From: Love, Bradley Michael
To: Vojin Janjic; Natalie Harris
Cc: Robert Alexander; Elizabeth Rorie
Subject: TVA - Kingston - NPDES Permit Nos. TN0005452 and TN0080870 - Updated Permit Renewal Application
Date: Tuesday, October 18, 2016 1:25:43 PM

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Mr. Janjic –

Please find attached an electronic copy of the updated NPDES renewal application package for KIF. A hard copy for your records has been placed in the mail. If you have any questions or comments, please let me know.

Thanks,

Brad Love
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Tennessee Valley Authority, 1101 Market Street, BR 4A, Chattanooga, Tennessee 37402-2801

October 14, 2016

Mr. Vojin Janjić
Division of Water Resources
Tennessee Department of Environment
  and Conservation (TDEC)
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243

Dear Mr. Janjić:

TENNESSEE VALLEY AUTHORITY (TVA) – KINGSTON FOSSIL PLANT (KIF) – NPDES PERMIT NOS. TN0005452 AND TN0080870 – UPDATED PERMIT RENEWAL APPLICATION

Enclosed is an updated NPDES permit application for KIF consisting of EPA Form 1, Location Map, EPA Form 2C, wastewater flow schematic, a reasonable potential review for whole effluent toxicity, permit contact information, and additional supporting enclosures as discussed below. The Form 2C analytical data are for renewal samples collected in June 2016 and recent monitoring data to reflect any changes in effluent quality which may have occurred since the 2007 submission for TN0005452 and 2013 submission for TN0080870.

Background

On December 3, 2007, TVA submitted a complete and timely application for renewal of the KIF NPDES Permit (TN0005452). At that time, TVA was in the process of constructing a selective catalytic reduction (SCR) and wet flue gas desulfurization system (FGD) for emission control which included a gypsum dewatering facility that discharges FGD wastewaters into at storm water pond along with runoff and leachate from the Peninsula Disposal Area where dry gypsum only was landfilled at that time. In October 2009, a new NPDES permit, TN0080870, was issued to authorize discharges from the FGD storm water pond and TN0005452 has remained administratively continued. A complete and timely application for renewal of TN0080870 was submitted on April 2, 2013.

Reasons for this Update

In April 2011 TVA entered into a Federal Facilities Compliance Agreement with the Environmental Protection Agency (EPA) to resolve alleged violations of the Clean Air Act. As a condition of that agreement, TVA is required to submit updated NPDES applications for its plants that are equipped with wet FGD systems to include legally-applicable requirements of the revised Effluent Limitation Guidelines (ELGs) related to wet FGD wastewaters within 12 months after publication in the Federal Register (i.e., on or before November 2, 2016). KIF is one of three TVA facilities in Tennessee subject to this requirement.

In addition, this application includes updated Form 2C analytical data for samples collected in June 2016 and historical monitoring data to reflect any changes in effluent quality which may have occurred since the previous renewal application submissions.

New and Revised ELGs

On January 4, 2016, the EPA final rule for Effluent Limitation Guidelines for the Steam Electric Power Generating Point Source Category became effective. The rule establishes or modifies technology-based effluent limitations for the following categories of wastewater:

- FGD Wastewater (generated specifically from wet flue gas desulfurization scrubber systems)
- Fly Ash Transport Water
- Bottom Ash Transport Water
- Flue Gas Mercury Control Wastewater (not applicable to KIF)
- Gasification Wastewater (not applicable to KIF)
- Combustion Residual Leachate
- Nonchemical Metal Cleaning Wastes (reserved)

The limitations for all wastewater categories other than Combustion Residual Leachate and Nonchemical Metal Cleaning Wastes are required to be met "as soon as possible beginning November 1, 2018, but no later than December 31, 2023." The phrase "as soon as possible" means November 1, 2018, unless the permitting authority establishes a later date, after receiving information from the discharger, which reflects a consideration of the following factors:

1. Time to expeditiously plan (including to raise capital), design, procure, and install equipment to comply with the requirements of this part.
2. Changes being made or planned at the plant in response to: specified Clean Air Act and Solid Waste Disposal Act/Resource Conservation and Recovery Act requirements.
3. For FGD wastewater requirements only, an initial commissioning period for the treatment system to optimize the installed equipment.
4. Other factors as appropriate.

Wet Scrubber Blowdown

The revised ELGs include technology-based limits for arsenic, mercury, selenium, and nitrate/nitrite in Wet Scrubber Blowdown. Based on the detailed analysis in the enclosed report, TVA's proposed applicability date for compliance with the wet FGD wastewater ELGs is October 1, 2022.

Fly Ash Transport Water

KIF has achieved compliance with the no-discharge standard for fly ash transport water. In accordance with the ELGs, the default applicability date for no discharge of fly ash transport water should be established as November 1, 2018.

Bottom Ash Transport Water

TVA has installed an interim tank-based bottom ash dewatering system in order to eliminate the wet disposal of these coal combustion residuals (CCR). This system was completed in early fall of 2015; however, it is not currently a no-discharge system and is planned to be replaced. TVA is currently installing a remote submerged flight conveyor system and will design and build the recirculation portion separately. As mentioned in other reports, TVA has separated the activities necessary to achieve the no-discharge standard into separate projects in order to balance project workload. These projects are separated into field activities for the construction of a dewatering facility and plant tie-ins to accommodate recirculation. Both the dewatering and the recirculation pieces must be in place in order to achieve the no-discharge requirement of the ELGs. As further described in the enclosed report, TVA's proposed applicability date for compliance with the no-discharge standard for bottom ash transport waters is April 1, 2021.

Combustion Residual Leachate

The existing peninsula disposal area CCR landfill underdrains and surface runoff are routed to the FGD storm water pond for treatment and monitoring prior to discharge through Outfall 01a. Historically, seeps from the ball field area (also formerly known as the abandoned ash pond area) discharged directly to the intake via Outfall 007. TVA is currently constructing a collection system for ball field area seepage which will route these flows to an impoundment for treatment and monitoring prior to discharge through Outfall 001. The expected completion date for this reroute is December 31, 2016. After this date, Outfall 007 discharges will be comprised of storm water only and coverage will be transferred under the Tennessee Multi-Sector Stormwater Permit (TMSP).

Active seeps exist along the eastern dike of the former sluice trench area adjacent to the plant intake. These active seeps have been inspected quarterly during dike inspections and reported annually to the Division. A project to repair this seepage area is planned and TVA is awaiting issuance of ARAP NRS16.142 and the associated 404 permit authorizing the construction.

TVA anticipates the permits will be issued and the seepage areas will be repaired prior to issuance of the renewal NPDES permit. A map depicting the active seepage areas as well as mitigated seeps has been included as an enclosure. Should any new seeps be identified during required dike inspections, they will be promptly repaired.

Non-chemical Metal Cleaning Wastes

Non-chemical Metal Cleaning Wastes, such as air preheater wash water, boiler fireside washes, and precipitator washes have been historically managed as a low volume waste (i.e., discharged to the ash pond without pre-treatment). TVA requests a BPJ determination that this practice can continue as specified in the revised ELGs.

Section 316(a) Alternative Thermal Limit

TVA requests continuation of the current alternative thermal limit (ATL) of 36.1°C as a calculated 24-hour average discharge temperature. The enclosed report discusses the results of shoreline and river bottom habitat/substrate characterization, reservoir fish assemblage and benthic index scores, visual wildlife observations, and water quality data collected upstream and downstream of KIF during 2015 with appropriate comparisons to historical data. TVA believes the results of this monitoring are indicative of a Balanced Indigenous Population (BIP) of aquatic life in the vicinity of KIF.

Compliance with EPA § 316(b) Regulations

EPA's final regulations to establish Best Technology Available (BTA) requirements for cooling water intake structures (CWIS) at existing facilities were published in the Federal Register on August 15, 2014, and became effective on October 14, 2014. Under § 125.95(a)(2), facilities whose currently effective permit expires prior to or on July 14, 2018, may request that the permitting authority provide an alternate schedule for submission of the information required in § 122.21. For existing facilities, such as KIF, with actual intake flows greater than 125 MGD, the information requirements are summarized below:

Source Water Physical Data (§ 122.21(r)(2)):

- Narrative description and scaled drawings showing the physical configuration of all source water bodies used by the facility;
- Characterization of the hydrological and geomorphological features of the water bodies used; and
- Locational maps.

Cooling Water Intake Structure Data (§ 122.21(r)(3)):

- Narrative description of configuration of CWIS and location of CWIS in waterbody;
- Latitude and longitude in degrees, minutes, and seconds for each CWIS at the facility; and
- Narrative description of the operations of each CWIS.

Source Water Biological Characterization Data (§ 122.21(r)(4)):

- List of species (or relevant taxa) for all life stages and their relative abundance;
- Identification of the most vulnerable species and life stages; and
- Other biological characterization data (specified in the specific section of the CFR Part 40).

Cooling Water System Data (§ 122.21(r)(5)):

- Narrative Description;
- Design and Engineering Calculations; and
- Descriptions of Existing Impingement and entrainment technologies or operational measures and a summary of their performance.

Chosen Method(s) of Compliance with Impingement Mortality Standard (§ 122.21(r)(6)):

- If applicant chooses the Modified Traveling Screens (40 CFR 125.94(c)(5)), they must submit an impingement technology performance optimization study (once the BTA requirements for entrainment have been established); or
- If applicant chooses to comply with Systems of Best Technology Available (40 CFR 125.94(c)(6)), they must also submit an impingement technology performance optimization study (once the BTA requirements for entrainment have been established), but it must also include data and explanations on the rate of impingement, impingement mortality, flow reduction, and total system performance.

Entrainment Performance (Survival) Studies (§ 122.21(r)(7)):

- Description of any biological survival studies conducted for the facility and a summary of any conclusions or results for entrainment related studies only.

Operational Status (§ 122.21(r)(8)):

- Descriptions of individual units, capacity utilization rate (for past 5 years), include any extended or unusual outages that affected current data for flow/impingement/entrainment/other;
- Descriptions of plans or schedules for any new units planned within the next 5 years.

Entrainment Characterization Study (§ 122.21(r)(9)):

- Entrainment Data Collection Method—The study should identify and document the data collection period and frequency, as well as detailing how the location of the cooling water intake structure in the waterbody and the water column are accounted for by the data collection locations;

- Biological Entrainment Characterization—Characterization of all life stages of fish, shellfish, and any species protected under Federal, State, or Tribal law, including a description of their abundance and temporal and special characteristics; and
- Analysis and Supporting Documentation—Documentation of the current entrainment of all life stages of fish, shellfish, and any species protected under Federal, State, or Tribal Law.

Comprehensive Technical Feasibility and Cost Evaluation Study (§ 122.21(r)(10))[1]:

- Technical Feasibility—an evaluation of the technical feasibility of close-cycle recirculating systems, fine mesh screens, and water reuse or alternate sources of cooling water;
- Other entrainment control technologies—an evaluation of additional technologies for reducing entrainment may be required by the permit writer; and
- Cost Evaluations—the study must include engineering cost estimates of all technologies considered in the aforementioned studies.

Benefits Valuation Study (§ 122.21(r)(11)):

- The study should include an evaluation of the benefits of the candidate entrainment reduction technologies an operations measures based on; incremental changes in the numbers of individual fish, description of basis for estimates of changes in stock sizes or harvest levels for commercial/recreational fish, description of basis for any monetized values assigned, and a discussion of mitigation efforts.

Non-water Quality Environmental and Other Impacts Study (§ 122.21(r)(12)):

- The study should be a detailed facility specific discussion of the changes in non-water quality environmental and other impacts attributed to each technology and operational measure considered, including: estimates to changes in energy consumption, estimates to air pollutant emissions, estimates to changes in noise, discussion of safety, discussion of facility reliability, and significant changes in consumption of water.

Based on the number and complexity of the studies, reports, and peer reviews to be conducted and the time needed to complete such efforts, TVA requests, per § 125.95(a)(2), that the reissued permit provide an alternate schedule requiring the submittal of the information specified in sections 122.21(r)(2) through 122.21(r)(13), as appropriate, no later than 180-days

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[1] Section 122.21(r)(10) through (12) studies are subject to an external peer review (§ 122.21(r)(13)) – Peer reviewers must have appropriate qualifications and their names and credentials must be included in the peer review report. Applicant must notify the permit writer in advance of the peer review, and permit writer may disapprove of a peer reviewer or require additional peer reviewers.

prior to the expiration of the renewed permit. For the same reasons given, TVA requests that the new permit be issued with the full five-year term to allow sufficient time to complete the 316(b) rule study requirements.

In accordance with § 125.98(b)(2)(ii)(6), completion of the above § 122.21(r) studies ensures that the Director will have all the information necessary to establish BTA requirements for impingement mortality and entrainment in the subsequent permit. In the interim, TVA requests that, based on evaluation of available information on the KIF cooling water intake structure, the Division make a Best Professional Judgment determination that the KIF cooling water intake structure represents BTA to minimize adverse environmental impact also in accordance with § 125.98 (b)(2)(ii)(6).

Reasonable Potential Evaluation for Whole Effluent Toxicity

As discussed in the application, the current permit requirement for chronic biomonitoring of Outfall 002 once per year with a permit limit of IC_{25} > 100% should be retained.

Additional Changes in Facility Operation

On June 28, 2013, TVA submitted a notification to the Division of plans to start disposal of dry fly ash and dry bottom ash, in addition to gypsum, in the peninsula disposal area. Leachate and storm water runoff from the disposal area drain into the FGD storm water pond which ultimately discharge through Outfall 01a. TVA has not observed appreciable impacts to water quality as a result of these operational changes.

In an effort to support closure of the existing stilling pond, TVA is in the process of constructing a new polishing pond (non-CCR impoundment) for treatment of plant wastewaters. A preliminary engineering report for the polishing pond design was submitted to the Division on April 27, 2016, and the final plans and specifications were submitted on August 16, 2016. Once construction is complete, plant wastewaters will be diverted from the stilling pond into the polishing pond which ties into and will discharge from the existing Outfall 001 structure.

Requested Permit Changes

TVA requests combination of NPDES permit nos. TN0005452 and TN0080870 into one facility permit, preferably under TN0005452.

As part of the Kingston Recovery Project (KRP) the iron and copper ponds were filled with ash and discharges from internal monitoring point (IMP) 005 ceased. This area is currently being closed under review by the Division of Solid Waste as part of the Ball Field Closure Project area. TVA requests removal of IMP 005 in the renewal permit.

Based on results from effluent samples collected at Outfall 006 during permit renewal monitoring enclosed on Form 2E, TVA requests continued authorization of the discharge with no monitoring requirements.

As previously discussed, a collection system is under construction to intercept seepage, which currently discharges through Outfall 007, from the ball field area (formerly described as abandoned ash pond) and will be routed to an impoundment for treatment and monitoring prior to discharge through Outfall 001. The project is expected to be complete by December 31, 2016, and the only discharges that will continue through Outfall 007 will be wholly comprised of industrial storm water runoff. Upon completion of the reroute, TVA will transfer coverage of discharges from Outfall 007 to the TMSP. Therefore, TVA requests removal of Outfall 007 from the renewal permit.

TVA requests removal of Outfall 008 from the renewal permit. Historical discharges were related to sluice line leaks or ruptures that would flow to a sump routed directly to the intake; however, these sump flows have been rerouted to discharge through Outfall 001.

In a letter from the Division to TVA dated June 9, 2011, TDEC rescinded the permit requirement to maintain and report the ash pond Free Water Volume (FWV). TVA requests removal of the FWV language from Part III.F. in the renewal permit.

TVA anticipates the language in Part III.G., Dike Inspections, will be updated in order to be consistent with recently issued TVA NPDES permits.

If you have questions or need additional information, please contact Brad Love at (423) 751-8518 in Chattanooga , or by email at bmlove@tva.gov.

Sincerely,

Terry E. Cheek

Terry E. Cheek
Senior Manager
Water Permits, Compliance, and Monitoring

Enclosures
cc (Enclosures):
Tennessee Department of Environment
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Knoxville Environmental Field Office
Attn: Mr. Michael Atchley
3711 Middlebrook Pike
Knoxville, Tennessee 37921

Tennessee Valley Authority (TVA) - Kingston Fossil Plant

Proposed Schedule and Information to Support Development of Applicability Dates under Steam Electric Power Generating Point Source Category Effluent Limitations Guidelines (ELGs)

EPA recently promulgated revised ELGs for the steam electric power generating point source category.[1] The rule provides that the limits set for each wastestream will be applied to individual dischargers in the next NPDES permit issued after the rule's effective date of January 4, 2016. However, the specific applicability dates vary among different wastestreams:

- Limits on certain wastestreams, such as coal yard runoff, low volume wastes, and metal cleaning wastes, were unchanged in the revised ELGs and are currently applicable.
- Limits on combustion residual leachate will apply on the date of issuance of the next NPDES permit.[2]
- Limits on wastestreams with new, more stringent limits under the revised ELG, such as for wet flue gas desulfurization (FGD) wastewaters and establishment of no discharge requirements for fly ash and bottom ash transport waters with few exceptions, will be applied to dischargers on a date to be set by the permitting authority that is as soon as possible beginning November 1, 2018, but no later than December 31, 2023.[3] The rule provides that discharges of these wastestreams before the chosen applicability date should be subject to limitations based on the previously promulgated BPT limitations or the plant's other applicable permit limitations (e.g., any water quality-based effluent limitations) until at least November 1, 2018, or later if dictated by the selected applicability date.[4]

TVA's Kingston Fossil Plant (KIF) is subject to the ELGs and the new limits for wet FGD wastewaters and fly ash and bottom ash transport waters. Other limitations such as those for coal yard runoff, low volume wastes, metal cleaning wastes, and combustion residual leachate also apply.

