APPENDIX I –
SEEP INVESTIGATION

APPENDIX I.1

SEEP INVESTIGATION SAMPLING AND ANALYSIS REPORT

Kingston Fossil Plant
Seep Sampling and Analysis Report

TDEC Commissioner's Order:
Environmental Investigation Plan
Kingston Fossil Plant
Harriman, Tennessee

June 17, 2020

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Record

Revision	Description	Author		Quality Check		Independent Review	
0	Draft to TDEC	Hiedi Waller	06/11/2020	Rebekah Brooks	6/11/2020	Carole Farr	6/11/2020

Sign-off Sheet

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Table of Contents

Abbreviations

AOC	Area of Concern
AOI	Area of Interest
CCR	Coal Combustion Residuals
DI	Deionized
DO	Dissolved Oxygen
EAR	Environmental Assessment Report
EIP	Environmental Investigation Plan
EnvStds	Environmental Standards, Inc.
FSP	Field Sampling Personnel
GPS	Global Positioning System
HSCluster-(C,R)	Historic Seeps C and R
HSD	Historic Seep D
HSK	Historic Seep K
ID	Identification
IDW	Investigation Derived Waste
KIF	Kingston Fossil Plant
L/AOC#2	Historic seep L/AOC#2
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
SU	Standard unit
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner’s Order OGC15-0177
TI	Technical Instruction
TVA	Tennessee Valley Authority

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) prepared this sampling and analysis report (SAR) on behalf of the Tennessee Valley Authority (TVA) to document the results of a seep investigation performed April 23-25, 2019 at TVA's Kingston Fossil Plant (KIF Plant) located in Harriman, Tennessee.

The purpose of this SAR is to document the work completed during the seep investigation and to present the information and data collected during the execution of the Seep Sampling and Analysis Plan (SAP) (Stantec 2018a). This SAR is not intended to provide conclusions or evaluations of seep investigation soil or water analytical results. The scope of the seep investigation represented herein is part of a larger environmental investigation. The evaluation of the results will consider other aspects of the environmental investigation at the KIF Plant and be presented in the Environmental Assessment Report (EAR).

The purpose of the seep investigation is to collect information regarding the potential presence of seeps at the KIF Plant in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order No. OGC15-0177 (TDEC Order) issued to TVA (TDEC 2015). The TDEC Order sets forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee. Seep investigation activities were conducted in general accordance with the following documents developed by TVA to support fulfilling the requirements of the TDEC Order at the KIF Plant:

- *Seep SAP,* Kingston Fossil Plant (Stantec 2018a)
- *Environmental Investigation Plan (EIP)* (Stantec 2018b)
- *Quality Assurance Project Plan (QAPP)* (Environmental Standards, Inc. 2018).

The seep investigation was implemented in accordance with TVA- and TDEC-approved Programmatic and Project-specific changes. No variances in scope or procedures occurred during field activities, as indicated in Section 3.7.

The seep investigation consisted of two main activities – inspecting accessible areas by foot or vehicle, and investigating inaccessible areas (i.e., areas covered by riprap) by boat. Inspections of accessible areas allowed for the identification of potentially active seeps and additional monitoring and/or sampling as warranted. Investigation of inaccessible areas involved collection of water quality parameter measurements using a multi-parameter sonde and following protocols approved by TDEC. The sonde measurements were evaluated using statistical methods to identify potentially active seeps located in the riprap-covered areas. Potentially active seeps identified during the accessible area inspection and from the statistical analysis of the water quality parameter measurements are referred to herein as areas of interest (AOIs). Quality Assurance oversight on data acquisition protocols, sampling practices, and data review was performed by Environmental Standards, Inc. (EnvStds) under direct contract to TVA.

2.0 OBJECTIVE AND SCOPE

The primary objective of the seep investigation conducted pursuant to the Seep SAP at the KIF Plant in response to the TDEC Order was to identify and collect information regarding the potential presence of active seeps. The approach for the investigation of active seeps was to:

- Identify AOIs in accessible areas, if any
- Collect water and soil samples at identified AOIs, if feasible, per TVA and TDEC directive and submit samples to the laboratory for analysis of coal combustion residuals (CCR)-related constituents as defined in the SAP
- Collect water quality parameters (pH, temperature, dissolved oxygen (DO), and specific conductance) in surface water in inaccessible areas (i.e., riprap covered) adjacent to historically identified seeps and areas of concern (AOCs) to assess whether AOIs exist in these areas
- Conduct statistical analysis of water quality parameter data to assess whether there was a potential for AOIs to exist in the inaccessible areas and whether additional investigation and/or sampling were warranted.

The scope of the seep investigation activities included:

- Visual inspection of accessible areas to identify AOIs and locations for additional investigation, if warranted
- Field measurement of water quality parameters by boat in the Emory River adjacent to historical seep locations/AOCs that were inaccessible due to riprap, etc.
- Statistical analysis of the water quality parameter data to determine if there are statistically significant differences between monitoring results collected “adjacent to” and “upstream of” historical seep locations or AOCs, and whether additional investigation and/or sampling were warranted.

Historic Seeps A, B, F, G, H, I, J, and Q are within the Kingston Recovery Project Ash Landfill which is not part of the study area defined in the EIP. Historic Seep E is monitored under the KIF Plant National Pollutant Discharge Elimination System permit. Historic Seeps N/AOC #4, O/AOC #5 and P/AOC #6 were located along the former dike separating the Kingston Recovery Project Ash Landfill and the Stilling Pond. This area is not part of the seep investigation.

3.0 FIELD ACTIVITIES

Seep investigation field activities at the KIF Plant were conducted April 23 - 25, 2019. Stantec performed field activities based on guidance and specifications in TVA's Environmental (ENV) Technical Instructions (TIs), the Seep SAP, and the QAPP prepared by EnvStds (EnvStds 2018). As part of TVA's commitment to generate representative and reliable data, EnvStds, under direct contract with TVA, conducted audits of field activities and provided quality reviews of field documentation.

Stantec conducted the following field activities:

- Visually inspected areas accessible by foot or vehicle to identify AOI locations
- Documented the locations of AOIs and water quality parameter measurements using a sub-meter global positioning system (GPS) and plotted them on maps
- Measured water quality parameters (pH, temperature, DO, and specific conductance) using a boat upstream, adjacent to, and downstream from historical seep/AOC locations that were inaccessible due to structural mitigation (e.g., limestone riprap) with a multi-parameter sonde using the frequencies and methods defined in the SAP and in accordance with ENV-TI-05.80.46 *Field Measurement Using a Multi-Parameter Sonde*
- Measured surface water quality parameters using a boat at control locations upstream and outside the influence of CCR units and at intermediate areas located between historical seep/AOC locations. Water quality parameter measurements at these locations were used for comparison to measurements collected at the intermediate areas
- Recorded field measurements of water quality parameters at 172 measurement locations.

Details of each activity are presented in the following sections. The water quality parameter measurement locations are provided in Appendix A, Exhibits A.1 through A.3. The data table is provided in Appendix B, Table B.1. Photographs of site conditions are provided in Appendix C. Statistical analysis methods and results are provided in Appendix D.

3.1 ACCESSIBLE AREA INSPECTION

An inspection of areas accessible by foot or vehicle was conducted on April 23, 2019, to identify AOIs and potential soil and water sample locations. TDEC and TVA staff accompanied Stantec personnel during the visual walkdown. Observations noted on the *Daily Field Activity Log* included:

- Historic Seep Location D, immediately adjacent to the F22 outfall, was covered with riprap. No signs of wetness or discoloration were observed
- Historic Seep Locations C and R, immediately adjacent to the plant diffuser piping, were covered with riprap. No signs of wetness or discoloration were observed

- Historic Seep Location K was covered with riprap which extended to the east end of the engineered wetlands. No signs of wetness or discoloration were observed
- Historic Seep Location L/AOC#2 was traversed. No signs of wetness or discoloration were observed
- The only accessible area (without riprap) was the vegetated downslope area adjacent to the Engineered Wetland. No indications of potential seepage were observed.

No AOIs were identified during the visual walkdown inspection of accessible areas, so no water or soil samples were collected for laboratory analysis.

3.2 INACCESSIBLE AREA INSPECTION AND WATER QUALITY PARAMETER MEASUREMENTS

To evaluate potential seeps not visible due to structural mitigation areas (e.g., riprap), a boat was used by TVA and Stantec field sampling personnel (FSP) to access locations near the bank of the Emory River for measurement of water quality parameters (pH, temperature, DO, and specific conductance). The water quality parameters were measured in surface water upstream, adjacent to, and downstream of four historical seepage/AOC locations, at 17 intermediate areas, and in two upstream control areas with a multi-parameter sonde. The locations of the water quality parameter measurements are shown on Exhibits A.1, A.2 and A.3 in Appendix A.

Water quality parameters (pH, specific conductance, temperature and DO) were recorded by Stantec FSP at each measurement location. Two control areas were established. The northern control area encompassed measurement locations KIF-UC-153 to KIF-UC-172 and, the southern control area included measurement locations KIF-UC-98 to KIF-UC-117 (Exhibit A.1; Appendix A).

Field parameter measurements were taken to collect water quality data associated with four Historic Seep/AOC locations. The location and measurement identifications for each historic seep/AOC are provided below.

- Historic Seep L/AOC #2 (L/AOC #2) – measurements were taken at locations KIF-LAOC2-D-2 to KIF-LAOC2-U-30 downstream, adjacent and upstream of Historic Seep Location L/AOC #2, as shown in Exhibit A.2
- Historic Seep K (HSK) – measurements were taken at locations KIF-HSK-D-35 to KIF-HSK-U-63 downstream, adjacent and upstream of Historic Seep Location K, as shown in Exhibit A.2
- Historic Seeps C and R (HSCluster-[C,R]) – measurements were taken at locations KIF-HSCR-D-69 to KIF-HSCR-U-96 downstream, adjacent and upstream of Historic Seep Locations C and R, as shown in Exhibit A.3. Because of their close proximity, the areas for these historic seep locations were combined (clustered) into a single dataset for evaluation

- Historic Seep M/AOC #3 and Historic Seep D (M/AOC#3,HSD) – measurements were taken at locations KIF-MAOC3HSD-D-119 to KIF-MAOC3HSD-U-147 downstream, adjacent and upstream of Historic Seep Location D/AOC #3 and Historic Seep location D, as shown in Exhibit A.3. Because of their close proximity, the areas for these historic seep and AOC locations were combined into a single dataset for evaluation.

The water quality parameter results are provided in Table B.1 in Appendix B. The upstream control measurements were taken at the locations shown on Exhibits A.2 and A.3 in Appendix A. Additional measurements were taken at the intermediate areas between historical seep locations/AOCs, as identified by "IA" in the measurement numbers (and indicated in the legend) in Exhibits A.2 and A.3 in Appendix A.

3.3 DOCUMENTATION

Stantec planned the seep investigation activities per ENV-TI-05.08.01, *Planning Sampling Events* and maintained field documentation in accordance with ENV-TI-05.80.03, Field Record Keeping, ENV-TI-05.80.46, Field Measurement Using a Multi-Parameter Sonde, the SAP, and QAPP. Field activities and data were recorded on program-specific field forms. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements. Additional information regarding field documentation is provided below.

