



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**

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## 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



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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

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



## **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

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Revision 0

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# INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

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- APPENDIX D LAG TIME COMPUTATIONS
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- APPENDIX F RATING CURVES
- APPENDIX G PRECIPITATION DATA
- APPENDIX H STAGE-STORAGE DATA

# INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Background  
October 5, 2016

## 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

## INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Existing Conditions  
October 5, 2016

### 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.

# INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Existing Conditions  
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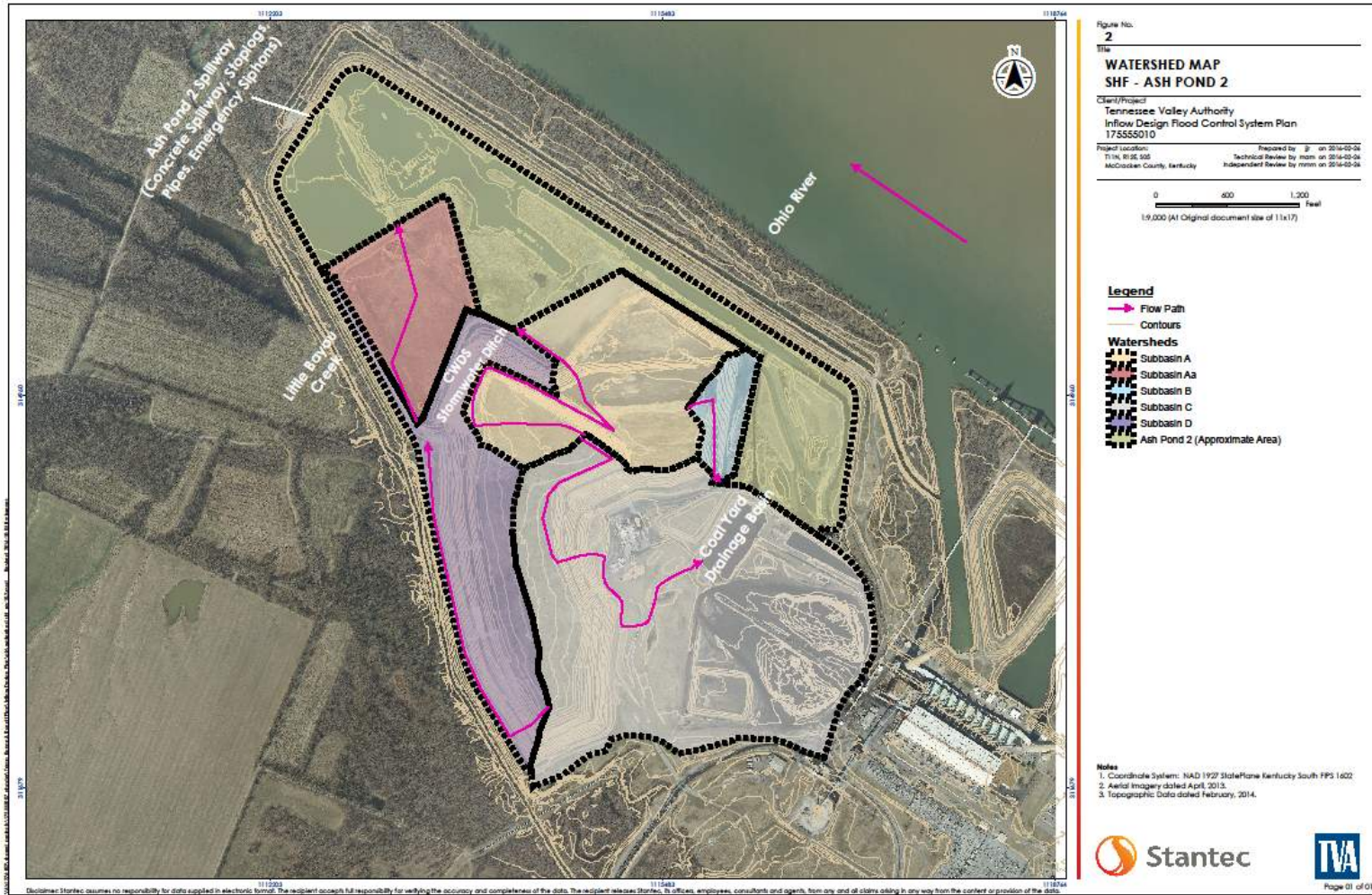


Figure 2 Hydraulic Structures

## INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Methods / Design Criteria  
October 5, 2016

### 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.

# INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Methods / Design Criteria  
October 5, 2016

## 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**

<b>Watershed</b>	<b>Drainage Area (acres)</b>	<b>Composite Curve Number</b>	<b>Lag Time (minutes)</b>
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

## INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Methods / Design Criteria  
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### 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.

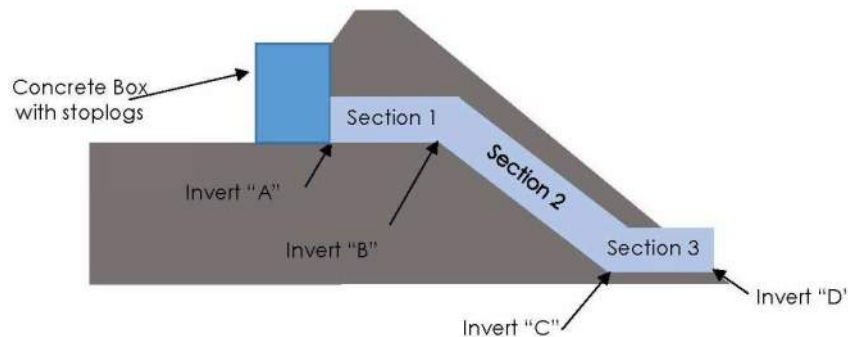
## INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Methods / Design Criteria  
October 5, 2016

### 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**

## INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Methods / Design Criteria  
October 5, 2016

**Table 2 Ash Pond 2 Spillway Data**

Inlet Structure	Stoplog Length (feet)	Stoplog Elevation (feet)	Pipe Inside Diameter <sup>(1)</sup> (inches)	Pipe Inlet Invert Elevation "A" (feet)	Pipe Inlet Invert Elevation "B" (feet)	Pipe Inlet Invert Elevation "C" (feet)	Pipe Inlet Invert Elevation <sup>(2)</sup> "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:

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

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:

## INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Methods / Design Criteria  
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$$Q = C_0 A [2g(H_c)]^{0.5} \quad \text{Eqn. 2}$$

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.

## INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Methods / Design Criteria  
October 5, 2016

### 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.

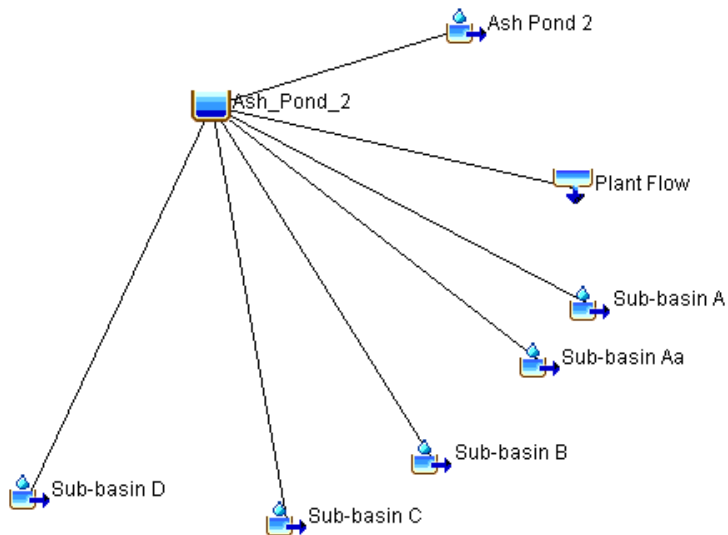


Figure 4 HEC-HMS Model Schematic

## INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Calculation Results  
October 5, 2016

### 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

## INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Conclusions  
October 5, 2016

### 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.

## INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

References  
October 5, 2016

### 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**



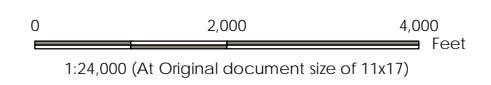
Figure No.  
**1**

Title  
**HYDROLOGIC OVERVIEW MAP  
SHF - ASH POND 2**

Client/Project  
Tennessee Valley Authority  
Inflow Design Flood Control System Plan  
17555010

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

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



**Legend**

- Ash Pond 2
- ➔ Flow Arrows

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

\\US1276-02\shared\_projects\17555007\_nbaider\Temp\_Runoff\_Plan\_Vinflow\_Design\_Plan\shf\_hydro\_overview.shf.mxd - Revised: 2016.03.16 By: jrtzyes

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**APPENDIX B  
WATERSHED MAP**

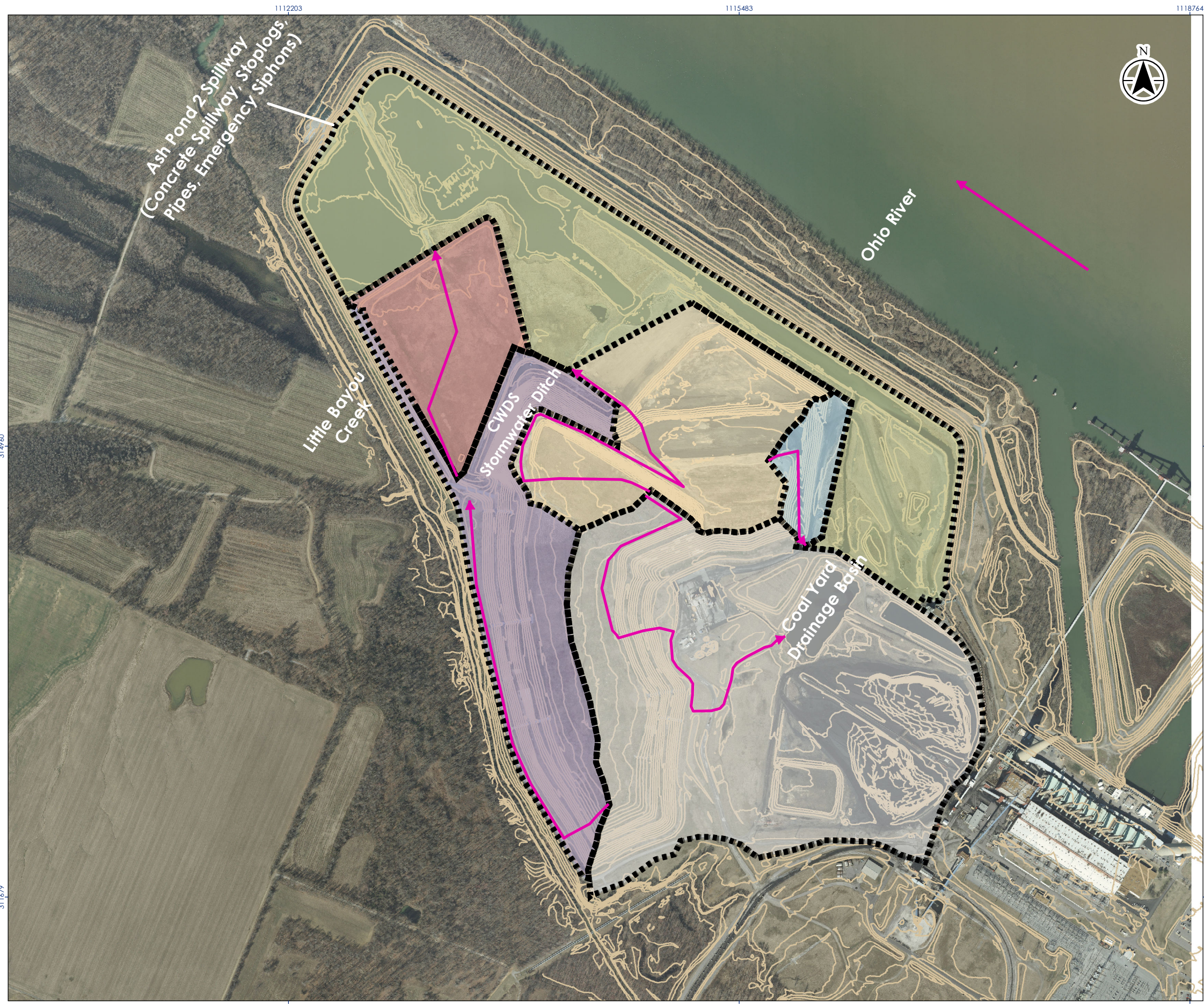


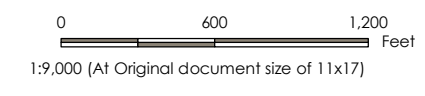
Figure No.  
**2**

Title  
**WATERSHED MAP  
SHF - ASH POND 2**

Client/Project  
Tennessee Valley Authority  
Inflow Design Flood Control System Plan  
17555010

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

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



- 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.



\\us1276402\shared\_projects\17555007\_nbsden\Temp\_Runon & Runoff Plan\Inflow Design Plan\shf\watershed\_inf\_rev10.2.mxd Revised: 2016-10-05 By: Juvayes  
 311679

**APPENDIX C**  
**CURVE NUMBER MAP AND**  
**COMPUTATIONS**

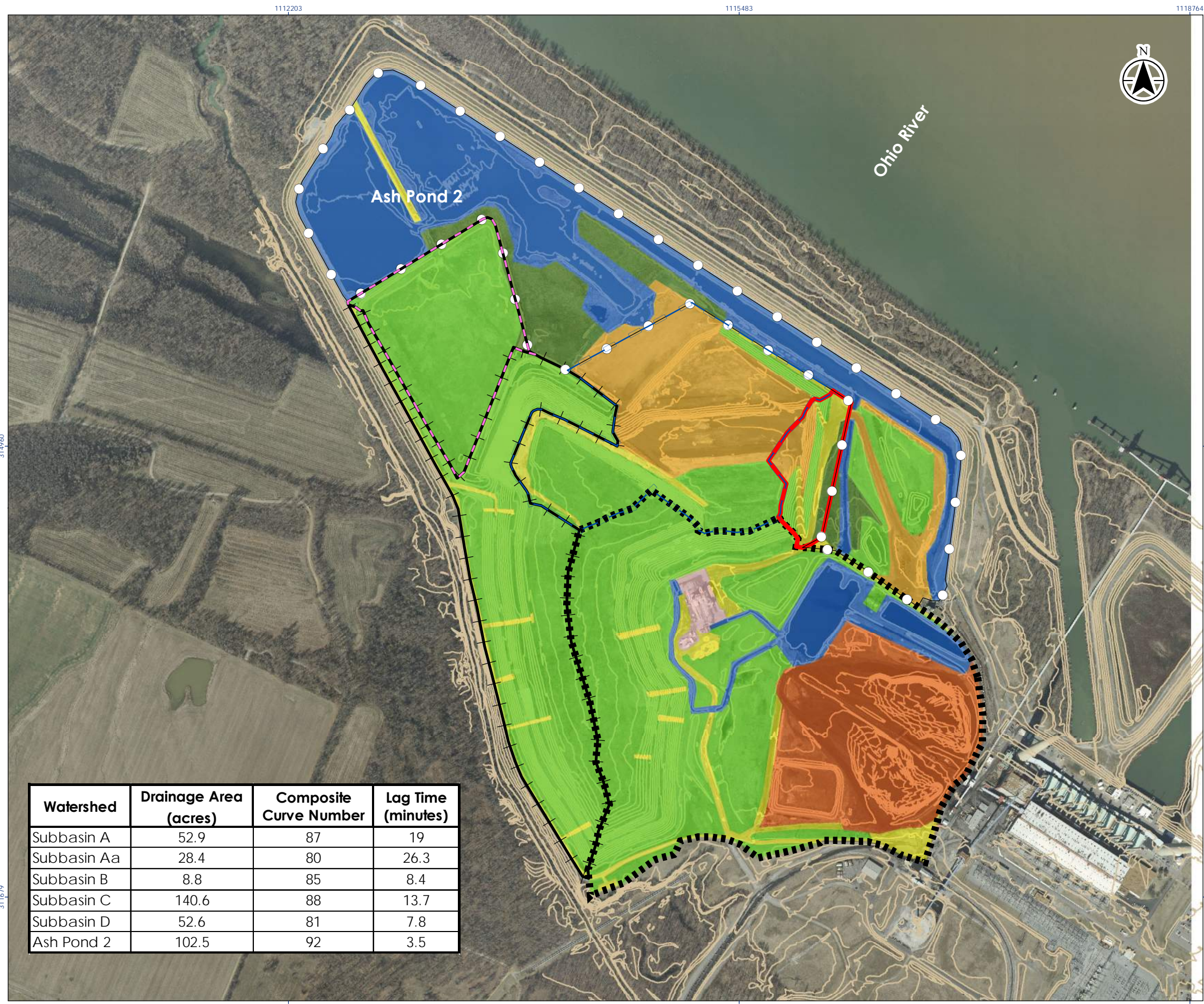


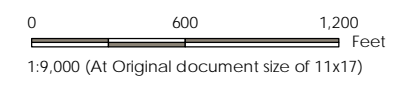
Figure No.  
**3**

Title  
**CURVE NUMBER MAP  
SHF - ASH POND 2**

Client/Project  
Tennessee Valley Authority  
Inflow Design Flood Control System Plan  
17555010

Project Location: 111N, R12E, S05  
McCracken County, Kentucky

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



- 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.