Under the revised ELG rule, the Tennessee Department of Environment and Conservation (TDEC) must set in the next renewal NPDES permit issued for the KIF facility stream-by-stream applicability dates for the identified limits on wet FGD wastewaters, fly ash transport waters, and bottom ash transport waters. As noted above, these applicability dates must be "as soon as possible beginning November 1, 2018, but no later than December 31, 2023."[5] The rule defines "as soon as possible" to mean November 1, 2018, unless TDEC establishes a later date, after receiving information from TVA, which reflects consideration of the following factors:

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[1] 80 Fed. Reg. 67,838 (Nov. 3, 2015).
[2] 80 Fed. Reg. at 67,882.
[3] *Id.*
[4] 80 Fed. Reg. at 67,883.
[5] 80 Fed. Reg. 67,895-96 (to be codified at 40 C.F.R. §§ 423.13(g)(1)(i), (h)(1)(i), (k)(1)(i)).

- Time to expeditiously plan (including to raise capital), design, procure, and install equipment to comply with the ELG;
- Changes being made or planned at the plant in response to emission guidelines for greenhouse gases from existing fossil-fueled electric generating units (i.e., the Clean Power Plan) or regulations that address the disposal of coal combustion residuals (CCR) as solid waste (i.e., the CCR Rule);
- For FGD wastewater requirements, an initial commissioning period for the treatment system to optimize the installed equipment; and
- Other appropriate factors.[6]

This document discusses the factors relevant to TVA and specifically applicable to the KIF facility that are intended to inform TDEC's determination of appropriate applicability dates for wet FGD wastewaters and fly ash and bottom ash transport waters at KIF to be implemented via the renewed NPDES permit. TVA is proposing applicability dates herein that reflect the complexity of the various projects and the potential issues that could hamper imposition of earlier dates.

TVA uses a three-phase project process: Phase 1 is the study phase, Phase 2 is the design phase, and Phase 3 is the construct phase. Further details on the activities occurring in each phase are described below for the various wastewater streams.

I. TVA Fleet-wide Considerations & Early Activities

TVA has initiated work to implement the ELGs on several fronts including initiating a Phase I study at a coal-fired site in Kentucky prior to the publication of the final ELGs in November 2015. TVA began the contracting process with wastewater treatment (WWT) engineering and design vendors for the other five remaining TVA coal-fired sites in late 2015 once the new ELGs were published. After preparing the workscopes for these sites, TVA then sent out requests for proposals (RFPs) for WWT engineering services in January 2016.

Other early work that TVA has been engaged in for ELG compliance has pertained to technology evaluations, initial wastewater characterization, and other preliminary engineering work. Technology assessments have focused primarily on selenium removal in wet FGD wastewater and have occurred mostly through active participation in projects conducted by the Electric Power Research Institute (EPRI) such as:

- Funding EPRI studies of GE ABMET efficacy for selenium treatment at a Powder River Basin coal-fired site;
- TVA-funded project for bench-scale testing Liberty Hydro (biological alternative treatment) for selenium removal at TVA's Paradise Fossil Plant in Kentucky;
- EPRI project to assess the existing physical-chemical WWT facilities at TVA's Kingston Fossil Plant for mercury and arsenic removal;
- Follow-on EPRI project at Kingston to evaluate biological treatment for selenium (in addition to installing a chemical precipitation pilot);

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[6] 80 Fed. Reg. at 67,883, 67,894 (to be codified at 40 C.F.R. § 423.11(t)).

- Participation in EPRI sampling project to assess water quality for bottom ash transport water at TVA's Bull Run Fossil Plant to determine suitability for wet FGD makeup;
- Participation in an EPRI sponsored test to evaluate a sulfite sensor to improve wet FGD process control; and
- Participation in EPRI sponsored testing for changes in wet FGD wastewater due to the Mercury and Air Toxics Standards rule.

In order to meet the new limits in the ELGs, TVA must evaluate and implement new WWT projects for several wastewaters at six coal sites planned to remain active, including KIF. The capital and operations and maintenance (O&M) expenditures for new WWT will be considerable. TVA has carefully considered the significant capital requirements and associated annual cash flows in our requested applicability dates. TVA's expansive project portfolio, including CCR pond closures and our commitment to conversion to dry combustion residual disposal, makes properly planning cash flows critical to fulfilling TVA's mission and keeping electric rates low. The ELGs allow consideration of this factor, which is a capital raising issue.[7]

There also will be a large number of WWT projects that will occur at approximately the same time as CCR Rule-related projects; these activities require careful coordination at the affected sites to ensure that one project's decisions do not adversely affect another project's outcome. Another factor for consideration in the development of these applicability dates is that, with the amount of industrial construction occurring on a near-simultaneous basis in the U.S. for various environmental projects, there is likely to be a significant shortage of skilled trades and labor craftsmen.

TVA is also somewhat unique compared to investor-owned utilities in that, as a federal agency, it is subject to the National Environmental Policy Act (NEPA). The Endangered Species Act and the National Historic Preservation Act also include sections with federal agency-specific requirements. TVA is planning to conduct much of the required environmental review under these statutes simultaneously with the detailed design stage (Phase 2) of WWT; however, the ability to proceed with projects can be subject to delays presented by the environmental review process itself or as a result of required mitigation that results from that process. For example, types of delays that can occur include avoiding construction during certain periods to protect threatened or endangered species such as bats or bird species. For this reason, TVA has included appropriate schedule contingency in each of the WWT facility project schedules to address potential delays due to environmental reviews or other construction delays, the specifics of which cannot be reasonably foreseen at this time.

II. Wastewater Treatment Facilities at Kingston

The types of wastewaters requiring new treatment or handling facilities for compliance with the ELGs include additional wet FGD wastewater treatment and completion of the conversion to a no discharge of bottom ash transport water system (while still allowing the limited exceptions provided for by EPA for FGD makeup and fly ash conditioning).

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[7] 80 Fed. Reg. at 67,894 (to be codified at 40 C.F.R. § 423.11(t)(1)).

TVA has been working with engineering firm(s) to establish workable preliminary conceptual schedules to support proposed ELG applicability dates for the various wastewaters at KIF. Based on these preliminary schedules and TVA's assessment of other relevant factors such as environmental review requirements, appropriate minimum proof-of-concept testing schedules for wet FGD wastewaters as well as preferred overlapping test periods for vendors, TVA's proposed applicability dates and the associated justifications are presented below.

A. Wet FGD Scrubber Wastewaters

EPA determined that the best available technology (BAT) for treatment of wet FGD wastewater is chemical precipitation followed by biological treatment. New ELGs for wet FGD wastewater were established for arsenic, mercury, selenium, and nitrate/nitrite based on these basis technologies. (EPA does not, however, regulate the type of equipment required to be used to comply with ELGs.)

Kingston operates a once-through, high-flow wet FGD scrubber. The existing materials of construction in the KIF FGD limit the ability to recycle flow back to the scrubber absorber; however, recycling would reduce the overall volume of wastewater to be treated. The materials of construction are not resistant to chlorides which can concentrate in wet FGDs when water is recycled which may cause accelerated corrosion. TVA may consider recycling a portion of wet FGD blowdown up to the recommended maximum chlorides concentration for the materials of construction limitations or relining the FGD equipment with corrosion resistant materials in order to significantly reduce the volume of wastewater to treat. However, the recycling of flows adds complexity to the wastewater being treated as it increases the dissolved constituents. The increase in dissolved constituents may hamper the removal of the target metals found in the ELGs. Considerable effort will be required to determine the optimum holistic approach for wet FGD WWT; respective advantages and disadvantages will be evaluated in Phase 1 (Study) at KIF.

Gypsum dewatering is a necessary first step for wet FGD WWT in order to separate the bulk of the wet FGD solids from this wastestream. KIF currently operates gypsum dewatering and chemical precipitation WWT equipment. The chemical precipitation equipment at the gypsum dewatering plant was originally designed for total suspended solids, oil and grease and pH limitations that were in the previous steam electric ELGs and to support the conversion to dry disposal of wet FGD CCRs. TVA has evaluated the physical-chemical equipment performance at Kingston Fossil Plant and found that the targeted monthly average mercury concentration was not successfully met during the testing. Further studies are underway in association with the biological pilots currently being operated in an EPRI study.

During Phase I (Study), TVA will continue to evaluate the capabilities of the existing chemical precipitation equipment at KIF in achieving the ELGs for mercury and arsenic and for preparing the wastewater for advanced treatment using biological or biological alternative treatment for selenium and nitrate-nitrite.

There are significant concerns about the ability to reliably meet the ELGs for any site; thus TVA will continue to evaluate wet FGD WWT technology options along with the rest of the industry, particularly for selenium. Selenium treatment is not as well-established as chemical precipitation. Extensive proof-of-concept testing for selenium treatment is vital in making the best WWT decision at KIF in order to comply with very stringent wet FGD ELGs. Proof-of-concept testing for selenium WWT technologies is planned to occur during Phase 2 (Design). TVA, many other utilities, and various WWT engineering providers suggest active testing for each technology that spans a period of at least six months. This allows evaluation to occur over various operational conditions and seasons. It is also preferable to conduct side-by-side testing of various vendors' technologies to expose them to identical operating conditions in order to gauge their relative merits. In addition, the proof-of-concept testing must occur at each wet FGD site; one site's results cannot reliably be applied to another site. TVA has seen ample evidence of the unique properties of each wet FGD wastewater. This variability among sites can be due to coals burned/blended, source water and limestone constituent contributions, and overall operational variability. Operational variability can be driven by how the generation units are dispatched (i.e., when and how operated) as well as how each wet FGD is operated such as the oxygen feed rates, blowdown frequencies, etc. (In fact, FGD operation can be vastly different between absorbers at the same plant due to the particular chemistry found in each absorber, even when the flue gas from all units enters a common exhaust duct and is then split between multiple FGD absorbers.)

Selenium and nitrate/nitrite removal pilot-scale units are likely to be in high demand by the industry. The supply of pilots is thought to be woefully inadequate, which could potentially cause delays in completing planned proof-of-concept testing and completion of Phase 2 design. The desired side-by-side testing also can be problematic with limited pilot-scale unit availability, so there is additional time built into the schedule to accommodate side-by-side testing for at least part of the time.

EPA also recognizes the need and allows time to optimize, tune, test, and adapt wet FGD WWT to ensure compliance with ELGs after installation of the WWT equipment in Phase 3.[8] TVA believes this optimization step is warranted and has allocated a minimum of eight months in Phase 3 (Construct) for testing and optimization in order to allow sufficient time to troubleshoot and respond with additional treatment as necessary.

Existing planned outage schedules must be taken into account when determining the ELG applicability date so that equipment tie-ins can occur during planned outages where feasible. Using planned outages versus requiring additional/special outages for tying in equipment ensures operations occur according to the generation plan which helps maintain electric grid reliability. Consideration of this factor is allowed by and planned for in the ELGs.

Detailed below are the various activities that are expected to occur during each phase of the FGD WWT project and reasonably foreseeable potential difficulties that may impact project schedule.

Project Phase 1 (Study)—Approximately 15 months

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[8] 80 Fed. Reg. at 67,894 (to be codified at 40 C.F.R. § 423.11(t)(3)).

Projected Activities: Develop approximate WWT footprint for additional treatment required and preliminary general arrangements, and propose and evaluate alternative locations. Conduct siting and geotechnical studies for proposed sites if needed. Develop performance specifications, conceptual budgets and refined schedules. Perform characterization of wet FGD wastewaters and conduct bench/treatability testing. Determine if existing physical-chemical treatment upgrades are needed or if additional secondary treatment for selenium and nitrate/nitrite will address deficiencies in physical-chemical treatment for arsenic and mercury. Conduct characterization of bottom ash transport water and determine suitability of bottom ash transport water for FGD makeup as part of the FGD WWT design group activities. Develop project planning document. Develop Request for Proposal (RFP) documents and initiate RFP process and evaluations to proceed to Phases 2 and 3. Obtain TVA Board approval for project.

Potential Schedule Issues: Delays in the RFP processes (i.e., required extensions, scope clarifications, best and final pricing requests, and contract negations).

Project Phase 2 (Design, Proof-of-Concept Testing, and Long Lead Items)—Approximately 20 months.

Projected Activities: Develop detailed design drawings/documents including power needs study for WWT. Conduct proof of concept testing for wet FGD wastewater for a minimum of 6 months active testing with side-by-side evaluations of technologies. Complete required environmental reviews (NEPA) and obtain construction stormwater and 404/401/other permits. Initiate the WWT plans approval process with TDEC after 90% design documents have been developed.

Potential Schedule Issues: Challenges to NEPA documents or permits. Delays in obtaining proof-of-concept equipment from vendors due to high demand. Scarcity or supplier bottlenecks for WWT equipment to be purchased as long lead item procurement could delay completion of Phase II and initiation/completion of Phase 3 (construction).

Project Phase 3 (Construct, Test, Train)—Approximately 32 months

Projected Activities: Wet FGD WWT site preparation and construction including establishment of construction stormwater best management practices, installation of wet FGD WWT equipment, piping, power, controls. Start-up of WWT equipment, debugging of controls/software. Testing and optimization of wet FGD WWT equipment; installation of additional/alternative treatment if necessary. Train operators; troubleshoot and respond to equipment design or reliability issues.

Potential Schedule Issues: Site construction delays due to weather, environmental review-related issues (e.g., potential "no construction" periods for bird and bat protection). Plant integration of controls, power, piping, etc., and dependence upon planned outages.

Proposed Applicability Date for Wet FGD Wastewater ELGs - October 1, 2022

B. Dry Fly Ash System

EPA's ELGs established a no-discharge standard for fly ash transport water for existing plants. KIF currently does not discharge fly ash transport water as defined by the ELGs. The dry fly ash handling system was upgraded in recent years to eliminate the possibility of wet sluicing the fly ash as a backup transport mechanism. This was accomplished in support of TVA's effort to eliminate wet disposal of CCRs. KIF has achieved compliance with the no-discharge standard for fly ash transport water. In accordance with the ELGs, the default applicability date for no discharge of fly ash transport water should be established as November 1, 2018.

C. Bottom Ash Transport Water Upgrades

The ELGs established a no-discharge standard for bottom ash transport water. EPA determined that BAT for this wastestream is a dry handling or a closed-loop system that recycles flow from the dewatering process.

For KIF, TVA installed an interim tank-based bottom ash dewatering system in order to eliminate the wet disposal of this CCR. This system was completed in early fall of 2015; however, it is not currently a no-discharge system and is planned to be replaced. TVA is currently installing a remote submerged flight conveyor system and will design and build the recirculation portion separately. As mentioned in other reports, TVA has separated the activities necessary to achieve the no-discharge standard into separate projects in order to balance project workload. These projects are separated into field activities for the construction of a dewatering facility and plant tie-ins to accommodate recirculation. Both the dewatering and the recirculation pieces must be in place in order to achieve the no-discharge requirement of the ELGs.

EPA does allow certain uses for bottom ash transport water such as FGD makeup water and fly ash conditioning to prevent dusting. As part of completing the design to make the system a no-discharge system, TVA will determine whether all flows should be used solely for bottom ash transport, or whether a portion of that water is suitable for FGD makeup water or fly ash conditioning as allowed for by EPA. This determination will involve evaluating flows and characterizing chemical constituents to ensure that operational problems or system damage does not occur due to characteristics of the bottom ash transport water such as fines that could erode pipes or equipment. After characterizing the bottom ash transport water, TVA will be able to determine the best reuse option.

The durations below are for the future activities as some actions have already been completed.

Project Phase 1 (Study)—Approximately 12 months

> **Projected Activities:** Conduct siting and geotechnical studies for proposed equipment. Develop vendor performance specifications, conceptual budgets and refined schedules. Develop project planning documents.

Potential Schedule Issues: Delays in the Request for Proposal processes (i.e., required extensions, scope clarifications, best and final pricing requests, and contract negations).

Project Phase 2 (Design and Long Lead Items)—Approximately <u>12</u> months

Projected Activities: Develop detailed design drawings/documents including power needs study for equipment. Complete required environmental reviews as required by NEPA and obtain construction stormwater and 404/401/other permits based on design documents.

Potential Schedule Issues: Delays in permitting or challenges to NEPA documents and scarcity or supplier bottlenecks for long lead equipment may cause delays.

Project Phase 3 (Construct)—Approximately <u>29</u> months

Projected Activities: Site preparation, construction including establishment of construction stormwater best management practices, installation of equipment, piping, power, controls. Complete plant tie-ins, working around outage schedules for 9 units. Perform start-up, testing, and optimization of system.

Potential Schedule Issues: Site construction delays due to weather, environmental review-related issues (e.g., potential "no construction" periods for bird and bat protection). Plant integration of controls, power, piping, etc., and dependence upon planned outages.

<u>**Proposed Bottom Ash No-Discharge Applicability Date**: April 1, 2021</u>

D. Legacy Wastewater

The ELGs also address appropriate limits for legacy wastewater, which the rule defines as wet FGD wastewater, fly ash transport water, bottom ash transport water, and certain other wastewaters generated prior to the applicability date for the new limits determined by the permitting authority for each of these streams.[9] Legacy wastewater at KIF will be subject to limits on total suspended solids (TSS), oil and grease (O&G) and pH that will apply to wet FGD wastewater, fly ash transport water, and bottom ash transport water generated before the new ELG applicability dates selected by TDEC for each of these wastestreams.[10] Due to the CCR rule, various impoundments are subject to closure. TVA is evaluating remaining basins to be repurposed for treatment of legacy wastewaters and general plant flows to the extent practicable.

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[9] 80 Fed. Reg. at 67,854-55.

[10] 80 Fed. Reg. at 67,854-55, 67,895-96 (to be codified at 40 C.F.R. §§ 423.13 (g)(1)(ii), (h)(1)(ii), (k)(1)(ii)).

