=10'
Note:
See Sheet 10W505-04 for Baseline B coordinates.



2/15 **SECTION – SHEET PILE WALL**
SCALE: 1"=10'



3/15 **PLAN – TURBIDITY CURTAIN LOCATION**
NOT TO SCALE

NOTE:
Revised construction approach shown on Sheet 15 added following concerns with ability to meet permitted limits for total suspended solids (TSS) at Outfall 001 during drawdown as detailed in Technical Specifications.

RECORD DRAWING NOTES:
1. These drawings have been prepared based on survey information performed by TVA Surveying in November and December, 2011 and provided to Stantec on December 7, 2011 and December 23, 2011 .
2. Items shown on the "record drawing"with clouded notation are items for which as-built information was available. All other items are shown for reference as they were in the "issued for construction" plan set.

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423.751.8416 OR 423.751.2571) SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

Bill of Materials	
Quantity	Description
8	PZ-27 Sheet Pile – 25 ft Long
66	PZ-27 Sheet Pile – 30 ft Long
2*	PZ-27 Female Corner Pile – 30 ft Long
2*	PZ-27 Male Corner Pile – 30 ft Long

*90' Corner Pile may be substituted for male and female corner piles. If so, (4) additional PZ-27 Sheet Pile – 30 ft long will be required.

MAPPING NOTE:
Topographic mapping shown on this layout was generated from surveys dated December 2009 and January 2010 and supplied by Tennessee Valley Authority (TVA). Horizontal coordinates are referenced to Kentucky South State Plane Coordinate System (Lambert), NAD 27. Elevations are based on NGVD 29.

Legend
- Existing Contours
- Proposed Contours
- Water Surface
- SF Silt Fence

GRAPHIC SCALE: 1" = 10'
CONTOUR INTERVAL = 2'
5 0 10 20 FEET

GENERAL PROVISIONS

1. The proposed project shown on this revision sheet 10W505-15 includes the installation of a cantilever sheet pile wall around the planned spillway structure excavation to allow for construction of the inlet structures in the dry. Specific sequencing of the planned activities to construct the sheet pile wall is described in the Sheet Pile Installation Sequencing notes shown on this drawing.
2. Refer to Sheets 10W505-02 and 10W505-03 for additional notes and technical specifications.
3. At least 10 working days prior to start of work, the Contractor shall submit to the Owner and Engineer supplier certifications stating that the sheet pile used on this project complies with the plans and notes included herein.
4. The Engineer shall provide full time observation during pile installation and regrading efforts to confirm that sequencing, materials, installation depths and alignment, and the inlet structure excavation are performed in accordance with the plans and specifications presented herein.
5. Vibrating wire piezometers to be installed 1 week prior to beginning pile installation and monitored throughout pile installation.
6. Turbidity curtain shall be 5' depth, flow-through type in accordance with Technical Specifications. Contractor to submit specifications to Engineer for approval prior to construction.

STEEL SHEET PILES

7. Sheet piles shall be handled and stored in such a manner as to avoid damage.
8. Sheet piles shall be PZ-27 sections and shall conform to ASTM A572 Grade 50.
9. The steel sheet piles shall be driven with a vibratory, impact or gravity hammer specifically designed for pile driving. In order to maintain satisfactory alignment, the sheet piles shall be driven in such increments of penetration as necessary to prevent distortion, twisting, out of position or pulling apart at the interlocks. Driving operations shall be continuous except when interrupted by an emergency. If the installed sheet piles are appreciably or otherwise damaged, the damaged piles shall be removed and replaced.
10. Tolerance for plumbness shall be ¼" per foot in directions parallel and perpendicular to the wall. Tolerance for the top of sheet piles shall be ±4 inches of final top elevation as shown herein. All sheeting outside of these tolerances shall be removed and redriven.
11. A fixed template shall be constructed and utilized when driving the sheet piles. The template shall provide a guide to achieve proper sheet pile alignment and shall remain in place until all sheet piles have been driven.