3.3.1 Field Forms

Stantec FSP used program-specific field forms to record field observations and data for specific activities. Field forms used during the seep investigation included:

- *Daily Field Activity Log*
- *Equipment Calibration Form*
- *Seep Investigation/Surface Stream Field Parameter Measurement Form.*

3.3.1.1 Daily Field Activity Logs

Stantec FSP recorded field team members, field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program. No deviations from the SAP, TIs, or QAPP occurred during this investigation as summarized in the Variations section of this report.

3.3.1.2 Equipment Calibration Form

Stantec FSP performed daily calibration of the water quality meter and documented the results on an *Equipment Calibration Log*. The form documented the calibration results for temperature, specific conductance, pH and DO and verified that the field instrument's sensors were operating within acceptance criteria. Refer to Section 3.4 for additional details on equipment calibration procedures.

3.3.1.3 Seep Investigation/Surface Stream Field Parameter Measurement Form

Stantec FSP recorded water quality parameters in accordance with ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde* on a *Seep Investigation/Surface Stream Field Parameter Measurement Form*. The form documented the AOIs; location type (Historic Seep, AOC, Upstream Control or Intermediate Area); measurement location (upstream, downstream, adjacent or control); measurement identification; latitude and longitude coordinates recorded by GPS at the time of measurement; date; time; pH; temperature; specific conductance; DO; presence of riprap; and general comments/observations.

3.4 EQUIPMENT CALIBRATION

The multi-parameter sonde used to collect, generate, or measure water quality parameters was calibrated each day prior to use as specified in the SAP, QAPP, and ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.* Afternoon calibration verifications were performed to evaluate if the instrument remained within acceptance criteria during data collection. Temperature and barometric pressure instrument readings were verified using a calibrated National Institute of Standards and Technology traceable thermometer, and National Weather Service (via mesowest.utah.edu) barometric pressure readings for Rockwood, Tennessee, respectively. Additional details regarding equipment calibration were recorded on the Equipment Calibration Form, as described in Section 3.3.1.2.

3.5 WATER QUALITY PARAMETER DATA COLLECTION

Stantec FSP collected field measurements of water quality parameters including:

- pH (in Standard Units)
- Specific conductance (in microSiemens per centimeter)
- DO (in milligrams per Liter)
- Temperature (in degrees Celsius).

Stantec FSP collected the measurements using a water quality meter (YSI ProPlus) at 172 locations over a three-day period, April 23-25, 2019. The measurement locations were identified using GIS coordinates on maps in advance of field activities, with individual historical seep locations/AOCs combined for evaluation purposes because of proximity (referred to as a “cluster”). Water quality parameters were measured immediately downstream, adjacent to, and upstream of each identified location, in intermediate areas between the historical seep/AOC locations, and at upstream control locations, as described in Section 3.2. Measurements were collected from a boat beginning at downstream locations and moving upstream for the targeted historical seep/AOC locations to minimize disturbance of water and sediment at the measurement location. Final measurement location coordinates were documented in the field using GPS.

Measurements, associated locations, field activities and notable observations were documented on electronic field forms described in Section 3.3. A summary of the water quality parameter results at the 172 measurement locations are provided in Table B.1 in Appendix B.

3.6 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during Seep Investigation activities included:

- Used calibration solutions
- Decontamination fluids
- Spent deionized (DI) water
- Disposable personal protective equipment (PPE)
- General trash.

IDW was handled in accordance with ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*; the KIF Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW was coordinated with TVA Plant personnel. Used calibration solution, spent DI water and decontamination fluids were containerized for later disposal as directed by the KIF Plant facility management. Used disposable PPE and general trash generated throughout the day were placed in garbage bags and disposed of in a general trash dumpster onsite at the end of each day.

3.7 VARIATIONS

The proposed scope and procedures for the seep investigation were outlined in the SAP, QAPP, and applicable TVA TIs as detailed in the sections above. No variations in scope or procedures were documented during field activities.

4.0 STATISTICAL ANALYSIS OF WATER QUALITY PARAMETER MEASUREMENTS

A statistical analysis of water quality parameter data collected in surface water adjacent to the KIF Plant was conducted as part of the seep investigation. The statistical analysis was used to evaluate whether there are statistically significant differences between monitoring results collected “adjacent to” and “upstream of” historical seep/AOC locations and between intermediate and upstream control areas. The statistical methods used in this analysis and the analysis results are provided in Appendix D.

The statistical analysis results indicate that there were no locations where all four parameters (pH, temperature, DO, and specific conductance) indicated statistically significantly differences when compared with upstream locations. Therefore, no AOIs associated with historical seeps/AOC were identified at the KIF Plant for further investigation or data collection.

5.0 SUMMARY

The data presented in this report are from the seep investigation at the KIF Plant. The scope of the seep investigation included:

- Visual inspection of accessible areas to identify AOIs and locations for additional investigation, if warranted
- Field measurement of water quality parameters in the Emory River adjacent to identified historical seep locations/AOCs that were inaccessible due to riprap, etc.
- Statistical analysis of the water quality parameter data to assess whether there was a potential for AOIs to exist in the inaccessible areas, and whether additional investigation and/or sampling were warranted.

No AOIs were identified during the visual walkdown inspection of accessible areas, so no water or soil samples were collected for laboratory analysis. Four historical seep/AOC locations were identified in inaccessible areas for additional investigation by boat. Water quality parameter measurements (pH, specific conductance, DO, and temperature) were taken at 172 measurement locations in the Emory River associated with four historical seep/AOC locations and at intermediate and upstream control areas. Based on statistical analysis of the water quality parameter data collected near the identified historical seep/AOC locations or intermediate areas, there were no locations where all four parameters indicated statistically significantly differences when compared with upstream locations. Therefore, no AOIs associated with historical seeps/AOC were identified at the KIF Plant for further investigation or data collection.

Stantec has completed the seep investigation at the KIF Plant in Harriman, Tennessee in accordance with the Seep SAP as documented herein. The data collected during the investigation are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order EIP. The complete dataset from this event will be evaluated along with data collected under other SAPs. This evaluation will be provided in the EAR.

6.0 REFERENCES

Environmental Standards, Inc., 2018. *Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Fossil Plant Environmental Investigation*. Prepared for Tennessee Valley Authority. Revision 2. January 2018.

Stantec Consulting Services Inc. (Stantec), 2018a. *Seep Sampling and Analysis Plan (SAP), Kingston Fossil Plant.* Revision 4 Final. Prepared for Tennessee Valley Authority. November 9, 2018.

Stantec, 2018b. *Environmental Investigation Plan (EIP), Kingston Fossil Plant.* Revision 4 Final. Prepared for Tennessee Valley Authority. November 9, 2018.

Tennessee Department of Environment and Conservation, 2015. *Commissioner's Order No. OGC15-0177.*

Tennessee Valley Authority (TVA), ENV-TI-05.80.01, *Planning Sampling Events.*

TVA, ENV-TI-05.80.03, *Field Record Keeping*.

TVA, ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*.

TVA, ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde*.

APPENDIX A - EXHIBITS

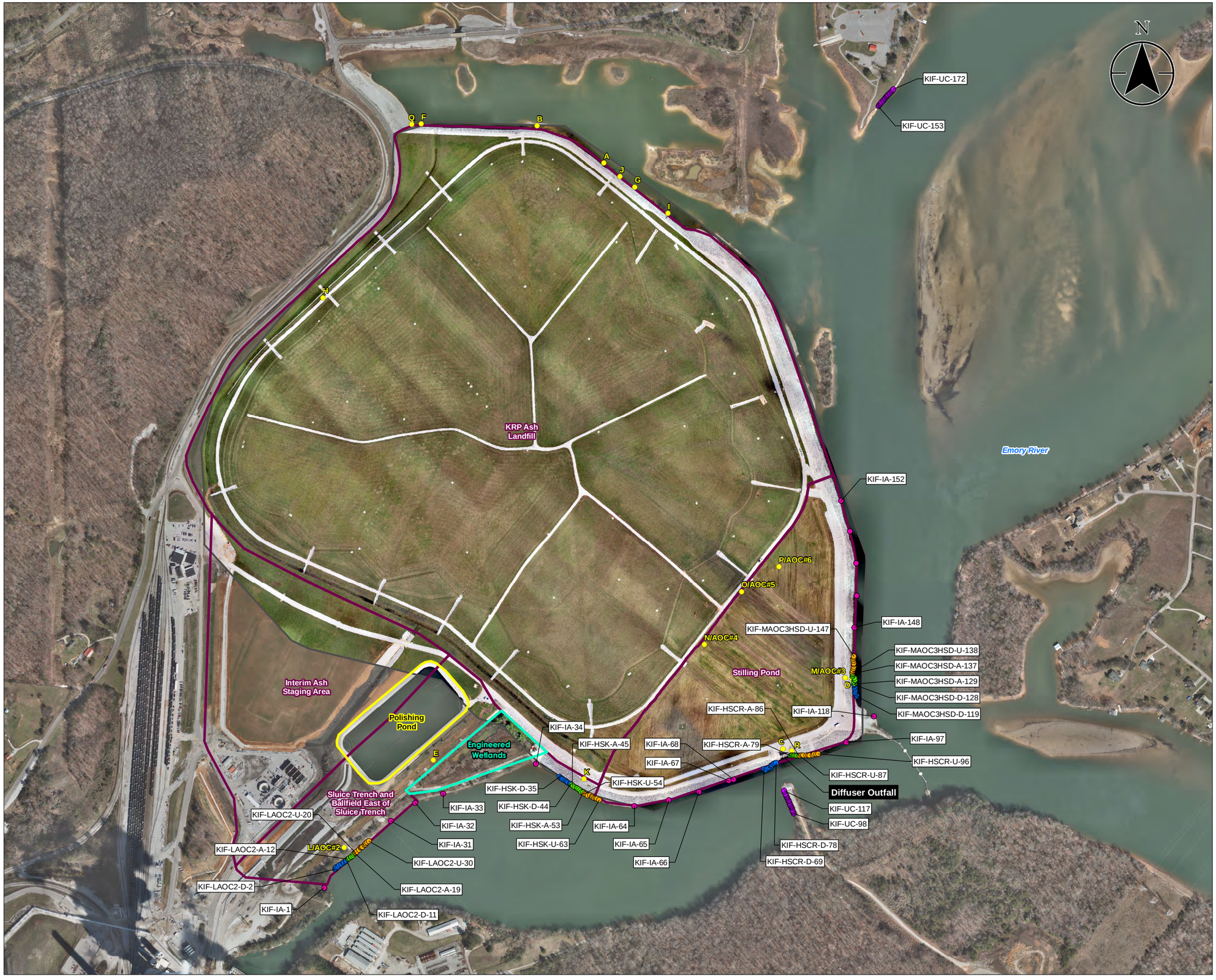


Exhibit No.