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

314960  
 311679  
 \\US1276-02\shared\_projects\17555007\_nbsider\Temp\_Runoff\_Plan\_Vinflow\_Design\_Plan\shf\_cn.shf.mxd  
 Reviewed: 2/10/16 6:03:16 By: juroyevs  
 1112203  
 1115483  
 1118764

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 Use Fly Ash CN=91.	80
Ash	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 <sub>L</sub> (hr)	T <sub>L</sub> (min)	T <sub>L</sub> (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  
 Watershed ID: Sub-basin Aa

By: JJR  
 Checked: MAM

Date:2/11/16  
 Date:2/19/16

Sheet Flow

1. Surface description
2. Manning's roughness coef., n
3. Flow length, L (Total L less than 300/100 ft)
4. Two-year, 24-hour Rainfall, P2
- 5a. Upstream elevation
- 5b. Downstream elevation
5. Land slope, S
6.  $T_t = [0.007(nL)^{0.8}]/[\text{sqrt}(P2) S^{0.4}]$

Segment ID		
	Grass, short prairie	
	0.15	
ft	100	
in	3.72	
ft	362	
ft	361.56	
ft / ft	0.004	
hr	0.28	

= 0.28 hr

Shallow Concentrated Flow

7. Surface description (paved or unpaved)
8. Flow length, L
- 9a. Upstream elevation
- 9b. Downstream elevation
9. Watercourse slope, S
10. Average velocity, V
11.  $T_t = L / 3600V$

Segment ID		
	Unpaved	
ft	1660.62	
ft	361.56	
ft	354.93	
ft / ft	0.003992485	
ft / s	1.0	
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  
 Watershed ID: Sub-basin B

By: JJR Date:2/11/16  
 Checked: MAM Date:2/19/16

Sheet Flow

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

Segment ID		
	Grass, short prairie	
	0.15	
ft	75.01	
in	3.72	
ft	402.53	
ft	401.91	
ft / ft	0.008	
hr	0.17	

= 0.17 hr

Shallow Concentrated Flow

7. Surface description (paved or unpaved)
8. Flow length, L
- 9a. Upstream elevation
- 9b. Downstream elevation
9. Watercourse slope, S
10. Average velocity, V
11.  $Tt = L / 3600V$

Segment ID		
	Unpaved	
ft	854.91	
ft	401.91	
ft	353.44	
ft / ft	0.056696026	
ft / s	3.8	
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 - 17555010  
 Watershed ID: Sub-basin C

By: JJR Date:2/11/16  
 Checked: MAM Date:2/19/16

Sheet Flow

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

Segment ID		
	Grass, short prairie	
	0.15	
	100	
	3.72	
	454.76	
	453.92	
	0.008	
	0.21	= 0.21 hr

Shallow Concentrated Flow

7. Surface description (paved or unpaved)
8. Flow length, L
- 9a. Upstream elevation
- 9b. Downstream elevation
9. Watercourse slope, S
10. Average velocity, V
11.  $Tt = L / 3600V$

Segment ID		
	Unpaved	
	211.8	
	453.92	
	445.88	
	0.03796034	
	3.1	
	0.02	= 0.02 hr

Open Channel Flow

12. Pipe or Open Channel
13. Diam (pipe) or depth (open)
14. Base width (open)
15. Channel side slope
16. Cross sectional flow area
17. Wetted perimeter, Pw
18. Hydraulic radius,  $r = a/Pw$
- 19a. Upstream elevation
- 19b. Downstream elevation
19. Channel slope, S
20. Runoff surface / pipe material
21. Manning's roughness coef., n
22.  $V = (1.49 r^{2/3} S^{1/2} / n)$
23. Flow length, L
24.  $Tt = L / 3600V$

Segment ID		
	Open-channel	
	0.8	
	0	
	17.5	
	11.20	
	28.05	
	0.40	
	446	
	432	
	0.011	
	bare soil	
	0.02	
	4.31	
	1216.79	
	0.08	= 0.08 hr

Open Channel Flow

12. Pipe or Open Channel
13. Diam (pipe) or depth (open)
14. Base width (open)
15. Channel side slope
16. Cross sectional flow area
17. Wetted perimeter, Pw
18. Hydraulic radius,  $r = a/Pw$
- 19a. Upstream elevation
- 19b. Downstream elevation
19. Channel slope, S
20. Runoff surface / pipe material
21. Manning's roughness coef., n
22.  $V = (1.49 r^{2/3} S^{1/2} / n)$
23. Flow length, L
24.  $Tt = L / 3600V$

Segment ID		
	Open-channel	
	0.5	
	13.7	
	2	
	7.35	
	15.94	
	0.46	
	432	
	354	
	0.254	
	riprap	
	0.04	
	11.21	
	307.05	
	0.01	= 0.01 hr

Open Channel Flow

12. Pipe or Open Channel
13. Diam (pipe) or depth (open)
14. Base width (open)
15. Channel side slope
16. Cross sectional flow area
17. Wetted perimeter, Pw
18. Hydraulic radius,  $r = a/Pw$
- 19a. Upstream elevation
- 19b. Downstream elevation
19. Channel slope, S
20. Runoff surface / pipe material
21. Manning's roughness coef., n
22.  $V = (1.49 r^{2/3} S^{1/2} / n)$
23. Flow length, L
24.  $Tt = L / 3600V$

Segment ID		
	Open-channel	
	4.32	
	9	
	1.5	
	66.87	
	24.58	
	2.72	
	344	
	335	
	0.006	
	earth, winding, grass weeds	
	0.03	
	7.36	
	1605.46	
	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  
 Watershed ID: Sub-basin D

By: JJR Date:2/11/16  
 Checked: MAM Date:2/19/16

Sheet Flow

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

Segment ID		
	Grass, short prairie	
	0.15	
ft	100	
in	3.72	
ft	438.19	
ft	429.53	
ft / ft	0.087	
hr	0.08	

= 0.08 hr

Shallow Concentrated Flow

7. Surface description (paved or unpaved)
8. Flow length, L
- 9a. Upstream elevation
- 9b. Downstream elevation
9. Watercourse slope, S
10. Average velocity, V
11.  $Tt = L / 3600V$

Segment ID		
	Unpaved	
ft	101.61	
ft	429.53	
ft	405.23	
ft / ft	0.23914969	
ft / s	7.9	
hr	0.00	

= 0.00 hr

Open Channel Flow

12. Pipe or Open Channel
13. Diam (pipe) or depth (open)
14. Base width (open)
15. Channel side slope
16. Cross sectional flow area
17. Wetted perimeter, Pw
18. Hydraulic radius,  $r = a/Pw$
- 19a. Upstream elevation
- 19b. Downstream elevation
19. Channel slope, S
20. Runoff surface / pipe material
21. Manning's roughness coef., n
22.  $V = (1.49 r^{2/3} S^{1/2} / n)$
23. Flow length, L
24.  $Tt = L / 3600V$

Segment ID		
	Open-channel	
ft	0.5	
ft	14	
XH:1V	4	
ft <sup>2</sup>	8.00	
ft	18.12	
ft	0.44	
ft	405	
ft	350	
ft / ft	0.261	
	riprap	
	0.04	
ft / s	11.04	
ft	213.32	
hr	0.01	

= 0.01 hr

Open Channel Flow

12. Pipe or Open Channel
13. Diam (pipe) or depth (open)
14. Base width (open)
15. Channel side slope
16. Cross sectional flow area
17. Wetted perimeter, Pw
18. Hydraulic radius,  $r = a/Pw$
- 19a. Upstream elevation
- 19b. Downstream elevation
19. Channel slope, S
20. Runoff surface / pipe material
21. Manning's roughness coef., n
22.  $V = (1.49 r^{2/3} S^{1/2} / n)$
23. Flow length, L
24.  $Tt = L / 3600V$

Segment ID		
	Open-channel	
ft	2.5	
ft	28	
XH:1V	6.5	
ft <sup>2</sup>	110.63	
ft	60.88	
ft	1.82	
ft	350	
ft	342	
ft / ft	0.003	
	bare soil	
	0.02	
ft / s	5.83	
ft	2584.93	
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	②	③	④
P.I. Sta. = 40+26.60	P.I. Sta. = 40+46.44	P.I. Sta. = 41+17.96	P.I. Sta. = 41+38.27
Northing = 317,248.59	Northing = 317,268.99	Northing = 317,329.86	Northing = 317,333.23
Easting = 1,112,538.46	Easting = 1,112,533.87	Easting = 1,112,573.69	Easting = 1,112,593.13
$\Delta = 46^{\circ}37'34''$	$\Delta = 45^{\circ}52'48''$	$\Delta = 47^{\circ}50'51''$	$\Delta = 47^{\circ}40'12''$
D = 254'38'52"	D = 216'12'38"	D = 216'12'38"	D = 254'38'52"
T = 9.70'	T = 11.22'	T = 11.76'	T = 9.94'
L = 18.31'	L = 21.22'	L = 22.13'	L = 18.72'
R = 22.50'	R = 26.50'	R = 26.50'	R = 22.50'
E = 2.00'	E = 2.28'	E = 2.49'	E = 2.10'
P.C. Sta. = 40+16.90	P.C. Sta. = 40+35.22	P.C. Sta. = 41+06.20	P.C. Sta. = 41+28.33
P.T. Sta. = 40+35.22	P.T. Sta. = 40+56.44	P.T. Sta. = 41+28.33	P.T. Sta. = 41+47.05

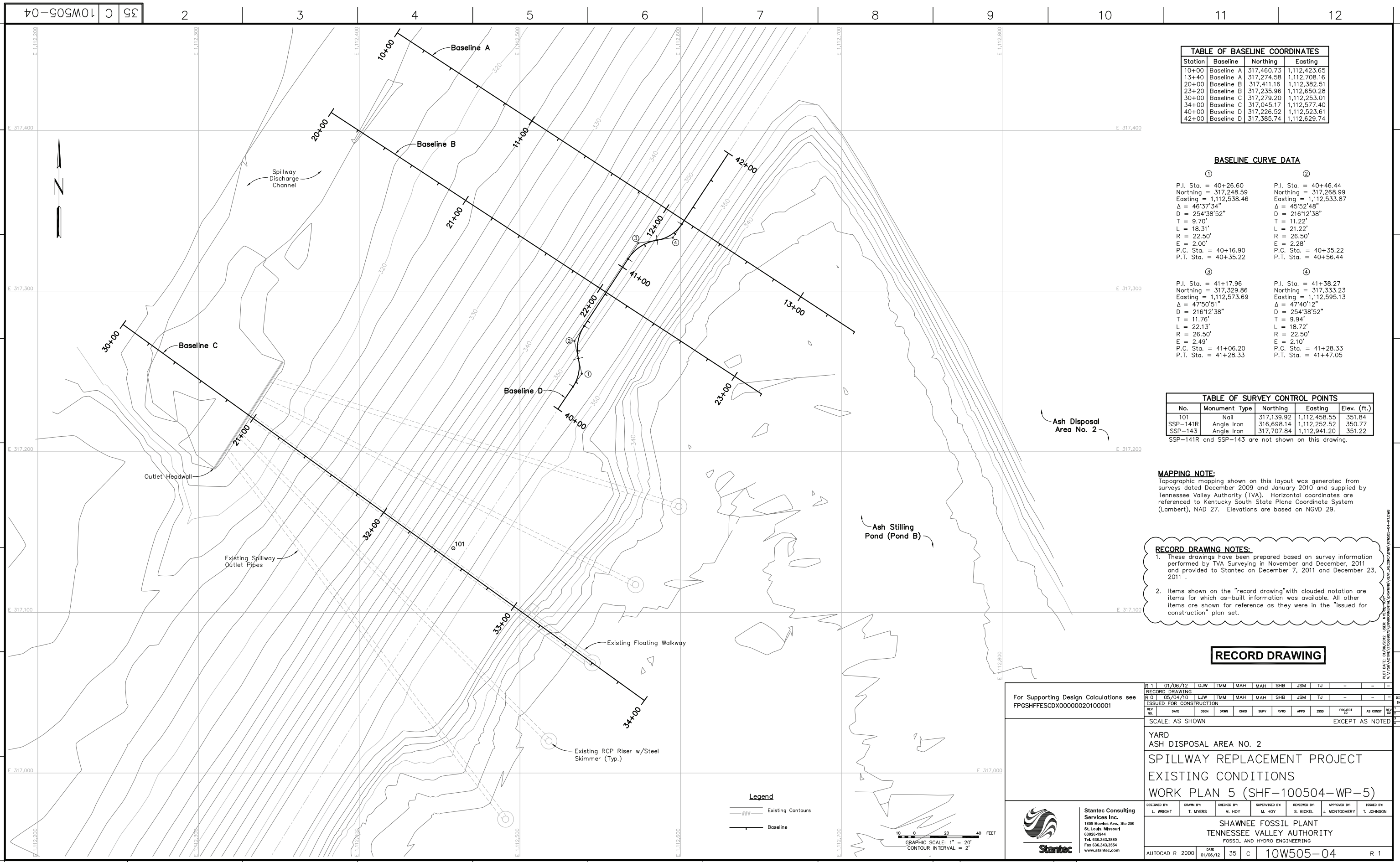
TABLE OF SURVEY CONTROL POINTS				
No.	Monument Type	Northing	Easting	Elev. (ft.)
101	Nail	317,139.92	1,112,458.55	351.84
SSP-141R	Angle Iron	316,698.14	1,112,252.52	350.77
SSP-143	Angle Iron	317,707.84	1,112,941.20	351.22

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.