SHEET PILE INSTALLATION SEQUENCING

1. Install turbidity curtain.
2. Lower ash pond pool using siphons and maintain at Elev. 344 feet or as otherwise directed by the Engineer throughout construction of the sheet pile wall and inlet structures.
3. Excavate upstream portions of the existing dike to Elev. 345 feet, grading up on either end of the planned sheet pile wall as shown on the plan view.
4. Install sheet pile wall as shown on the plan view and cross-section to the depths and top of wall elevations provided.
5. Excavate and install pipe sections from bulkhead at filter diaphragm to back of inlet structure and encase in concrete as shown on Sheet 10W505-08.
6. Backfill and compact embankment over pipes and encasements in accordance with specifications.
7. Excavate remaining limits of inlet structure construction excavation downstream of the sheet pile wall following grading plan and limits shown on the plan view. Excavation shall not occur below elevation 340 ft and no more than 5 ft of differential soil elevation will be maintained along length of sheet pile wall at any time during construction.
8. Install inlet structures and stoplogs.
9. Construct final backfill along downstream and sides of inlet structures as shown on Sheet 10W505-05.
10. Notify plant and temporarily lower pool using siphons and maintain at Elev. 340 feet during rock apron construction.
11. Excavate upstream of the sheet pile wall to construct the rock apron as shown on Sheet 10W505-05. During remaining excavation operations and rock apron construction, cut the top of the sheet pile wall down to match the proposed final grades and install steel skimmer on upstream face of inlet structures.
12. Raise ash pond to final pool level at Elev. 344.5 feet.

RECORD DRAWING

Section or Detail No.
Sheet Where Shown
REFERENCE KEY

For Supporting Design Calculations see FPGSHFFESCDX000000020100001

REV NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV NO.
R 1	01/06/12	GJW	TMM	MAH	MAH	DGS	MST	JCK	–	–	–
RECORD DRAWING											
R 0	12/09/10	NAB	TMM	MAH	MAH	DGS	MST	JCK	–	–	–
ISSUED FOR CONSTRUCTION											

DISCIPLINE INTERFACE

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
ASH DISPOSAL AREA NO. 2

SPILLWAY REPLACEMENT PROJECT
TEMPORARY SHEET PILE COFFERDAM
WORK PLAN 5 (SHF-100504-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L.J. PERKINS	T.M. MYERS	M.A. HOY	M.A. HOY	D.G. STEVENS	M.S. TURNBOW	J.C. KAMMEYER

Stantec Consulting Services Inc.
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SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 01/06/12	35	C	10W505-15	R 1

STANTEC | 1
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:10
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

APPENDIX F
RATING CURVES

Rating Curves - HEC-HMS Input
Inflow Design Flow Control System Plan
Ash Pond 2, Shawnee Fossil Plant
Project Number: 175555010
Calculation Performed by: JJR Calculation Date: 2/17/2016
Checked by: Checked By Date:

Elevation	Discharge (cfs) (1)	Storage (acre-ft)
343.90	0.00	233.42
344.00	4.35	236.44
344.50	64.02	251.96
345.00	146.36	267.47
345.50	165.96	283.47
346.00	183.47	299.47
346.50	199.45	315.90
347.00	214.25	332.34
347.50	228.08	349.31
348.00	241.13	366.28
348.50	253.50	383.83
349.00	265.30	401.38
349.50	276.59	419.18
350.00	287.44	436.98
350.50	297.90	454.97
351.00	308.00	472.97

Notes:
1. Flow rate for 6 stoplogs

Rating Curves - HY-8 Output
Inflow Design Flow Control System Plan
Ash Pond 2, Shawnee Fossil Plant
Project Number: 175555010
Calculation Performed by: JJR Calculation Date: 2/17/2016
Checked by: Checked By Date:

HY-8 Output

Stoplog	
Q (cfs)(1)	**Headwater (ft)**
0	342
5	342.91
10	343.41
15	343.88
20	344.39
25	345
30	345.76
35	346.67
40	347.73
45	348.94
50	350.31
53.98	351.5

Notes:
1. Flow rate is for only 1 stop log

Rating Curve Development
Inflow Design Flow Control System Plan
Ash Pond 2, Shawnee Fossil Plant
Project Number: 175555010
Calculation Performed by: JJR Calculation Date: 2/17/2016
Checked by: Checked By Date:

Stoplog								
	Weir Flow		Pipe Orifice Flow		Outlet Pipe Flow (from HY-8)		Rating Curve for HEC-HMS	
Elevation	H (ft)	$Q=Cw(L - .02H)H^{1.5}$ (cfs)	H_c (ft)	$Q=C_0A(2gH_c)^{0.5}$ (cfs)	Assumed TW (ft)	Q (cfs)	HW Elevation (ft)	Q (cfs)
343.50	0.00	0.00	0.25	9.22	337	12.70	343.50	0.00
344.00	0.10	0.72	0.75	15.97	337	16.18	344.00	0.72
344.50	0.60	10.67	1.25	20.62	337	20.90	344.50	10.67
345.00	1.10	26.54	1.75	24.39	337	25.00	345.00	24.39
345.50	1.60	46.63	2.25	27.66	337	28.29	345.50	27.66
346.00	2.10	70.18	2.75	30.58	337	31.32	346.00	30.58
346.50	2.60	96.73	3.25	33.24	337	34.07	346.50	33.24
347.00	3.10	125.93	3.75	35.71	337	36.56	347.00	35.71
347.50	3.60	157.52	4.25	38.01	337	38.92	347.50	38.01
348.00	4.10	191.27	4.75	40.19	337	41.12	348.00	40.19
348.50	4.60	226.98	5.25	42.25	337	43.18	348.50	42.25
349.00	5.10	264.47	5.75	44.22	337	45.22	349.00	44.22
349.50	5.60	303.56	6.25	46.10	337	47.04	349.50	46.10
350.00	6.10	344.11	6.75	47.91	337	48.87	350.00	47.91
350.50	6.60	385.95	7.25	49.65	337	50.64	350.50	49.65
351.00	7.10	428.94	7.75	51.33	337	52.31	351.00	51.33

Notes:

1. The computed values are for one (1) stoplog - flowrates are assumed to be the same for all 6 stoplogs.
2. Cells highlighted in yellow are limiting flows and were used in developing rating curve.

Rating Curve Inputs
Inflow Design Flow Control System Plan
Ash Pond 2, Shawnee Fossil Plant
Project Number: 175555010
Calculation Performed by: JJR Calculation Date: 2/17/2016
Checked by: Checked By Date:

Ash Pond 2 Outlet Structure

Stoplog*			Data Source
Weir Elev=	343.9	feet	1
Weir L =	7	feet	1
Pipe Inlet=	342	feet	1
Pipe Outlet=	341.14	feet	1
Pipe Inside D=	2.19	feet	2
Length=	34	feet	1
C_w=	Varies		C_w=3.27+0.4(H/H_c (Chow 1959 - Assumed to behave as sharp crested weir - contraction)
H_c=	3.58		1 (Hight of the weir crest above the structure base)
C_0=	0.61		(Based on Brater and King 1976)

Computed Values			Equation/Comment
L_{weir}=	7	feet	Reference 1
A_{pipe}=	3.766848	sq. ft.	Area = PI*D^2/4
Elev C**=	343.25	feet	Pipe Outside diameter = 2.5 feet

References:

1 Spillway Replacement Project Ash Disposal Area No. 2 Work Plan 5 record drawings dated 2011
2 JM Eagle, Polyethylene Water and Sewer Pipe for Municipal & Industrial Applications

Notes:

* Stoplog data applies to all 6 Stoplogs
** "Elev C" is the elevation of centerline of the outlet pipe inlet