A.1

Title

Water Quality Parameter Measurement Locations Overview

Client/Project

Tennessee Valley Authority
Kingston Fossil Plant - TDEC Order

Project Location

Roane County, Tennessee

175668043

Prepared by DMB on 2020-04-08
Technical Review by HW on 2020-04-08

0 300 600 900 1,200 Feet

1:3,600 (At original document size of 22x34)

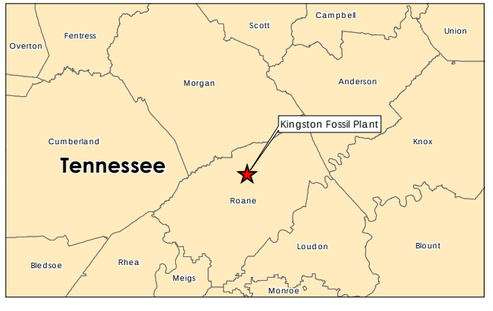
Legend

Measurement Locations

- Adjacent (A)
- Downstream (D)
- Upstream (U)
- Upstream Control (UC)
- Intermediate Area (IA)
- Historic Seep (HS)/Area of Concern (AOC)
- 2018 Imagery Boundary
- CCR Unit Area (Approximate)
- Engineered Wetlands Area (Approximate)
- Polishing Pond (Approximate)

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery provided by TVA and flown by Tuck Mapping on March 16, 2017; 2018 Imagery provided by TVA and is dated September 12, 2018



Stantec TVA

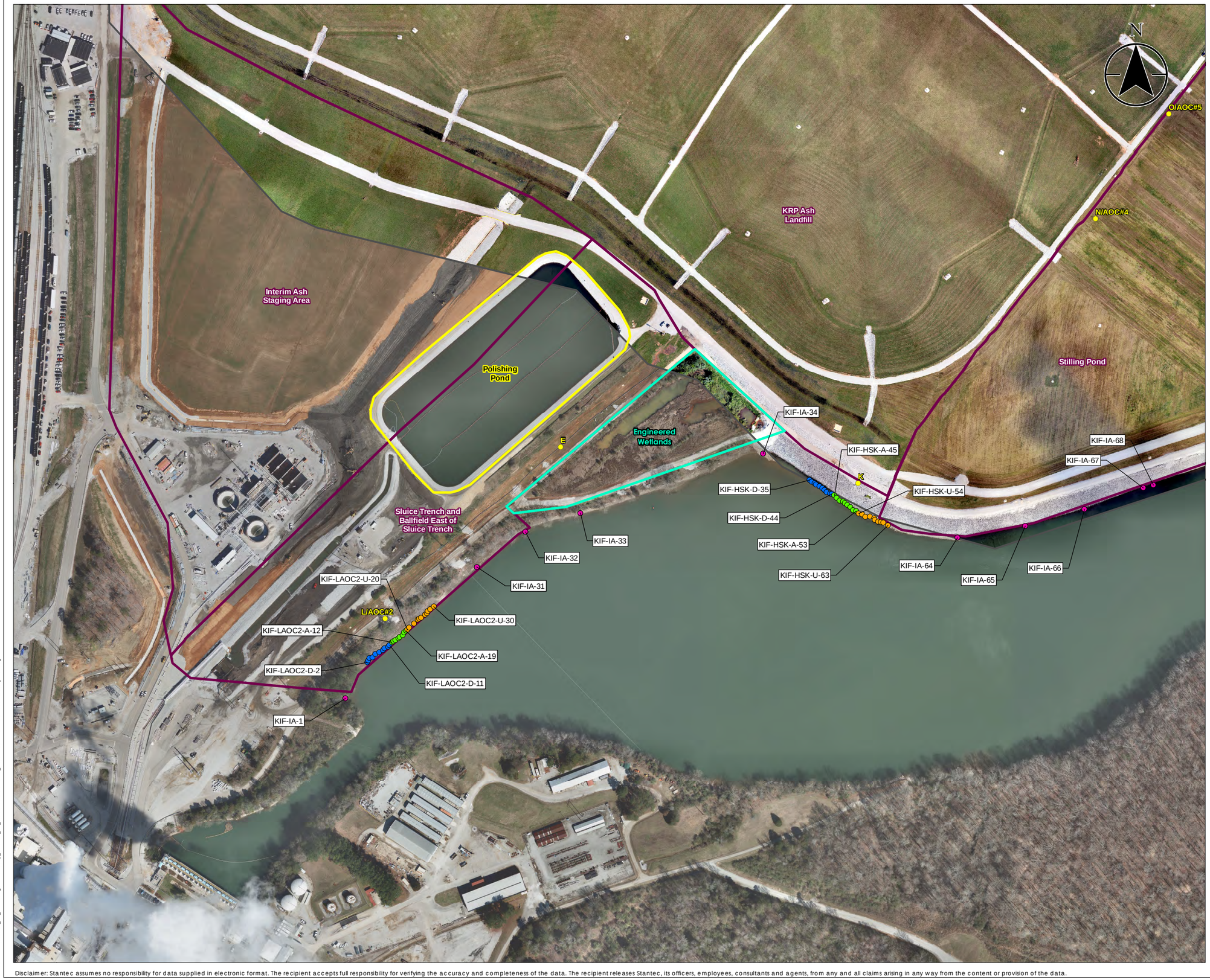


Exhibit No.

A.2

Title

Water Quality Parameter Measurement Locations Overview - Southern Detail

Client/Project

Tennessee Valley Authority
Kingston Fossil Plant - TDEC Order

Project Location

Roane County, Tennessee

175668043

Prepared by DMB on 2020-04-08
Technical Review by HW on 2020-04-08

0 150 300 450 600 Feet

1:1,800 (At original document size of 22x34)

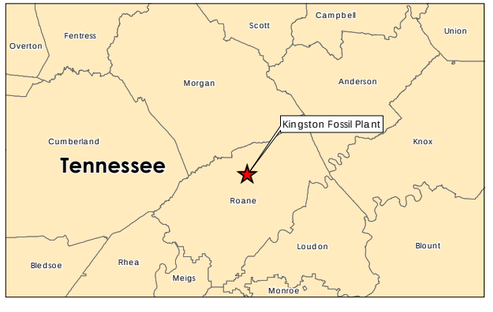
Legend

Measurement Locations

- Adjacent (A)
- Downstream (D)
- Upstream (U)
- Intermediate Area (IA)
- Historic Seep (HS)/Area of Concern (AOC)
- 2018 Imagery Boundary
- CCR Unit Area (Approximate)
- Engineered Wetlands Area (Approximate)
- Polishing Pond (Approximate)

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery provided by TVA and flown by Tuck Mapping on March 16, 2017; 2018 Imagery provided by TVA and is dated September 12, 2018



Stantec TVA

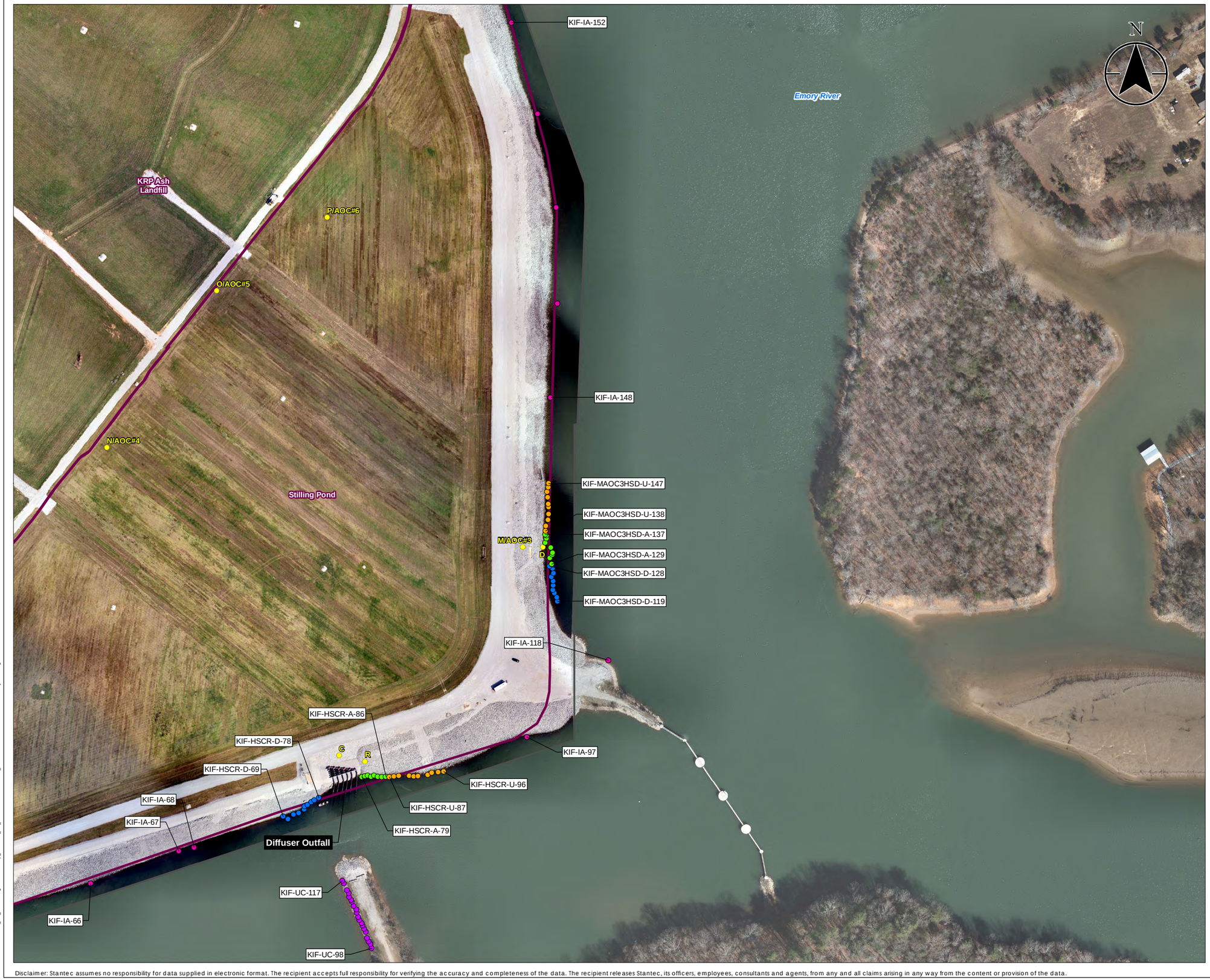


Exhibit No.