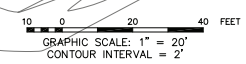
**RECORD DRAWING NOTES:**  
 1. These drawings have been prepared based on survey information performed by TVA Surveying in November and December, 2011 and provided to Stantec on December 7, 2011 and December 23, 2011.  
 2. Items shown on the "record drawing" with clouded notation are items for which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

**RECORD DRAWING**



**Legend**

- Existing Contours
- Baseline



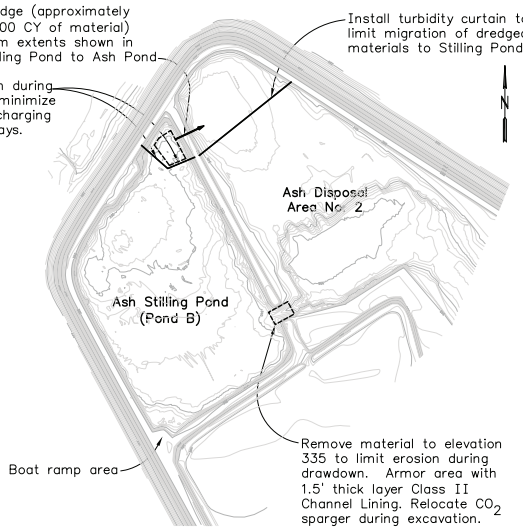
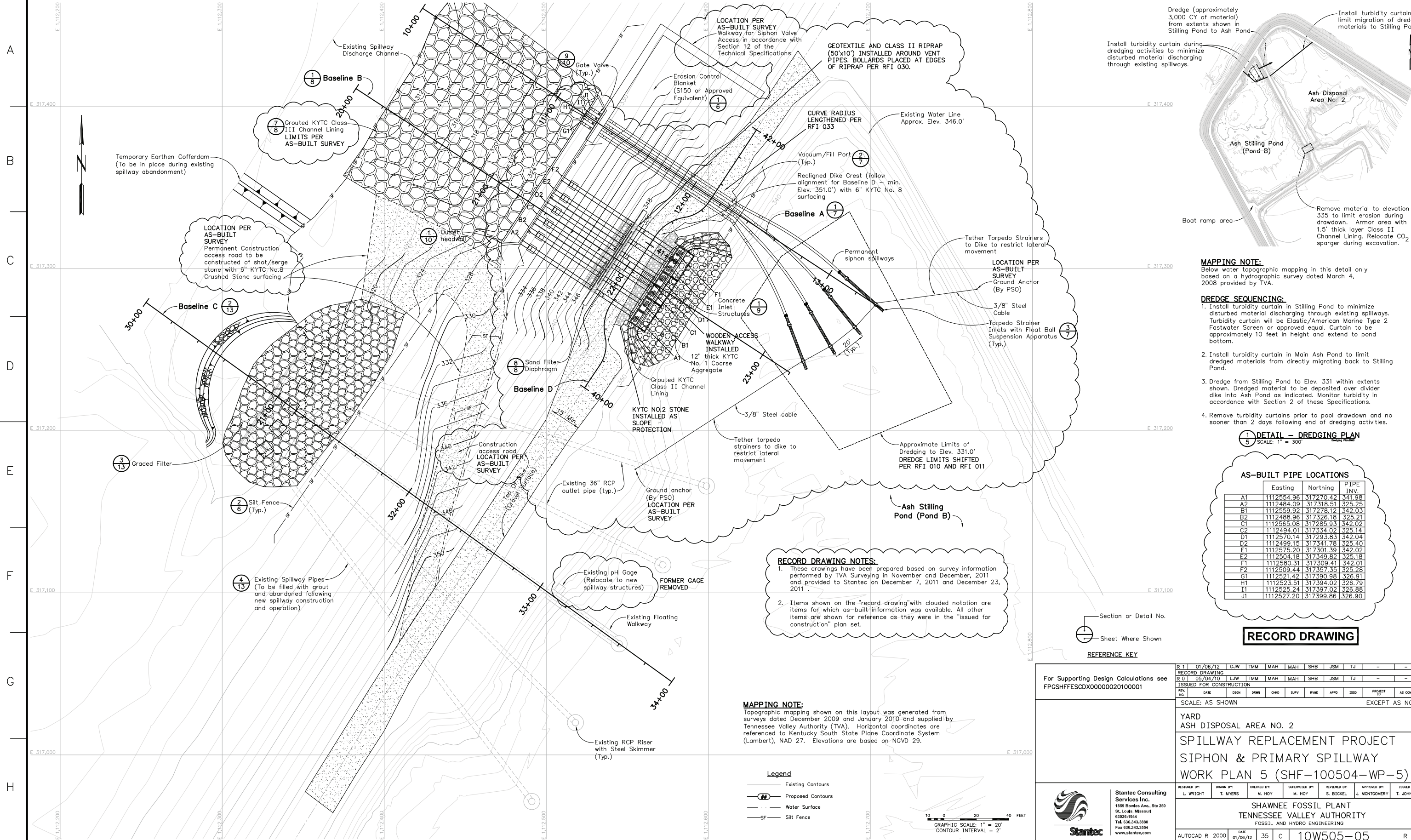
For Supporting Design Calculations see FPGSHFFESC00000020100001		<table border="1"> <tr> <td>R 1</td> <td>01/06/12</td> <td>G/W</td> <td>TMM</td> <td>MAH</td> <td>MAH</td> <td>SHB</td> <td>JSM</td> <td>TJ</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td colspan="12">RECORD DRAWING</td> </tr> <tr> <td>R 0</td> <td>05/04/10</td> <td>L/W</td> <td>TMM</td> <td>MAH</td> <td>MAH</td> <td>SHB</td> <td>JSM</td> <td>TJ</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td colspan="12">ISSUED FOR CONSTRUCTION</td> </tr> <tr> <td>REV. NO.</td> <td>DATE</td> <td>ISSN</td> <td>DRWN</td> <td>CHD</td> <td>SUPV</td> <td>RVD</td> <td>APPD</td> <td>ISSD</td> <td>PROJECT</td> <td>AS CONST</td> <td>REV</td> </tr> <tr> <td colspan="12">SCALE: AS SHOWN EXCEPT AS NOTED</td> </tr> <tr> <td colspan="12">YARD ASH DISPOSAL AREA NO. 2 SPILLWAY REPLACEMENT PROJECT EXISTING CONDITIONS WORK PLAN 5 (SHF-100504-WP-5)</td> </tr> <tr> <td>DESIGNED BY:</td> <td>DRAWN BY:</td> <td>CHECKED BY:</td> <td>SUPERVISED BY:</td> <td>REVIEWED BY:</td> <td>APPROVED BY:</td> <td>ISSUED BY:</td> <td colspan="5"></td> </tr> <tr> <td>L. WRIGHT</td> <td>T. MYERS</td> <td>M. HOY</td> <td>S. BICKEL</td> <td>J. MONTGOMERY</td> <td>T. JOHNSON</td> <td colspan="5"></td> </tr> <tr> <td colspan="12" style="text-align: center;"> <b>SHAWNEE FOSSIL PLANT</b>                  TENNESSEE VALLEY AUTHORITY                  FOSSIL AND HYDRO ENGINEERING             </td> </tr> <tr> <td>AUTOCAD R 2000</td> <td>DATE</td> <td>35</td> <td>C</td> <td>10W505-04</td> <td>R 1</td> <td colspan="6"></td> </tr> <tr> <td></td> <td>01/06/12</td> <td></td> <td></td> <td></td> <td></td> <td colspan="6"></td> </tr> </table>		R 1	01/06/12	G/W	TMM	MAH	MAH	SHB	JSM	TJ	-	-	-	RECORD DRAWING												R 0	05/04/10	L/W	TMM	MAH	MAH	SHB	JSM	TJ	-	-	-	ISSUED FOR CONSTRUCTION												REV. NO.	DATE	ISSN	DRWN	CHD	SUPV	RVD	APPD	ISSD	PROJECT	AS CONST	REV	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	S. BICKEL	J. MONTGOMERY	T. JOHNSON						<b>SHAWNEE FOSSIL PLANT</b> TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING												AUTOCAD R 2000	DATE	35	C	10W505-04	R 1								01/06/12										
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Stantec Consulting Services Inc.  
 1859 Bowles Ave., Ste 250  
 St. Louis, Missouri 63026-1944  
 Tel: 636.343.3880  
 Fax: 636.343.3554  
 www.stantec.com

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.

**DETAIL - DREDGING PLAN**

SCALE: 1" = 300'

**AS-BUILT PIPE LOCATIONS**

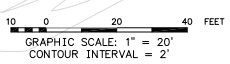
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A2	1112484.09	317318.51	325.25
B1	1112559.92	317278.12	342.03
B2	1112488.96	317326.18	325.21
C1	1112565.08	317285.93	342.02
C2	1112494.01	317334.02	325.14
D1	1112570.14	317293.83	342.04
D2	1112499.15	317341.78	325.40
E1	1112575.20	317301.39	342.02
E2	1112504.18	317349.82	325.18
F1	1112580.31	317309.41	342.01
F2	1112509.44	317357.55	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 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.

**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
  - Silt Fence



Section or Detail No.  
Sheet Where Shown  
**REFERENCE KEY**

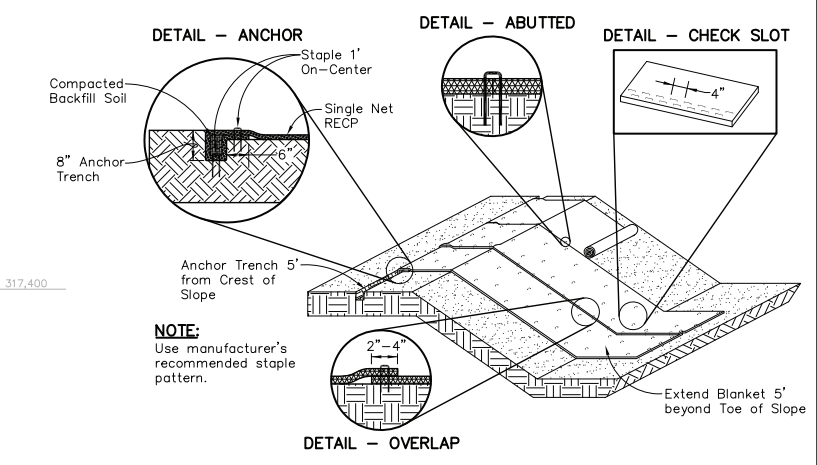
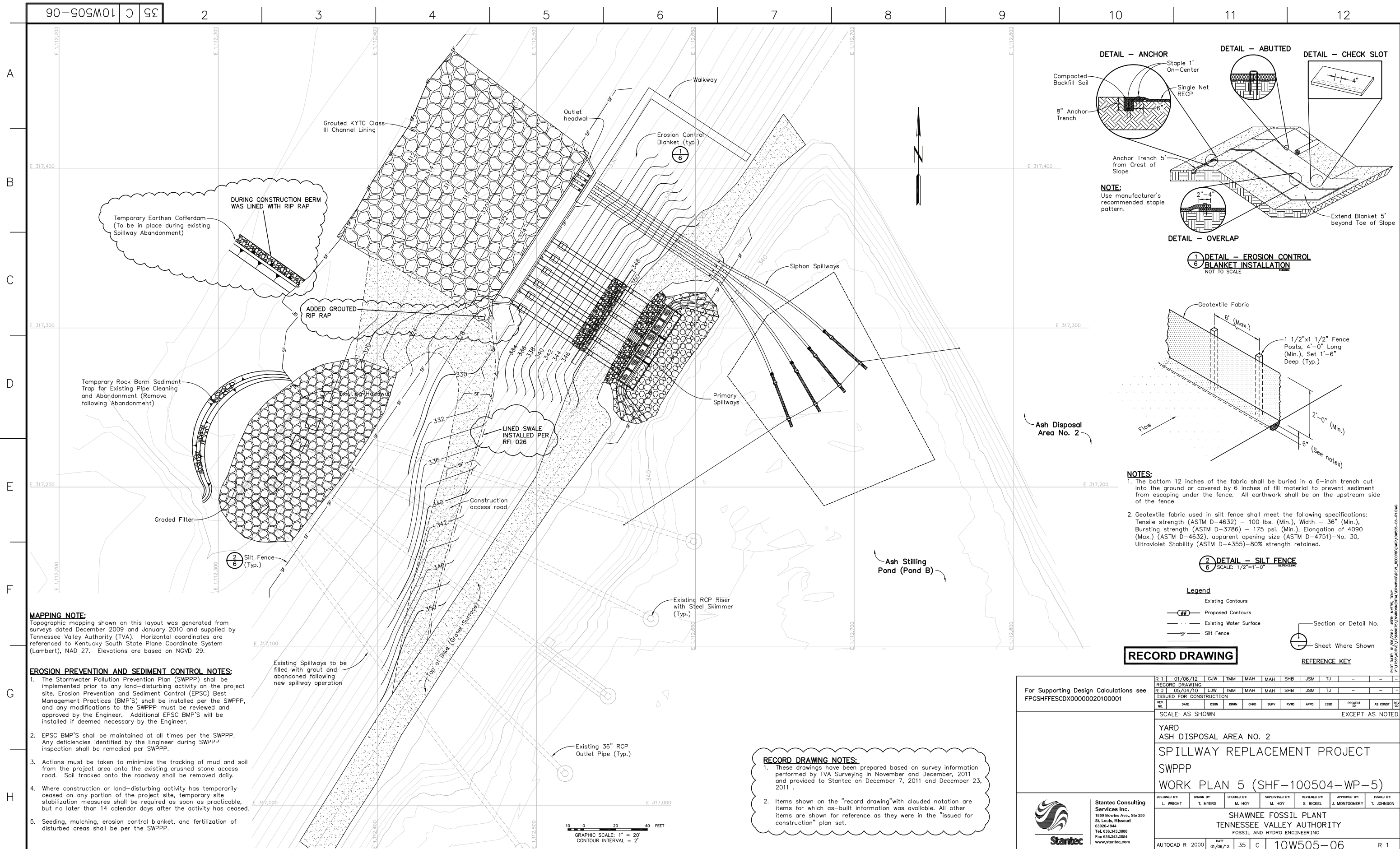
For Supporting Design Calculations see  
FPGSHFFSCDX00000020100001

**Stantec Consulting Services Inc.**  
1859 Bowles Ave., Ste 250  
St. Louis, Missouri  
63026-1944  
Tel: 636.343.3880  
Fax: 636.343.3554  
www.stantec.com

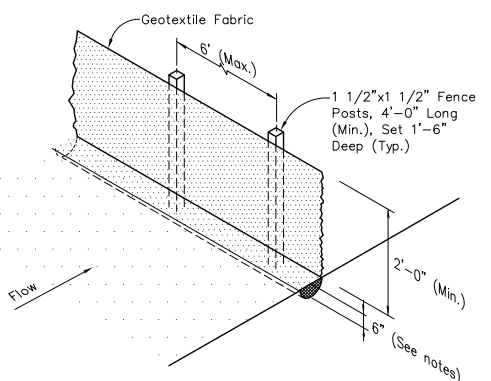
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RECORD DRAWING											
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ISSUED FOR CONSTRUCTION											
REV. NO.	DATE	ISSN	DRWN	CHD	SUPV	RVD	APPD	ISSD	PROJECT	AS CONST	REV. BY
SCALE: AS SHOWN EXCEPT AS NOTED											
YARD ASH DISPOSAL AREA NO. 2											
SPILLWAY REPLACEMENT PROJECT SIPHON & PRIMARY SPILLWAY WORK PLAN 5 (SHF-100504-WP-5)											
DESIGNED BY:	L. WRIGHT	DRAWN BY:	T. MYERS	CHECKED BY:	M. HOY	SUPERVISED BY:	M. HOY	REVIEWED BY:	S. BICKEL	APPROVED BY:	J. MONTGOMERY
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



1 6 DETAIL - EROSION CONTROL BLANKET INSTALLATION NOT TO SCALE



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

**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.

**Legend**

- - - Existing Contours
- - - Proposed Contours
- - - Existing Water Surface
- - - Silt Fence
- 1 6 Section or Detail No.
- Sheet Where Shown

**RECORD 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.

- EROSION PREVENTION AND SEDIMENT CONTROL NOTES:**
- 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.
  - 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.
  - 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.
  - 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.
  - Seeding, mulching, erosion control blanket, and fertilization of disturbed areas shall be per the SWPPP.