E. General Plant Flows

In addition to wet FGD wastewater and fly ash and bottom ash transport waters, the KIF facility includes a number of other general plant flows. TVA is using the term general plant flows to refer to several types of wastewater including coal pile runoff, low volume wastes, combustion residual leachate, and chemical and nonchemical metal cleaning wastes with established ELGs. The ELG does not allow the permitting authority to determine future applicability dates for these flows but they are included in this document for completeness.

Much of the plant's general plant flows are currently collected and treated in the site's ash pond that discharges via Outfall 001 to the plant intake and eventually to the Clinch River. In the near future, this basin's function will be replaced with the process flows polishing pond that will flow to the same outfall. In addition, some general plant flows are routed to the stormwater pond at the Gypsum Disposal Facility and discharged via outfall 01A. If necessary, additional WWT may be applied or augmented at these basins in the future such as pH control or polymer injection, with appropriate state approvals of the additives and/or treatment.

Chemical metal cleaning wastes will be either collected in frac tanks and any hazardous portions will be disposed of as hazardous wastes, or they will be evaporated in the boilers if allowed. If collected and not evaporated, the non-hazardous fraction of chemical cleaning wastes will be discharged in accordance with limits in the NPDES permit on TSS, O&G, pH, copper, and iron.

Non-chemical metal cleaning wastes will continue to be discharged in accordance with historical limits in the NPDES permit. As established in the ELGs and prior NPDES permits, non-chemical metal cleaning wastes were formerly treated as low volume wastes subject only to TSS, O&G and pH limitations and not copper and iron limitations.

III. Conclusion

The following table summarizes appropriate ELG applicability dates for each type of wastewater, accounting for all of the necessary planning, design, and implementation activities and other factors described above.

Table 1. ELG Applicability Date Summary

Wastewater Stream	Limits	Proposed Applicability Date
Wet FGD Wastewater	Arsenic (8, 11 ug/L), Mercury (365, 788 ng/L); Se (12, 23 ug/L), N/N (4.4, 17 mg/L)	October 1, 2022
Fly Ash Transport Water	No discharge	November 1, 2018
Bottom Ash Transport Water	No discharge; exceptions for wet FGD makeup, use for fly ash conditioning, and small quantities due to line repair	April 1, 2021
Combustion Residual Leachate	TSS (30,100 mg/L); O&G (15, 20 mg/L); pH (6-9)	Date of permit issuance
Coal Pile Runoff	TSS (50 mg/L); pH (6-9)	Applicable now
Low Volume Wastes	TSS (30,100 mg/L); O&G (15, 20 mg/L); pH (6-9)	Applicable now
Chemical metal cleaning wastes	TSS (30,100 mg/L); O&G (15, 20 mg/L); pH (6-9); Copper (1, 1 mg/L); Iron (1, 1 mg/L)	Applicable now
Nonchemical metal cleaning wastes	TSS (30,100 mg/L); O&G (15, 20 mg/L); pH (6-9)	Applicable now

In each case of new applicability dates as shown above, TVA is requesting these applicability dates be established at the beginning of a monitoring period due to sampling and discharge monitoring report (DMR) reporting considerations.

In order to keep TDEC abreast of TVA's progress toward installing the necessary equipment to meet the wet FGD wastewater and bottom ash transport water limits, TVA proposes to provide TDEC with an annual report detailing progress achieved during the preceding calendar year. This report could be submitted by January 31 of each year detailing the projects progress from the preceding year.

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved. OMB No. 2040-0086. Approval expires 5-31-92.

FORM
1
GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program
(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

S F		T/A	C
F	T N 8 6 4 0 0 0 6 6 8 2		D
1	2 … 13	14	15

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)* , please provide it in the proper fill-in area*(s)* below. If the label is complete and correct, you need not complete *Items 1, III, V, and VI (except VI-B which must be completed regardless).* Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold-faced terms**.

SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S**.? (FORM 2B)		X	
	16	17	18		19	20	21
C. Is this a facility which currently results in **discharges** to **waters of the U.S**. other than those described in A or B above? (FORM 2C)	X		X	D. Is this a proposed facility *(other than those described in A or B above) which will result in a discharge to* **waters of the U.S.**? (FORM 2D)	X		X
	22	23	24		25	26	27
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)		X		F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
	28	29	30		31	32	33
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
	34	35	36		37	38	39
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)		X		J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)		X	
	40	41	42		43	44	45

III. NAME OF FACILITY

1 SKIP US TVA KINGSTON FOSSIL PLANT
15 16-29 30 … 69

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*		
2 B. DOUG KEELING Plant Manager	865	717	2500
15 16 … 45	46 - 48	49 - 51	52 - 55

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3 714 SWANPOND RD
15 16 … 45

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 HARRIMAN	TN	37746
15 16 … 40	41 42	47 - 51

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5 714 SWAN POND RD
15 16 … 45

B. COUNTY NAME

ROANE
46 … 70

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE *(if known)*
6 HARRIMAN	TN	37746	
15 16 … 40	41 42	47 - 51	52 - 54

CONTINUE ON PAGE 2

CONTINUED FROM PAGE 1

VII. SIC CODES *(4-digit, in order of priority)*

A. FIRST		
C 7	4, 9, 1, 1	*(specify)* Electric Services
15	16 - 19	
B. SECOND		
C 7		*(specify)*
15	16 - 19	
C. THIRD		
C 7		*(specify)*
15	16 - 19	
D. FOURTH		
C 7		*(specify)*
15	16 - 19	

VIII. OPERATOR INFORMATION

A. NAME
C 8 TENNESSEE VALLEY AUTHORITY
15 16 — 55

B. Is the name listed as Item VIII-A also the owner? ☒ YES ☐ NO
66

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box; if "Other", specify.)*
F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC *(other than federal or state)*
O = OTHER *(specify)*
F (56) *(specify)*

D. PHONE *(area code & no.)*
C A 8, 6, 5 7, 1, 7 2, 5, 0, 0
15 16 - 18 19 - 21 22 - 25

E. STREET OR P.O. BOX
7, 1, 4, SWAN POND RD
26 — 55

F. CITY OR TOWN
C B HARRIMAN
15 16 — 40

G. STATE
TN
41 42

H. ZIP CODE
3, 7, 7, 4, 6
47 - 51

IX. INDIAN LAND
Is the facility located on Indian lands? ☐ YES ☒ NO
52

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES *(Discharges to Surface Water)*	**D. PSD** *(Air Emissions from Proposed Sources)*		
C T I 9 N	TN0005452	C T I 9 P	548401
15 16 17 18 — 30		15 16 17 18 — 30	Title V Air Permit
B. UIC *(Underground Injection of Fluids)*	**E. OTHER** *(specify)*		
C T I 9 U		C T I 9	IDL 73-0094
15 16 17 18 — 30		15 16 17 18 — 30	*(specify)* Landfill Permit
C. RCRA *(Hazardous Wastes)*	**E. OTHER** *(specify)*		
C T I 9 R	TN8640006682	C T I 9	TNR051787
15 16 17 18 — 30		15 16 17 18 — 30	*(specify)* TMSP, See attachment for additional permits

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS *(provide a brief description)*

Kingston Stream Plant is a fossil fueled, steam electric generating plant located near Kingston, Tennessee on Watts Bar Reservoir at approximate Clinch River mile 2.5. The plant has nine coal fired units with a combined rated generating capacity of 1,700 megawatts.

XIII. CERTIFICATION *(see instructions)*

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*
B. Doug Keeling, Plant Manager
TVA Kingston Fossil Plant

B. SIGNATURE
B Doug Keeling

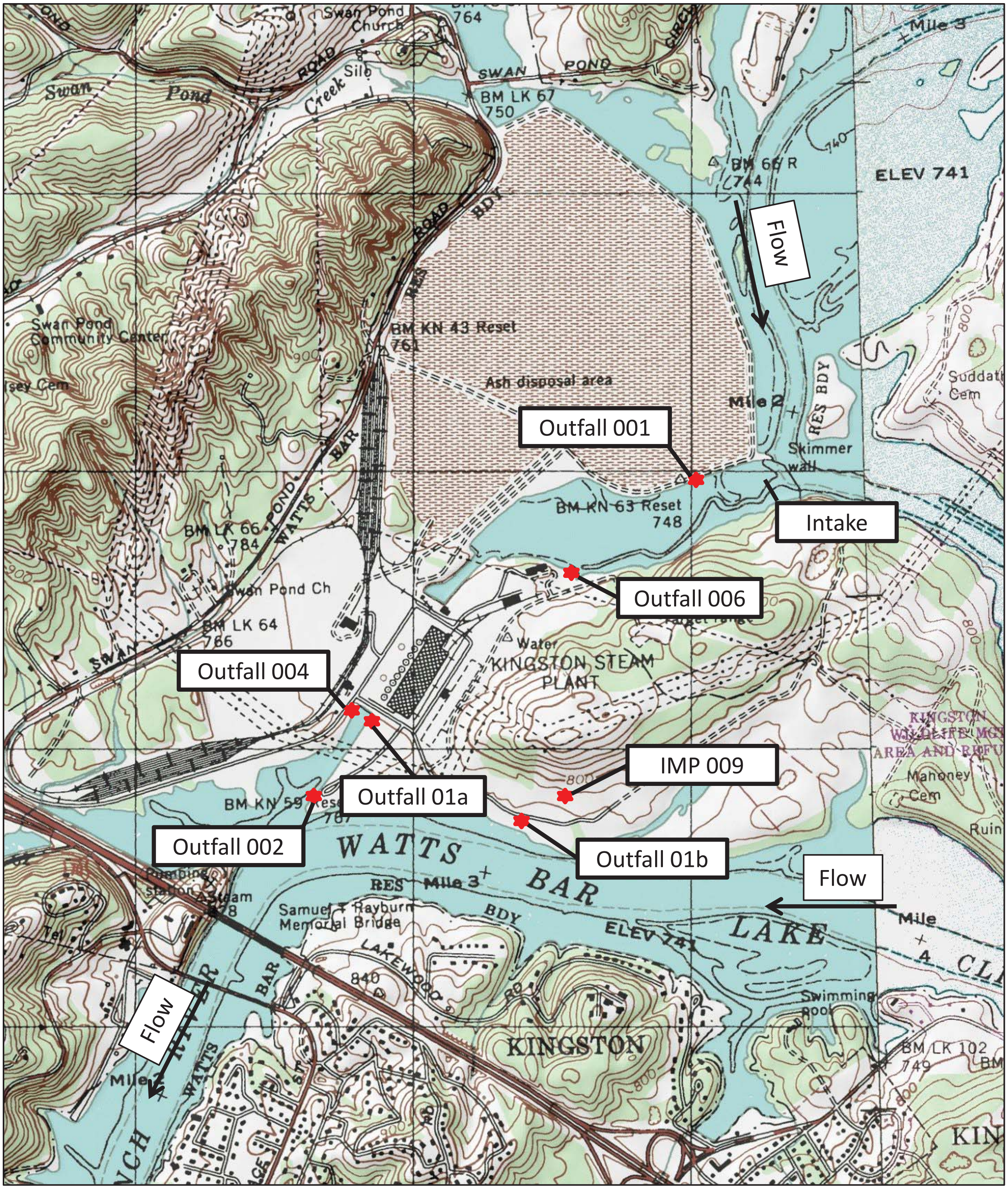
C. DATE SIGNED
10-14-16

COMMENTS FOR OFFICIAL USE ONLY
C
C
15 16 — 55

EPA Form 3510-1 (8-90)

Form 1 - General Section X - Existing Environmental Permits

1. IDL 73-0211, Coal Combustion Byproduct Disposal Facility – Peninsula Site
2. TNR191557, Ball Field Closure and Flow Management Projects Construction Permit
3. TNR191259, Gypsum Disposal Area and Fly Ash Haul Road Construction Permit
4. TNR191509, Bottom Ash Dewatering Facility Construction Permit
5. NRS16.121, General Permit for Construction of Intake and Outfall Structures
6. NRS16.142 (Pending), Individual Permit to repair Eastern Dike Seepage



Tennessee Valley Authority
Kingston Fossil Plant
NPDES Permit No. TN0005452
Roane County, Tennessee

Seep Number	Latitude	Longitude
1	35° 53' 30"	-84° 30' 45"
2	35° 54' 15"	-84° 31' 0"

Figure No.
1

Title
Kingston Fossil Plant Seepage Layout Fossil Plant & Surrounding Area

Project Location
Harriman
Roane County, Tennessee

175656169
Prepared by WSW on 2016-09-21
Technical Review by JW on 2016-09-21
Independent Review by TR on 2016-09-21

0 600 1,200 Feet
1:7,200 (At original document size of 11x17)

Legend

- ● Active Seep
- ● Mitigated Seep

PRIVILEGED AND CONFIDENTIAL

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Kingston Fossil Plant Aerial Image courtesy of USGS © 2016 Microsoft Corporation
3. No TVA Identified Wetlands Within Map View.
4. Seep Table Coordinates Shown In NAD 1983 StatePlane Tennessee FIPS 4100

Stantec TVA

V:\1756\active\175656169\gis\mxd\NPDESFigures_20160921\KIF_SL_NPDES_Figure1.mxd Revised: 2016-09-21 By: swheatley

Seep Number	Latitude	Longitude
3	35° 54' 15"	-84° 30' 15"

Figure No.
2

Title
Kingston Fossil Plant Seepage Layout Area North of Fossil Plant

Project Location
Harriman
Roane County, Tennessee

175656169
Prepared by WSW on 2016-09-21
Technical Review by JW on 2016-09-21
Independent Review by TR on 2016-09-21

0 500 1,000
Feet
1:6,000 (At original document size of 11x17)

Legend

● Mitigated Seep

PRIVILEGED AND CONFIDENTIAL

Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Kingston Fossil Plant Aerial Image courtesy of USGS © 2016 Microsoft Corporation
3. No TVA Identified Wetlands Within Map View.
4. Seep Table Coordinates Shown In NAD 1983 StatePlane Tennessee FIPS 4100

Please print or type in the unshaded areas only

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
TN8640006682

Form Approved
OMB No. 2040-0086
Approval expires 5/31/92

FORM
2C
NPDES

EPA

U. S. ENVIRONMENTAL PROTECTION AGENCY

APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER

EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS

Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (*name*)
	1. DEG.	2. MIN	3. SEC.	1. DEG.	2. MIN.	3. SEC.	
001	35	54	15	84	30	15	Plant Intake (to Watts Bar Reservoir) via Outfall 002
002	35	53	45	84	31	15	Watts Bar Reservoir
004	35	53	45	84	31	15	Watts Bar Reservoir via Outfall 002
006	35	54	0	84	30	0	Plant Intake (to Watts Bar Reservoir) via Outfall 002
01a	35	53	45	84	31	15	Watts Bar Reservoir via Outfall 002
01b	35	53	30	84	30	45	Watts Bar Reservoir (Emergency Only)
IMP 009	35	53	45	84	30	45	Internal Discharge to FGD Storm Water Pond (Outfall 01a)

II. FLOWS, SOURCES, OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined *(e.g., for certain mining activities)* , provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO (*list*)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
001	Stilling Pond (Polishing Pond)	**14.03 MGD**	Treatment for 001 includes:		
	The existing stilling pond provides treatment		(1) Coagulation	2	D
	over a 24 acre area; however, this pond		(2) Flocculation	1	G
	will soon be closed and replaced by a new		(3) Settling	1	U
	polishing pond which is currently under		(4) Neutralization	2	K
	construction and will have an operating		(5) Discharge to surface	4	A
	surface area of approximately 6.6 acres.		water via Plant Intake		
			Channel via Outfall 002.		
			(6) Reuse of treated effluent	4	C
	Outfall 001 receives flow from the		for cooling water		
	following sources:				
	(1) Coal yard runoff which includes:	0.145 MGD			
	(a) Coal storage area drainage	(0.110 MGD)			
	(b) Utility building area drainage	(0.035 MGD)			
	(c) Fire protection flushes	(0.000064 MGD)			
	(2) Redwater wetlands	0.171 MGD	Treatment occurs in a 4-acre		
	(a) Seepage	(0.170 MGD)	constructed wetlands system;		
	(b) Precipitation	(0.010 MGD)	effluent is pumped to pond.		
	(c) Evaporation	-(0.009 MGD)			
	(3) Less seepage from the ash pond	-0.170 MGD			
	(4) Nonchemical metal cleaning wastes	Negligible			
	(5) Ammonia storage area runoff	0.002 MGD			
	(6) Bottom ash sluicing	6.814 MGD			

OFFICIAL USE ONLY *(effluent guidelines sub-categories)*

Continue on Page 2

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Form Approved
OMB No. 2040-0086
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FORM
2C
NPDES

EPA

U. S. ENVIRONMENTAL PROTECTION AGENCY

APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER

EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS

Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER *(list)*	**B. LATITUDE**			**C. LONGITUDE**			**D. RECEIVING WATER** *(name)*
	1. DEG.	**2. MIN**	**3. SEC.**	**1. DEG.**	**2. MIN.**	**3. SEC.**	

II. FLOWS, SOURCES, OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined *(e.g., for certain mining activities)* , provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO *(list)*	**2. OPERATION(S) CONTRIBUTING FLOW**		**3. TREATMENT**		
	a. OPERATION *(list)*	**b. AVERAGE FLOW** *(include units)*	**a. DESCRIPTION**	**b. LIST CODES FROM TABLE 2C-1**	
001 (Con't.)	(10) Water treatment plant wastes via	0.267 MGD			
	NLDF Sump, which includes:				
	(a) RO System Reject	(0.239 MGD)			
	(b) RO System Backwash	(0.028 MGD)			
	(11) Drainage from sluice line trench	0.018 MGD			
	includes: sluice line ruptures, precipitator				
	area drainage & fire protection flushes				
	(12) Station sump discharge which includes:	7.712 MGD			
	(a) Ash system leakage and boiler	(4.155 MGD)			
	bottom overflow and Units 5-9 ID fan				
	bearing cooling water				
	(b) Miscellaneous equipment cooling	(3.438 MGD)			
	and lubricating water				
	(c) Fire protection flushes	(0.000034 MGD)			
	(d) Floor Washing and other low	(0.025 MGD)			
	volume wastes				
	(e) Roof drains and precipitator	(0.018 MGD)			
	washdown				
	(f) Boiler water leakage	(0.061 MGD)			
	(g) Analytical process wastewater	(0.005 MGD)			
	(h) Basement boiler blowdown tank	Negligible			
	(start up only)				
	(i) Lab sample stations	(0.010 MGD)			
	(13) Ballfield area seepage collection	0.397 MGD			