A.3

Title

Water Quality Parameter Measurement Locations Overview - Eastern Detail

Client/Project

Tennessee Valley Authority
Kingston Fossil Plant - TDEC Order

Project Location

Roane County, Tennessee

175668043

Prepared by DMB on 2020-04-08
Technical Review by HW on 2020-04-08

0 100 200 300 400 Feet

1:1,200 (At original document size of 22x34)

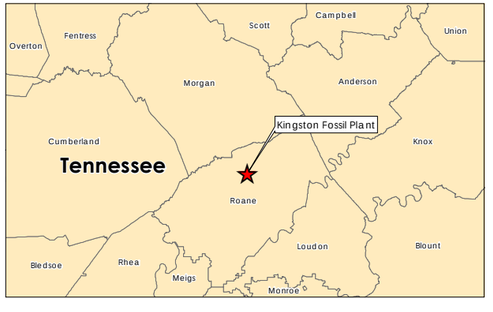
Legend

Measurement Locations

- Adjacent (A)
- Downstream (D)
- Upstream (U)
- Upstream Control (UC)
- Intermediate Area (IA)
- Historic Seep (HS)/Area of Concern (AOC)
- 2018 Imagery Boundary
- CCR Unit Area (Approximate)

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery provided by TVA and flown by Tuck Mapping on March 16, 2017; 2018 Imagery provided by TVA and is dated September 12, 2018



Stantec TVA

APPENDIX B - TABLE

TABLE B.1 - Summary of Water Quality Parameter Results
Kingston Fossil Plant
April 2019

Measurement ID	Measurement Date	Dissolved Oxygen	pH (field)	Specific Cond_ (Field)	Temperature, Water (C)
		mg/L	SU	uS/cm	DEG C
KIF-IA-1	4/23/2019	9.21	6.29	61.5	15.6
KIF-LAOC2-D-2	4/23/2019	8.52	6.72	53.7	15.5
KIF-LAOC2-D-3	4/23/2019	8.37	6.59	48.2	15.2
KIF-LAOC2-D-4	4/23/2019	8.29	6.60	48.4	15.2
KIF-LAOC2-D-5	4/23/2019	8.36	6.73	47.4	15.1
KIF-LAOC2-D-6	4/23/2019	8.95	6.81	49.7	15.3
KIF-LAOC2-D-7	4/23/2019	8.49	6.83	48.1	15.3
KIF-LAOC2-D-8	4/23/2019	8.48	6.87	50.9	15.5
KIF-LAOC2-D-9	4/23/2019	7.94	6.77	47.6	15.3
KIF-LAOC2-D-10	4/23/2019	8.35	6.79	50.4	15.5
KIF-LAOC2-D-11	4/23/2019	8.01	6.89	56.8	15.3
KIF-LAOC2-A-12	4/23/2019	8.70	6.89	57.4	15.3
KIF-LAOC2-A-13	4/23/2019	8.41	6.88	46.5	14.8
KIF-LAOC2-A-14	4/23/2019	8.15	6.84	47.0	15.0
KIF-LAOC2-A-15	4/23/2019	9.12	6.88	48.2	15.1
KIF-LAOC2-A-16	4/23/2019	8.09	6.95	54.9	15.1
KIF-LAOC2-A-17	4/23/2019	8.06	6.95	63.3	15.0
KIF-LAOC2-A-18	4/23/2019	8.49	6.95	50.5	14.9
KIF-LAOC2-A-19	4/23/2019	8.13	6.92	48.4	14.9
KIF-LAOC2-U-20	4/23/2019	8.11	6.94	49.9	15.0
KIF-LAOC2-U-21	4/23/2019	7.69	6.98	55.3	15.0
KIF-LAOC2-U-22	4/23/2019	8.00	6.96	48.9	14.9
KIF-LAOC2-U-23	4/24/2019	8.06	6.26	47.2	14.6
KIF-LAOC2-U-24	4/24/2019	8.25	6.51	46.8	14.4
KIF-LAOC2-U-25	4/24/2019	7.56	6.65	47.5	14.5
KIF-LAOC2-U-26	4/24/2019	7.73	6.72	47.2	14.5
KIF-LAOC2-U-27	4/24/2019	8.68	6.81	48.7	14.5
KIF-LAOC2-U-28	4/24/2019	7.96	6.88	53.9	14.6
KIF-LAOC2-U-29	4/24/2019	7.49	6.87	48.5	14.7
KIF-LAOC2-U-30	4/24/2019	8.07	6.89	50.0	15.0
KIF-IA-31	4/24/2019	7.69	6.93	50.5	14.9
KIF-IA-32	4/24/2019	8.09	6.94	55.2	15.1
KIF-IA-33	4/24/2019	8.20	6.98	59.6	15.1
KIF-IA-34	4/24/2019	7.65	6.96	59.0	15.8
KIF-HSK-D-35	4/24/2019	8.67	7.00	54.0	15.1
KIF-HSK-D-36	4/24/2019	8.62	6.97	52.1	15.2
KIF-HSK-D-37	4/24/2019	7.58	7.00	53.1	15.2
KIF-HSK-D-38	4/24/2019	8.67	6.93	53.7	15.2
KIF-HSK-D-39	4/24/2019	8.46	7.02	52.3	15.3
KIF-HSK-D-40	4/24/2019	8.49	7.03	50.4	15.5
KIF-HSK-D-41	4/24/2019	8.29	7.17	50.9	15.8
KIF-HSK-D-42	4/24/2019	8.89	7.11	49.7	15.6
KIF-HSK-D-43	4/24/2019	8.66	7.09	49.4	15.6
KIF-HSK-D-44	4/24/2019	8.80	7.03	53.0	15.6
KIF-HSK-A-45	4/24/2019	7.97	7.01	52.0	15.5
KIF-HSK-A-46	4/24/2019	7.75	7.05	51.7	15.5
KIF-HSK-A-47	4/24/2019	7.98	7.13	50.7	15.6
KIF-HSK-A-48	4/24/2019	8.30	7.14	50.9	15.5
KIF-HSK-A-49	4/24/2019	8.04	7.08	50.5	15.4
KIF-HSK-A-50	4/24/2019	8.28	7.06	49.4	15.4
KIF-HSK-A-51	4/24/2019	8.91	7.01	50.3	15.8
KIF-HSK-A-52	4/24/2019	7.94	7.09	50.5	15.7
KIF-HSK-A-53	4/24/2019	8.21	7.07	52.5	15.5
KIF-HSK-U-54	4/24/2019	7.99	7.06	49.2	15.5
KIF-HSK-U-55	4/24/2019	7.64	7.08	49.7	15.7
KIF-HSK-U-56	4/24/2019	7.74	7.05	50.8	16.1
KIF-HSK-U-57	4/24/2019	9.04	6.95	52.8	17.2
KIF-HSK-U-58	4/24/2019	8.69	6.97	50.2	16.0
KIF-HSK-U-59	4/24/2019	9.02	6.90	49.7	16.0
KIF-HSK-U-60	4/24/2019	7.71	6.99	50.1	16.1
KIF-HSK-U-61	4/24/2019	8.83	6.93	49.8	16.0
KIF-HSK-U-62	4/24/2019	8.78	6.94	49.9	16.2
KIF-HSK-U-63	4/24/2019	9.30	6.95	51.2	16.7
KIF-IA-64	4/24/2019	8.33	7.24	60.8	15.9
KIF-IA-65	4/24/2019	8.68	7.11	47.7	15.1
KIF-IA-66	4/24/2019	8.91	7.27	53.5	15.1
KIF-IA-67	4/24/2019	9.02	7.23	49.9	15.4
KIF-IA-68	4/24/2019	8.97	7.25	46.7	15.0

See notes on last page.

TABLE B.1 - Summary of Water Quality Parameter Results
Kingston Fossil Plant
April 2019

Measurement ID	Measurement Date	Dissolved Oxygen	pH (field)	Specific Cond_ (Field)	Temperature, Water (C)
		mg/L	SU	uS/cm	DEG C
KIF-HSCR-D-69	4/24/2019	9.21	7.22	49.8	15.6
KIF-HSCR-D-70	4/24/2019	8.77	7.28	49.1	15.6
KIF-HSCR-D-71	4/24/2019	9.02	7.23	50.1	15.5
KIF-HSCR-D-72	4/24/2019	8.89	7.26	50.5	15.4
KIF-HSCR-D-73	4/24/2019	9.09	7.14	47.7	15.1
KIF-HSCR-D-74	4/24/2019	9.27	7.18	47.6	15.1
KIF-HSCR-D-75	4/24/2019	9.16	7.09	48.3	15.2
KIF-HSCR-D-76	4/24/2019	9.31	7.08	48.1	15.1
KIF-HSCR-D-77	4/24/2019	9.36	7.12	47.9	15.1
KIF-HSCR-D-78	4/24/2019	9.70	6.98	47.7	15.1
KIF-HSCR-A-79	4/24/2019	8.39	7.44	53.2	15.5
KIF-HSCR-A-80	4/24/2019	8.45	7.28	47.4	15.1
KIF-HSCR-A-81	4/24/2019	8.39	7.28	50.1	15.4
KIF-HSCR-A-82	4/24/2019	8.29	7.37	51.4	15.4
KIF-HSCR-A-83	4/24/2019	8.54	7.43	51.9	15.7
KIF-HSCR-A-84	4/24/2019	8.35	7.46	51.2	15.7
KIF-HSCR-A-85	4/24/2019	8.22	7.44	49.8	15.5
KIF-HSCR-A-86	4/24/2019	8.43	7.41	51.1	15.5
KIF-HSCR-U-87	4/24/2019	8.69	7.36	50.0	15.2
KIF-HSCR-U-88	4/24/2019	8.15	7.39	50.5	15.4
KIF-HSCR-U-89	4/24/2019	7.63	7.26	48.4	15.2
KIF-HSCR-U-90	4/24/2019	8.19	7.61	56.0	15.3
KIF-HSCR-U-91	4/24/2019	8.35	7.50	50.2	15.2
KIF-HSCR-U-92	4/24/2019	8.94	7.30	47.5	15.3
KIF-HSCR-U-93	4/24/2019	8.78	7.24	45.4	15.1
KIF-HSCR-U-94	4/24/2019	7.38	7.26	47.2	15.3
KIF-HSCR-U-95	4/24/2019	7.78	7.30	49.2	15.2
KIF-HSCR-U-96	4/24/2019	7.97	7.23	48.2	15.1
KIF-IA-97	4/24/2019	7.95	7.17	46.3	15.2
KIF-UC-98	4/24/2019	7.69	7.21	46.8	17.4
KIF-UC-99	4/24/2019	7.22	7.24	47.1	17.3
KIF-UC-100	4/24/2019	7.60	7.20	47.2	17.1
KIF-UC-101	4/24/2019	7.97	7.21	47.2	17.1
KIF-UC-102	4/24/2019	7.74	7.17	47.2	17.1
KIF-UC-103	4/24/2019	8.29	7.15	46.9	17.2
KIF-UC-104	4/24/2019	8.01	7.14	46.6	16.5
KIF-UC-105	4/24/2019	7.62	7.18	46.7	17.2
KIF-UC-106	4/24/2019	8.05	7.15	47.1	16.8
KIF-UC-107	4/24/2019	7.83	7.17	47.5	17.2
KIF-UC-108	4/24/2019	7.89	7.15	47.4	16.6
KIF-UC-109	4/24/2019	7.97	7.14	47.7	16.8
KIF-UC-110	4/24/2019	7.81	7.12	46.8	17.3
KIF-UC-111	4/24/2019	7.75	7.14	46.8	17.1
KIF-UC-112	4/24/2019	7.97	7.15	47.2	17.0
KIF-UC-113	4/24/2019	7.76	7.12	46.5	16.6
KIF-UC-114	4/24/2019	7.52	7.10	46.6	18.4
KIF-UC-115	4/24/2019	7.41	7.18	47.2	18.0
KIF-UC-116	4/24/2019	7.96	7.17	47.2	17.6
KIF-UC-117	4/24/2019	7.78	7.13	46.7	18.0
KIF-IA-118	4/25/2019	7.01	6.40	56.7	19.0
KIF-MAOC3HSD-D-119	4/25/2019	6.68	6.90	56.3	19.0
KIF-MAOC3HSD-D-120	4/25/2019	7.72	6.99	59.2	19.2
KIF-MAOC3HSD-D-121	4/25/2019	7.25	7.09	58.9	19.2
KIF-MAOC3HSD-D-122	4/25/2019	6.87	7.14	59.8	19.2
KIF-MAOC3HSD-D-123	4/25/2019	6.46	7.21	61.3	19.3
KIF-MAOC3HSD-D-124	4/25/2019	8.74	7.32	63.1	19.6
KIF-MAOC3HSD-D-125	4/25/2019	8.28	7.23	59.8	19.3
KIF-MAOC3HSD-D-126	4/25/2019	6.93	7.30	60.7	19.3
KIF-MAOC3HSD-D-127	4/25/2019	6.81	7.42	64.4	19.6
KIF-MAOC3HSD-D-128	4/25/2019	7.37	7.41	63.5	19.5
KIF-MAOC3HSD-A-129	4/25/2019	7.44	7.31	59.8	19.4
KIF-MAOC3HSD-A-130	4/25/2019	8.33	7.39	62.5	19.6
KIF-MAOC3HSD-A-131	4/25/2019	8.33	7.44	64.1	19.6
KIF-MAOC3HSD-A-132	4/25/2019	7.34	7.39	63.3	19.5
KIF-MAOC3HSD-A-133	4/25/2019	7.26	7.38	65.9	19.5
KIF-MAOC3HSD-A-134	4/25/2019	7.49	7.65	67.5	19.8
KIF-MAOC3HSD-A-135	4/25/2019	6.98	7.63	63.7	19.8
KIF-MAOC3HSD-A-136	4/25/2019	7.30	7.66	63.5	19.5
KIF-MAOC3HSD-A-137	4/25/2019	6.75	7.63	62.7	19.7
KIF-MAOC3HSD-U-138	4/25/2019	7.22	7.69	62.7	19.7