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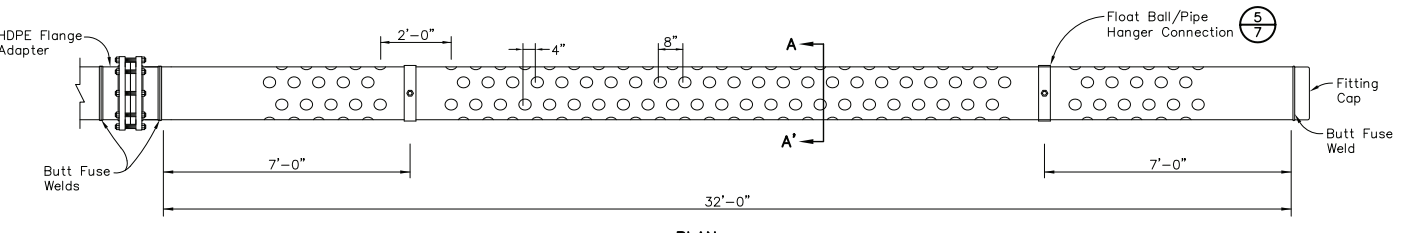
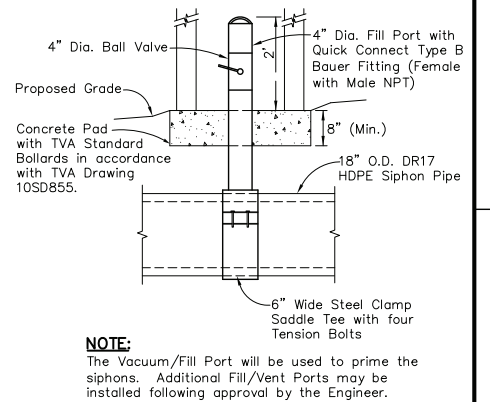
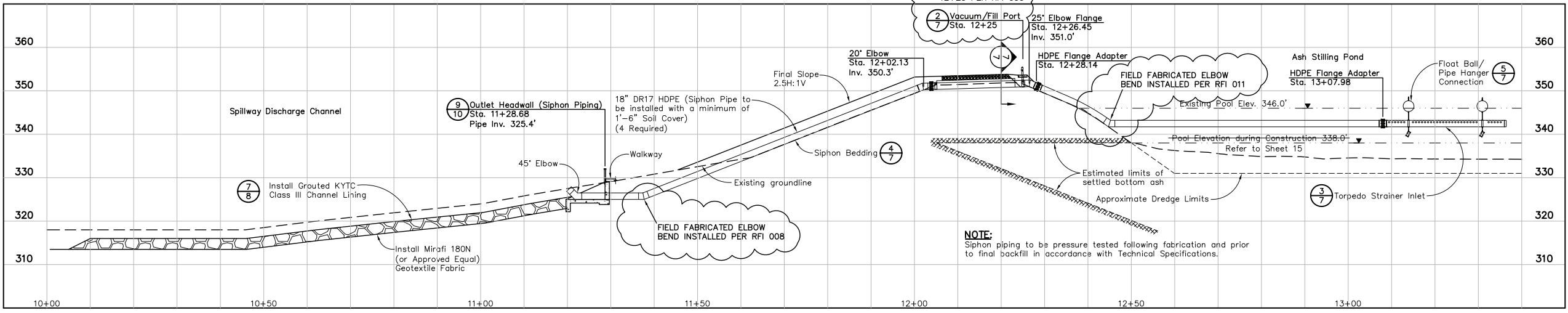
For Supporting Design Calculations see FPGSHFFSCDX00000020100001		<table border="1"> <tr> <td>R 1</td><td>01/06/12</td><td>G/W</td><td>TMM</td><td>MAH</td><td>MAH</td><td>SHB</td><td>JSM</td><td>TJ</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td> </tr> <tr> <td colspan="14">RECORD DRAWING</td> </tr> <tr> <td>R 0</td><td>05/04/10</td><td>L/W</td><td>TMM</td><td>MAH</td><td>MAH</td><td>SHB</td><td>JSM</td><td>TJ</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td> </tr> <tr> <td colspan="14">ISSUED FOR CONSTRUCTION</td> </tr> <tr> <td>REV.</td><td>DATE</td><td>ISSN</td><td>DRWN</td><td>CHG</td><td>SUPV</td><td>RVD</td><td>APPD</td><td>ISSD</td><td>PROJECT</td><td>AS CONST</td><td>REV</td><td>BY</td><td>DATE</td> </tr> <tr> <td colspan="14">SCALE: AS SHOWN EXCEPT AS NOTED</td> </tr> <tr> <td colspan="14">YARD ASH DISPOSAL AREA NO. 2</td> </tr> <tr> <td colspan="14">SPILLWAY REPLACEMENT PROJECT</td> </tr> <tr> <td colspan="14">SWPPP</td> </tr> <tr> <td colspan="14">WORK PLAN 5 (SHF-100504-WP-5)</td> </tr> <tr> <td>DESIGNED BY:</td><td>L. WRIGHT</td><td>DRAWN BY:</td><td>T. MYERS</td><td>CHECKED BY:</td><td>M. HOY</td><td>SUPERVISED BY:</td><td>M. HOY</td><td>REVIEWED BY:</td><td>S. BICKEL</td><td>APPROVED BY:</td><td>J. MONTGOMERY</td><td>ISSUED BY:</td><td>T. JOHNSON</td> </tr> <tr> <td colspan="14">SHAWNEE FOSSIL PLANT</td> </tr> <tr> <td colspan="14">TENNESSEE VALLEY AUTHORITY</td> </tr> <tr> <td colspan="14">FOSSIL AND HYDRO ENGINEERING</td> </tr> <tr> <td>AUTOCAD R 2000</td><td>DATE</td><td>01/06/12</td><td>35</td><td>C</td><td colspan="4">10W505-06</td><td colspan="5">R 1</td> </tr> </table>												R 1	01/06/12	G/W	TMM	MAH	MAH	SHB	JSM	TJ	-	-	-	-	-	RECORD DRAWING														R 0	05/04/10	L/W	TMM	MAH	MAH	SHB	JSM	TJ	-	-	-	-	-	ISSUED FOR CONSTRUCTION														REV.	DATE	ISSN	DRWN	CHG	SUPV	RVD	APPD	ISSD	PROJECT	AS CONST	REV	BY	DATE	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:	L. WRIGHT	DRAWN BY:	T. MYERS	CHECKED BY:	M. HOY	SUPERVISED BY:	M. HOY	REVIEWED BY:	S. BICKEL	APPROVED BY:	J. MONTGOMERY	ISSUED BY:	T. JOHNSON	SHAWNEE FOSSIL PLANT														TENNESSEE VALLEY AUTHORITY														FOSSIL AND HYDRO ENGINEERING														AUTOCAD R 2000	DATE	01/06/12	35	C	10W505-06				R 1				
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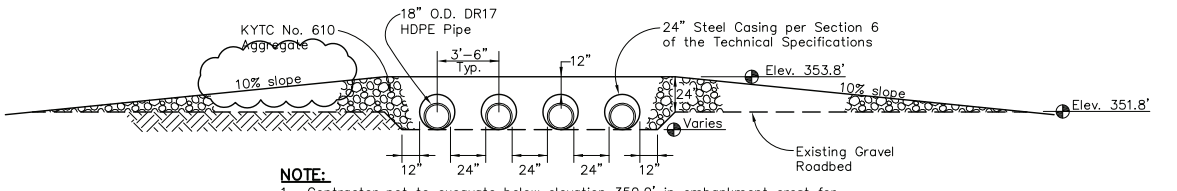
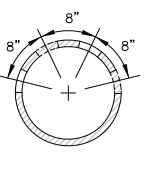
Stantec Consulting Services Inc.  
 1859 Bowles Ave., Ste 250  
 St. Louis, Missouri  
 63126-1944  
 Tel: 636.343.3880  
 Fax: 636.343.3554  
 www.stantec.com

STANTEC 1  
 TASK COMPLETED BY: REV NO.

PLOT FACTOR: 20 W\_TVA C.A.D. DRAWING DO NOT ALTER MANUALLY

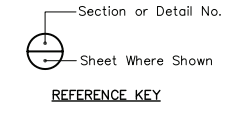
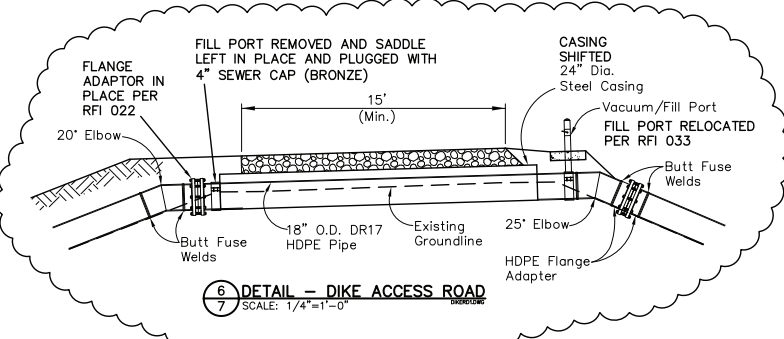
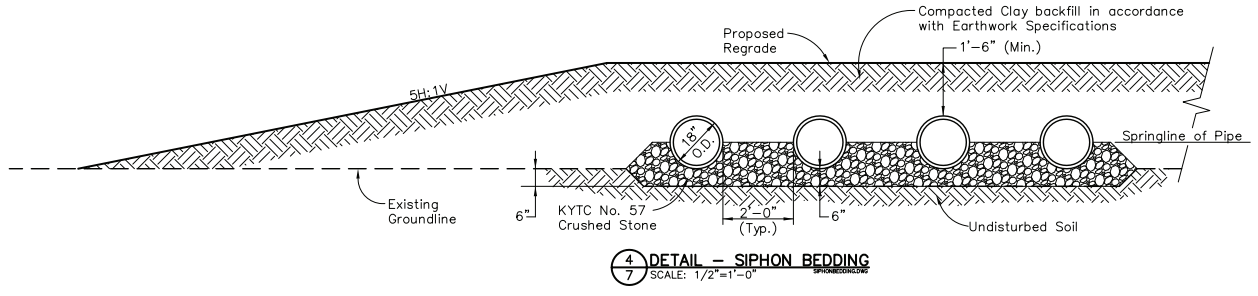
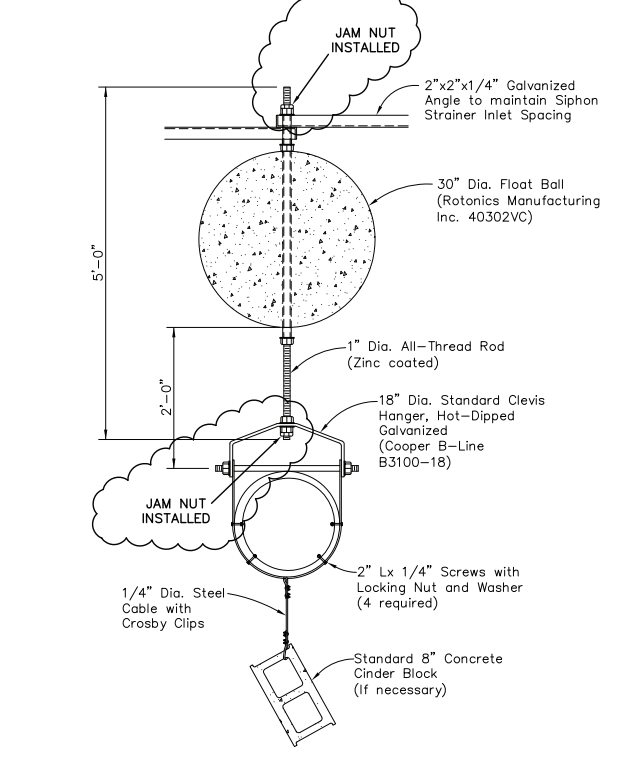


- NOTES:**
- Holes will be on top half of pipe only.
  - 4" dia. holes at 8" center to center.
  - 144 holes per strainer (4 rows with 36 holes each).
  - Rows are to be 8" apart center to center, and the holes will be offset by 4".
  - Provide 2 foot length without holes at 7 feet from each end for float ball hangers.



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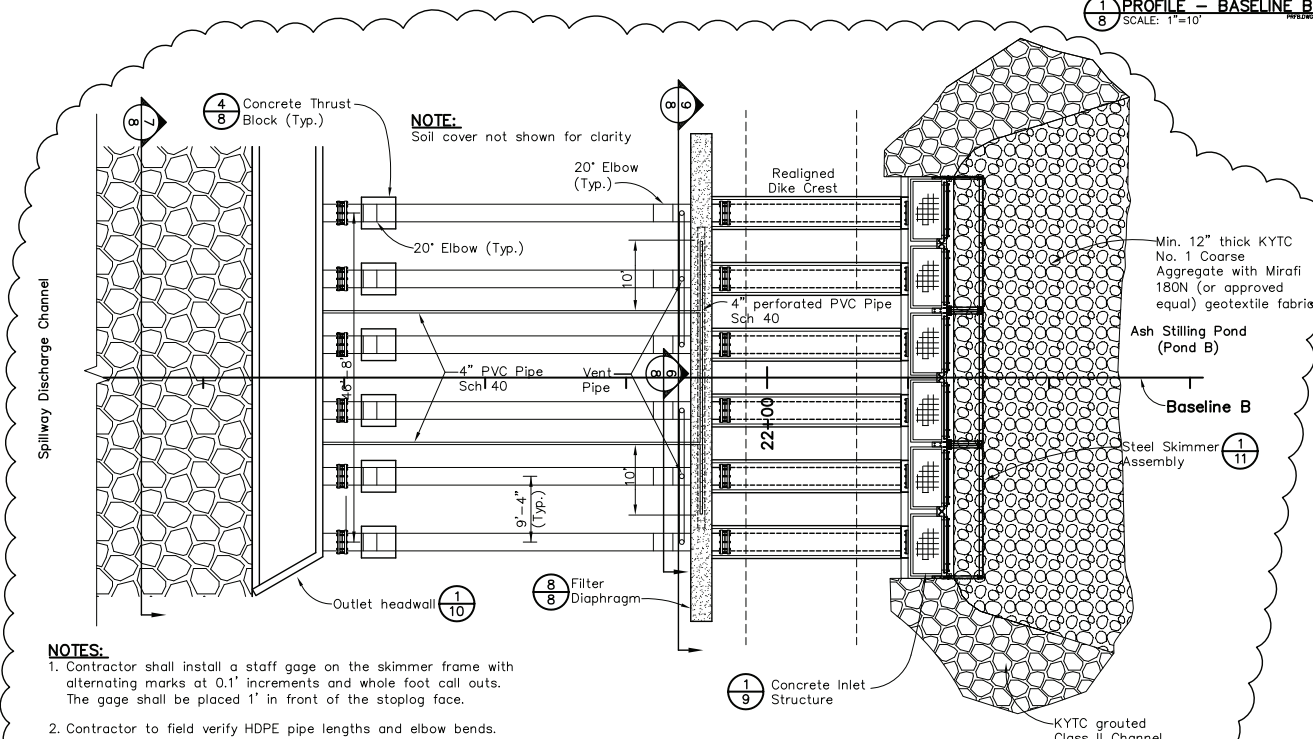
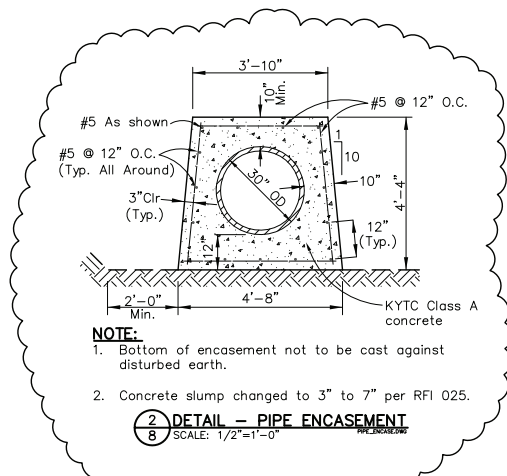
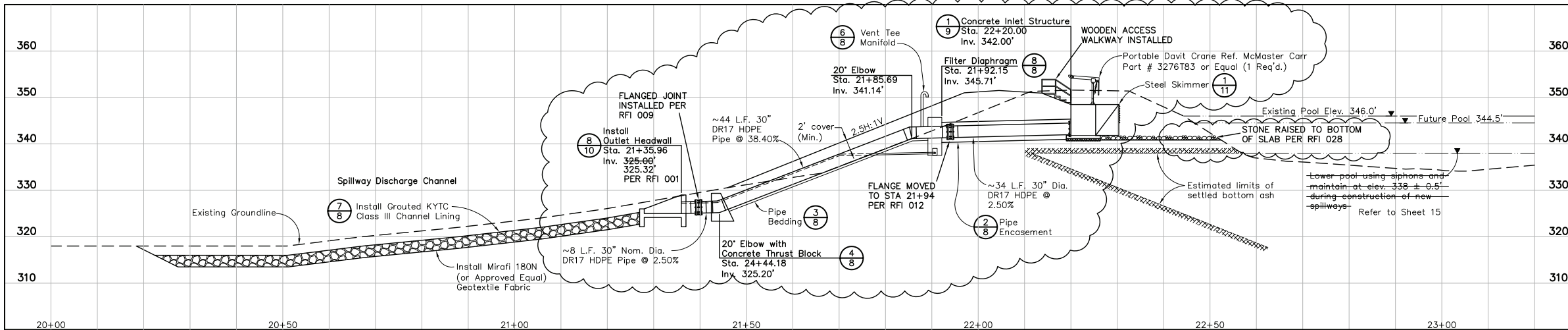