APPENDIX G
PRECIPITATION DATA

1000-year 6-hour Rainfall Depth 7.32

From Isopluvial Map

1000-year 6-hour SCS Type II "Late Peak" Hydrograph		
Time	Incremental Depth	Cumulative Depth
0	0	0
0.1	0.032208	0.032208
0.2	0.03294	0.065148
0.3	0.03294	0.098088
0.4	0.03294	0.131028
0.5	0.03294	0.163968
0.6	0.03294	0.196908
0.7	0.033672	0.23058
0.8	0.033672	0.264252
0.9	0.033672	0.297924
1	0.034404	0.332328
1.1	0.034404	0.366732
1.2	0.035136	0.401868
1.3	0.035136	0.437004
1.4	0.035136	0.47214
1.5	0.035868	0.508008
1.6	0.037332	0.54534
1.7	0.037332	0.582672
1.8	0.038796	0.621468
1.9	0.038796	0.660264
2	0.039528	0.699792
2.1	0.04026	0.740052
2.2	0.041724	0.781776
2.3	0.042456	0.824232
2.4	0.043188	0.86742
2.5	0.046116	0.913536
2.6	0.046116	0.959652
2.7	0.04758	1.007232
2.8	0.04758	1.054812
2.9	0.049776	1.104588
3	0.049776	1.154364
3.1	0.052704	1.207068
3.2	0.053436	1.260504
3.3	0.055632	1.316136
3.4	0.056364	1.3725
3.5	0.057828	1.430328
3.6	0.060024	1.490352
3.7	0.06222	1.552572
3.8	0.064416	1.616988
3.9	0.06588	1.682868
4	0.068076	1.750944
4.1	0.071004	1.821948
4.2	0.0732	1.895148
4.3	0.076128	1.971276
4.4	0.079056	2.050332
4.5	0.082716	2.133048
4.6	0.087108	2.220156
4.7	0.089304	2.30946
4.8	0.099552	2.409012
4.9	0.101748	2.51076
5	0.1098	2.62056
5.1	0.119316	2.739876
5.2	0.126636	2.866512
5.3	0.148596	3.015108
5.4	0.17202	3.187128
5.5	0.196908	3.384036
5.6	0.245952	3.629988
5.7	0.493368	4.123356
5.8	0.791292	4.914648
5.9	0.985272	5.89992
6	1.42008	7.32

1000-year 6-hour SCS Type II "Middle Peak" Hydrograph		
Time	Incremental Depth	Cumulative Depth
0	0	0
0.1	0.03294	0.03294
0.2	0.033672	0.066612
0.3	0.03294	0.099552
0.4	0.03294	0.132492
0.5	0.03294	0.165432
0.6	0.033672	0.199104
0.7	0.033672	0.232776
0.8	0.035136	0.267912
0.9	0.037332	0.305244
1	0.039528	0.344772
1.1	0.04026	0.385032
1.2	0.042456	0.427488
1.3	0.046116	0.473604
1.4	0.04758	0.521184
1.5	0.049776	0.57096
1.6	0.052704	0.623664
1.7	0.055632	0.679296
1.8	0.060024	0.73932
1.9	0.064416	0.803736
2	0.068076	0.871812
2.1	0.0732	0.945012
2.2	0.079056	1.024068
2.3	0.089304	1.113372
2.4	0.099552	1.212924
2.5	0.1098	1.322724
2.6	0.119316	1.44204
2.7	0.245952	1.687992
2.8	0.493368	2.18136
2.9	0.791292	2.972652
3	1.42008	4.392732
3.1	0.985272	5.378004
3.2	0.196908	5.574912
3.3	0.17202	5.746932
3.4	0.148596	5.895528
3.5	0.126636	6.022164
3.6	0.101748	6.123912
3.7	0.087108	6.21102
3.8	0.082716	6.293736
3.9	0.076128	6.369864
4	0.071004	6.440868
4.1	0.06588	6.506748
4.2	0.06222	6.568968
4.3	0.057828	6.626796
4.4	0.056364	6.68316
4.5	0.053436	6.736596
4.6	0.049776	6.786372
4.7	0.04758	6.833952
4.8	0.046116	6.880068
4.9	0.043188	6.923256
5	0.041724	6.96498
5.1	0.038796	7.003776
5.2	0.038796	7.042572
5.3	0.037332	7.079904
5.4	0.035868	7.115772
5.5	0.035136	7.150908
5.6	0.035136	7.186044
5.7	0.034404	7.220448
5.8	0.034404	7.254852
5.9	0.03294	7.287792
6	0.032208	7.32