See notes on last page.

TABLE B.1 - Summary of Water Quality Parameter Results
Kingston Fossil Plant
April 2019

Measurement ID	Measurement Date	Dissolved Oxygen	pH (field)	Specific Cond_ (Field)	Temperature, Water (C)
		mg/L	SU	uS/cm	DEG C
KIF-MAOC3HSD-U-139	4/25/2019	6.61	7.92	67.0	19.8
KIF-MAOC3HSD-U-140	4/25/2019	6.78	7.90	65.3	19.8
KIF-MAOC3HSD-U-141	4/25/2019	6.85	7.89	65.6	19.7
KIF-MAOC3HSD-U-142	4/25/2019	6.77	7.78	62.1	19.8
KIF-MAOC3HSD-U-143	4/25/2019	6.81	7.79	63.3	19.9
KIF-MAOC3HSD-U-144	4/25/2019	7.16	7.88	64.6	19.9
KIF-MAOC3HSD-U-145	4/25/2019	7.01	7.84	62.1	19.9
KIF-MAOC3HSD-U-146	4/25/2019	6.56	7.82	63.8	19.9
KIF-MAOC3HSD-U-147	4/25/2019	7.25	7.80	63.7	20.0
KIF-IA-148	4/25/2019	7.85	7.88	64.4	19.5
KIF-IA-149	4/25/2019	7.48	7.83	60.7	19.8
KIF-IA-150	4/25/2019	7.85	7.85	60.2	19.8
KIF-IA-151	4/25/2019	7.70	7.81	56.9	19.6
KIF-IA-152	4/25/2019	8.95	7.65	59.2	19.2
KIF-UC-153	4/25/2019	8.68	7.44	49.4	19.4
KIF-UC-154	4/25/2019	8.28	7.46	49.7	19.4
KIF-UC-155	4/25/2019	8.49	7.43	51.6	19.4
KIF-UC-156	4/25/2019	7.76	7.48	49.8	19.4
KIF-UC-157	4/25/2019	8.62	7.37	50.1	19.2
KIF-UC-158	4/25/2019	8.65	7.41	50.6	19.5
KIF-UC-159	4/25/2019	8.35	7.43	50.6	19.2
KIF-UC-160	4/25/2019	8.11	7.42	50.9	19.2
KIF-UC-161	4/25/2019	7.83	7.40	50.2	19.1
KIF-UC-162	4/25/2019	7.33	7.39	49.7	19.1
KIF-UC-163	4/25/2019	8.43	7.29	49.5	18.9
KIF-UC-164	4/25/2019	7.92	7.34	50.6	19.1
KIF-UC-165	4/25/2019	8.04	7.32	48.7	18.8
KIF-UC-166	4/25/2019	7.27	7.40	49.9	19.2
KIF-UC-167	4/25/2019	7.90	7.38	49.6	19.1
KIF-UC-168	4/25/2019	8.34	7.38	50.8	19.3
KIF-UC-169	4/25/2019	8.16	7.36	49.1	19.1
KIF-UC-170	4/25/2019	7.78	7.38	50.3	19.2
KIF-UC-171	4/25/2019	8.46	7.41	52.3	19.3
KIF-UC-172	4/25/2019	8.34	7.42	50.1	19.2

Notes:

Cond.	conductance
DEG C	degrees Celsius
ID	identification
mg/L	milligrams per Liter
SU	Standard Units
uS/cm	microSiemens per centimeter

APPENDIX C – PHOTOGRAPHS OF SITE CONDITIONS

Exhibit No.

C.1

Title

Photographs of Site Conditions for the KIF Seep SAR

Client/Project

Tennessee Valley Authority
Kingston Fossil Plant - TDEC Order

Project Location

Roane County, Tennessee

175668043

Prepared by DMB on 2020-04-22
Technical Review by HW on 2020-04-22

0 300 600 900 1,200 Feet

1:3,600 (At original document size of 22x34)

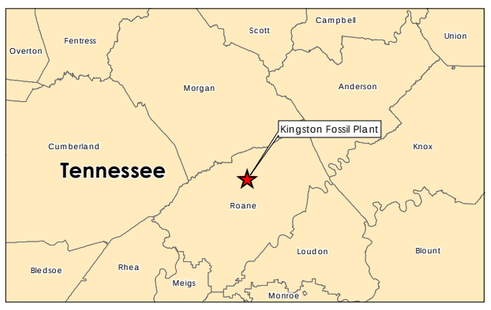
Legend

Measurement Locations

- Adjacent (A)
- Downstream (D)
- Upstream (U)
- Upstream Control (UC)
- Intermediate Area (IA)
- Historic Seep (HS)/Area of Concern (AOC)
- Photo Location
- 2018 Imagery Boundary
- CCR Unit Area (Approximate)
- Engineered Wetlands Area (Approximate)
- Polishing Pond (Approximate)

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery provided by TVA and flown by Tuck Mapping on March 16, 2017; 2018 Imagery provided by TVA and is dated September 12, 2018



Stantec TVA

Stantec

Photographic Log

Client:	**TVA**	**Project:**	**Seep Investigation**
Site Name:	**Kingston Fossil Plant**	**Site Location:**	**Harriman, TN**

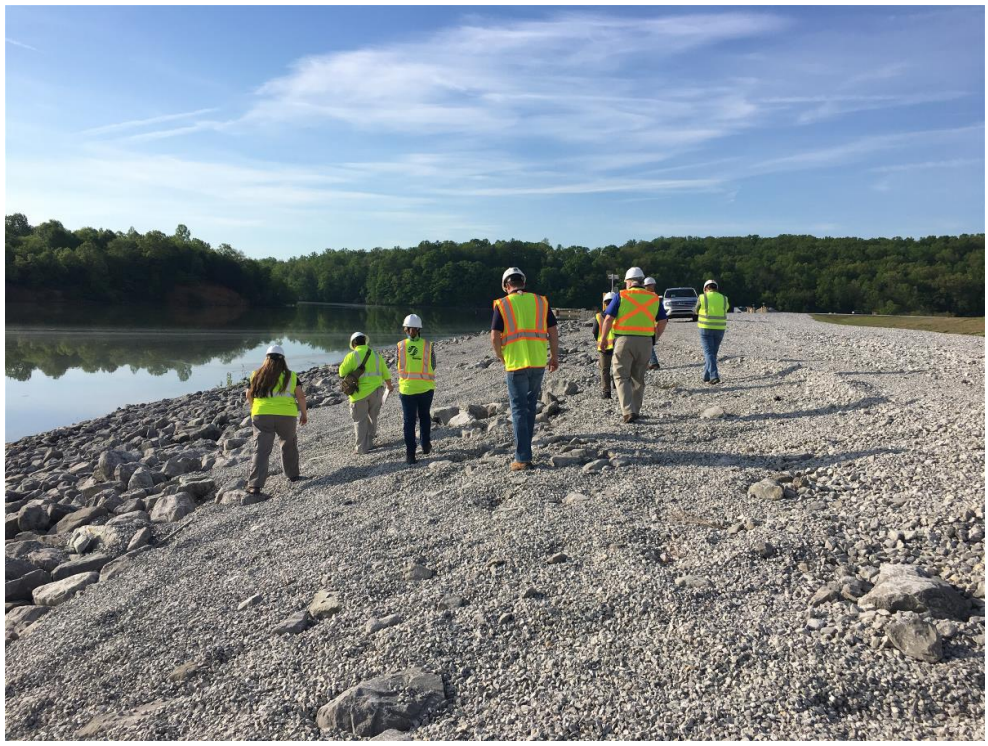
Photograph ID: 1

Photo Location:
Former Stilling Pond

Direction:
South - Southeast

Survey Date:
4/23/2019

Comments:
TDEC/TVA Inspection



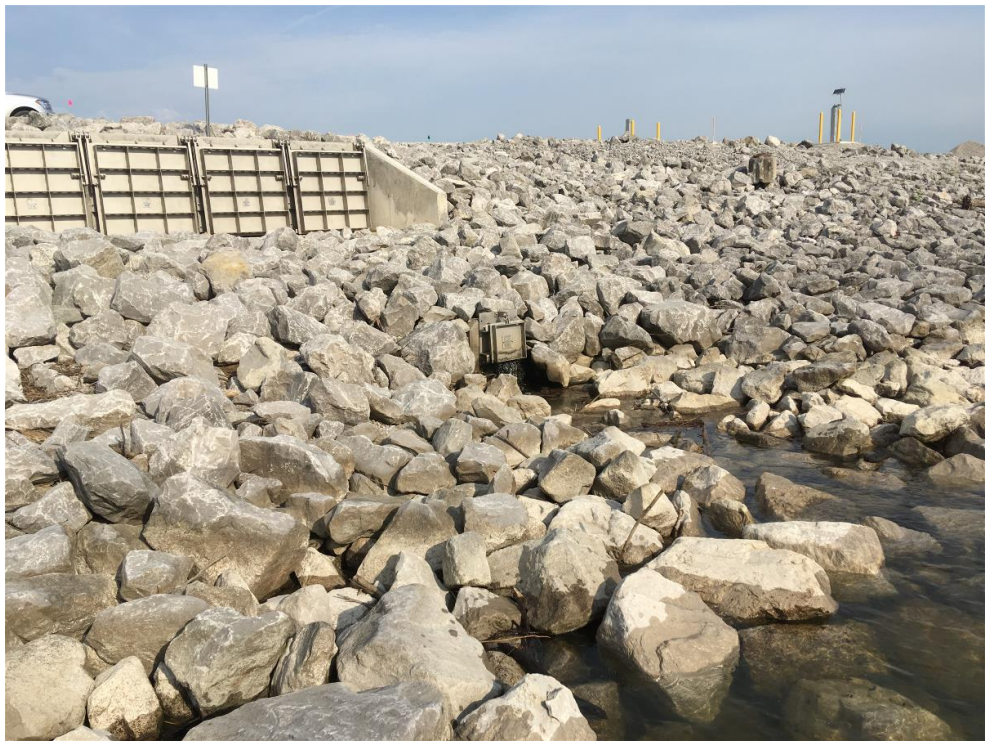
Photograph ID: 2

Photo Location:
Former Stilling Pond

Direction:
Northwest

Survey Date:
4/25/2019

Comments:
TDEC/TVA Inspection - Storm water outfall



Client:	**TVA**	**Project:**	**Seep Investigation**
Site Name:	**Kingston Fossil Plant**	**Site Location:**	**Harriman, TN**