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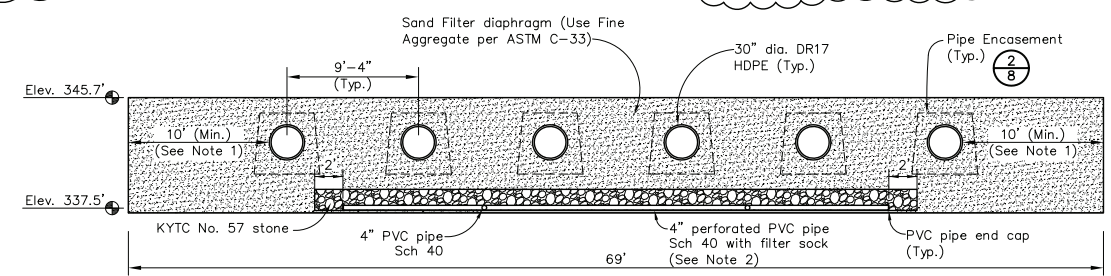
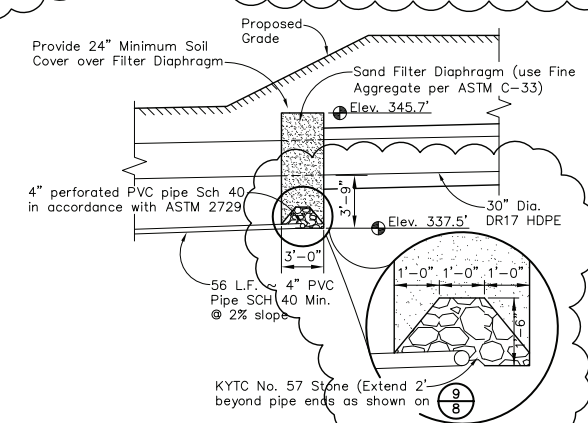
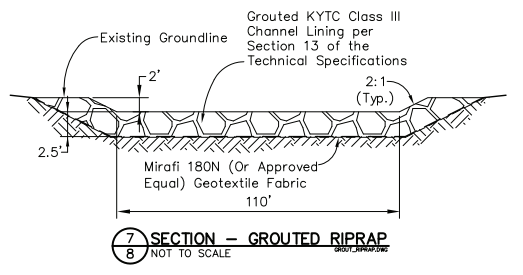
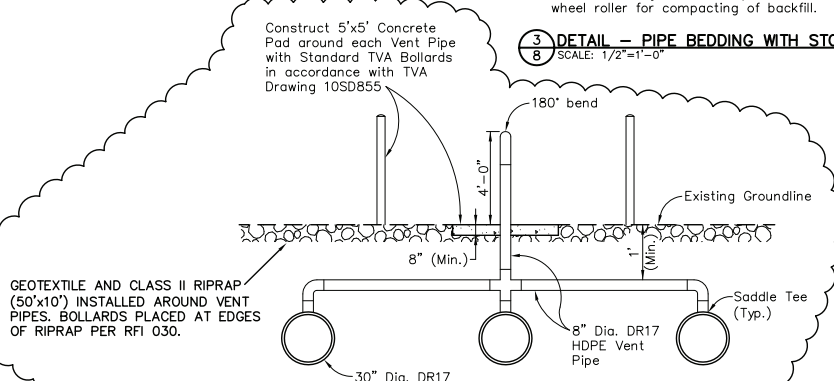
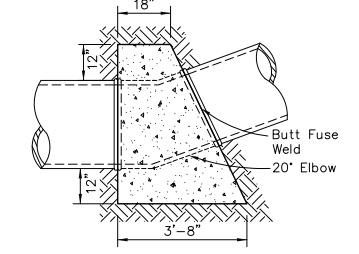
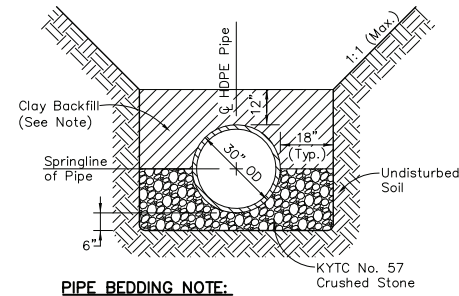
For Supporting Design Calculations see  
FPGSHFFSCDX0000020100001



PROJECT REVISION HISTORY											
R 2	01/06/12	NAB	TMM	MAH	MAH	DGS	MST	JCK	-	-	-
R 1	12/09/10	NAB	TMM	MAH	MAH	DGS	MST	JCK	-	-	-
REVISION NO.1											
R 0	05/04/10	LJP	TMM	MAH	MAH	DGS	MST	JCK	-	-	-
ISSUED FOR CONSTRUCTION											
REV.	DATE	ISSN	DRWN	CHD	SUPV	RVD	APPD	ISSD	PROJECT	AS CONST	BY
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:	DRWN 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					
SHAWNEE FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING											
AUTOCAD R 2000	DATE	35	C	10W505-07	R 2						
STANTEC		2		PLOT FACTOR:1							
TASK COMPLETED BY:		REV NO.		W_TVA							
C.A.D. DRAWING DO NOT ALTER MANUALLY											



**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.



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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.

**RECORD DRAWING**

REV.	DATE	ISSN	DRWN	CHD	SUPV	RVD	APPD	ISSD	PROJECT	AS CONST	REV	CD
R 2	01/06/12	G.W.	T.M.	M.A.H.	M.A.H.	D.G.S.	J.S.M.	J.C.K.				
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R 0	05/04/10	L.P.	T.M.	M.A.H.	M.A.H.	D.G.S.	M.S.T.	J.C.K.				

SCALE: AS SHOWN EXCEPT AS NOTED

YARD  
ASH DISPOSAL AREA NO. 2  
SPILLWAY REPLACEMENT PROJECT  
PRIMARY SPILLWAY  
WORK PLAN 5 (SHF-100504-WP-5)

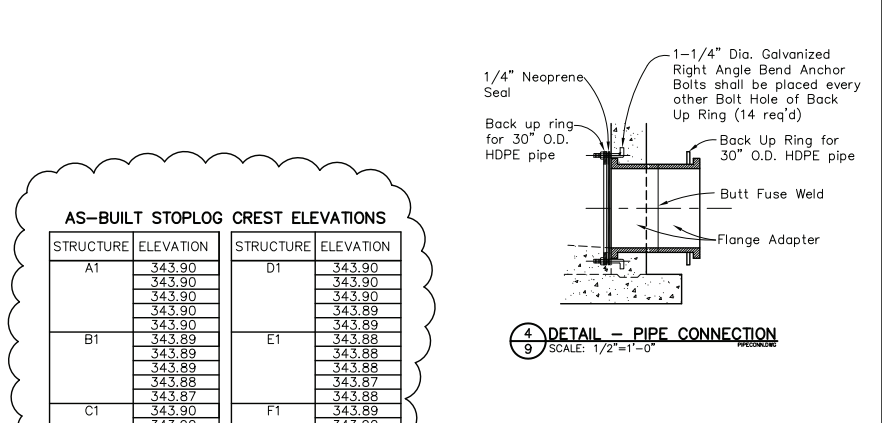
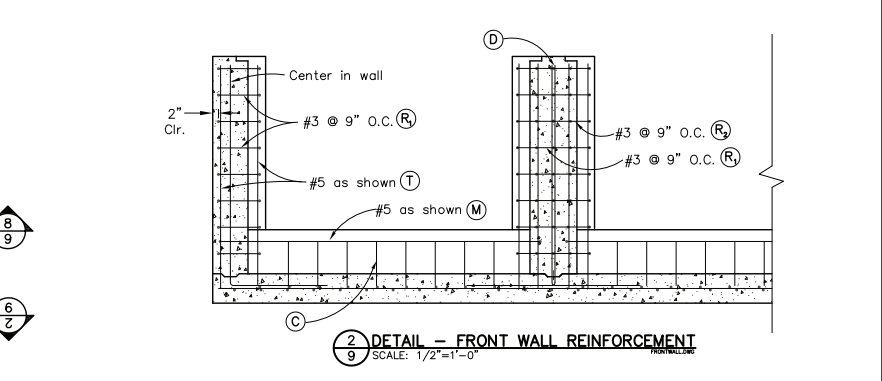
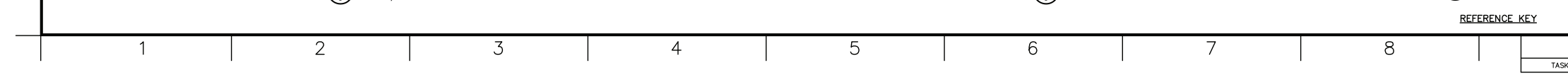
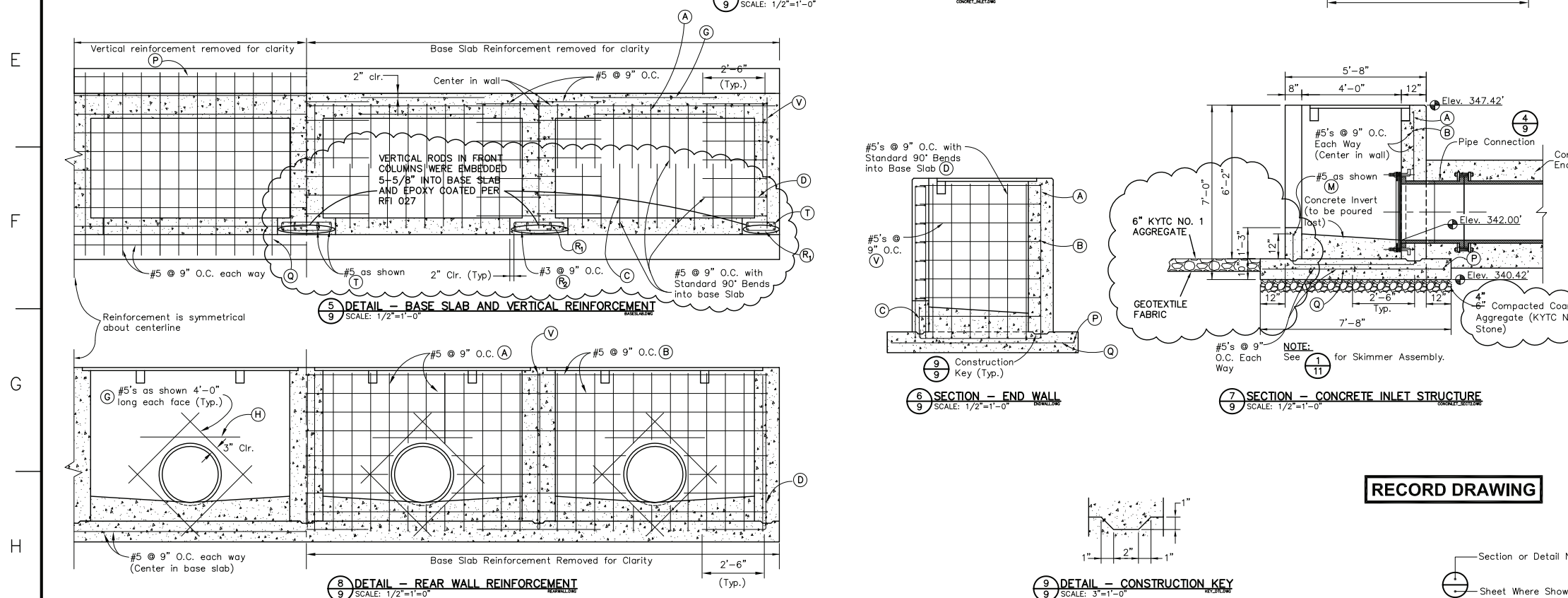
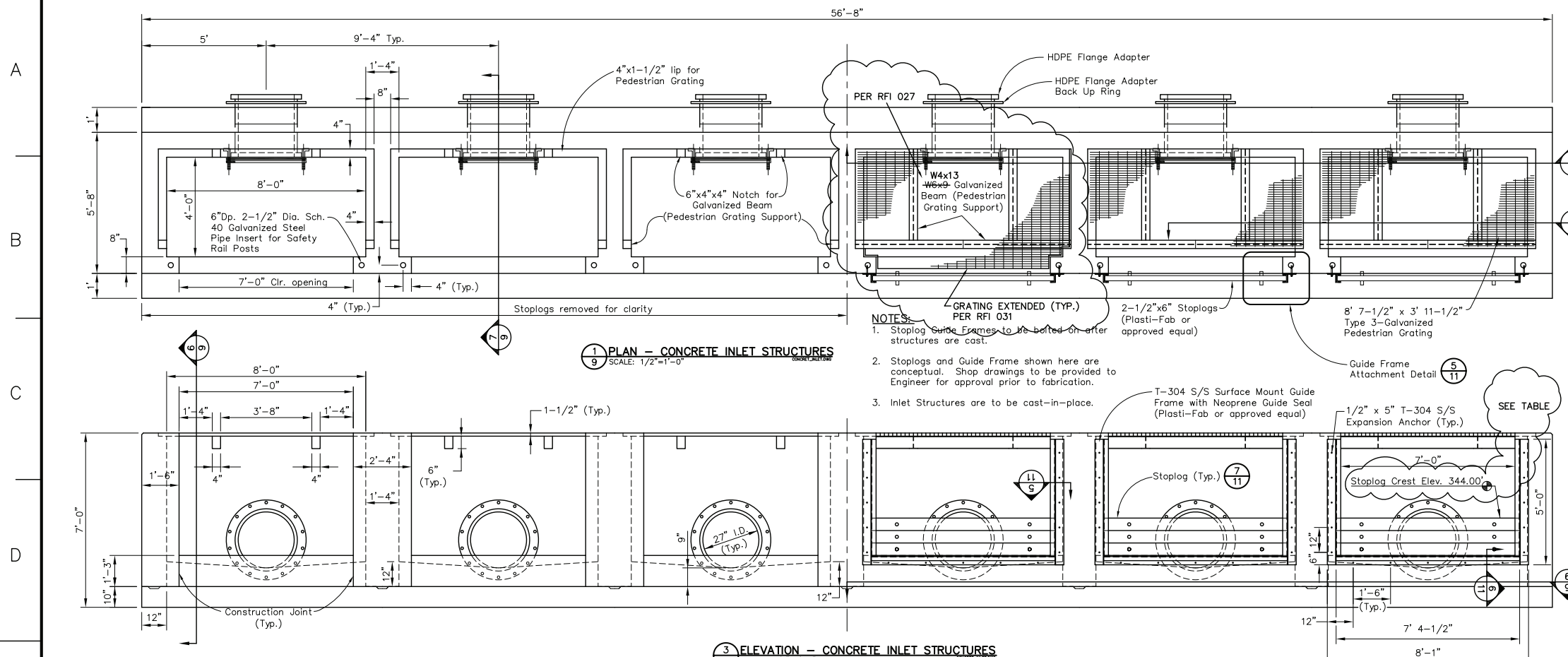
DESIGNED BY: L.J. PERKINS  
DRAWN BY: T.M. MYERS  
CHECKED BY: M.A. HOY  
SUPERVISED BY: M.A. HOY  
REVIEWED BY: D.G. STEVENS  
M.S. TURNBOW  
ISSUED BY: J.C. KAMMEYER

SHAWNEE FOSSIL PLANT  
TENNESSEE VALLEY AUTHORITY  
FOSSIL AND HYDRO ENGINEERING

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

For Supporting Design Calculations see FPGSHFFESCDX00000020100001





**AS-BUILT STOPLOG CREST ELEVATIONS**

STRUCTURE	ELEVATION	STRUCTURE	ELEVATION
A1	343.90	D1	343.90
	343.90		343.90
	343.90		343.89
	343.89		343.89
B1	343.89	E1	343.88
	343.89		343.88
	343.89		343.87
	343.87		343.88
	343.90		343.89
C1	343.90	F1	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.	Feet	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 <sub>1</sub>	3	56	2	11
R <sub>2</sub>	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.