OFFICIAL USE ONLY *(effluent guidelines sub-categories)*

Continue on Page 2

Please print or type in the unshaded areas only

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Approval expires 5/31/92

FORM **2C** NPDES

EPA

U. S. ENVIRONMENTAL PROTECTION AGENCY

APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER

EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS

Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER *(list)*	B. LATITUDE 1. DEG.	B. LATITUDE 2. MIN	B. LATITUDE 3. SEC.	C. LONGITUDE 1. DEG.	C. LONGITUDE 2. MIN.	C. LONGITUDE 3. SEC.	D. RECEIVING WATER *(name)*

II. FLOWS, SOURCES, OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined *(e.g., for certain mining activities)* , provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO *(list)*	2. OPERATION(S) CONTRIBUTING FLOW a. OPERATION *(list)*	2. b. AVERAGE FLOW *(include units)*	3. TREATMENT a. DESCRIPTION	3. b. LIST CODES FROM TABLE 2C-1	
001 (Con't.)	(13) Storm water runoff from FGD area	0.020 MGD			
	sump				
	(14) AAF area sump, including	0.012 MGD			
	precipitator wash and raw water				
	leakage				
	(15) Precipitation	0.574 MGD			
	(16) Less evaporation	-0.238 MGD			
002	Condenser cooling water discharge	**999.14 MGD**	Discharge to surface water	4	A
	channel. Outfall 002 receives flow from:				
	(1) Once-through condenser cooling	997.06 MGD			
	water, including flows from Outfall 001.				
	(2) 3rd Floor Boiler blowdown	0.014 MGD			
	(3) Discharge from underflow ponds,	0.010 MGD			
	including fire protection flushes,				
	raw water leakage, and runoff				
	from the south transformer and switchyard				
	(4) Intake screen backwash from	0.252 MGD			
	Outfall 004 and FGD strainers				
	(5) Discharge from FGD storm water	1.605 MGD			
	pond (Outfall 01a)				
	(6) Discharge from Outfall 006	0.203 MGD			

OFFICIAL USE ONLY *(effluent guidelines sub-categories)*

Please print or type in the unshaded areas only

EPA I.D. NUMBER (*copy from Item 1 of Form 1)*
TN8640006682

Form Approved
OMB No. 2040-0086
Approval expires 5/31/92

FORM
2C
NPDES

EPA

U. S. ENVIRONMENTAL PROTECTION AGENCY

APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER

EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS

Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER *(list)*	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER *(name)*
	1. DEG.	2. MIN	3. SEC.	1. DEG.	2. MIN.	3. SEC.	

II. FLOWS, SOURCES, OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined *(e.g., for certain mining activities)* , provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO *(list)*	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION *(list)*	b. AVERAGE FLOW *(include units)*	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
004	Intake screen backwash (raw river water)	**0.252 MGD**	Discharge to surface water	4	A
006	Electrical control building air conditioning	**0.203 MGD**	Discharge to surface water	4	A
	condensate, fire protection flushes and				
	leakage to which no chemicals have been				
	added.				
01a	FGD storm water pond which receives flow	**1.605 MGD**	Treatment occurs in a 6.87 acre		
	from:	(estimated max flow	pond providing:		
		based on design)	(1) Coagulation	2	D
			(2) Flocculation	1	G
			(3) Settling	1	U
			(4) Neutralization	2	K
			(5) Discharge to Surface Waters	4	A
	(1) FGD Dewatering Facility via IMP009	(0.923 MGD)			
	(2) Leachate and storm water runoff from	(0.064 MGD)			
	the dry FGD, bottom ash, and fly ash				
	Peninsula Disposal Area.				
	(3) Precipitation	(0.032 MGD)			
	(4) Evaporation	(-0.016 MGD)			

OFFICIAL USE ONLY *(effluent guidelines sub-categories)*

Continue on Page 2

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FORM
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U. S. ENVIRONMENTAL PROTECTION AGENCY

APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER

EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS

Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (*name*)
	1. DEG.	2. MIN	3. SEC.	1. DEG.	2. MIN.	3. SEC.	

II. FLOWS, SOURCES, OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined *(e.g., for certain mining activities)* , provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO (*list*)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
01b	Emergency overflow point for FGD Storm	**0 MGD**			
	Water Pond. (would only discharge in				
	response to a probable maximum				
	precipitation event)				
IMP 009	FGD Dewatering Facility	**0.923 MGD**	Treatment occurs in the FGD		
			Dewatering Facility prior to		
			discharge in to FGD storm water		
			pond:		
			(1) Centrifugation	5	D
			(2) Belt Filtration	5	C
			(3) Vacuum Filtration	5	U
			(4) Coagulation	2	D
			(5) Flocculation	1	G
			(6) Settling	1	U
			(7) Neutratlization	2	K

OFFICIAL USE ONLY *(effluent guidelines sub-categories)*

Continue on Page 2

CONTINUED FROM PAGE 1

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

☒ YES *(complete the following table)* ☐ NO *(go to Section III)*

1. OUTFALL NUMBER *(list)*	**2. OPERATION*(s)* CONTRIBUTING FLOW** *(list)*	**3. FREQUENCY** **a. DAYS PER WEEK** *(specify average)*	**b. MONTHS PER YEAR** *(specify average)*	**4. FLOW** **a. FLOW RATE** *(in mgd)* 1. LONG TERM AVERAGE	2. MAXIMUM DAILY	**b. TOTAL VOLUME** *(specify with units)* 1. LONG TERM AVERAGE	2. MAXIMUM DAILY	**c. DURATION** *(in days)*
IMP 009	FGD Dewatering Facility	5-7	12	0.923	1.846			

The KIF FGD Gypsum Dewatering Facility typically operates 5-7 days per week for approximately 10-12 hours per day. The flow rates reported above are based on mechanical process design flows. The long term average flow is based on 12 hour operation and the daily maxium flow is based on 24 hour operation. During off peak load seasons such as spring and fall, KIF may go into "Not in Demand" status and the plant may be offline for longer durations of time. On the other hand, during peak load seasons such as late summer and winter the GDF may operate more frequently or for longer hours based on plant operation to meet load.

III. PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

☒ YES *(complete Item III-B)* ☐ NO *(go to Section IV)*

B. Are the limitations in the applicable effluent guideline expressed in terms of production *(or other measure of operation)*?

☐ YES *(complete Item III-C)* ☒ NO *(go to Section IV)*

C. If you answered "yes" to Item III-B, list the quantity which represents an actual measurement of your level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

1. AVERAGE DAILY PRODUCTION a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. *(specify)*	**2. AFFECTED OUTFALLS** *(list outfall numbers)*

IV. IMPROVEMENTS

A. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

☐ **YES** *(complete the following table)* ☒ **NO** *(go to Item IV-B)*

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	**2. AFFECTED OUTFALLS** a. NO.	b. SOURCE OF DISCHARGE	**3. BRIEF DESCRIPTION OF PROJECT**	**4. FINAL COMPLIANCE DATE** a. REQUIRED	b. PROJECTED

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs *(or other environmental projects which may affect your discharges)* you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction.

☐ MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAMS IS ATTACHED

Continue on Page 3

CONTINUED FROM PAGE 2

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*

TN8640006682

V. INTAKE AND EFFLUENT CHARACTERISTICS

A, B, & C: See instructions before proceeding - Complete one set of tables for each outfall - Annotate the outfall number in the space provided.

NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

D. Use the space below to list any of the pollutants listed in Table 2C-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE
Vanadium pentoxide	Selective catalytic reduction (SCR) for NOx air emissions control uses this material as a catalyst.		

VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

Is any pollutant listed in Item V-C a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ **YES** *(list all such pollutants below)* ☒ **NO** *(go to Item VI-B)*

Continue on Page 4

CONTINUED FROM PAGE 3

VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☒ **YES** *(identify the test(s) and describe their purposes below)* ☐ **NO** *(go to Section VIII)*

Toxicity testing is conducted on effluent from Outfall 002 on an annual basis in accordance with Part III of TN0005452. Toxicity test reports have been submitted to the State with the associated discharge monitoring reports.

VIII. CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

☒ **YES** *(list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)* ☐ **NO** *(go to Section IX)*

A. NAME	B. ADDRESS	C. TELEPHONE *(area code & no.)*	D. POLLUTANTS ANALYZED *(list)*
TestAmerica Laboratories, Inc.	2960 Foster Creighton Drive Nashville, TN 37204	615-726-0177	All parameters except pH, total residual chlorine, temperature, sulfite and flow.

IX. CERTIFICATION

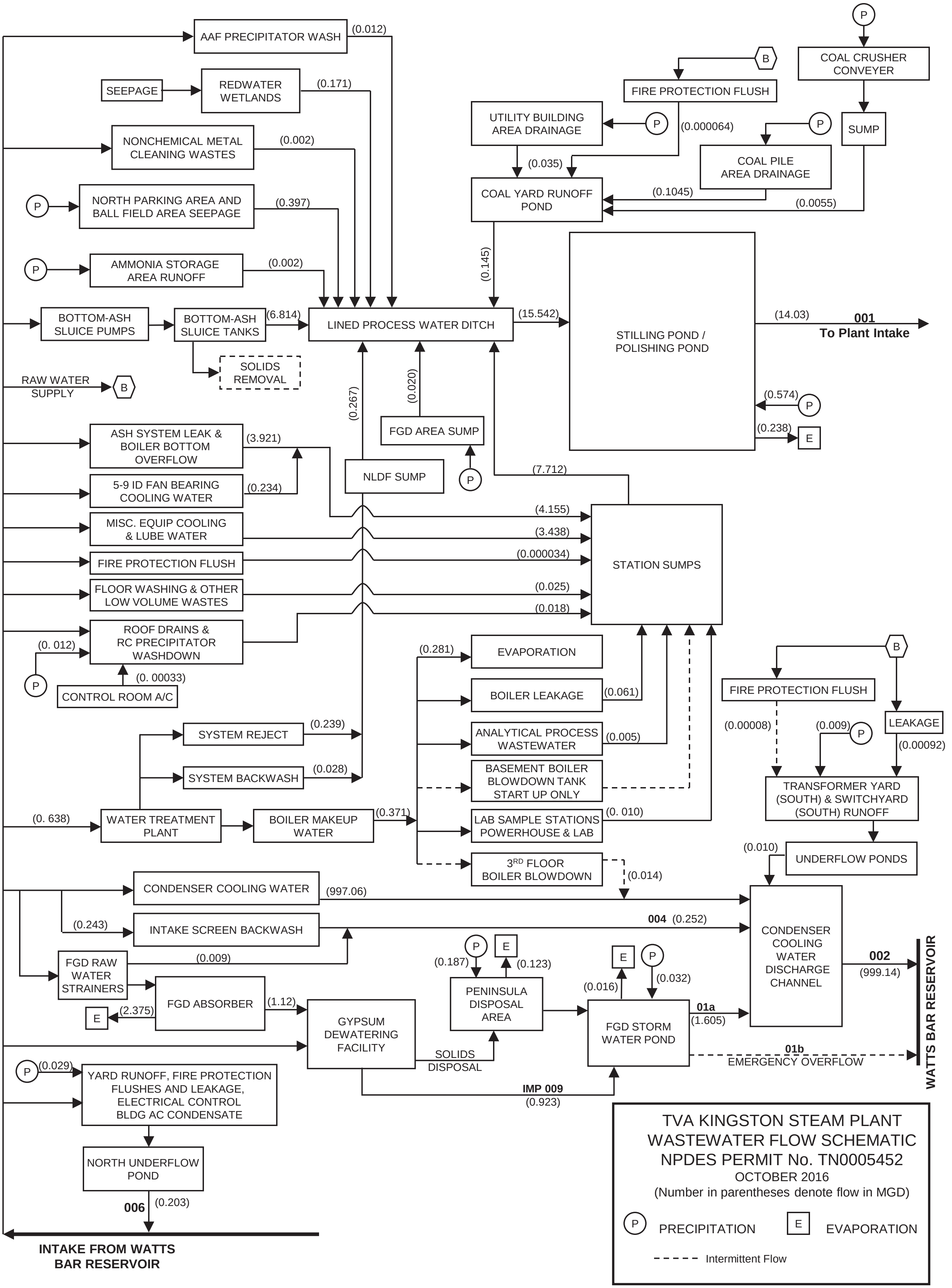
I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage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

A. NAME & OFFICIAL TITLE *(type or print)*
B. Doug Keeling, Plant Manager

B. PHONE NO. *(area code & no.)*
865-717-2500

C. SIGNATURE
B Doug Keeling

D. DATE SIGNED
10-14-16



TVA KINGSTON STEAM PLANT
WASTEWATER FLOW SCHEMATIC
NPDES PERMIT No. TN0005452
OCTOBER 2016
(Number in parentheses denote flow in MGD)

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
TN8640006682

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO.
001

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	**2. EFFLUENT**							**3. UNITS** *(specify if blank)*		**4. INTAKE** *(optional)*		
	a. MAXIMUM DAILY VALUE		**b. MAXIMUM 30 DAY VALUE** *(if available)*		**c. LONG TERM AVRG. VALUE** *(if available)*		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand *(BOD)*	13.3						1					
b. Chemical Oxygen Demand *(COD)*	< 20.0						1					
c. Total Organic Carbon *(TOC)*	2.62						1					
d. Total Suspended Solids *(TSS)*	29.4				9.7		19	mg/l				
e. Ammonia *(as N)*	1.44				< 0.171		36	mg/l				
f. Flow	VALUE 27.5		VALUE		VALUE 14.0		79	MGD				
g. Temperature *(winter)*	VALUE		VALUE		VALUE			°C				
h. Temperature *(summer)*	VALUE 30.6		VALUE		VALUE		4	°C				
I. pH	MINIMUM 6.3	MAXIMUM 8.7	MINIMUM	MAXIMUM	☒		90	STANDARD UNITS		☒		

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	**2. MARK 'X'**		**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. BE-LIEVED PRE-SENT	b. BE-LIEVED AB-SENT	**a. MAXIMUM DAILY VALUE**		**b. MAXIMUM 30 DAY VALUE** *(if available)*		**c. LONG TERM AVRG. VALUE** *(if available)*		d. NO. OF ANAL-YSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL-YSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)	X		< 1.00						1	mg/l				
b. Chlorine, Total Residual	X		< 0.05						4	mg/l				
c. Color	X		< 5.00						1	PCU				
d. Fecal Coliform		X												
e. Fluoride (16984-48-8)	X		0.105						1	mg/l				
f. Nitrate-Nitrite *(as N)*	X		< 0.100						1	mg/l				

CONTINUE ON PAGE V-2

ITEM V-B CONTINUED FROM PAGE V-1

1. POLLUTANT AND CAS NO. *(if available)*	**2. MARK 'X'**		**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	X		< 0.250						1	mg/l				
h. Oil and Grease	X		< 5.26				< 4.41		22	mg/l				
I. Phosphorus *(as P),* Total (7723-14-0)	X		< 0.100						1	mg/l				
j. Radioactivity														
(1) Alpha, Total		X*												
(2) Beta, Total		X*												
(3) Radium, Total		X*												
(4) Radium 226, Total		X*												
k. Sulfate *(as SO_4)* (14808-79-8)	X		30.1						1	mg/l				
l. Sulfide *(as S)*	X		< 1.00						1	mg/l				
m Sulfite *(as SO_4)* (14265-45-3)	X		0.64						4	mg/l				
n. Surfactants	X		0.083						1	mg/l				
o. Aluminum, Total (7429-90-5)	X		0.312						1	mg/l				
p. Barium, Total (7440-39-3)	X		0.0706						1	mg/l				
q. Boron, Total (7440-42-8)	X		0.105						1	mg/l				
r. Cobalt, Total (7440-48-4)	X		< 0.00200						1	mg/l				
s. Iron,Total (7439-89-6)	X		0.169						1	mg/l				
t. Magnesium, Total (7439-95-4)	X		11.1						1	mg/l				
u. Molybdenum, Total (7439-98-7)	X		< 0.0500						1	mg/l				
v. Manganese, Total (7439-96-5)	X		0.0485						1	mg/l				
w. Tin, Total (7440-31-5)	X		< 0.0500						1	mg/l				
x. Titanium, Total (7440-32-6)	X		< 0.0500						1	mg/l				

*None believed present above natural background

CONTINUE ON PAGE V-3

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
TN8640006682	001

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			< 0.00200						1	mg/l				
2M. Arsenic, Total (7440-38-2)	X			0.00322						1	mg/l				
3M. Beryllium, Total, (7440-41-7)	X			< 0.00100*						1	mg/l				
4M. Cadmium, Total (7440-43-9)	X			< 0.00100						1	mg/l				
5M. Chromium, Total (7440-47-3)	X			< 0.000500*						1	mg/l				
6M. Copper, Total (7440-50-8)	X			0.00342						1	mg/l				
7M. Lead, Total (7439-92-1)	X			0.000486**						1	mg/l				
8M. Mercury, Total (7439-97-6)	X			0.00000226						4	mg/l				
9M. Nickel, Total (7440-02-0)	X			< 0.00200						1	mg/l				
10M. Selenium, Total (7782-49-2)	X			< 0.00200						1	mg/l				
11M. Silver, Total (7440-22-4)	X			< 0.000500*						1	mg/l				
12M. Thallium, Total (7440-28-0)	X			< 0.00200						1	mg/l				
13M. Zinc, Total (7440-66-6)	X			0.0105**						1	mg/l				
14M. Cyanide, Total (57-12-5)	X			< 0.00700***						4	mg/l				
15M. Phenols, Total (108-95-2)	X			< 0.0500						4	mg/l				
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

*The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

**The data reported is below the laboratory RL but above the MDL and the concentration reported is an approximate value.

***The contract laboratory cannot meet the TDEC RRL for this parameter. Data is reported down to the MDL and a letter from the lab is maintained on file and available by request.