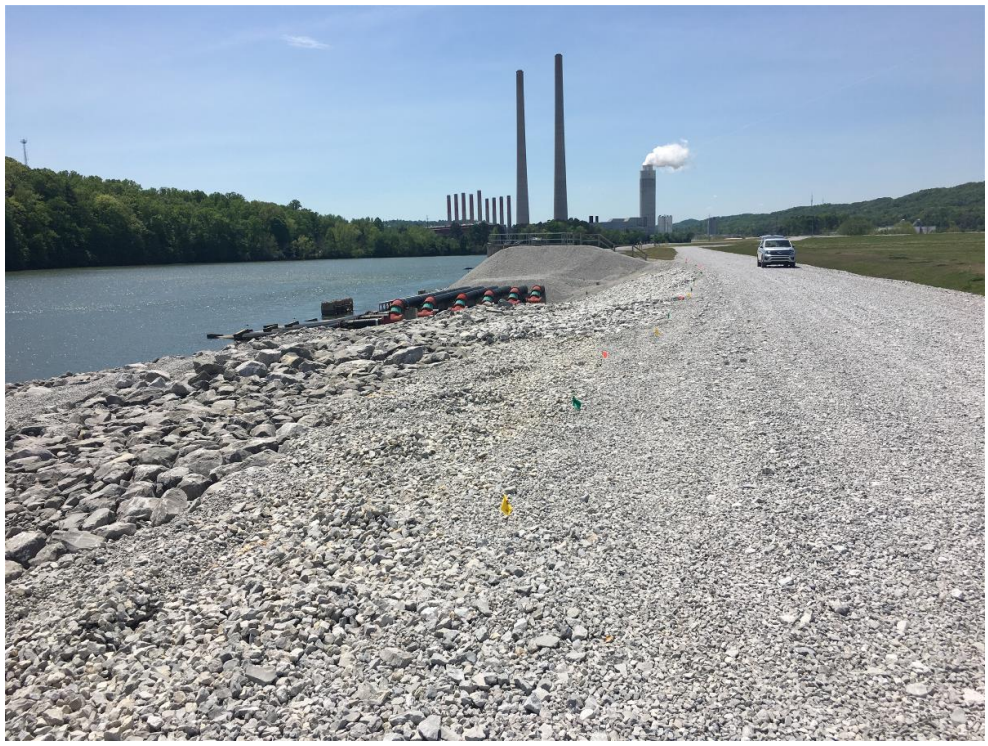
Photograph ID: 3

Photo Location:
Former Stilling Pond

Direction:
West

Survey Date:
4/24/2019

Comments:
TDEC/TVA Inspection - diffuser area



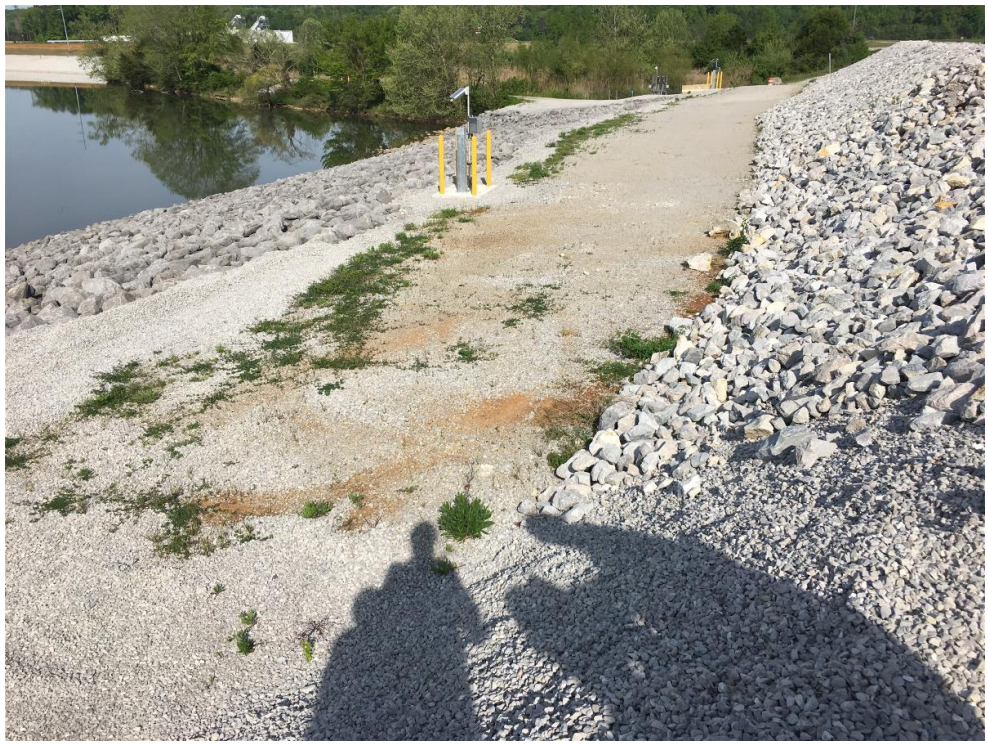
Photograph ID: 4

Photo Location:
Former Stilling Pond/ KRP Ash Landfill

Direction:
Northwest

Survey Date:
4/23/2019

Comments:
TDEC/TVA Inspection - Intersection of former Stilling Pond and KRP Landfill.



Client:	**TVA**	**Project:**	**Seep Investigation**
Site Name:	**Kingston Fossil Plant**	**Site Location:**	**Harriman, TN**

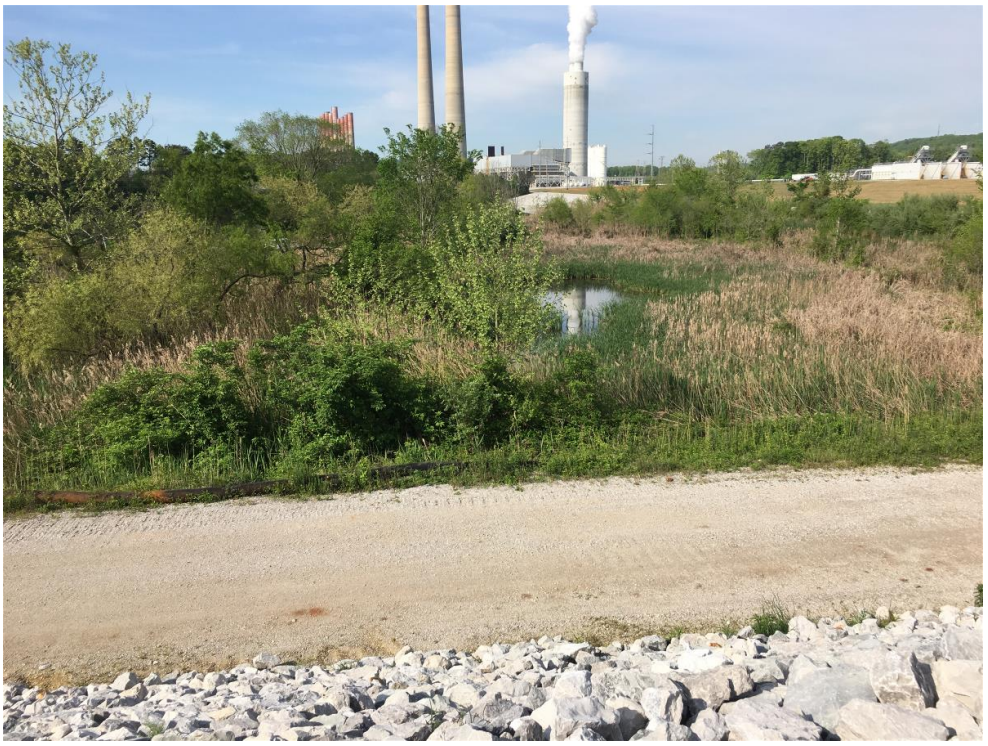
Photograph ID: 5

Photo Location:
Engineered Wetland

Direction:
West

Survey Date:
4/23/2019

Comments:
TDEC/TVA Inspection - NPDES permit area.



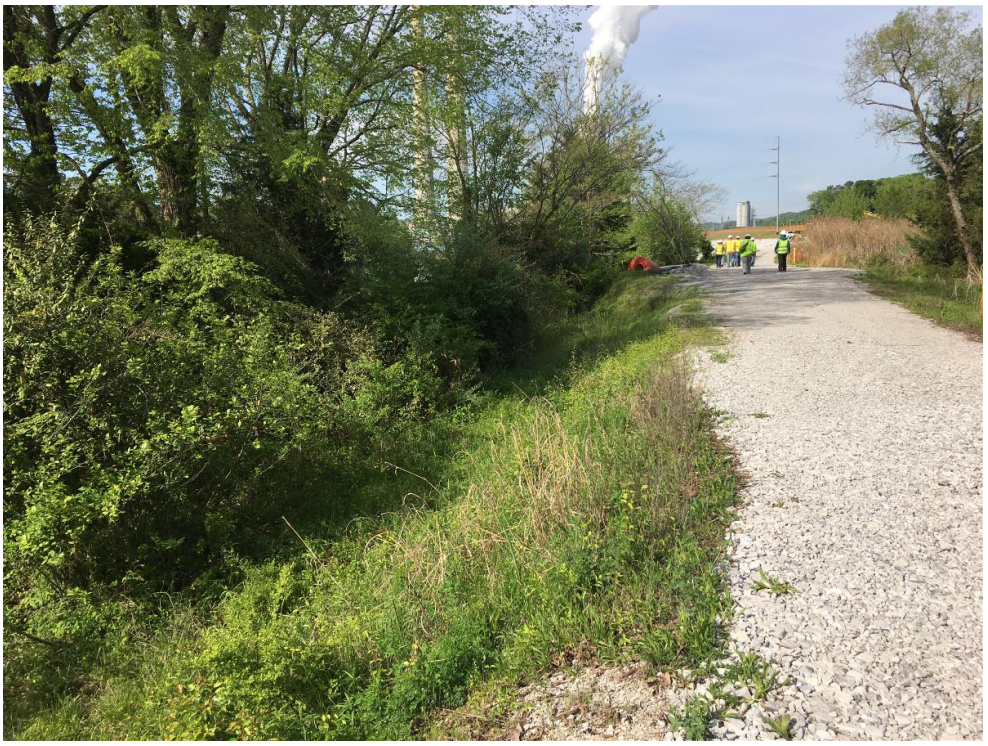
Photograph ID: 6

Photo Location:
Engineered Wetland

Direction:
West

Survey Date:
4/23/2019

Comments:
TDEC/TVA Inspection - downslope area on left.