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**RECORD DRAWING**

For Supporting Design Calculations see FPGSHFFSCDX0000020100001

REV.	DATE	ISSN	DRWN	CHD	SUPV	RVD	APPD	ISSD	PROJECT	AS CONST
R 1	01/06/12	G/W	TMM	MAH	MAH	SHB	JSM	TJ		

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

SHAWNEE FOSSIL PLANT  
TENNESSEE VALLEY AUTHORITY  
FOSSIL AND HYDRO ENGINEERING

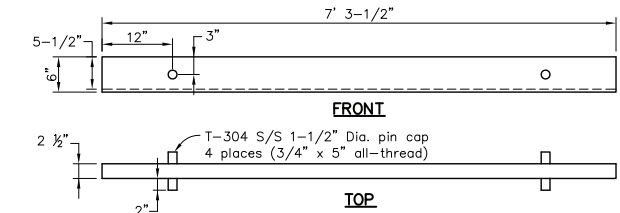
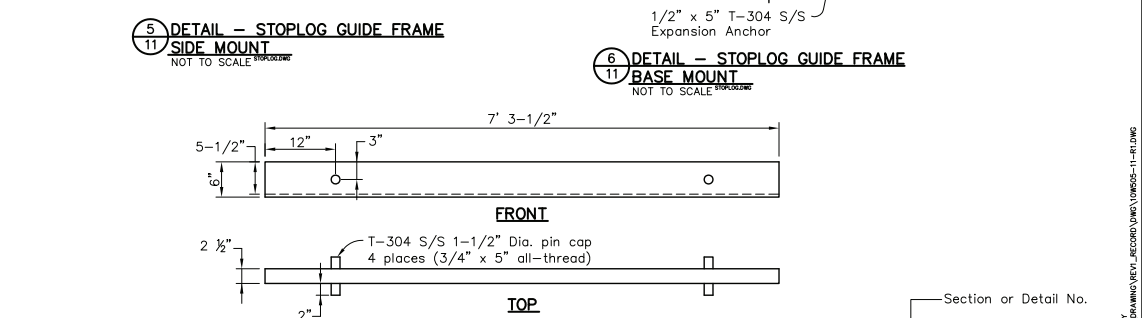
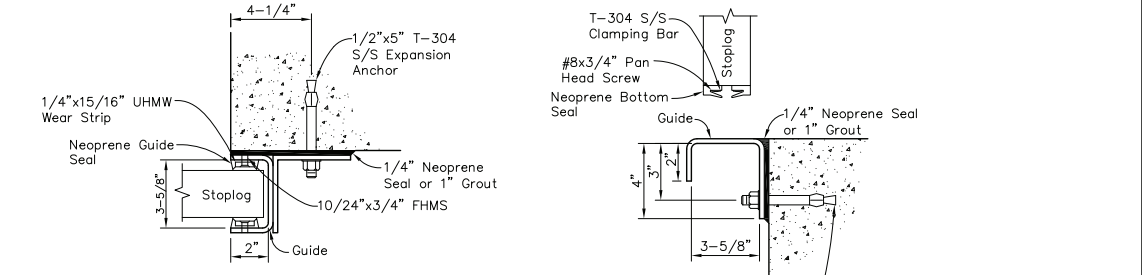
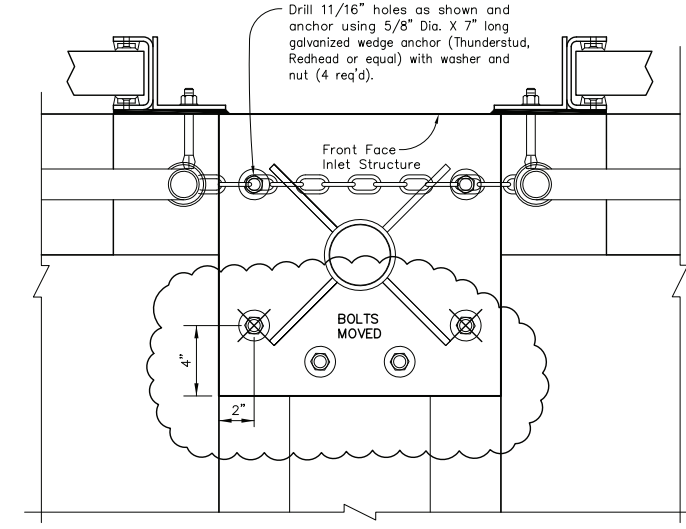
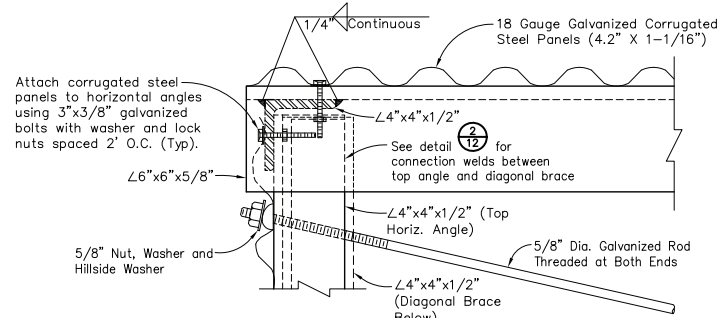
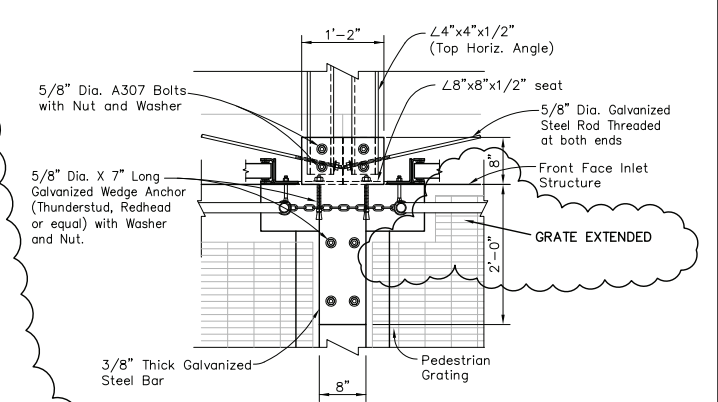
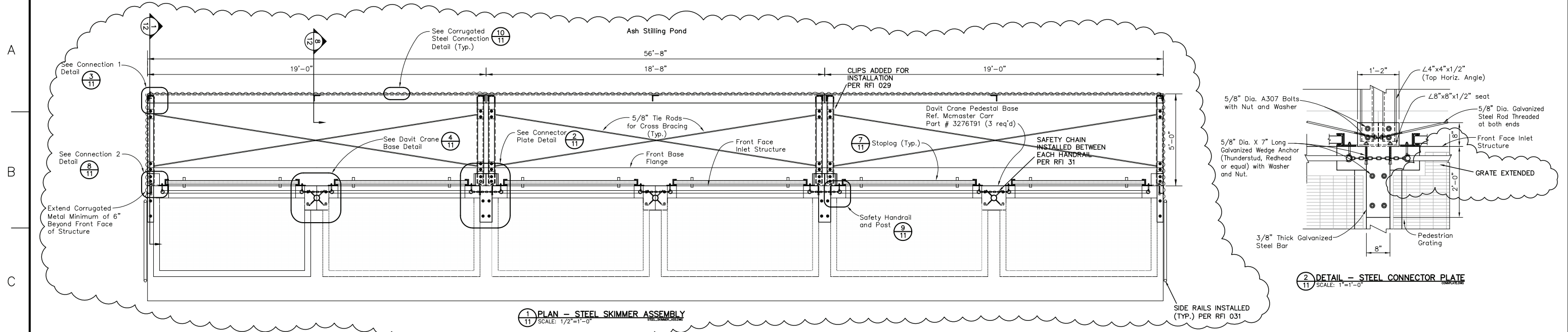
STANTEC CONSULTING SERVICES INC.  
1859 Bowles Ave., Ste 250  
St. Louis, Missouri  
63026-1944  
Tel: 636.343.3880  
Fax: 636.343.3554  
www.stantec.com

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

STANTEC 1  
TASK COMPLETED BY: REV NO.

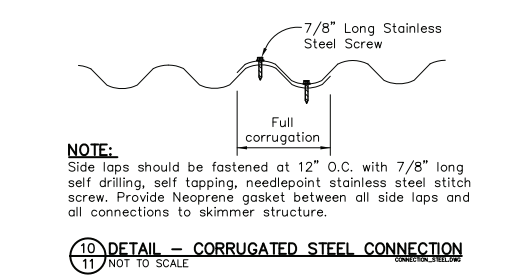
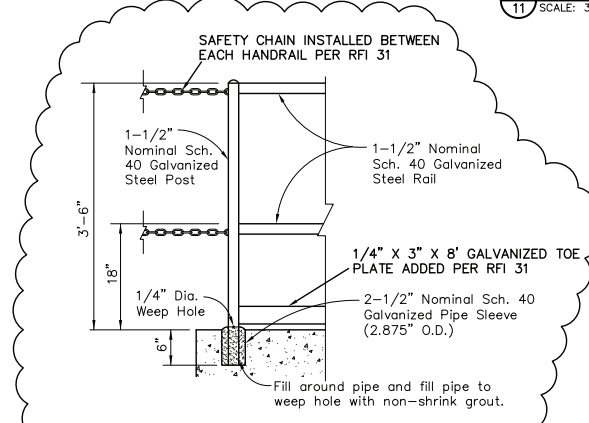
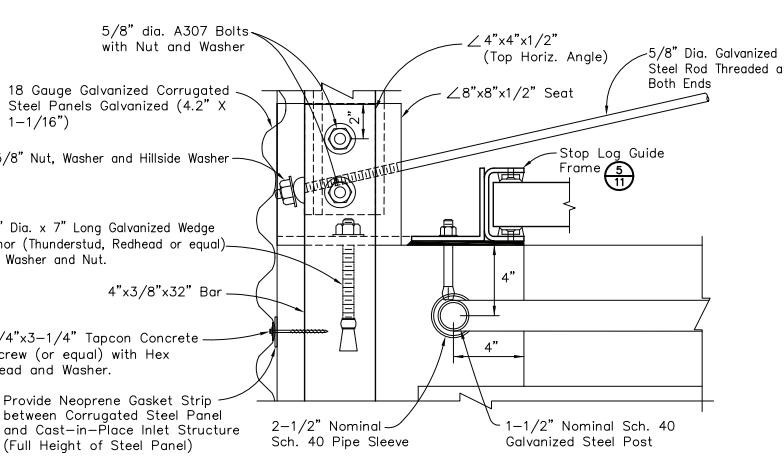
PLOT FACTOR: 1  
W\_TVA  
C.A.D. DRAWING  
DO NOT ALTER MANUALLY





**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.

**RECORD DRAWING**



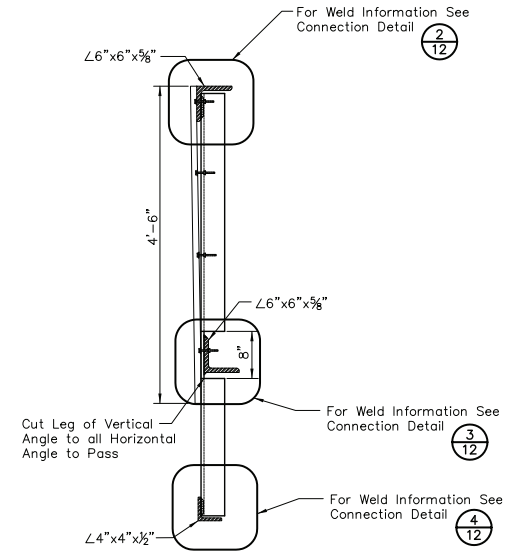
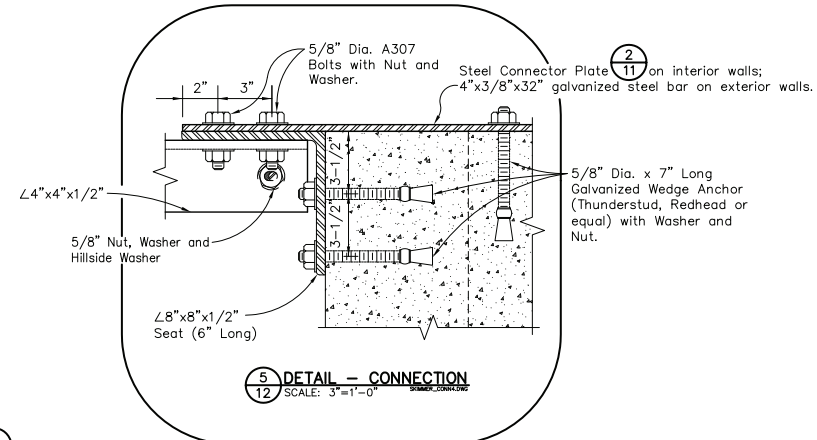
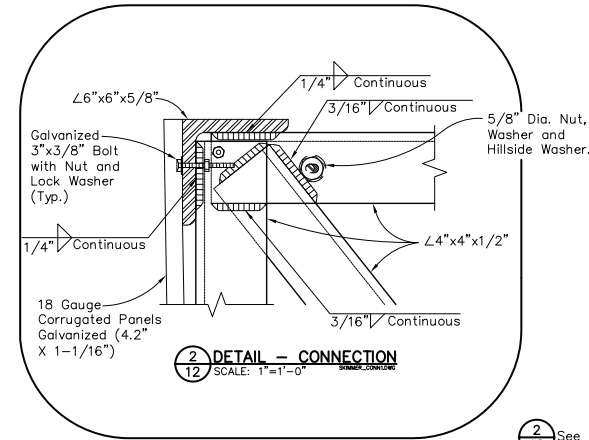
**RECORD DRAWING NOTES:**  
 1. These drawings have been prepared based on survey information performed by TVA Surveying in November and December, 2011 and provided to Stantec on December 7, 2011 and December 23, 2011.  
 2. Items shown on the "record drawing" with clouded notation are items for which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

For Supporting Design Calculations see FPGSHFFESCXD0000020100001		R 1 01/06/12 G/W TMM MAH MAH SHB JSM TJ - - -	
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ISSUED FOR CONSTRUCTION		ISSUED FOR CONSTRUCTION	
REV. NO.	DATE	ISSN	DRWN
1	01/06/12	35	C
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 L. WRIGHT	DRAWN BY T. MYERS	CHECKED BY M. HOY	SUPERVISED BY M. HOY
REVIEWED BY S. BICKEL	APPROVED BY J. MONTGOMERY	ISSUED BY T. JOHNSON	
SHAWNEE FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING			
AUTOCAD R 2000	DATE 01/06/12	SHEET 35	PROJECT NO. 10W505-11



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 Fax: 636.343.3554  
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A