1000-year 6-hour SCS Type II "Early Peak" Hydrograph		
Time	Incremental Depth	Cumulative Depth
0	1.42008	1.42008
0.1	0.985272	2.405352
0.2	0.791292	3.196644
0.3	0.493368	3.690012
0.4	0.245952	3.935964
0.5	0.196908	4.132872
0.6	0.17202	4.304892
0.7	0.148596	4.453488
0.8	0.126636	4.580124
0.9	0.119316	4.69944
1	0.1098	4.80924
1.1	0.101748	4.910988
1.2	0.099552	5.01054
1.3	0.089304	5.099844
1.4	0.087108	5.186952
1.5	0.082716	5.269668
1.6	0.079056	5.348724
1.7	0.076128	5.424852
1.8	0.0732	5.498052
1.9	0.071004	5.569056
2	0.068076	5.637132
2.1	0.06588	5.703012
2.2	0.064416	5.767428
2.3	0.06222	5.829648
2.4	0.060024	5.889672
2.5	0.057828	5.9475
2.6	0.056364	6.003864
2.7	0.055632	6.059496
2.8	0.053436	6.112932
2.9	0.052704	6.165636
3	0.049776	6.215412
3.1	0.049776	6.265188
3.2	0.04758	6.312768
3.3	0.04758	6.360348
3.4	0.046116	6.406464
3.5	0.046116	6.45258
3.6	0.043188	6.495768
3.7	0.042456	6.538224
3.8	0.041724	6.579948
3.9	0.04026	6.620208
4	0.039528	6.659736
4.1	0.038796	6.698532
4.2	0.038796	6.737328
4.3	0.037332	6.77466
4.4	0.037332	6.811992
4.5	0.035868	6.84786
4.6	0.035136	6.882996
4.7	0.035136	6.918132
4.8	0.035136	6.953268
4.9	0.034404	6.987672
5	0.034404	7.022076
5.1	0.033672	7.055748
5.2	0.033672	7.08942
5.3	0.033672	7.123092
5.4	0.03294	7.156032
5.5	0.03294	7.188972
5.6	0.03294	7.221912
5.7	0.03294	7.254852
5.8	0.03294	7.287792
5.9	0.032208	7.32
6	0	7.32

General Info
Homepage
Current Projects
FAQ
Glossary

Precipitation Frequency (PF)
PF Data Server
PF in GIS Format
PF Maps
Temporal Distr.
Time Series Data
PFDS Perform.
PF Documents

Probable Maximum Precipitation (PMP)
PMP Documents

Miscellaneous
Publications
AEP Storm Analysis
Record Precipitation

Contact Us
Inquiries
List-server

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: KY

DATA DESCRIPTION

Data type: precipitation depth | Units: english | Time series type: partial duration

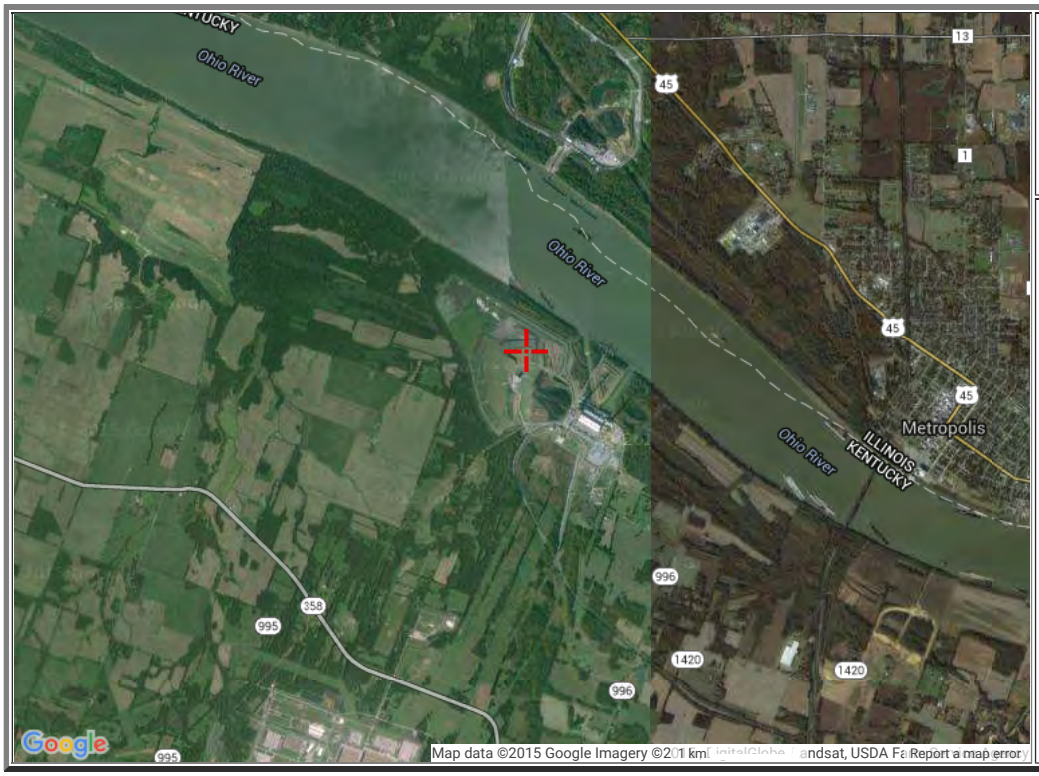
SELECT LOCATION

1. Manually:

a) Enter location (decimal degrees, use "-" for S and W): latitude: 37.1569 longitude: -88.7915 submit

b) Select station (click here for a list of stations used in frequency analysis for KY): select station