CONTINUE ON PAGE V-4

CONTINUED FROM PAGE V-3

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TEST-ING RE-QUIRED	b. BE-LIEVED PRE-SENT	c. BE-LIEVED AB-SENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANAL-YSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL-YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCEN-TRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	X			< 0.000870*						1	mg/l				
2V. Acrylonitrile (107-13-1)	X			< 0.00170**						1	mg/l				
3V. Benzene (71-43-2)	X			< 0.00100						1	mg/l				
4V. Bis *(Chloro-methyl)* Ether (542-88-1)			X												
5V. Bromoform (75-25-2)	X			< 0.00100						1	mg/l				
6V. Carbon Tetrachloride (56-23-5)	X			< 0.00100						1	mg/l				
7V. Chlorobenzene (108-90-7)	X			< 0.00100						1	mg/l				
8V. Chlorodi-bromomethane (124-48-1)	X			< 0.00100						1	mg/l				
9V. Chloroethane (75-00-3)	X			< 0.00100						1	mg/l				
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X			< 0.00500						1	mg/l				
11V. Chloroform (67-66-3)	X			0.000219***						1	mg/l				
12V. Dichloro-bromomethane (75-27-4)	X			< 0.00100						1	mg/l				
13V. Dichloro-difluoromethane (75-71-8)			X	< 0.00100						1	mg/l				
14V. 1,1-Dichloro-ethane (75-34-3)	X			< 0.00100						1	mg/l				
15V. 1,2-Dichloro-ethane (107-06-2)	X			< 0.00100						1	mg/l				
16V. 1,1-Dichloro-ethylene (75-35-4)	X			< 0.00100						1	mg/l				
17V. 1,2-Dichloro-propane (78-87-5)	X			< 0.00100						1	mg/l				
18V. 1,3-Dichloro-propylene (542-75-6)	X			< 0.00100						1	mg/l				
19V. Ethylbenzene (100-41-4)	X			< 0.00100						1	mg/l				
20V. Methyl Bromide (74-83-9)	X			< 0.00100						1	mg/l				
21V. Methyl Chloride (74-87-3)	X			< 0.00100						1	mg/l				

Bis (Chloro-methyl) Ether and Dichloro-difluoromethane were removed as requirements from 40 CFR Part 123 by US EPA in 1995.

*The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

**The contract laboratory cannot meet the TDEC RRL for this parameter. Data is reported down to the MDL and a letter from the lab is maintained on file and available by request.

***The data reported is below the laboratory RL but above the MDL and the concentration reported is an approximate value.

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CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V. Methylene Chloride (75-09-2)	X			< 0.00100*						1	mg/l				
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X			< 0.000240*						1	mg/l				
24V. Tetrachloroethylene (127-18-4)	X			< 0.000310*						1	mg/l				
25V. Toluene (108-88-3)	X			< 0.00100						1	mg/l				
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X			< 0.00100						1	mg/l				
27V. 1,1,1-Trichloroethane (71-55-6)	X			< 0.00100						1	mg/l				
28V. 1,1,2-Trichloroethane (79-00-5)	X			< 0.000200*						1	mg/l				
29V. Trichloroethylene (79-01-6)	X			< 0.00100						1	mg/l				
30V. Trichlorofluoromethane (75-69-4)			X	< 0.00100						1	mg/l				
31V. Vinyl Chloride (75-01-4)	X			< 0.00100						1	mg/l				
GC/MS FRACTION - ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X			< 0.00962						1	mg/l				
2A. 2,4-Dichlorophenol (120-83-2)	X			< 0.00962						1	mg/l				
3A. 2,4-Dimethylphenol (105-67-9)	X			< 0.00962						1	mg/l				
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X			< 0.0240						1	mg/l				
5A. 2,4-Dinitrophenol (51-28-5)	X			< 0.0240						1	mg/l				
6A. 2-Nitrophenol (88-75-5)	X			< 0.00962						1	mg/l				
7A. 4-Nitrophenol (100-02-7)	X			< 0.0240						1	mg/l				
8A. P-Chloro-M Cresol (59-50-7)	X			< 0.00962						1	mg/l				
9A. Pentachlorophenol (87-86-5)	X			< 0.0240						1	mg/l				
10A. Phenol (108-95-2)	X			< 0.00962						1	mg/l				
11A. 2,4,6-Trichlorophenol (88-06-2)	X			< 0.00654**						1	mg/l				

Trichlorofluoromethane was removed as a requirement from 40 CFR Part 123 by US EPA in 1995.

*The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

**The contract laboratory cannot meet the TDEC RRL for this parameter. Data is reported down to the MDL and a letter from the lab is maintained on file and available by request.

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CONTINUED FROM PAGE V-5

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)			X												
2B. Acenaphtylene (208-96-8)			X												
3B. Anthracene (120-12-7)			X												
4B. Benzidine (92-87-5)			X												
5B. Benzo *(a)* Anthracene (56-55-3)			X												
6B. Benzo *(a)* Pyrene (50-32-8)			X												
7B. 3,4-Benzofluoranthene (205-99-2)			X												
8B. Benzo *(ghi)* Perylene (191-24-2)			X												
9B. Benzo *(k)* Fluoranthene (207-08-9)			X												
10B. Bis *(2-Chloroethoxy)* Methane (111-91-1)			X												
11B. Bis *(2-Chloroethyl)* Ether (111-44-4)			X												
12B. Bis *(2-Chloroisopropyl)* Ether (102-60-1)			X												
13B. Bis *(2-Ethylhexyl)* Phthalate (117-81-7)			X												
14B. 4-Bromophenyl Phenyl Ether (101-55-3)			X												
15B. Butyl Benzyl Phthalate (85-68-7)			X												
16B. 2-Chloronaphthalene (91-58-7)			X												
17B. 4-Chlorophenyl Phenyl Ether (7005-72-3)			X												
18B. Chrysene (218-01-9)			X												
19B. Dibenzo *(a,h)* Anthracene (53-70-3)			X												
20B. 1,2-Dichlorobenzene (95-50-1)			X												
21B. 1,3-Dichlorobenzene (541-73-1)			X												

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1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
22B. 1,4-Dichlorobenzene (106-46-7)			X												
23B. 3,3'-Dichlorobenzidine (91-94-1)			X												
24B. Diethyl Phthalate (84-66-2)			X												
25B. Dimethyl Phthalate (131-11-3)			X												
26B. Di-N-Butyl Phthalate (84-74-2)			X												
27B. 2,4-Dinitrotoluene (121-14-2)			X												
28B. 2,6-Dinitrotoluene (606-20-2)			X												
29B. Di-N-Octyl Phthalate (117-84-0)			X												
30B. 1,2-Diphenylhydrazine *(as Azobenzene)* (122-66-7)			X												
31B. Fluoranthene (206-44-0)			X												
32B. Fluorene (86-73-7)			X												
33B. Hexachlorobenzene (118-74-1)			X												
34B. Hexachlorobutadiene (87-68-3)			X												
35B. Hexachlorocyclopentadiene (77-47-4)			X												
36B. Hexachloroethane (67-72-1)			X												
37B. Indeno *(1,2,3-cd)* Pyrene (193-39-5)			X												
38B. Isophorone (78-59-1)			X												
39B. Naphthalene (91-20-3)			X												
40B. Nitrobenzene (98-95-3)			X												
41B. N-Nitrosodimethylamine (62-75-9)			X												
42B. N-Nitrosodi-Propylamine (621-64-7)			X												

CONTINUE ON PAGE V-8

CONTINUED FROM PAGE V-7

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE *(optional)***		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B. N-Nitrosodiphenylamine (86-30-6)			X												
44B. Phenanthrene (85-01-8)			X												
45B. Pyrene (129-00-0)			X												
46B. 1,2,4 - Trichlorobenzene (120-82-1)			X												
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X												
2P. α–BHC (319-84-6)			X												
3P. β -BHC (319-85-7)			X												
4P. γ- BHC (58-89-9)			X												
5P. δ- BHC (319-86-8)			X												
6P. Chlordane (57-74-9)			X												
7P. 4,4'-DDT (50-29-3)			X												
8P. 4,4'-DDE (72-55-9)			X												
9P. 4,4'-DDD (72-54-8)			X												
10P. Dieldrin (60-57-1)			X												
11P. α-Endosulfan (115-29-7)			X												
12P. β-Endosulfan (115-29-7)			X												
13P. Endosulfan Sulfate (1031-07-8)			X												
14P. Endrin (72-20-8)			X												
15P. Endrin Aldehyde (7421-93-4)			X												
16P. Heptachlor (76-44-8)			X												

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1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. LONG TERM AVERAGE VALUE		a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17B. Heptachlor Epoxide (1024-57-3)			X												
18P. PCB-1242 (53469-21-9)			X												
19P. PCB-1254 (11097-69-1)			X												
20P. PCB-1221 (11104-28-2)			X												
21P. PCB-1232 (11141-16-5)			X												
22P. PCB-1248 (12672-29-6)			X												
23P. PCB-1260 (11096-82-5)			X												
24P. PCB-1016 (12674-11-2)			X												
25P. Toxaphene (8001-35-2)			X												

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages.
SEE INSTRUCTIONS.

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V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO.
002

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	**2. EFFLUENT**							**3. UNITS** *(specify if blank)*		**4. INTAKE** *(optional)*		
	a. MAXIMUM DAILY VALUE		**b. MAXIMUM 30 DAY VALUE** *(if available)*		**c. LONG TERM AVRG. VALUE** *(if available)*		d. NO. OF ANALYSES			a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCEN-TRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand *(BOD)*	19.2						1	mg/l		< 2.00		1
b. Chemical Oxygen Demand *(COD)*	< 20.0						1	mg/l		< 20.0		1
c. Total Organic Carbon *(TOC)*	2.06						1	mg/l		2.63		1
d. Total Suspended Solids *(TSS)*	10.0						1	mg/l		7.40		1
e. Ammonia *(as N)*	0.176						1	mg/l		0.171		1
f. Flow	VALUE 1357		VALUE		VALUE 997		609	MGD				
g. Temperature *(winter)*	VALUE 22.7		VALUE		VALUE 12.9		273	°C		9.9		273
h. Temperature *(summer)*	VALUE 34.5		VALUE		VALUE 25.0		274	°C		20.9		274
I. pH	MINIMUM 6.1	MAXIMUM 8.0	MINIMUM	MAXIMUM			90	STANDARD UNITS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUT-ANT AND CAS NO. *(if available)*	**2. MARK 'X'**		**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. BE-LIEVED PRE-SENT	b. BE-LIEVED AB-SENT	**a. MAXIMUM DAILY VALUE**		**b. MAXIMUM 30 DAY VALUE** *(if available)*		**c. LONG TERM AVRG. VALUE** *(if available)*		d. NO. OF ANAL-YSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL-YSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)	X		< 1.00						1	mg/l		< 1.00		1
b. Chlorine, Total Residual	X		< 0.05						4	mg/l		< 0.05		4
c. Color	X		< 5.00						1	PCU		< 5.00		1
d. Fecal Coliform		X	N/A											
e. Fluoride (16984-48-8)	X		0.109						1	mg/l		< 0.100		1
f. Nitrate-Nitrite *(as N)*	X		0.191						1	mg/l		0.13		1

CONTINUE ON PAGE V-2

ITEM V-B CONTINUED FROM PAGE V-1

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	X		< 0.250						1	mg/l		1.26		1
h. Oil and Grease	X		< 4.39						4	mg/l		< 4.49		4
I. Phosphorus *(as P)*, Total (7723-14-0)	X		< 0.100						1	mg/l		< 0.100		1
j. Radioactivity														
(1) Alpha, Total		X*												
(2) Beta, Total		X*												
(3) Radium, Total		X*												
(4) Radium 226, Total		X*												
k. Sulfate *(as SO_4)* (14808-79-8)	X		21.4						1	mg/l		19.3		1
l. Sulfide *(as S)*	X		< 1.00						1	mg/l		< 1.00		1
m Sulfite *(as SO_4)* (14265-45-3)	X		0.64						4	mg/l		0.64		4
n. Surfactants	X		0.0750**						1	mg/l		0.0790**		1
o. Aluminum, Total (7429-90-5)	X		0.124						1	mg/l		0.155		1
p. Barium, Total (7440-39-3)	X		0.0391						1	mg/l		0.0409		1
q. Boron, Total (7440-42-8)	X		0.102						1	mg/l		0.0682		1
r. Cobalt, Total (7440-48-4)	X		< 0.00200						1	mg/l		< 0.00200		1
s. Iron,Total (7439-89-6)	X		0.160						1	mg/l		0.179		1
t. Magnesium, Total (7439-95-4)	X		11.4						1	mg/l		11.0		1
u. Molybdenum, Total (7439-98-7)	X		< 0.0500						1	mg/l		< 0.0500		1
v. Manganese, Total (7439-96-5)	X		0.0769						1	mg/l		0.0776		1
w. Tin, Total (7440-31-5)	X		< 0.0500						1	mg/l		< 0.0500		1
x. Titanium, Total (7440-32-6)	X		< 0.0500						1	mg/l		< 0.0500		1

*None expected above natural background.
**Compound was detected in method blank.

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CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions)* , mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			< 0.00200						1	mg/l		< 0.00200		1
2M. Arsenic, Total (7440-38-2)	X			< 0.00200						1	mg/l		< 0.00200		1
3M. Beryllium, Total, (7440-41-7)	X			< 0.00100**						1	mg/l		< 0.00100**		1
4M. Cadmium, Total (7440-43-9)	X			< 0.00100						1	mg/l		< 0.00100		1
5M. Chromium, Total (7440-47-3)	X			< 0.000500**						1	mg/l		< 0.000500**		1
6M. Copper, Total (7440-50-8)	X			0.00573						1	mg/l		0.00201		1
7M. Lead, Total (7439-92-1)	X			0.00028*						1	mg/l		0.000210*		1
8M. Mercury, Total (7439-97-6)	X			0.00000638						4	mg/l		0.00000385		1
9M. Nickel, Total (7440-02-0)	X			< 0.00200						1	mg/l		< 0.00200		1
10M. Selenium, Total (7782-49-2)	X			< 0.00200						1	mg/l		< 0.00200		1
11M. Silver, Total (7440-22-4)	X			< 0.000500**						1	mg/l		< 0.000500**		1
12M. Thallium, Total (7440-28-0)	X			< 0.00200						1	mg/l		< 0.00200		1
13M. Zinc, Total (7440-66-6)	X			0.0379						1	mg/l		< 0.0100**		1
14M. Cyanide, Total (57-12-5)	X			< 0.00700***						4	mg/l		< 0.00700***		4
15M. Phenols, Total (108-95-2)	X			< 0.0500						4	mg/l		< 0.0500		4
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

*The data reported is below the laboratory RL but above the MDL and the concentration reported is an approximate value.

**The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

***The contract laboratory cannot meet the TDEC RRL for this parameter. Data is reported down to the MDL and a letter from the lab is maintained on file and available by request.

CONTINUE ON PAGE V-4

CONTINUED FROM PAGE V-3

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	X			< 0.000870*						1	mg/l		< 0.000870*		1
2V. Acrylonitrile (107-13-1)	X			< 0.00170**						1	mg/l		< 0.00170**		1
3V. Benzene (71-43-2)	X			< 0.00100						1	mg/l		< 0.00100		1
4V. Bis *(Chloromethyl)* Ether (542-88-1)			X												
5V. Bromoform (75-25-2)	X			< 0.00100						1	mg/l		< 0.00100		1
6V. Carbon Tetrachloride (56-23-5)	X			< 0.00100						1	mg/l		< 0.00100		1
7V. Chlorobenzene (108-90-7)	X			< 0.00100						1	mg/l		< 0.00100		1
8V. Chlorodibromomethane (124-48-1)	X			< 0.00100						1	mg/l		< 0.00100		1
9V. Chloroethane (75-00-3)	X			< 0.00100						1	mg/l		< 0.00100		1
10V. 2-Chloroethylvinyl Ether (110-75-8)	X			< 0.00500						1	mg/l		< 0.00500		1
11V. Chloroform (67-66-3)	X			< 0.000200*						1	mg/l		< 0.000200*		1
12V. Dichlorobromomethane (75-27-4)	X			< 0.00100						1	mg/l		< 0.00100		1
13V. Dichlorodifluoromethane (75-71-8)			X	< 0.00100						1	mg/l		< 0.00100		1
14V. 1,1-Dichloroethane (75-34-3)	X			< 0.00100						1	mg/l		< 0.00100		1
15V. 1,2-Dichloroethane (107-06-2)	X			< 0.00100						1	mg/l		< 0.00100		1
16V. 1,1-Dichloroethylene (75-35-4)	X			< 0.00100						1	mg/l		< 0.00100		1
17V. 1,2-Dichloropropane (78-87-5)	X			< 0.00100						1	mg/l		< 0.00100		1
18V. 1,3-Dichloropropylene (542-75-6)	X			< 0.00100						1	mg/l		< 0.00100		1
19V. Ethylbenzene (100-41-4)	X			< 0.00100						1	mg/l		< 0.00100		1
20V. Methyl Bromide (74-83-9)	X			< 0.00100						1	mg/l		< 0.00100		1
21V. Methyl Chloride (74-87-3)	X			< 0.00100						1	mg/l		< 0.00100		1

Bis (Chloro-methyl) Ether and Dichloro-difluoromethane were removed as requirements from 40 CFR Part 123 by US EPA in 1995.