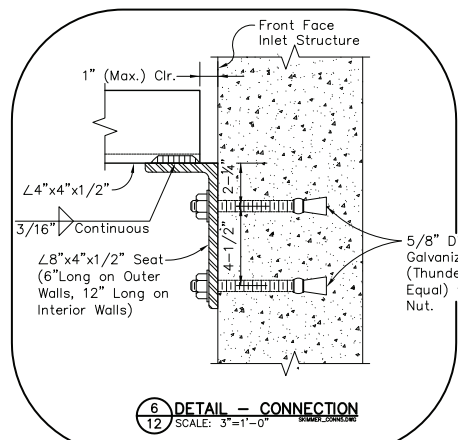
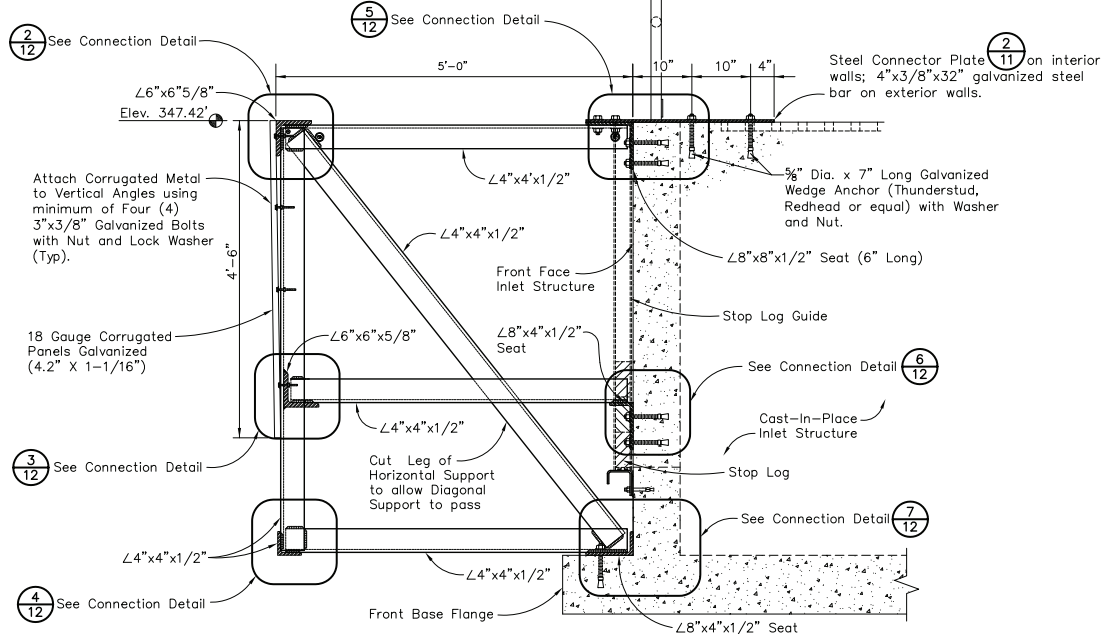
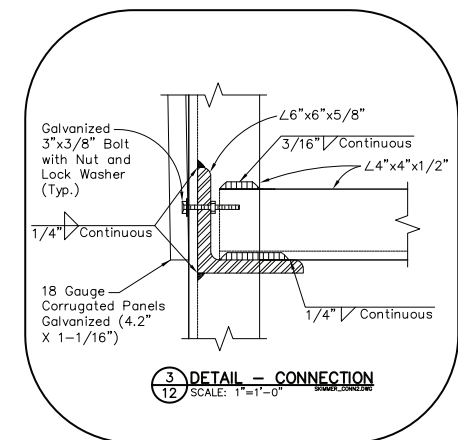


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B

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C

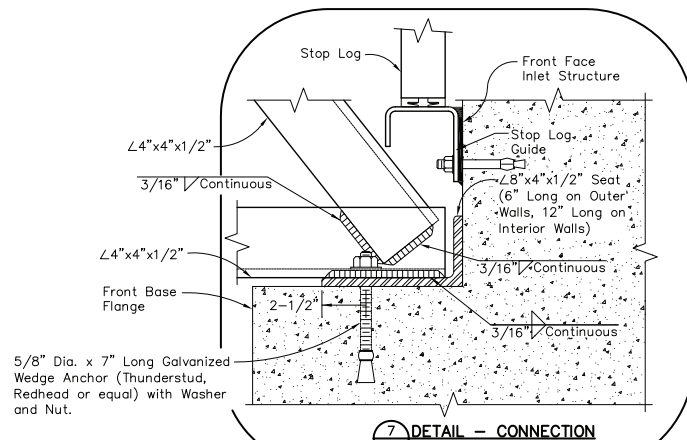
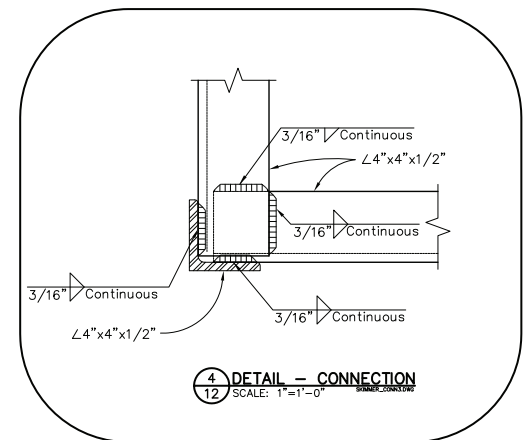


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**RECORD DRAWING NOTES:**

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- 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 FPGSHFFSCDX00000020100001		R 1	01/06/12	G/W	TMM	MAH	MAH	SHB	JSM	TJ	-	-	-	-	-	-	-	-	-
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ISSUED FOR CONSTRUCTION																			
REV.	NO.	DATE	ISSN	DRWN	CHD	SUPV	RVD	APPD	ISSD	PROJECT	NO.	AS CONST	BY	DATE	DISCIPLINE	INTERFACE	BY	DATE	BY
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	L. WRIGHT	DRAWN BY	T. MYERS	CHECKED BY	M. HOY	SUPERVISED BY	M. HOY	REVIEWED BY	S. BICKEL	APPROVED BY	J. MONTGOMERY	ISSUED BY	T. JOHNSON						
SHAWNEE FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING																			
AUTOCAD R 2000	DATE	01/06/12	35	C	10W505-12	R 1													



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Section or Detail No.  
Sheet Where Shown  
**REFERENCE KEY**

PLOT DATE: 01/06/2012 USER: JAMES STOKER V:\PROJECTS\2011\SPILLWAY REPLACEMENT\ENVIRONMENTAL\SHAWNEE\RECORD DRAWING\10W505-12-RECORD

A

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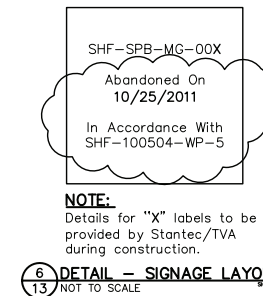
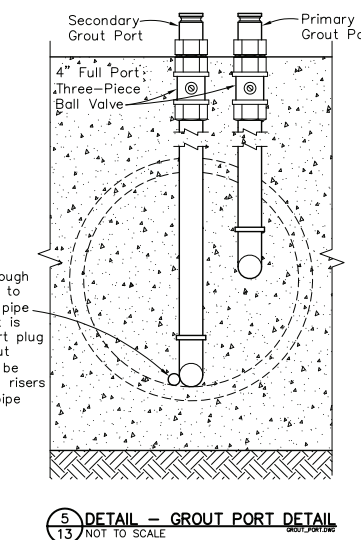
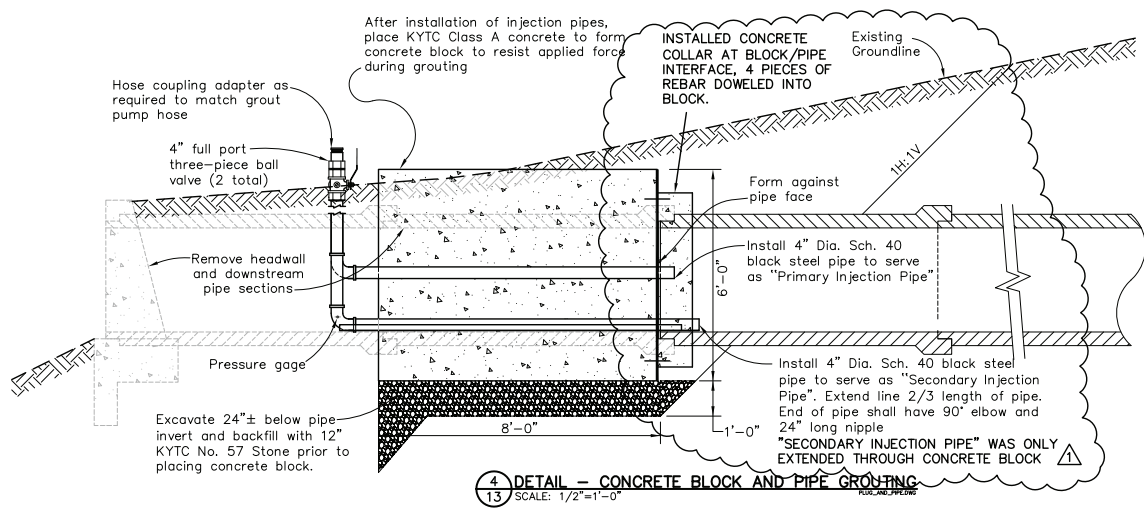
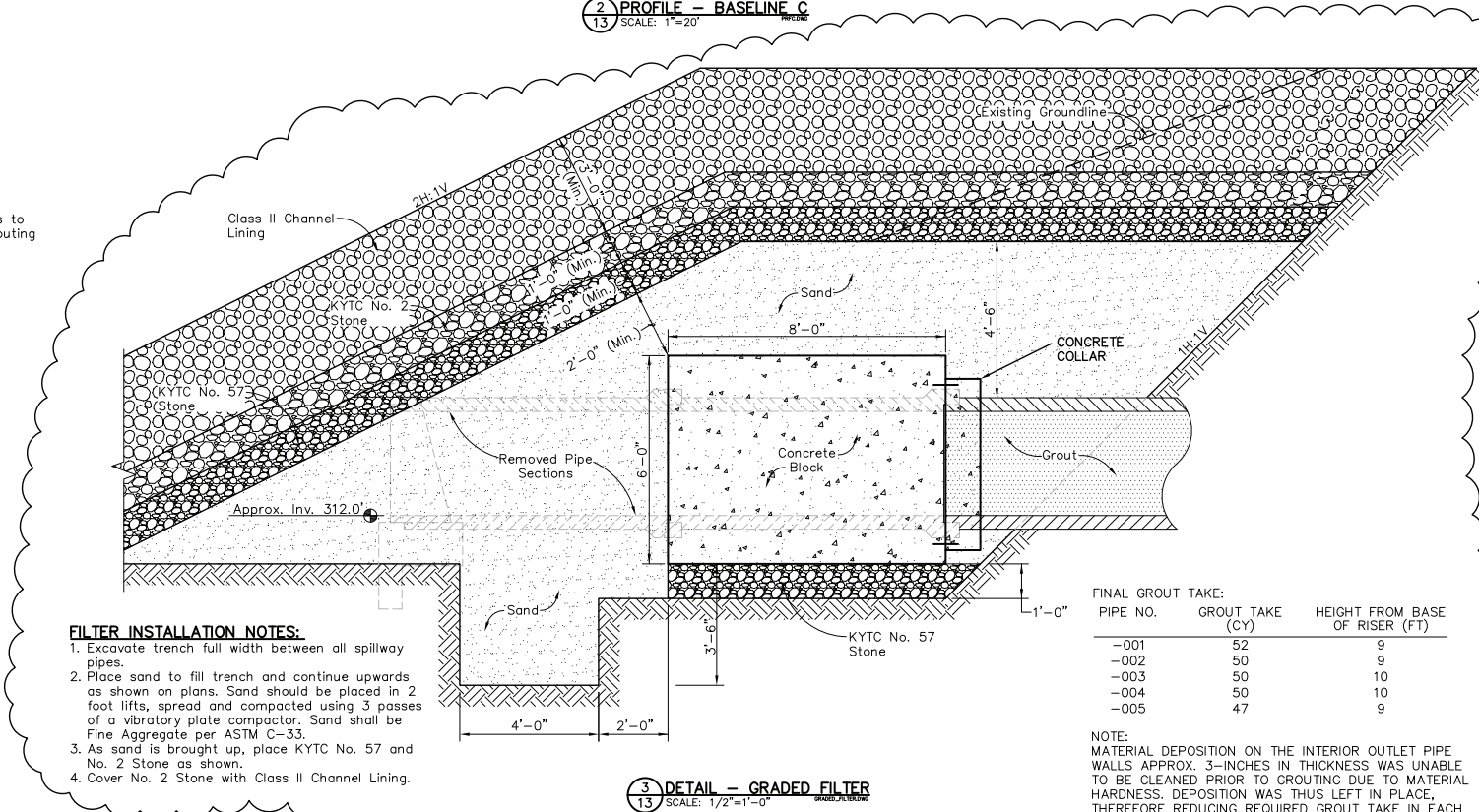
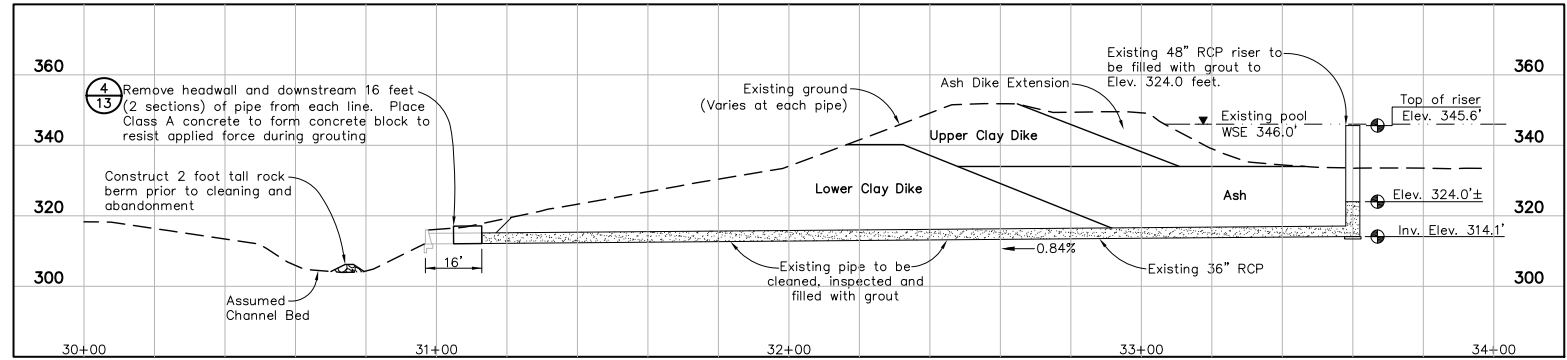
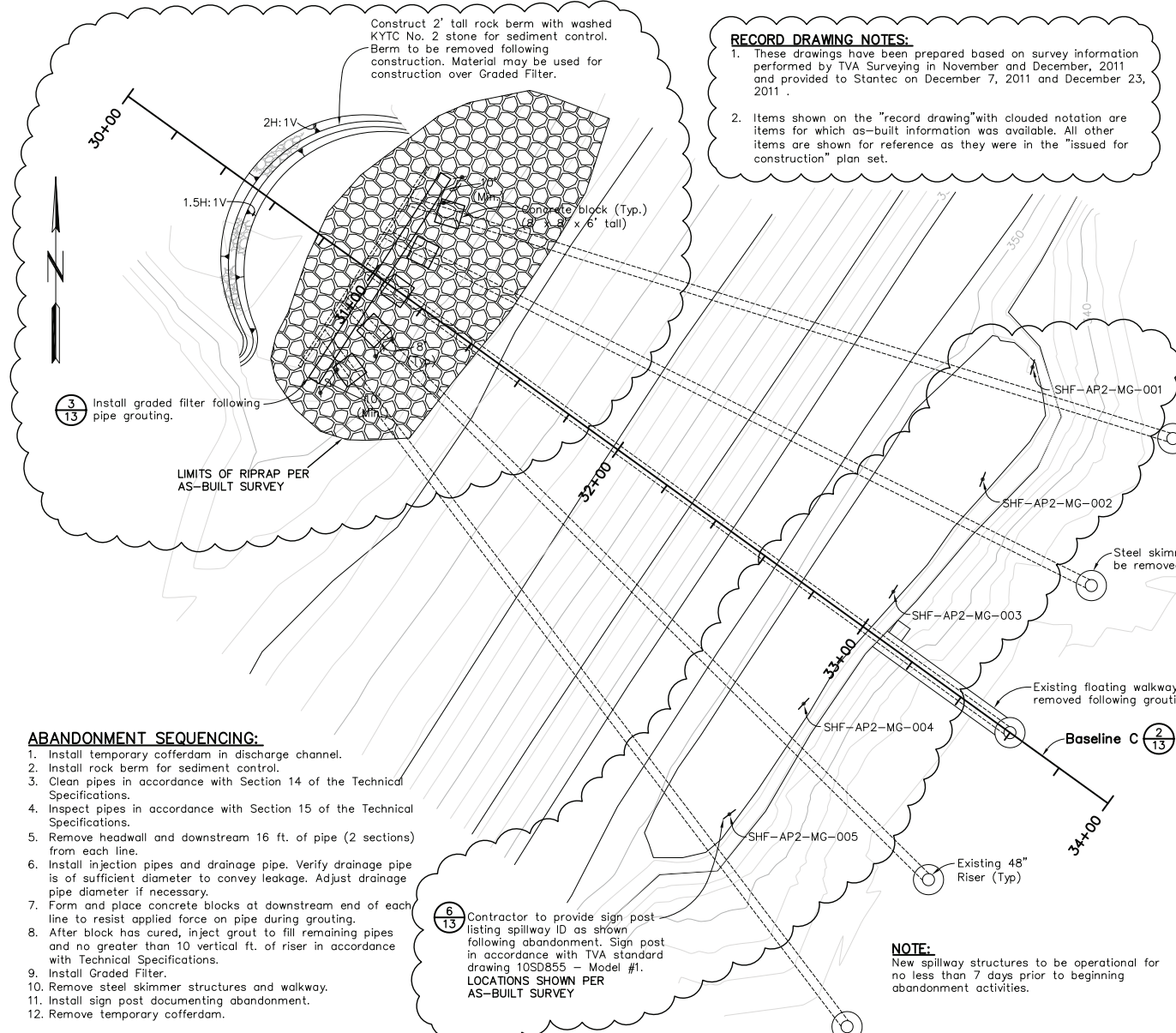
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**RECORD DRAWING**