Client:	**TVA**	**Project:**	**Seep Investigation**
Site Name:	**Kingston Fossil Plant**	**Site Location:**	**Harriman, TN**

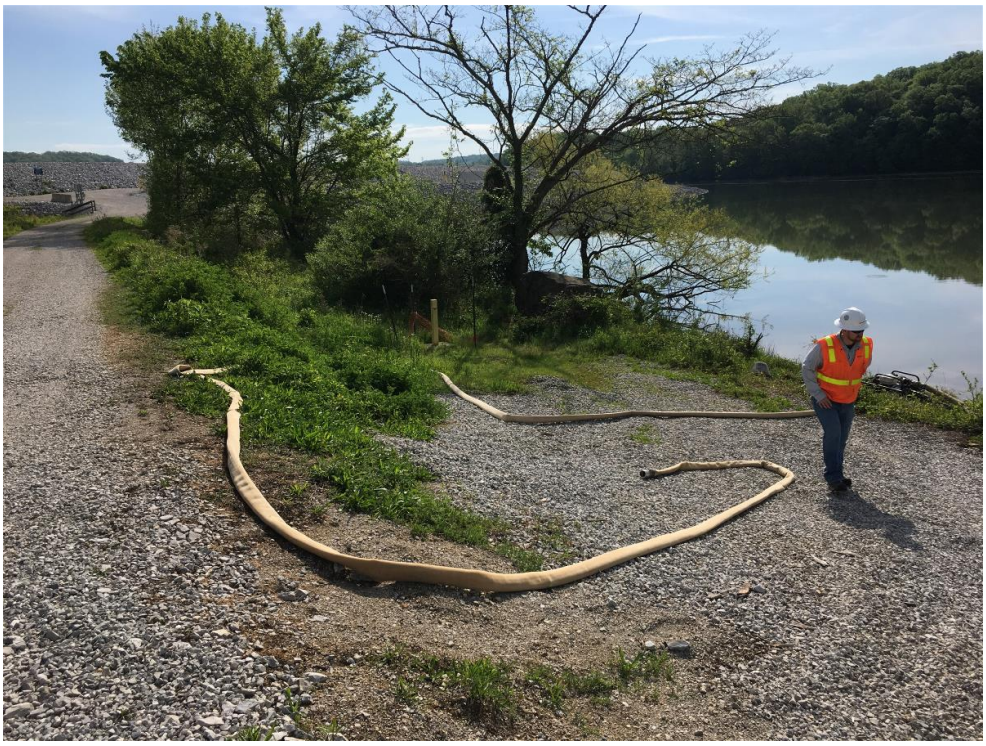
Photograph ID: 7

Photo Location:
Engineered Wetland

Direction:
East

Survey Date:
4/23/2019

Comments:
TDEC/TVA Inspection - downslope area on right.



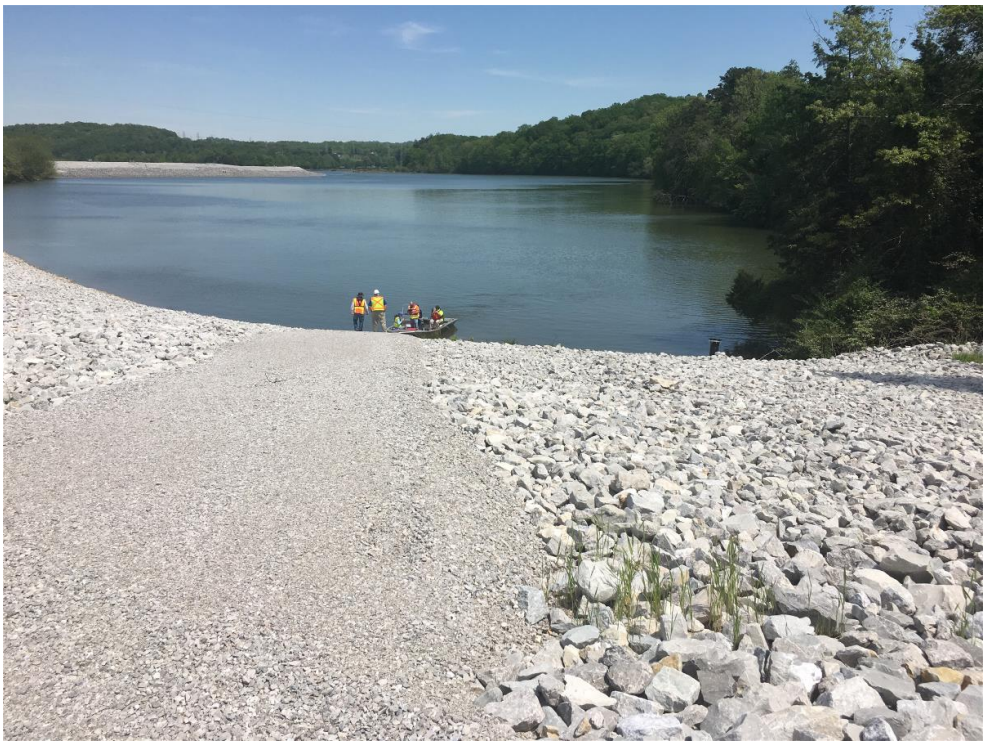
Photograph ID: 8

Photo Location:
Reverse Grade filter

Direction:
Southeast

Survey Date:
4/23/2019

Comments:
TDEC/TVA Inspection



Client:	**TVA**	**Project:**	**Seep Investigation**
Site Name:	**Kingston Fossil Plant**	**Site Location:**	**Harriman, TN**

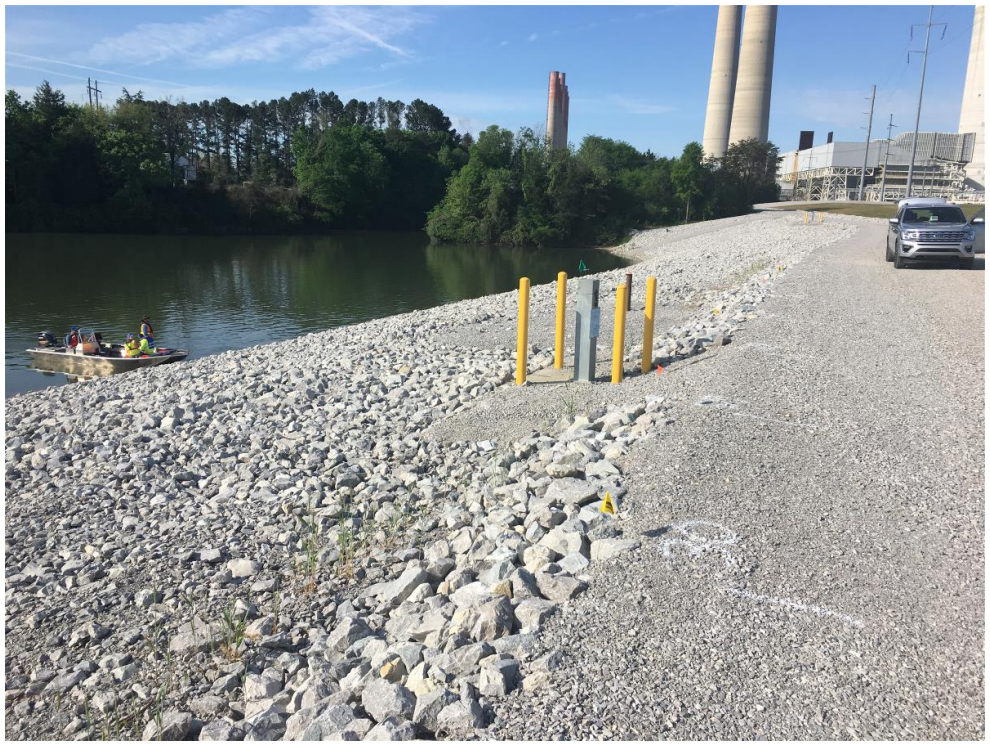
Photograph ID: 9

Photo Location:
Reverse Grade filter

Direction:
Southwest

Survey Date:
4/24/2019

Comments:
TDEC/TVA Inspection



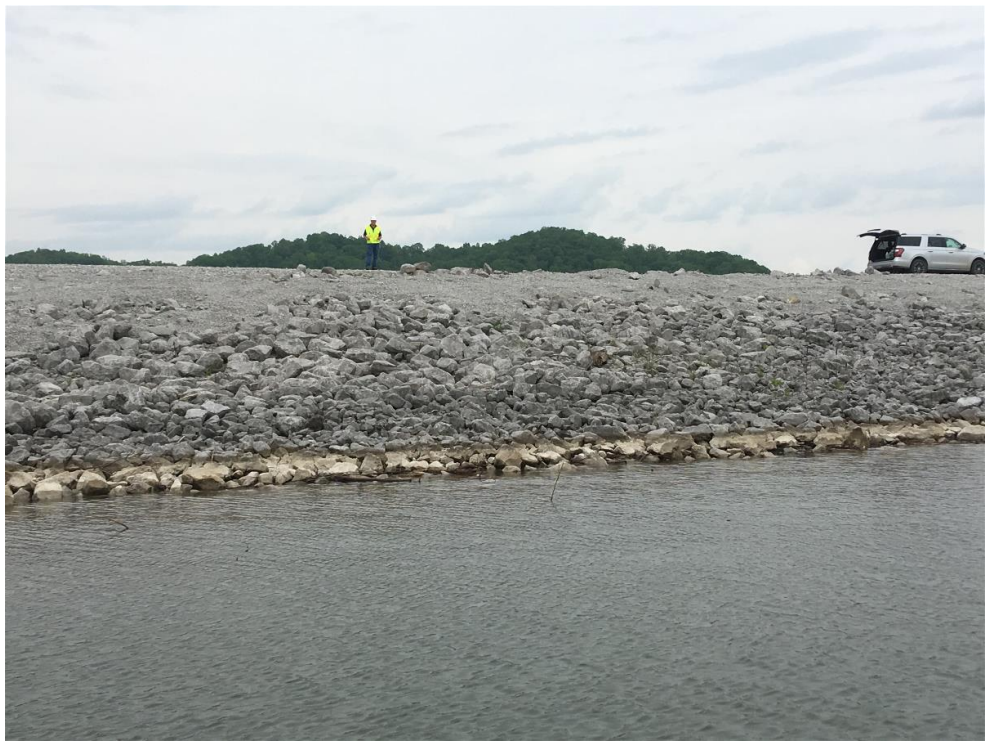
Photograph ID: 10

Photo Location: East Bank of Former Stilling Pond

Direction:
North

Survey Date:
4/25/2019

Comments:
Boat Inspection/Sonde Measurements



Client:	**TVA**	**Project:**	**Seep Investigation**
Site Name:	**Kingston Fossil Plant**	**Site Location:**	**Harriman, TN**