*The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

**The contract laboratory cannot meet the TDEC RRL for this parameter. Data is reported down to the MDL and a letter from the lab is maintained on file and available by request.

CONTINUE ON PAGE V-5

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
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CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TEST-ING RE-QUIRED	b. BE-LIEVED PRE-SENT	c. BE-LIEVED AB-SENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANAL-YSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL-YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCEN-TRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V. Methylene Chloride (75-09-2)	X			< 0.00100*						1	mg/l		< 0.00100*		1
23V. 1,1,2,2-Tetra-chloroethane (79-34-5)	X			< 0.000240*						1	mg/l		< 0.000240*		1
24V. Tetrachloro-ethylene (127-18-4)	X			< 0.000310*						1	mg/l		< 0.000310*		1
25V. Toluene (108-88-3)	X			< 0.00100						1	mg/l		< 0.00100		1
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X			< 0.00100						1	mg/l		< 0.00100		1
27V. 1,1,1-Tri-chloroethane (71-55-6)	X			< 0.00100						1	mg/l		< 0.00100		1
28V. 1,1,2-Tri-chloroethane (79-00-5)	X			< 0.000200*						1	mg/l		< 0.000200*		1
29V. Trichloro-ethylene (79-01-6)	X			< 0.00100						1	mg/l		< 0.00100		1
30V. Trichloro-fluoromethane (75-69-4)			X	< 0.00100						1	mg/l		< 0.00100		1
31V. Vinyl Chloride (75-01-4)	X			< 0.00100						1	mg/l		< 0.00100		1
GC/MS FRACTION - ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X			< 0.0100						1	mg/l		< 0.00926		1
2A. 2,4-Dichloro-phenol (120-83-2)	X			< 0.0100						1	mg/l		< 0.00926		1
3A. 2,4-Dimethyl-phenol (105-67-9)	X			< 0.0100						1	mg/l		< 0.00926		1
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X			< 0.00930*						1	mg/l		< 0.0231		1
5A. 2,4-Dinitro-phenol (51-28-5)	X			< 0.0250						1	mg/l		< 0.0231		1
6A. 2-Nitrophenol (88-75-5)	X			< 0.0100						1	mg/l		< 0.00926		1
7A. 4-Nitrophenol (100-02-7)	X			< 0.0250						1	mg/l		< 0.0231		1
8A. P-Chloro-M Cresol (59-50-7)	X			< 0.0100						1	mg/l		< 0.00926		1
9A. Pentachloro-phenol (87-86-5)	X			< 0.0250						1	mg/l		< 0.0231		1
10A. Phenol (108-95-2)	X			< 0.0100						1	mg/l		< 0.00926		1
11A. 2,4,6-Trichloro-phenol (88-06-2)	X			< 0.00680**						1	mg/l		< 0.00630**		1

Trichlorofluoromethane was removed as a requirement from 40 CFR Part 123 by US EPA in 1995.

*The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

**The contract laboratory cannot meet the TDEC RRL for this parameter. Data is reported down to the MDL and a letter from the lab is maintained on file and available by request.

CONTINUE ON PAGE V-6

CONTINUED FROM PAGE V-5

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)			X												
2B. Acenaphtylene (208-96-8)			X												
3B. Anthracene (120-12-7)			X												
4B. Benzidine (92-87-5)			X												
5B. Benzo *(a)* Anthracene (56-55-3)			X												
6B. Benzo *(a)* Pyrene (50-32-8)			X												
7B. 3,4-Benzofluoranthene (205-99-2)			X												
8B. Benzo *(ghi)* Perylene (191-24-2)			X												
9B. Benzo *(k)* Fluoranthene (207-08-9)			X												
10B. Bis *(2-Chloroethoxy)* Methane (111-91-1)			X												
11B. Bis *(2-Chloroethyl)* Ether (111-44-4)			X												
12B. Bis *(2-Chloroisopropyl)* Ether (102-60-1)			X												
13B. Bis *(2-Ethylhexyl)* Phthalate (117-81-7)			X												
14B. 4-Bromophenyl Phenyl Ether (101-55-3)			X												
15B. Butyl Benzyl Phthalate (85-68-7)			X												
16B. 2-Chloronaphthalene (91-58-7)			X												
17B. 4-Chlorophenyl Phenyl Ether (7005-72-3)			X												
18B. Chrysene (218-01-9)			X												
19B. Dibenzo *(a,h)* Anthracene (53-70-3)			X												
20B. 1,2-Dichlorobenzene (95-50-1)			X												
21B. 1,3-Dichlorobenzene (541-73-1)			X												

CONTINUE ON PAGE V-7

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
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CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TEST-ING RE-QUIRED	b. BE-LIEVED PRE-SENT	c. BE-LIEVED AB-SENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANAL-YSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL-YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCEN-TRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
22B. 1,4-Dichloro-benzene (106-46-7)			X												
23B. 3,3'-Dichloro-benzidine (91-94-1)			X												
24B. Diethyl Phthalate (84-66-2)			X												
25B. Dimethyl Phthalate (131-11-3)			X												
26B. Di-N-Butyl Phthalate (84-74-2)			X												
27B. 2,4-Dinitro-toluene (121-14-2)			X												
28B. 2,6-Dinitro-toluene (606-20-2)			X												
29B. Di-N-Octyl Phthalate (117-84-0)			X												
30B. 1,2-Diphenyl-hydrazine *(as Azo-benzene)* (122-66-7)			X												
31B. Fluoranthene (206-44-0)			X												
32B. Fluorene (86-73-7)			X												
33B. Hexachlorobenzene (118-74-1)			X												
34B. Hexa-chlorobutadiene (87-68-3)			X												
35B. Hexachloro-cyclopentadiene (77-47-4)			X												
36B. Hexachloro-ethane (67-72-1)			X												
37B. Indeno *(1,2,3-cd)* Pyrene (193-39-5)			X												
38B. Isophorone (78-59-1)			X												
39B. Naphthalene (91-20-3)			X												
40B. Nitrobenzene (98-95-3)			X												
41B. N-Nitro-sodimethylamine (62-75-9)			X												
42B. N-Nitrosodi-Propylamine (621-64-7)			X												

CONTINUE ON PAGE V-8

CONTINUED FROM PAGE V-7

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B. N-Nitrosodiphenylamine (86-30-6)			X												
44B. Phenanthrene (85-01-8)			X												
45B. Pyrene (129-00-0)			X												
46B. 1,2,4 - Trichlorobenzene (120-82-1)			X												
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X												
2P. α–BHC (319-84-6)			X												
3P. β -BHC (319-85-7)			X												
4P. γ- BHC (58-89-9)			X												
5P. δ- BHC (319-86-8)			X												
6P. Chlordane (57-74-9)			X												
7P. 4,4'-DDT (50-29-3)			X												
8P. 4,4'-DDE (72-55-9)			X												
9P. 4,4'-DDD (72-54-8)			X												
10P. Dieldrin (60-57-1)			X												
11P. α-Endosulfan (115-29-7)			X												
12P. β-Endosulfan (115-29-7)			X												
13P. Endosulfan Sulfate (1031-07-8)			X												
14P. Endrin (72-20-8)			X												
15P. Endrin Aldehyde (7421-93-4)			X												
16P. Heptachlor (76-44-8)			X												

CONTINUE ON PAGE V-9

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
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CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. LONG TERM AVERAGE VALUE		a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17B. Heptachlor Epoxide (1024-57-3)			X												
18P. PCB-1242 (53469-21-9)			X												
19P. PCB-1254 (11097-69-1)			X												
20P. PCB-1221 (11104-28-2)			X												
21P. PCB-1232 (11141-16-5)			X												
22P. PCB-1248 (12672-29-6)			X												
23P. PCB-1260 (11096-82-5)			X												
24P. PCB-1016 (12674-11-2)			X												
25P. Toxaphene (8001-35-2)			X												

Please print or type in the unshaded areas only.	EPA ID Number *(copy from Item 1 of Form 1)*	Form Approved. OMB No. 2040-0086. Approval expires 5-31-92.

FORM
2E
NPDES

EPA Facilities Which Do Not Discharge Process Wastewater

I. RECEIVING WATERS

For this outfall, list the latitude and longitude, and name of the receiving water(s).

Outfall Number *(list)*	Latitude			Longitude			Receiving Water *(name)*
	Deg	Min	Sec	Deg	Min	Sec	Plant intake channel (Watts Bar Reservoir)
006	35.0	54.0	0.00	84.0	30.0	0.00	

II. DISCHARGE DATE *(If a new discharger, the date you expect to begin discharging)*

III. TYPE OF WASTE

A. Check the box(es) indicating the general type(s) of wastes discharged.

☐ Sanitary Wastes ☐ Restaurant or Cafeteria Wastes ☑ Noncontact Cooling Water ☐ Other Nonprocess Wastewater *(Identify)*

B. If any cooling water additives are used, list them here. Briefly describe their composition if this information is available.

No cooling water additives are currently used.

IV. EFFLUENT CHARACTERISTICS

A. **Existing Sources** — Provide measurements for the parameters listed in the left-hand column below, unless waived by the permitting authority *(see instructions)*.

B. **New Dischargers** — Provide estimates for the parameters listed in the left-hand column below, unless waived by the permitting authority. Instead of the number of measurements taken, provide the source of estimated values *(see instructions)*.

Pollutant or Parameter	(1) Maximum Daily Value *(include units)*		(2) Average Daily Value *(last year)* *(include units)*		*(3)* Number of Measurements Taken *(last year)*	*(or)* *(4)* Source of Estimate *(if new discharger)*
	Mass	Concentration	Mass	Concentration		
Biochemical Oxygen Demand (BOD)		< 2.00 mg/L			1.00	
Total Suspended Solids (TSS)		3.70 mg/L			1.00	
Fecal Coliform *(if believed present or if sanitary waste is discharged)*		N/A				
Total Residual Chlorine *(if chlorine is used)*		< 0.05 mg/L			4.00	
Oil and Grease		< 4.38 mg/L			4.00	
*Chemical oxygen demand (COD)		< 20.0 mg/L			1.00	
*Total organic carbon (TOC)		1.86 mg/L			1.00	
Ammonia *(as N)*		0.375* mg/L			1.00	
Discharge Flow	Value 0.203 MGD				4.00	
pH *(give range)*	Value 7.86 - 8.13 S.U.				4.00	
Temperature *(Winter)*	°C		°C			
Temperature *(Summer)*	30.50 °C		°C		4.00	

*If noncontact cooling water is discharged

*Ammonia was also found in the blank above the method detection limit.

V. Except for leaks or spills, will the discharge described in this form be intermittent or seasonal?

If yes, briefly describe the frequency of flow and duration.

☐ Yes ☑ No

VI. TREATMENT SYSTEM *(Describe briefly any treatment system(s) used or to be used)*

There is no treatment system in service for this discharge.

There is no treatment system in service for this discharge.

VII. OTHER INFORMATION *(Optional)*

Use the space below to expand upon any of the above questions or to bring to the attention of the reviewer any other information you feel should be considered in establishing permit limitations. Attach additional sheets, if necessary.

VIII. CERTIFICATION

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

A. Name & Official Title
B. Doug Keeling, Plant Manager

B. Phone No. *(area code & no.)*
(865) 717-2500

C. Signature
B. Doug Keeling, Plant Manager
B Doug Keeling

D. Date Signed
(865) 717-2500
10-14-16

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
TN8640006682

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO.
01a

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	**2. EFFLUENT**							**3. UNITS** *(specify if blank)*		**4. INTAKE** *(optional)*		
	a. MAXIMUM DAILY VALUE		**b. MAXIMUM 30 DAY VALUE** *(if available)*		**c. LONG TERM AVRG. VALUE** *(if available)*		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand *(BOD)*	< 2.00						1					
b. Chemical Oxygen Demand *(COD)*	53.7						1					
c. Total Organic Carbon *(TOC)*	10.9						1					
d. Total Suspended Solids *(TSS)*	7.45				< 2.52		19					
e. Ammonia *(as N)*	1.86						1					
f. Flow	VALUE 0.0077**		VALUE		VALUE 0.00302**		79	MGD				
g. Temperature *(winter)*	VALUE N/A		VALUE		VALUE			°C				
h. Temperature *(summer)*	VALUE 32.3		VALUE		VALUE		4	°C				
I. pH	MINIMUM 6.3	MAXIMUM 8.0	MINIMUM	MAXIMUM			90	STANDARD UNITS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUT-ANT AND CAS NO. *(if available)*	**2. MARK 'X'**		**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. BE-LIEVED PRE-SENT	b. BE-LIEVED AB-SENT	**a. MAXIMUM DAILY VALUE**		**b. MAXIMUM 30 DAY VALUE** *(if available)*		**c. LONG TERM AVRG. VALUE** *(if available)*		d. NO. OF ANAL-YSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL-YSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)	X		17.7*						1	mg/l				
b. Chlorine, Total Residual	X		< 0.05						4	mg/l				
c. Color	X		10.0						1	PCU				
d. Fecal Coliform		X												
e. Fluoride (16984-48-8)	X		16.5						1	mg/l				
f. Nitrate-Nitrite *(as N)*	X		5.81						1	mg/l				

*The data reported is below the laboratory RL but above the MDL and the concentration reported is an approximate value.

**Data provided are measured values; however, the estimated max flow based on design for Outfall 01a is 1.605 MGD.

CONTINUE ON PAGE V-2

ITEM V-B CONTINUED FROM PAGE V-1

1. POLLUTANT AND CAS NO. *(if available)*	**2. MARK 'X'**		**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	X		3.78						1	mg/l				
h. Oil and Grease	X		< 5.49				< 4.42		22	mg/l				
I. Phosphorus *(as P),* Total (7723-14-0)	X		< 0.100						1	mg/l				
j. Radioactivity														
(1) Alpha, Total		X*												
(2) Beta, Total		X*												
(3) Radium, Total		X*												
(4) Radium 226, Total		X*												
k. Sulfate *(as SO_4)* (14808-79-8)	X		2600						1	mg/l				
l. Sulfide *(as S)*	X		< 1.00						1	mg/l				
m Sulfite *(as SO_4)* (14265-45-3)	X		0.64						4	mg/l				
n. Surfactants	X		0.417						1	mg/l				
o. Aluminum, Total (7429-90-5)	X		< 0.100						1	mg/l				
p. Barium, Total (7440-39-3)	X		0.193						1	mg/l				
q. Boron, Total (7440-42-8)	X		24.8						1	mg/l				
r. Cobalt, Total (7440-48-4)	X		0.00454						1	mg/l				
s. Iron,Total (7439-89-6)	X		< 0.100						1	mg/l				
t. Magnesium, Total (7439-95-4)	X		424						1	mg/l				
u. Molybdenum, Total (7439-98-7)	X		0.504						1	mg/l				
v. Manganese, Total (7439-96-5)	X		2.58						1	mg/l				
w. Tin, Total (7440-31-5)	X		< 0.0500						1	mg/l				
x. Titanium, Total (7440-32-6)	X		< 0.0500						1	mg/l				

*None expected above natural background.

CONTINUE ON PAGE V-3

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
TN8640006682	01a

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions)* , mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			< 0.00200						1	mg/l				
2M. Arsenic, Total (7440-38-2)	X			0.0386				< 0.0063		19	mg/l				
3M. Beryllium, Total, (7440-41-7)	X			< 0.00100*						1	mg/l				
4M. Cadmium, Total (7440-43-9)	X			0.0196				< 0.0058		19	mg/l				
5M. Chromium, Total (7440-47-3)	X			0.0592						1	mg/l				
6M. Copper, Total (7440-50-8)	X			< 0.020				< 0.0062		19	mg/l				
7M. Lead, Total (7439-92-1)	X			< 0.020				< 0.0047		19	mg/l				
8M. Mercury, Total (7439-97-6)	X			0.00193				< 0.0006879		9	mg/l				
9M. Nickel, Total (7440-02-0)	X			0.0462				< 0.0291		19	mg/l				
10M. Selenium, Total (7782-49-2)	X			0.921				0.353		19	mg/l				
11M. Silver, Total (7440-22-4)	X			< 0.000500*						1	mg/l				
12M. Thallium, Total (7440-28-0)	X			< 0.020				< 0.00484		19	mg/l				
13M. Zinc, Total (7440-66-6)	X			1.15				0.554		19	mg/l				
14M. Cyanide, Total (57-12-5)	X			0.071						4	mg/l				
15M. Phenols, Total (108-95-2)	X			< 0.0500						4	mg/l				
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

*The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

CONTINUE ON PAGE V-4

CONTINUED FROM PAGE V-3

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	X			< 0.000870*						1	mg/l				
2V. Acrylonitrile (107-13-1)	X			< 0.00170**						1	mg/l				
3V. Benzene (71-43-2)	X			< 0.00100						1	mg/l				
4V. Bis *(Chloro-methyl)* Ether (542-88-1)			X												
5V. Bromoform (75-25-2)	X			< 0.00100						1	mg/l				
6V. Carbon Tetrachloride (56-23-5)	X			< 0.00100						1	mg/l				
7V. Chlorobenzene (108-90-7)	X			< 0.00100						1	mg/l				
8V. Chlorodi-bromomethane (124-48-1)	X			< 0.00100						1	mg/l				
9V. Chloroethane (75-00-3)	X			< 0.00100						1	mg/l				
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X			< 0.00500						1	mg/l				
11V. Chloroform (67-66-3)	X			< 0.000200*						1	mg/l				
12V. Dichloro-bromomethane (75-27-4)	X			< 0.00100						1	mg/l				
13V. Dichloro-difluoromethane (75-71-8)			X	< 0.00100						1	mg/l				
14V. 1,1-Dichloro-ethane (75-34-3)	X			< 0.00100						1	mg/l				
15V. 1,2-Dichloro-ethane (107-06-2)	X			< 0.00100						1	mg/l				
16V. 1,1-Dichloro-ethylene (75-35-4)	X			< 0.00100						1	mg/l				
17V. 1,2-Dichloro-propane (78-87-5)	X			< 0.00100						1	mg/l				
18V. 1,3-Dichloro-propylene (542-75-6)	X			< 0.00100						1	mg/l				
19V. Ethylbenzene (100-41-4)	X			< 0.00100						1	mg/l				
20V. Methyl Bromide (74-83-9)	X			< 0.00100						1	mg/l				
21V. Methyl Chloride (74-87-3)	X			< 0.00100						1	mg/l				

Bis (Chloro-methyl) Ether and Dichloro-difluoromethane were removed as requirements from 40 CFR Part 123 by US EPA in 1995.