2. Use map:



a) Select location (move crosshair or double click)
b) Click on station icon
(show stations on map)

LOCATION INFORMATION:
Name: Kevil, Kentucky, US*
Latitude: 37.1591°
Longitude: -88.7855°
Elevation: 395 ft*

* source: Google Maps

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 2, Version 3

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PDS-based precipitation frequency estimates with 90% confidence intervals (in inches) [1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.422 (0.389-0.460)	0.498 (0.459-0.542)	0.579 (0.533-0.629)	0.644 (0.592-0.698)	0.724 (0.663-0.785)	0.783 (0.715-0.848)	0.841 (0.765-0.909)	0.901 (0.816-0.975)	0.978 (0.880-1.06)	1.04 (0.926-1.12)
10-min	0.658 (0.606-0.717)	0.779 (0.718-0.847)	0.905 (0.832-0.983)	0.998 (0.918-1.08)	1.11 (1.02-1.21)	1.20 (1.09-1.30)	1.28 (1.16-1.38)	1.36 (1.23-1.47)	1.46 (1.31-1.57)	1.53 (1.36-1.66)
15-min	0.809 (0.745-0.880)	0.958 (0.883-1.04)	1.12 (1.03-1.21)	1.23 (1.14-1.34)	1.38 (1.26-1.50)	1.49 (1.36-1.61)	1.59 (1.45-1.72)	1.69 (1.53-1.83)	1.82 (1.64-1.97)	1.91 (1.71-2.07)
30-min	1.08 (0.991-1.17)	1.29 (1.19-1.40)	1.54 (1.42-1.67)	1.73 (1.59-1.87)	1.97 (1.80-2.13)	2.14 (1.96-2.32)	2.32 (2.11-2.51)	2.49 (2.26-2.70)	2.73 (2.45-2.95)	2.90 (2.59-3.14)
60-min	1.32 (1.22-1.44)	1.59 (1.46-1.73)	1.94 (1.78-2.10)	2.20 (2.03-2.39)	2.56 (2.34-2.77)	2.84 (2.59-3.07)	3.12 (2.83-3.37)	3.40 (3.08-3.68)	3.79 (3.41-4.10)	4.09 (3.66-4.44)
2-hr	1.58 (1.45-1.72)	1.90 (1.74-2.07)	2.33 (2.13-2.54)	2.67 (2.44-2.90)	3.12 (2.84-3.40)	3.48 (3.16-3.79)	3.86 (3.48-4.19)	4.24 (3.81-4.61)	4.77 (4.25-5.19)	5.19 (4.59-5.65)
3-hr	1.72 (1.57-1.88)	2.06 (1.89-2.27)	2.54 (2.32-2.78)	2.91 (2.66-3.19)	3.42 (3.11-3.74)	3.84 (3.47-4.19)	4.26 (3.84-4.65)	4.71 (4.22-5.14)	5.34 (4.74-5.82)	5.84 (5.14-6.37)
6-hr	2.12 (1.94-2.34)	2.55 (2.33-2.81)	3.13 (2.85-3.44)	3.59 (3.27-3.94)	4.23 (3.83-4.64)	4.75 (4.28-5.20)	5.29 (4.75-5.79)	5.86 (5.23-6.41)	6.67 (5.88-7.30)	7.32 (6.41-8.01)