For Supporting Design Calculations see FPGSHFFESCDX0000020100001

REV.	DATE	ISSN	DRWN	CHD	SUPV	RVND	APPD	ISSD	PROJECT	AS CONST	REV
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R 0	05/04/10	L/W	TMM	MAH	MAH	SHB	JSM	TJ			

SCALE: AS SHOWN EXCEPT AS NOTED

YARD ASH DISPOSAL AREA NO. 2

**SPILLWAY REPLACEMENT PROJECT**

**SPILLWAY ABANDONMENT DETAILS**

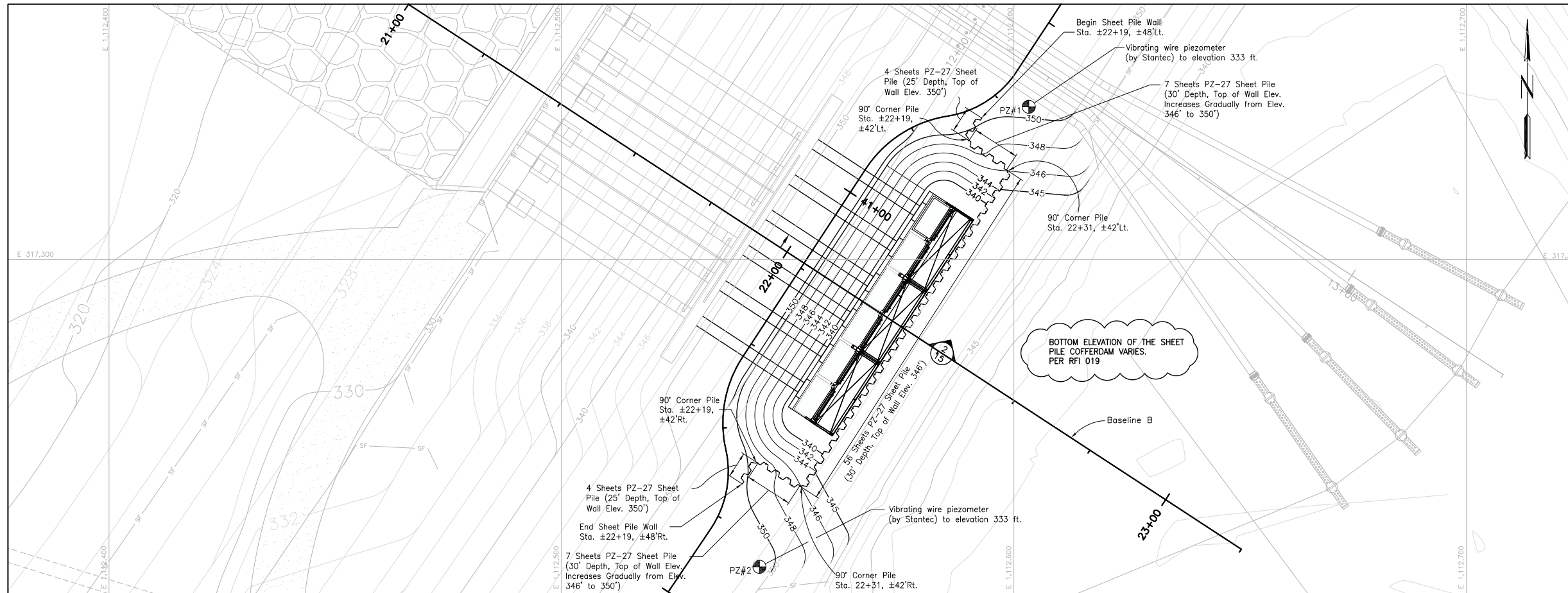
**WORK PLAN 5 (SHF-100504-WP-5)**

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

SHAWNEE FOSSIL PLANT  
FOSSIL AND HYDRO ENGINEERING

DATE: 01/06/12  
SHEET: 35 OF 35  
PROJECT NO: 10W505-13  
SCALE: R 1

STANTEC	1
TASK COMPLETED BY:	REV NO.

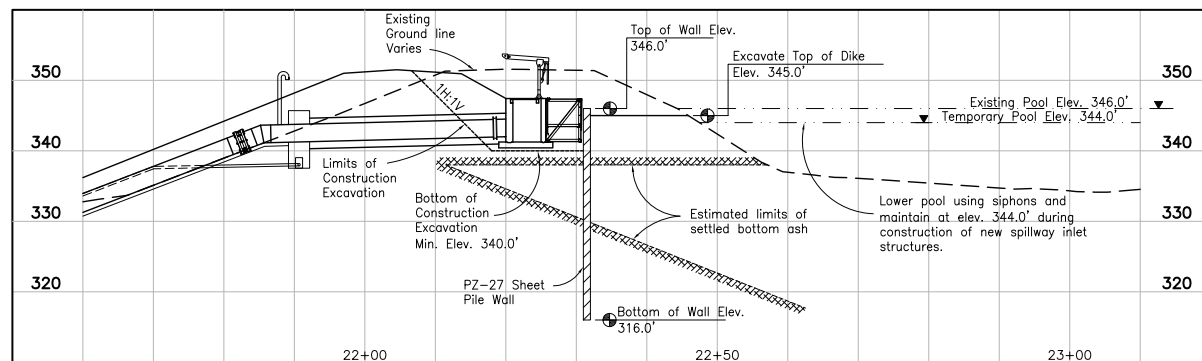


PZ #	COORDINATES	
	N	E
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2	317,232.07	1,112,543.77

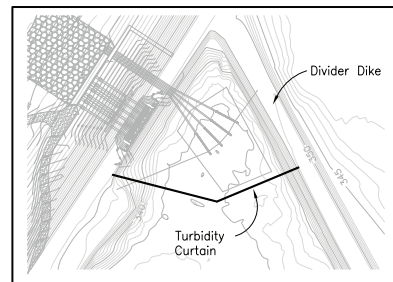
**1 PLAN - TEMPORARY SHEET PILE COFFERDAM**  
 SCALE: 1"=10'  
 Note: See Sheet 10W505-04 for Baseline B coordinates.

**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.



**2 SECTION - SHEET PILE WALL**  
 SCALE: 1"=10'



**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:**

- 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.
- 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.

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

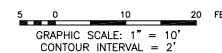
\*90° Corner Pile may be substituted for male and female corner piles. If so, (4) additional PZ-27 Sheet Pile - 30 ft long will be required.

**MAPPING NOTE:**

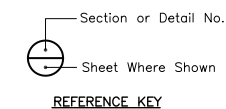
Topographic mapping shown on this layout was generated from surveys dated December 2009 and January 2010 and supplied by Tennessee Valley Authority (TVA). Horizontal coordinates are referenced to Kentucky South State Plane Coordinate System (Lambert), NAD 27. Elevations are based on NGVD 29.

**Legend**

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



**RECORD DRAWING**



**GENERAL PROVISIONS**

- 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.
- Refer to Sheets 10W505-02 and 10W505-03 for additional notes and technical specifications.
- 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.
- 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.
- Vibrating wire piezometers to be installed 1 week prior to beginning pile installation and monitored throughout pile installation.
- 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**

- Sheet piles shall be handled and stored in such a manner as to avoid damage.
- Sheet piles shall be PZ-27 sections and shall conform to ASTM A572 Grade 50.
- 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.
- Tolerance for plumbness shall be 1/4" 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.
- 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**

- Install turbidity curtain.
- 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.
- 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.
- Install sheet pile wall as shown on the plan view and cross-section to the depths and top of wall elevations provided.
- 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.
- Backfill and compact embankment over pipes and encasements in accordance with specifications.
- Excavate remaining limits of inlet structure 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.
- Install inlet structures and stoplogs.
- Construct final backfill along downstream and sides of inlet structures as shown on Sheet 10W505-05.
- Notify plant and temporarily lower pool using siphons and maintain at Elev. 340 feet during rock apron construction.
- 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.
- Raise ash pond to final pool level at Elev. 344.5 feet.

For Supporting Design Calculations see FPGSHFFESCDX00000020100001

R 1	01/06/12	G/W	TMM	MAH	MAH	DGS	MST	JCK	-	-	-
RECORD DRAWING											
R 0	12/09/10	NAB	TMM	MAH	MAH	DGS	MST	JCK	-	-	-
ISSUED FOR CONSTRUCTION											
REV. NO.	DATE	ISSN	DRWN	CHD	SUPV	RVD	APPD	ISSD	PROJECT NO.	AS CONST	REV. CD.
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: L.J. PERKINS	DRAWN BY: T.M. MYERS	CHECKED BY: M.A. HOY	SUPERVISED BY: M.A. HOY	REVIEWED BY: D.G. STEVENS	APPROVED BY: M.S. TURNBOW	ISSUED BY: J.C. KAMMEYER
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SHAWNEE FOSSIL PLANT  
 TENNESSEE VALLEY AUTHORITY  
 FOSSIL AND HYDRO ENGINEERING



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 Tel: 636.343.3880  
 Fax: 636.343.3554  
 www.stantec.com

**3 PLAN - TURBIDITY CURTAIN LOCATION**  
 NOT TO SCALE

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:

<b>Elevation</b>	<b>Discharge (cfs) (1)</b>	<b>Storage (acre-ft)</b>
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								
Elevation	Weir Flow		Pipe Orifice Flow		Outlet Pipe Flow (from HY-8)		Rating Curve for HEC-HMS	
	H (ft)	$Q=Cw(L - .02H)H^{1.5}$ (cfs)	$H_c$ (ft)	$Q=C_oA(2gH_c)^{0.5}$ (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*	
Weir Elev=	343.9 feet
Weir L =	7 feet
Pipe Inlet=	342 feet
Pipe Outlet=	341.14 feet
Pipe Inside D=	2.19 feet
Length=	34 feet
C <sub>w</sub> =	Varies
H <sub>c</sub> =	3.58
C <sub>0</sub> =	0.61

Computed Values	
L <sub>weir</sub> =	7 feet
A <sub>pipe</sub> =	3.766848 sq. ft.
Elev C**=	343.25 feet

Data Source
1
1
1
1
2
1
C <sub>w</sub> =3.27+0.4(H/H <sub>c</sub> ) (Chow 1959 - Assumed to behave as sharp crested weir - contraction)
1 (Hight of the weir crest above the structure base)
(Based on Brater and King 1976)

Equation/Comment
Reference 1
Area = PI*D <sup>2</sup> /4
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

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## NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: KY

### DATA DESCRIPTION

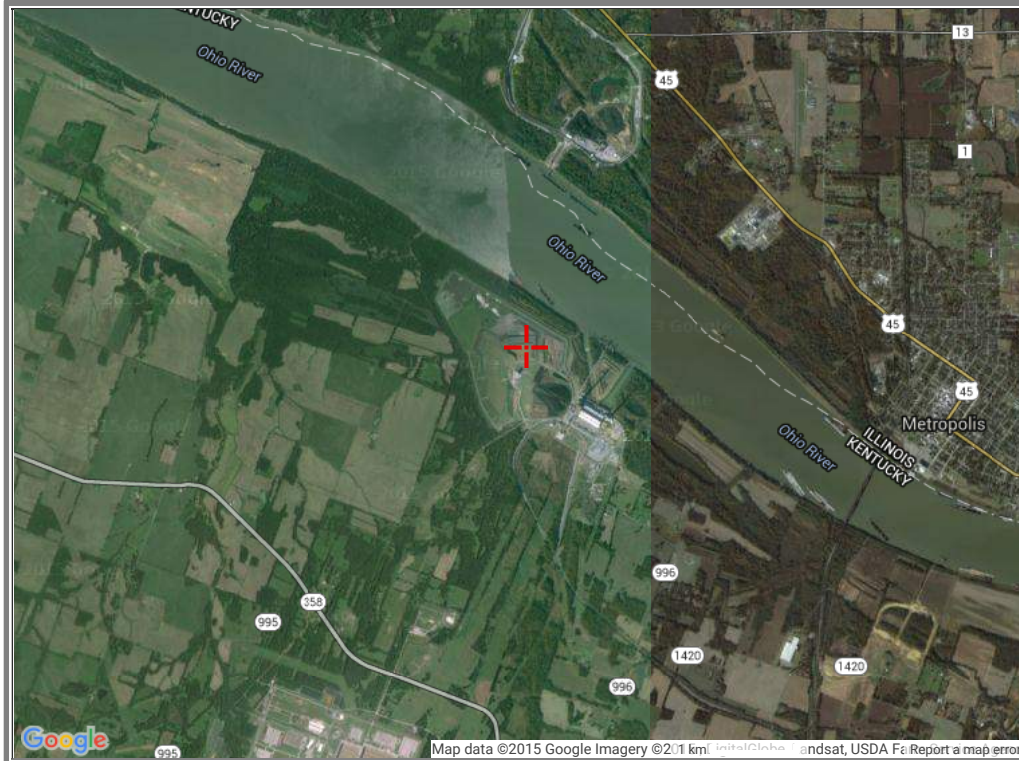
Data type:  Units:  Time series type:

### SELECT LOCATION

**1. Manually:**

a) Enter location (decimal degrees, use "-" for S and W): latitude:  longitude:    
 b) Select station (click here for a list of stations used in frequency analysis for KY):

**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

PF tabular

PF graphical

Supplementary information

Print Page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup>										
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)

PFDS: Contiguous US

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

<sup>1</sup> 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:

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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