*The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

**The contract laboratory cannot meet the TDEC RRL for this parameter. Data is reported down to the MDL and a letter from the lab is maintained on file and available by request.

CONTINUE ON PAGE V-5

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
TN8640006682	01a

CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TEST-ING RE-QUIRED	b. BE-LIEVED PRE-SENT	c. BE-LIEVED AB-SENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANAL-YSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL-YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCEN-TRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V. Methylene Chloride (75-09-2)	X			< 0.00100*						1	mg/l				
23V. 1,1,2,2-Tetra-chloroethane (79-34-5)	X			< 0.000240*						1	mg/l				
24V. Tetrachloro-ethylene (127-18-4)	X			< 0.000310*						1	mg/l				
25V. Toluene (108-88-3)	X			< 0.00100						1	mg/l				
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X			< 0.00100						1	mg/l				
27V. 1,1,1-Tri-chloroethane (71-55-6)	X			< 0.00100						1	mg/l				
28V. 1,1,2-Tri-chloroethane (79-00-5)	X			< 0.000200*						1	mg/l				
29V. Trichloro-ethylene (79-01-6)	X			< 0.00100						1	mg/l				
30V. Trichloro-fluoromethane (75-69-4)			X	< 0.00100						1	mg/l				
31V. Vinyl Chloride (75-01-4)	X			< 0.00100						1	mg/l				
GC/MS FRACTION - ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X			< 0.00943						1	mg/l				
2A. 2,4-Dichloro-phenol (120-83-2)	X			< 0.00943						1	mg/l				
3A. 2,4-Dimethyl-phenol (105-67-9)	X			< 0.00943						1	mg/l				
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X			< 0.0236						1	mg/l				
5A. 2,4-Dinitro-phenol (51-28-5)	X			< 0.0236						1	mg/l				
6A. 2-Nitrophenol (88-75-5)	X			< 0.00943						1	mg/l				
7A. 4-Nitrophenol (100-02-7)	X			< 0.0236						1	mg/l				
8A. P-Chloro-M Cresol (59-50-7)	X			< 0.00943						1	mg/l				
9A. Pentachloro-phenol (87-86-5)	X			< 0.0236						1	mg/l				
10A. Phenol (108-95-2)	X			< 0.00943						1	mg/l				
11A. 2,4,6-Trichloro-phenol (88-06-2)	X			< 0.00943**						1	mg/l				

Trichlorofluoromethane was removed as a requirement from 40 CFR Part 123 by US EPA in 1995.
*The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.
**The contract laboratory cannot meet the TDEC RRL for this parameter. Data is reported down to the MDL and a letter from the lab is maintained on file and available by request.

CONTINUE ON PAGE V-6

CONTINUED FROM PAGE V-5

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)			X												
2B. Acenaphtylene (208-96-8)			X												
3B. Anthracene (120-12-7)			X												
4B. Benzidine (92-87-5)			X												
5B. Benzo *(a)* Anthracene (56-55-3)			X												
6B. Benzo *(a)* Pyrene (50-32-8)			X												
7B. 3,4-Benzofluoranthene (205-99-2)			X												
8B. Benzo *(ghi)* Perylene (191-24-2)			X												
9B. Benzo *(k)* Fluoranthene (207-08-9)			X												
10B. Bis *(2-Chloroethoxy)* Methane (111-91-1)			X												
11B. Bis *(2-Chloroethyl)* Ether (111-44-4)			X												
12B. Bis *(2-Chloroisopropyl)* Ether (102-60-1)			X												
13B. Bis *(2-Ethylhexyl)* Phthalate (117-81-7)			X												
14B. 4-Bromophenyl Phenyl Ether (101-55-3)			X												
15B. Butyl Benzyl Phthalate (85-68-7)			X												
16B. 2-Chloronaphthalene (91-58-7)			X												
17B. 4-Chlorophenyl Phenyl Ether (7005-72-3)			X												
18B. Chrysene (218-01-9)			X												
19B. Dibenzo *(a,h)* Anthracene (53-70-3)			X												
20B. 1,2-Dichlorobenzene (95-50-1)			X												
21B. 1,3-Dichlorobenzene (541-73-1)			X												

CONTINUE ON PAGE V-7

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: TN8640006682

OUTFALL NUMBER: 01a

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
22B. 1,4-Dichlorobenzene (106-46-7)			X												
23B. 3,3'-Dichlorobenzidine (91-94-1)			X												
24B. Diethyl Phthalate (84-66-2)			X												
25B. Dimethyl Phthalate (131-11-3)			X												
26B. Di-N-Butyl Phthalate (84-74-2)			X												
27B. 2,4-Dinitrotoluene (121-14-2)			X												
28B. 2,6-Dinitrotoluene (606-20-2)			X												
29B. Di-N-Octyl Phthalate (117-84-0)			X												
30B. 1,2-Diphenylhydrazine *(as Azobenzene)* (122-66-7)			X												
31B. Fluoranthene (206-44-0)			X												
32B. Fluorene (86-73-7)			X												
33B. Hexachlorobenzene (118-74-1)			X												
34B. Hexachlorobutadiene (87-68-3)			X												
35B. Hexachlorocyclopentadiene (77-47-4)			X												
36B. Hexachloroethane (67-72-1)			X												
37B. Indeno *(1,2,3-cd)* Pyrene (193-39-5)			X												
38B. Isophorone (78-59-1)			X												
39B. Naphthalene (91-20-3)			X												
40B. Nitrobenzene (98-95-3)			X												
41B. N-Nitrosodimethylamine (62-75-9)			X												
42B. N-Nitrosodi-Propylamine (621-64-7)			X												

CONTINUE ON PAGE V-8

CONTINUED FROM PAGE V-7

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B. N-Nitrosodiphenylamine (86-30-6)			X												
44B. Phenanthrene (85-01-8)			X												
45B. Pyrene (129-00-0)			X												
46B. 1,2,4 - Trichlorobenzene (120-82-1)			X												
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X												
2P. α–BHC (319-84-6)			X												
3P. β -BHC (319-85-7)			X												
4P. γ- BHC (58-89-9)			X												
5P. δ- BHC (319-86-8)			X												
6P. Chlordane (57-74-9)			X												
7P. 4,4'-DDT (50-29-3)			X												
8P. 4,4'-DDE (72-55-9)			X												
9P. 4,4'-DDD (72-54-8)			X												
10P. Dieldrin (60-57-1)			X												
11P. α-Endosulfan (115-29-7)			X												
12P. β-Endosulfan (115-29-7)			X												
13P. Endosulfan Sulfate (1031-07-8)			X												
14P. Endrin (72-20-8)			X												
15P. Endrin Aldehyde (7421-93-4)			X												
16P. Heptachlor (76-44-8)			X												

CONTINUE ON PAGE V-9

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: TN8640006682

OUTFALL NUMBER: 01a

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. LONG TERM AVERAGE VALUE		a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES ***(continued)***															
17B. Heptachlor Epoxide (1024-57-3)			X												
18P. PCB-1242 (53469-21-9)			X												
19P. PCB-1254 (11097-69-1)			X												
20P. PCB-1221 (11104-28-2)			X												
21P. PCB-1232 (11141-16-5)			X												
22P. PCB-1248 (12672-29-6)			X												
23P. PCB-1260 (11096-82-5)			X												
24P. PCB-1016 (12674-11-2)			X												
25P. Toxaphene (8001-35-2)			X												

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
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V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO.
IMP 009

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	**2. EFFLUENT**							**3. UNITS** *(specify if blank)*		**4. INTAKE** *(optional)*		
	a. MAXIMUM DAILY VALUE		**b. MAXIMUM 30 DAY VALUE** *(if available)*		**c. LONG TERM AVRG. VALUE** *(if available)*		d. NO. OF ANALYSES			a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCEN-TRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand *(BOD)*	5.80						1	mg/l				
b. Chemical Oxygen Demand *(COD)*	65.8						1	mg/l				
c. Total Organic Carbon *(TOC)*	15.8						1	mg/l				
d. Total Suspended Solids *(TSS)*	5.60						1	mg/l				
e. Ammonia *(as N)*	1.25						1	mg/l				
f. Flow	VALUE 1.846*		VALUE		VALUE 0.923*		1	MGD				
g. Temperature *(winter)*	VALUE N/A		VALUE		VALUE			°C				
h. Temperature *(summer)*	VALUE 41.0		VALUE		VALUE		4	°C				
I. pH	MINIMUM 6.8	MAXIMUM 7.0	MINIMUM	MAXIMUM			4	STANDARD UNITS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	**2. MARK 'X'**		**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	**a. MAXIMUM DAILY VALUE**		**b. MAXIMUM 30 DAY VALUE** *(if available)*		**c. LONG TERM AVRG. VALUE** *(if available)*		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)	X		17.1						1	mg/l				
b. Chlorine, Total Residual	X		< 0.05						4	mg/l				
c. Color	X		5.00						1	PCU				
d. Fecal Coliform		X												
e. Fluoride (16984-48-8)	X		15.5						1	mg/l				
f. Nitrate-Nitrite *(as N)*	X		7.30						1	mg/l				

* GDF flows are based on mechanical process design flow. The long term average is based on GDF operation over 12 hours and the daily maximum is based on GDF operation over 24 hours.

CONTINUE ON PAGE V-2

ITEM V-B CONTINUED FROM PAGE V-1

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	X		6.45						1	mg/l				
h. Oil and Grease	X		< 4.35						4	mg/l				
I. Phosphorus *(as P)*, Total (7723-14-0)	X		< 0.100						1	mg/l				
j. Radioactivity														
(1) Alpha, Total		X*												
(2) Beta, Total		X*												
(3) Radium, Total		X*												
(4) Radium 226, Total		X*												
k. Sulfate *(as SO_4)* (14808-79-8)	X		2350						1	mg/l				
l. Sulfide *(as S)*	X		< 1.00						1	mg/l				
m Sulfite *(as SO_4)* (14265-45-3)	X		0.64						4	mg/l				
n. Surfactants	X		0.317**						1	mg/l				
o. Aluminum, Total (7429-90-5)	X		< 0.100						1	mg/l				
p. Barium, Total (7440-39-3)	X		0.203						1	mg/l				
q. Boron, Total (7440-42-8)	X		24.2						1	mg/l				
r. Cobalt, Total (7440-48-4)	X		0.00586						1	mg/l				
s. Iron,Total (7439-89-6)	X		0.209						1	mg/l				
t. Magnesium, Total (7439-95-4)	X		498						1	mg/l				
u. Molybdenum, Total (7439-98-7)	X		< 0.0500						1	mg/l				
v. Manganese, Total (7439-96-5)	X		3.06						1	mg/l				
w. Tin, Total (7440-31-5)	X		< 0.0500						1	mg/l				
x. Titanium, Total (7440-32-6)	X		0.0575						1	mg/l				

*None believe present above natural background.

**Compound was found in the blank above method detection level.

CONTINUE ON PAGE V-3

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CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			< 0.00200						1	mg/l				
2M. Arsenic, Total (7440-38-2)	X			0.00300*						1	mg/l				
3M. Beryllium, Total, (7440-41-7)	X			< 0.00100**						1	mg/l				
4M. Cadmium, Total (7440-43-9)	X			0.0382						1	mg/l				
5M. Chromium, Total (7440-47-3)	X			0.00889						1	mg/l				
6M. Copper, Total (7440-50-8)	X			< 0.00500***						1	mg/l				
7M. Lead, Total (7439-92-1)	X			0.000433*						1	mg/l				
8M. Mercury, Total (7439-97-6)	X			0.000398						4	mg/l				
9M. Nickel, Total (7440-02-0)	X			0.0645						1	mg/l				
10M. Selenium, Total (7782-49-2)	X			0.221						1	mg/l				
11M. Silver, Total (7440-22-4)	X			< 0.000500**						1	mg/l				
12M. Thallium, Total (7440-28-0)	X			< 0.00200						1	mg/l				
13M. Zinc, Total (7440-66-6)	X			0.626						1	mg/l				
14M. Cyanide, Total (57-12-5)	X			0.160						4	mg/l				
15M. Phenols, Total (108-95-2)	X			< 0.0500						4	mg/l				
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

*The data reported is below the laboratory RL but above the MDL and the concentration reported is an approximate value.

**The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

***Sample dilution for analysis increased the MDL above the TDEC RRL.

CONTINUE ON PAGE V-4

CONTINUED FROM PAGE V-3

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	X			< 0.000870*						1	mg/l				
2V. Acrylonitrile (107-13-1)	X			< 0.00170**						1	mg/l				
3V. Benzene (71-43-2)	X			< 0.00100						1	mg/l				
4V. Bis *(Chloro-methyl)* Ether (542-88-1)			X												
5V. Bromoform (75-25-2)	X			< 0.00100						1	mg/l				
6V. Carbon Tetrachloride (56-23-5)	X			< 0.00100						1	mg/l				
7V. Chlorobenzene (108-90-7)	X			< 0.00100						1	mg/l				
8V. Chlorodibromomethane (124-48-1)	X			< 0.00100						1	mg/l				
9V. Chloroethane (75-00-3)	X			< 0.00100						1	mg/l				
10V. 2-Chloroethylvinyl Ether (110-75-8)	X			< 0.00500						1	mg/l				
11V. Chloroform (67-66-3)	X			< 0.000200*						1	mg/l				
12V. Dichlorobromomethane (75-27-4)	X			< 0.00100						1	mg/l				
13V. Dichlorodifluoromethane (75-71-8)			X	< 0.00100						1	mg/l				
14V. 1,1-Dichloroethane (75-34-3)	X			< 0.00100						1	mg/l				
15V. 1,2-Dichloroethane (107-06-2)	X			< 0.00100						1	mg/l				
16V. 1,1-Dichloroethylene (75-35-4)	X			< 0.00100						1	mg/l				
17V. 1,2-Dichloropropane (78-87-5)	X			< 0.00100						1	mg/l				
18V. 1,3-Dichloropropylene (542-75-6)	X			< 0.00100						1	mg/l				
19V. Ethylbenzene (100-41-4)	X			< 0.00100						1	mg/l				
20V. Methyl Bromide (74-83-9)	X			< 0.00100						1	mg/l				
21V. Methyl Chloride (74-87-3)	X			< 0.00100						1	mg/l				

Bis (Chloro-methyl) Ether and Dichloro-difluoromethane were removed as requirements from 40 CFR Part 123 by US EPA in 1995.

*The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

**The contract laboratory cannot meet the TDEC RRL for this parameter. Data is reported down to the MDL and a letter from the lab is maintained on file and available by request.

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1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V. Methylene Chloride (75-09-2)	X			< 0.00100*						1	mg/l				
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X			< 0.000240*						1	mg/l				
24V. Tetrachloroethylene (127-18-4)	X			< 0.000310*						1	mg/l				
25V. Toluene (108-88-3)	X			< 0.00100						1	mg/l				
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X			< 0.00100						1	mg/l				
27V. 1,1,1-Trichloroethane (71-55-6)	X			< 0.00100						1	mg/l				
28V. 1,1,2-Trichloroethane (79-00-5)	X			< 0.000200*						1	mg/l				
29V. Trichloroethylene (79-01-6)	X			< 0.00100						1	mg/l				
30V. Trichlorofluoromethane (75-69-4)			X	< 0.00100						1	mg/l				
31V. Vinyl Chloride (75-01-4)	X			< 0.00100						1	mg/l				
GC/MS FRACTION - ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X			< 0.0100						1	mg/l				
2A. 2,4-Dichlorophenol (120-83-2)	X			< 0.0100						1	mg/l				
3A. 2,4-Dimethylphenol (105-67-9)	X			< 0.0100						1	mg/l				
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X			< 0.00930*						1	mg/l				
5A. 2,4-Dinitrophenol (51-28-5)	X			< 0.0250						1	mg/l				
6A. 2-Nitrophenol (88-75-5)	X			< 0.0100						1	mg/l				
7A. 4-Nitrophenol (100-02-7)	X			< 0.0250						1	mg/l				
8A. P-Chloro-M Cresol (59-50-7)	X			< 0.0100						1	mg/l				
9A. Pentachlorophenol (87-86-5)	X			< 0.0250						1	mg/l				
10A. Phenol (108-95-2)	X			< 0.0100						1	mg/l				
11A. 2,4,6-Trichlorophenol (88-06-2)	X			< 0.00680**						1	mg/l				

Trichlorofluoromethane was removed as a requirement from 40 CFR Part 123 by US EPA in 1995.

*The laboratory reporting limit (RL) does not meet the TDEC RRL; therefore, the data is reported down to the MDL.

**The contract laboratory cannot meet the TDEC RRL for this parameter. Data is reported down to the MDL and a letter from the lab is maintained on file and available by request.