12-hr	2.56 (2.34-2.81)	3.07 (2.81-3.38)	3.78 (3.45-4.14)	4.34 (3.95-4.76)	5.11 (4.63-5.59)	5.74 (5.18-6.27)	6.39 (5.72-6.98)	7.07 (6.30-7.73)	8.03 (7.08-8.80)	8.81 (7.71-9.66)
24-hr	3.09 (2.88-3.32)	3.72 (3.47-3.99)	4.57 (4.26-4.90)	5.21 (4.85-5.59)	6.08 (5.64-6.51)	6.75 (6.25-7.24)	7.44 (6.87-7.97)	8.14 (7.48-8.72)	9.09 (8.31-9.75)	9.83 (8.95-10.6)
2-day	3.66 (3.41-3.93)	4.40 (4.10-4.72)	5.39 (5.02-5.77)	6.14 (5.71-6.58)	7.13 (6.61-7.63)	7.89 (7.31-8.45)	8.66 (8.00-9.28)	9.44 (8.70-10.1)	10.5 (9.62-11.3)	11.3 (10.3-12.1)
3-day	3.87 (3.61-4.15)	4.65 (4.33-4.99)	5.68 (5.29-6.09)	6.46 (6.01-6.93)	7.49 (6.95-8.02)	8.29 (7.68-8.88)	9.09 (8.39-9.73)	9.89 (9.11-10.6)	11.0 (10.1-11.8)	11.8 (10.8-12.7)
4-day	4.08 (3.80-4.38)	4.91 (4.57-5.26)	5.98 (5.57-6.41)	6.79 (6.32-7.28)	7.86 (7.30-8.42)	8.68 (8.04-9.30)	9.51 (8.78-10.2)	10.3 (9.52-11.1)	11.4 (10.5-12.3)	12.3 (11.2-13.2)
7-day	4.75 (4.42-5.10)	5.69 (5.30-6.12)	6.95 (6.46-7.47)	7.92 (7.35-8.51)	9.21 (8.53-9.89)	10.2 (9.44-11.0)	11.2 (10.3-12.1)	12.3 (11.2-13.2)	13.7 (12.5-14.7)	14.7 (13.4-15.9)
10-day	5.30 (4.94-5.68)	6.33 (5.91-6.80)	7.68 (7.17-8.25)	8.71 (8.11-9.34)	10.1 (9.35-10.8)	11.1 (10.3-11.9)	12.1 (11.2-13.0)	13.2 (12.2-14.2)	14.6 (13.4-15.7)	15.6 (14.3-16.8)
20-day	7.20 (6.76-7.67)	8.56 (8.04-9.12)	10.2 (9.56-10.9)	11.4 (10.7-12.1)	13.0 (12.1-13.8)	14.2 (13.2-15.1)	15.3 (14.3-16.3)	16.4 (15.3-17.5)	17.9 (16.6-19.1)	19.0 (17.6-20.3)
30-day	8.79 (8.29-9.34)	10.4 (9.84-11.1)	12.3 (11.6-13.0)	13.7 (12.9-14.5)	15.4 (14.5-16.4)	16.7 (15.7-17.8)	18.0 (16.9-19.2)	19.3 (18.0-20.5)	20.9 (19.5-22.3)	22.2 (20.6-23.6)
45-day	11.0 (10.4-11.7)	13.1 (12.3-13.9)	15.3 (14.4-16.2)	16.9 (15.9-17.9)	18.9 (17.7-20.0)	20.4 (19.1-21.6)	21.9 (20.4-23.2)	23.3 (21.7-24.7)	25.1 (23.3-26.6)	26.4 (24.5-28.1)
60-day	13.1 (12.4-13.8)	15.4 (14.6-16.3)	17.9 (17.0-18.9)	19.8 (18.7-20.8)	22.0 (20.8-23.2)	23.7 (22.4-25.0)	25.3 (23.8-26.7)	26.8 (25.2-28.4)	28.8 (27.0-30.5)	30.3 (28.3-32.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in csv format: precipitation frequency estimates ▼ Submit

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APPENDIX H
STAGE-STORAGE DATA

Ash Pond 2

Stage Storage

Elevation (feet)	Storage (cubic yards)	Storage (acre-feet)
331.5	0	0.0
332	2,183.69	1.4
333	6,334.49	3.9
334	15,790.24	9.8
335	31,016.15	19.2
336	53,096.01	32.9
337	80,226.57	49.7
338	113,387.54	70.3
339	153,469.53	95.1
340	195,772.27	121.3
341	239,451.68	148.4
342	285,168.95	176.8
343	332,678.11	206.2
344	381,460.33	236.4
345	431,520.10	267.5
346	483,146.56	299.5
347	536,170.21	332.3
348	590,925.58	366.3
349	647,564.52	401.4
350	704,990.64	437.0
351	763,054.73	473.0