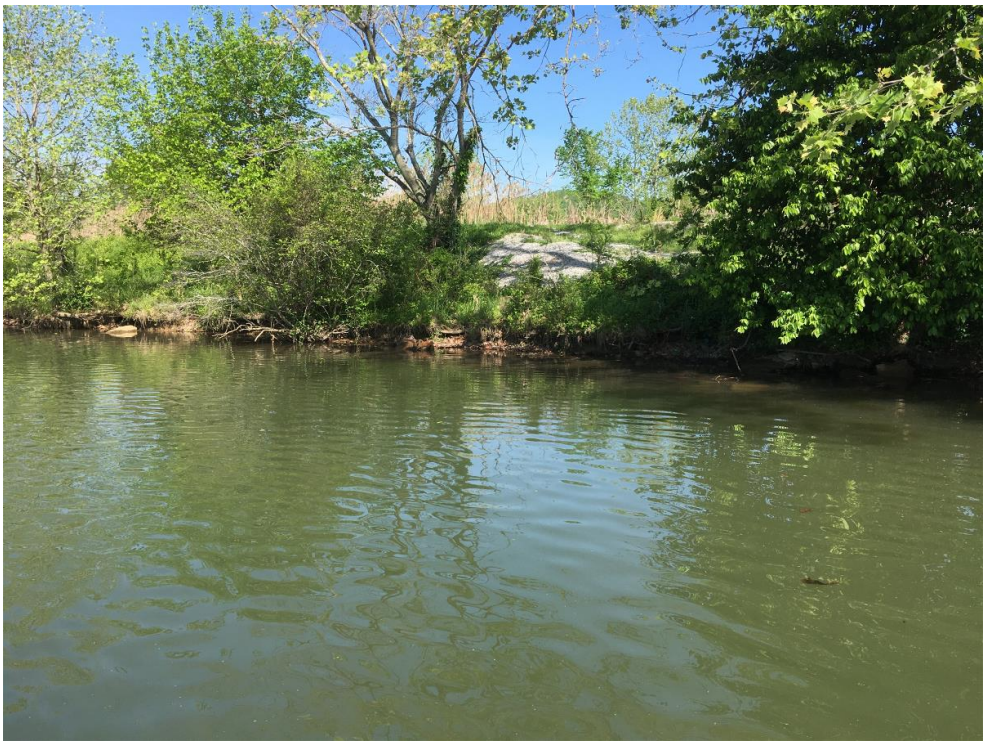
Photograph ID: 11

Photo Location:
Engineered Wetland

Direction:
North

Survey Date:
4/24/2019

Comments:
Boat Inspection/Sonde Measurements



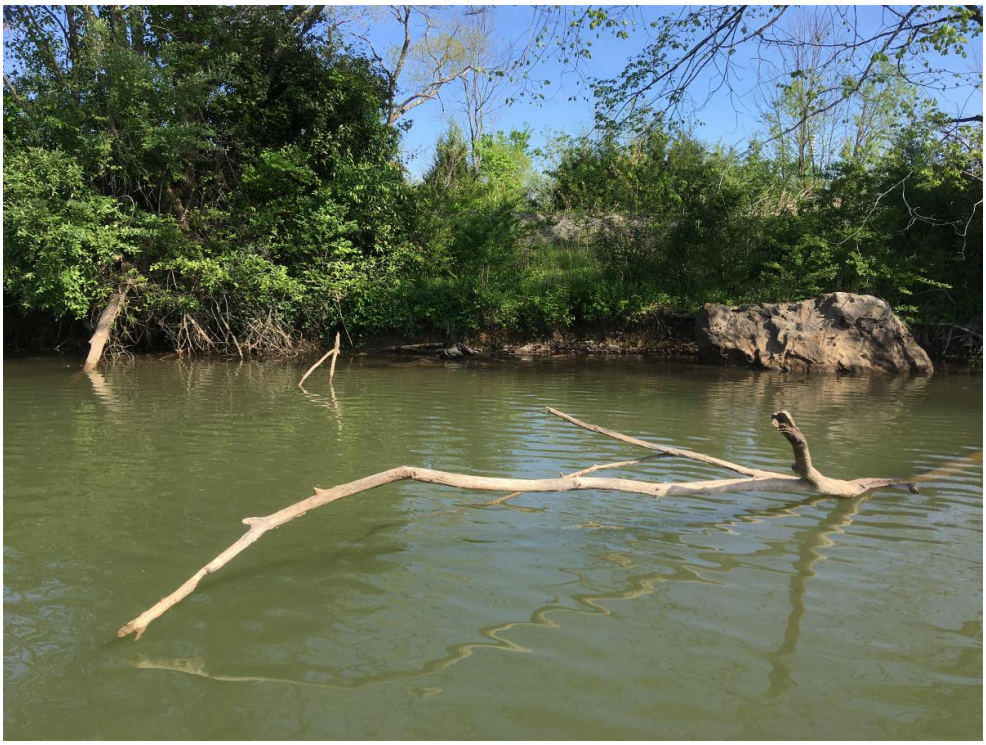
Photograph ID: 12

Photo Location:
Engineered Wetland

Direction:
North

Survey Date:
4/24/2019

Comments:
Boat Inspection/Sonde Measurements



Client:	**TVA**	**Project:**	**Seep Investigation**
Site Name:	**Kingston Fossil Plant**	**Site Location:**	**Harriman, TN**

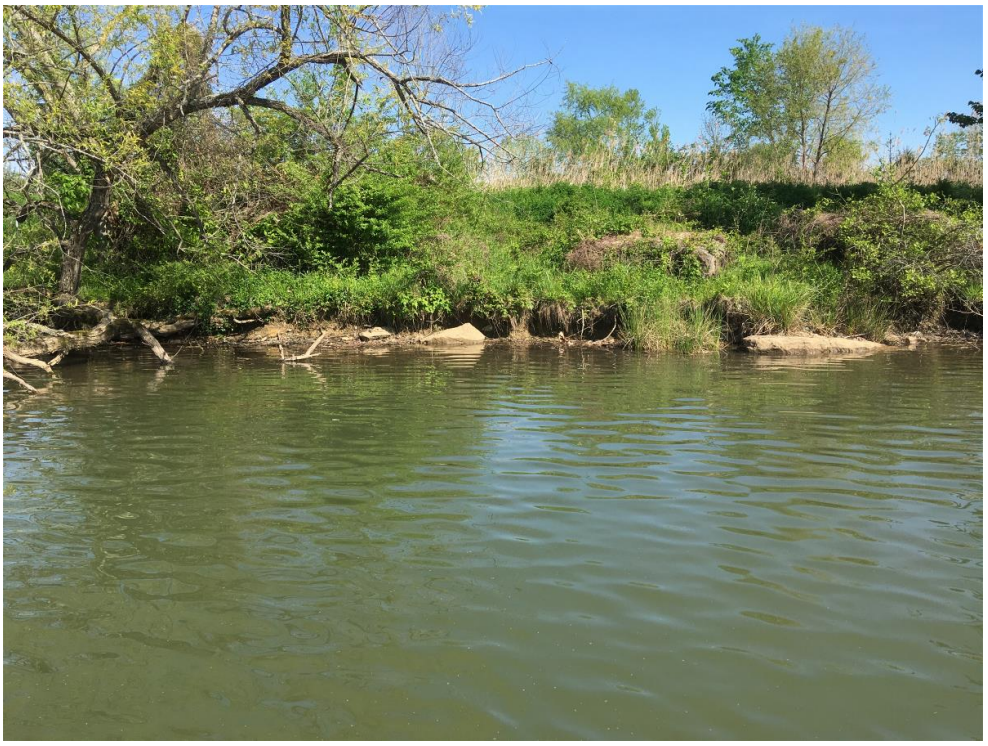
Photograph ID: 13

Photo Location:
Engineered Wetland

Direction:
North

Survey Date:
4/24/2019

Comments:
Boat Inspection/Sonde Measurements



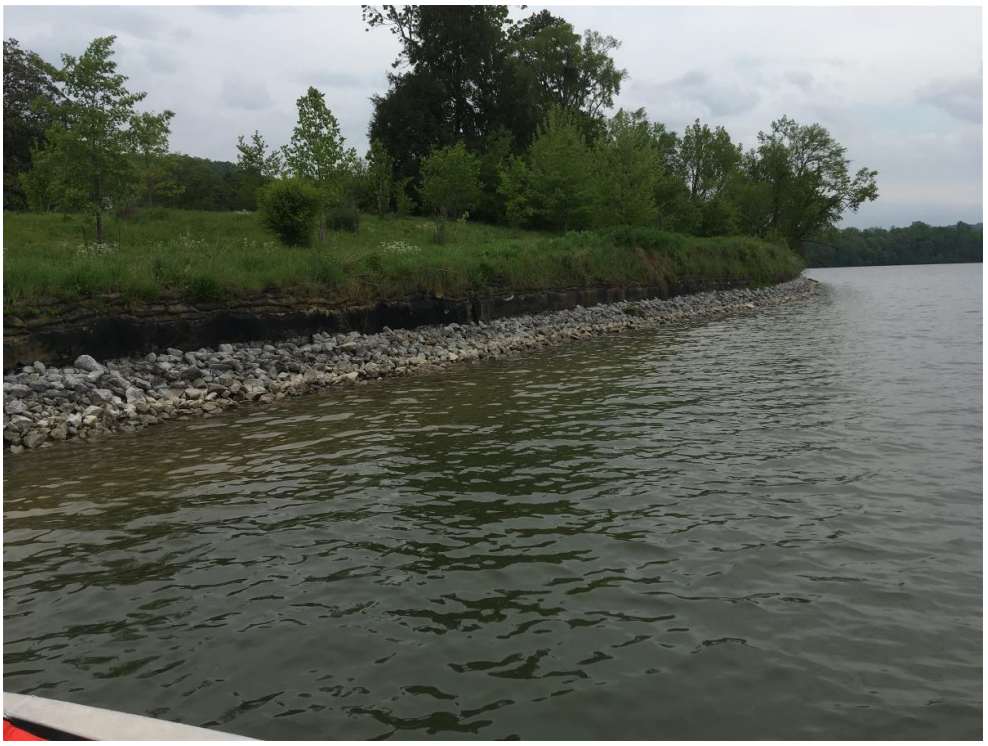
Photograph ID: 14

Photo Location:
North Control Area

Direction:
North

Survey Date:
4/25/2019

Comments:
Boat Inspection/Sonde Measurements



APPENDIX D - STATISTICAL ANALYSIS OF WATER QUALITY PARAMETERS

REFER TO APPENDIX E.4 - SEEPS