CONTINUE ON PAGE V-6

CONTINUED FROM PAGE V-5

1. POLLUTANT AND CAS NUMBER *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)			X												
2B. Acenaphtylene (208-96-8)			X												
3B. Anthracene (120-12-7)			X												
4B. Benzidine (92-87-5)			X												
5B. Benzo *(a)* Anthracene (56-55-3)			X												
6B. Benzo *(a)* Pyrene (50-32-8)			X												
7B. 3,4-Benzofluoranthene (205-99-2)			X												
8B. Benzo *(ghi)* Perylene (191-24-2)			X												
9B. Benzo *(k)* Fluoranthene (207-08-9)			X												
10B. Bis *(2-Chloroethoxy)* Methane (111-91-1)			X												
11B. Bis *(2-Chloroethyl)* Ether (111-44-4)			X												
12B. Bis *(2-Chloroisopropyl)* Ether (102-60-1)			X												
13B. Bis *(2-Ethylhexyl)* Phthalate (117-81-7)			X												
14B. 4-Bromophenyl Phenyl Ether (101-55-3)			X												
15B. Butyl Benzyl Phthalate (85-68-7)			X												
16B. 2-Chloronaphthalene (91-58-7)			X												
17B. 4-Chlorophenyl Phenyl Ether (7005-72-3)			X												
18B. Chrysene (218-01-9)			X												
19B. Dibenzo *(a,h)* Anthracene (53-70-3)			X												
20B. 1,2-Dichlorobenzene (95-50-1)			X												
21B. 1,3-Dichlorobenzene (541-73-1)			X												

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1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
22B. 1,4-Dichlorobenzene (106-46-7)			X												
23B. 3,3'-Dichlorobenzidine (91-94-1)			X												
24B. Diethyl Phthalate (84-66-2)			X												
25B. Dimethyl Phthalate (131-11-3)			X												
26B. Di-N-Butyl Phthalate (84-74-2)			X												
27B. 2,4-Dinitrotoluene (121-14-2)			X												
28B. 2,6-Dinitrotoluene (606-20-2)			X												
29B. Di-N-Octyl Phthalate (117-84-0)			X												
30B. 1,2-Diphenylhydrazine *(as Azobenzene)* (122-66-7)			X												
31B. Fluoranthene (206-44-0)			X												
32B. Fluorene (86-73-7)			X												
33B. Hexachlorobenzene (118-74-1)			X												
34B. Hexachlorobutadiene (87-68-3)			X												
35B. Hexachlorocyclopentadiene (77-47-4)			X												
36B. Hexachloroethane (67-72-1)			X												
37B. Indeno *(1,2,3-cd)* Pyrene (193-39-5)			X												
38B. Isophorone (78-59-1)			X												
39B. Naphthalene (91-20-3)			X												
40B. Nitrobenzene (98-95-3)			X												
41B. N-Nitrosodimethylamine (62-75-9)			X												
42B. N-Nitrosodi-Propylamine (621-64-7)			X												

CONTINUE ON PAGE V-8

CONTINUED FROM PAGE V-7

1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE *(optional)***		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B. N-Nitrosodiphenylamine (86-30-6)			X												
44B. Phenanthrene (85-01-8)			X												
45B. Pyrene (129-00-0)			X												
46B. 1,2,4 - Trichlorobenzene (120-82-1)			X												
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X												
2P. α–BHC (319-84-6)			X												
3P. β -BHC (319-85-7)			X												
4P. γ- BHC (58-89-9)			X												
5P. δ- BHC (319-86-8)			X												
6P. Chlordane (57-74-9)			X												
7P. 4,4'-DDT (50-29-3)			X												
8P. 4,4'-DDE (72-55-9)			X												
9P. 4,4'-DDD (72-54-8)			X												
10P. Dieldrin (60-57-1)			X												
11P. α-Endosulfan (115-29-7)			X												
12P. β-Endosulfan (115-29-7)			X												
13P. Endosulfan Sulfate (1031-07-8)			X												
14P. Endrin (72-20-8)			X												
15P. Endrin Aldehyde (7421-93-4)			X												
16P. Heptachlor (76-44-8)			X												

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1. POLLUTANT AND CAS NUMBER *(if available)*	**2. MARK 'X'**			**3. EFFLUENT**							**4. UNITS**		**5. INTAKE** *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. LONG TERM AVERAGE VALUE		a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17B. Heptachlor Epoxide (1024-57-3)			X												
18P. PCB-1242 (53469-21-9)			X												
19P. PCB-1254 (11097-69-1)			X												
20P. PCB-1221 (11104-28-2)			X												
21P. PCB-1232 (11141-16-5)			X												
22P. PCB-1248 (12672-29-6)			X												
23P. PCB-1260 (11096-82-5)			X												
24P. PCB-1016 (12674-11-2)			X												
25P. Toxaphene (8001-35-2)			X												

TENNESSEE VALLEY AUTHORITY (TVA) – KINGSTON FOSSIL PLANT (KIF) - NPDES PERMIT NO. TN0005452 – REASONABLE POTENTIAL DETERMINATION

Current Whole Effluent Toxicity (WET) Requirements:

Outfall 002 -	7-day or 3-brood IC_{25} > 100% [IWC = 100% effluent (1.0 TUc)] Fathead minnow point estimate based on results from UV-treated samples. Monitoring Frequency = Annual (1 per year)

Proposed WET Requirements:

Outfall 002 -	7-day or 3-brood IC_{25} > 100% [IWC = 100% effluent (1.0 TUc)] Fathead minnow point estimate based on results from UV-treated samples. Monitoring Frequency = Annual (1 per year)

Outfall 002:

Under current and previous permits, biomonitoring of Outfall 001 has not been conducted with samples collected from the stilling pond discharge. Because the effluent from Outfall 001 mixes readily with the condenser cooling water (CCW) intake channel, is diluted, and subsequently discharges through Outfall 002, historical biomonitoring results for Outfall 002 serve as an indirect means of estimating toxicity of the stilling pond discharge.

Thirty-three toxicity studies with Outfall 002 samples were conducted from 1995 to 2016 (see summary table on pages 2 – 4). None of the *Ceriodaphnia dubia* tests conducted during that period have resulted in IC_{25} values less than the permit limit of 100% effluent. Fathead minnow tests conducted from 1999 to 2001 experienced pathogen interference, which led to studies that demonstrated the need for UV treatment of Outfall 002 samples. Beginning in 2006, TVA was granted approval to conduct fathead minnow tests with UV-treated samples only, and all tests subsequent to that have resulted in no toxicity.

Based on guidance from EPA's *Technical Support Document for Water Quality-based Toxics Control*, it is appropriate to use Outfall 002 biomonitoring results since 2006 for determining reasonable potential for the Outfall 002 discharge to exceed the chronic instream WET criterion (CCC = 1.0 TUc). Using the Outfall 002 flow of 999.14 MGD and receiving stream 1Q10 flow of 155.8 MGD, there is insufficient dilution available for demonstrating no reasonable potential for exceeding the CCC (see calculations on page 5).

KIF Documentation

Summary of Outfall 002 WET Biomonitoring Results:

Test Date	Test Species	Acute Results (96-h Survival)		Chronic Results
		% Survival 100% Sample	Study Toxicity Units (TUa)	Study Toxicity Units (TUc)
1. Aug. 23-30, 1995	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas	100		
2. Mar. 19-26, 1996	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas	100		
3. Aug. 20-27, 1996	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas	100		
4. Jan. 28-Feb. 4, 1997	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas	100		
5. Jul. 29-Aug 4, 1997	*Ceriodaphnia dubia*	100	<1	<1
Aug. 7-14, 1997	*Pimephales promelas*	100		
6. Feb. 19-26, 1998	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas	100		
7. Sept. 15-22, 1998	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas	100		
8. Mar. 30-Apr. 6, 1999	*Ceriodaphnia dubia*	100	<1	1.3
	Pimephales promelas	88		
9. Apr. 27-May 4, 1999 *repeat* *	*Pimephales promelas*	100	<1	<1
10. October 14-21, 1999	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas	100		
11. April 13-20, 2000	*Ceriodaphnia dubia*	100	<1	2.4
	Pimephales promelas	92		
12. May 2-9, 2000 *repeat* *	*Pimephales promelas*	100	<1	<1
13. October 3-10, 2000	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas	100		
14. May 20-27, 2001	*Ceriodaphnia dubia*	90	<1	6.0
May 19-26, 2001	*Pimephales promelas*	68		
15. June 12-19, 2001 *repeat* *	*Pimephales promelas*	100	<1	<1

Summary of Outfall 002 WET Biomonitoring Results, continued:

Test Date	Test Species	Acute Results (96-h Survival)		Chronic Results
		% Survival 100% Sample	Study Toxicity Units (TUa)	Study Toxicity Units (TUc)
16. Feb. 13-20, 2002	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas†	100		
17. Nov. 5-12, 2002	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas†	100		
18. August 12-19, 2003	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas†	100		
19. November 11-18, 2003	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas†	100		
20. October 12-19, 2004	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas†	100		
21. August 9-16, 2005	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas†	100		
22. June 6-13, 2006	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas‡	100		
23. February 16-23, 2007	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas‡	100		
24. October 9-16, 2007	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas‡	100		
25. August 5-12, 2008	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas‡	100		
26. June 18-25, 2009	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas‡	100		
27. August 3-10, 2010	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas‡	100		
28. June 7-14, 2011	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas‡	100		
29. July 17-24, 2012	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas‡	100		
30. February 5-12, 2013	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas‡	100		

Summary of Outfall 002 WET Biomonitoring Results, continued:

Test Date	Test Species	Acute Results (96-h Survival)		Chronic Results
		% Survival 100% Sample	Study Toxicity Units (TUa)	Study Toxicity Units (TUc)
31. February 4-11, 2014	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas[‡]	100		
32. July 14-21, 2015	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas[‡]	100		
33. July 12-19, 2016	*Ceriodaphnia dubia*	100	<1	<1
	Pimephales promelas[‡]	100		

Note: data from June 2006 to July 2016 (shaded area) used for summary below.

n		12	12	12
Maximum		100	< 1	< 1
Minimum		100	< 1	< 1
Mean		100	< 1	< 1
CV		0	0	0

* Single species retest

[†] UV fathead minnow test conducted parallel with regular compliance test

[‡] UV fathead minnow test conducted only - TDEC approval obtained April 7, 2006

Dilution and Instream Waste Concentration Calculation

Outfall 002:
Average Discharge = 999.14 MGD

Clinch River Low Flow 1Q10 = 155.8 MGD (from Appendix 1, page R-16 of the current permit, effective October 1, 2003)

Dilution Factor (DF): $DF = \frac{Qs}{Qw} = \frac{155.8}{999.14} = 0.16$

Instream Wastewater Concentration (IWC): $IWC = \frac{Qw}{Qs} = \frac{999.14}{155.8} x 100 = 641\%$

Insufficient dilution is available for demonstrating no reasonable potential for exceeding the chronic instream WET criterion (CCC = 1.0 TUc). The dilution factor would need to be greater than 1.0 in order to conduct that demonstration for chronic toxicity.

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
Water-Based Systems
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, TN 37243-1102

PERMIT CONTACT INFORMATION

Please complete all sections. If one person serves multiple functions, please repeat this information in each section.

PERMIT NUMBER: TN0005452 & TN0080870
DATE: October 2016

PERMITTED FACILITY: Kingston Fossil Plant
COUNTY: Roane

OFFICIAL PERMIT CONTACT:

(The permit signatory authority, e.g. responsible corporate officer, principle executive officer or ranking elected official)

Official Contact: David Sorrick
Title or Position: Senior VP, Power Operations
Mailing Address: 1101 Market Street, LP 3K-C
City: Chattanooga
State: TN
Zip: 37402
Phone number(s): 423-751-6634
E-mail: dwsorrick@tva.gov

PERMIT BILLING ADDRESS (where invoices should be sent):

Billing Contact: Adele Dennison
Title or Position: Environmental Scientist
Mailing Address: 714 Swan Pond Road
City: Harriman
State: TN
Zip: 37748
Phone number(s): 865-717-2157
E-mail: amdennison@tva.gov

FACILITY LOCATION (actual location of permit site and local contact for site activity):

Facility Location Contact: Adele Dennison
Title or Position: Environmental Scientist
Facility Location (physical street address): 714 Swan Pond Road
City: Harriman
State: TN
Zip: 37748
Phone number(s): 865-717-2157
E-mail: amdennison@tva.gov

Alternate Contact (if desired): Cynthia McCowan
Title or Position: Environmental Scientist
Mailing Address: 714 Swan Pond Road
City: Harriman
State: TN
Zip: 37748
Phone number(s): 865-717-2531
E-mail: cowebb@tva.gov

FACILITY REPORTING (Discharge Monitoring Report (DMR) or other reporting):

Cognizant Official authorized for permit reporting: B. Doug Keeling
Title or Position: Plant Manager
Mailing Address: 714 Swan Pond Road
City: Harriman
State: TN
Zip: 37748
Phone number(s): 865-717-2500
E-mail: bdkeelin@tva.gov
Fax number for reporting: 865-717-2505
Does the facility have interest in starting electronic DMR reporting? [✓ Yes] No
The plant has registered for NetDMR.

Biological Monitoring of the Clinch River Near Kingston Fossil Plant Discharge, Autumn 2015

May 2016

Tennessee Valley Authority
River and Reservoir Compliance Montoring
Knoxville, Tennessee

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Acronyms and Abbreviations

ATL	Alternate Thermal Limit
BIP	Balanced Indigenous Population
CCW	Condenser cooling water
CRM	Clinch River Mile
CWA	Clean Water Act
ERM	Emory River Mile
KIF	Kingston Fossil Plant
QA	Quality Assurance
RBI	Reservoir Benthic Index
RFAI	Reservoir Fish Assemblage Index
SAHI	Shoreline Aquatic Habitat Index
TRM	Tennessee River Mile
TVA	Tennessee Valley Authority
REH	Reservoir Ecological Health monitoring program

Executive Summary

In 2015, samples of the ecological community upstream and downstream of Kingston Fossil Plant (KIF) were collected, analyzed, and compared to historical data to determine any effects of the thermal effluent from the plant in compliance with §316(a) of the Clean Water Act.

Shoreline aquatic habitat was assessed along both banks at sites upstream and downstream of KIF during 2015. The average rating for all sections of shoreline assessed was "Fair". No aquatic macrophytes were found on either shoreline upstream. Downstream, aquatic macrophytes were found along an average of 13.0% of the shoreline assessed on the left descending bank; no aquatic macrophytes were found on the right descending bank. Assessment of river bottom habitat indicated that silt and detritus were the most common substrates by proportion both upstream and downstream. Gravel and mollusk shell were present at both sites in similar proportions.

RFAI scores differed between the sites upstream and downstream of KIF by four points during autumn 2015. The two sites were similar in diversity, sustainability, and impact from pollution tolerant species, but showed high proportions of non-indigenous species and different trophic compositions. The difference in scores was within the acceptable range of variation (six points) and the fish community at the downstream site met the requirements of a balanced indigenous population. Benthic macroinvertebrate communities at both downstream sites were considered similar to the upstream benthic community. All three sites received RBI ratings of "Excellent". Visual wildlife surveys showed similar types and numbers of wildlife upstream and downstream of KIF.

Water quality parameters measured – water temperature, conductivity, dissolved oxygen concentration, and pH – were similar and within acceptable ranges upstream and downstream of KIF.

It was thus concluded that the downstream site was not adversely affected by operation of KIF in 2015.

Introduction

Section 316(a) of the Clean Water Act (CWA) authorizes alternate thermal limits (ATL) for the control of the thermal component of a point source discharge so long as the limits will assure the protection of Balanced Indigenous Populations (BIP) of aquatic life. The term "balanced indigenous population," as defined in Environmental Protection Agency regulations, describes a biotic community that is typically characterized by:

1) diversity appropriate to the ecoregion;
2) the capacity to sustain itself through cyclic seasonal changes;
3) the presence of necessary food chain species; and
4) the lack of domination by pollution-tolerant species

Prior to 2001, the Tennessee Valley Authority's (TVA) Kingston Fossil Plant (KIF) was operating under an ATL that had been continued with each permit renewal based on studies conducted in the mid-1970s. In 1999, EPA Region IV began requesting additional data in conjunction with National Pollutant Discharge Elimination System (NPDES) permit renewal applications to verify that BIP was being maintained at TVA's thermal plants with ATLs. The EPA Region IV guidance to the States for conducting 316(a) studies specified that future ATL requests require new data to demonstrate that aquatic communities in the vicinity of the permitee's plant meet the BIP standard. In the Tennessee River system, TVA has used a reservoir Reservoir Ecological Health (REH) monitoring program since 1990 to evaluate ecological conditions in major reservoirs. One of the five indicators used in the REH program to evaluate reservoir health is the Reservoir Fish Assemblage Index (RFAI) methodology. RFAI has been thoroughly tested on TVA and other reservoirs and published in peer-reviewed literature (Jennings et al., 1995; Hickman and McDonough, 1996; McDonough and Hickman, 1999). Fish communities are used to evaluate ecological conditions because of their importance in the aquatic food web and because fish life cycles are long enough to integrate conditions over time. Benthic macroinvertebrate populations are assessed using the Reservoir Macroinvertebrate Benthic Index (RBI) methodology. Because benthic macroinvertebrates are relatively immobile, negative impacts to aquatic ecosystems can be detected earlier in benthic macroinvertebrate communities than in fish communities. These data are used to supplement RFAI results to provide a more thorough examination of differences in aquatic communities upstream and downstream of thermal discharges.

TVA proposed using data from its existing REH monitoring program, supplemented with fish community monitoring upstream and downstream of power plants with ATLs, to verify the conclusion of the earlier studies that BIP was being maintained. The Tennessee Department of Environment and Conservation agreed with this proposal in a letter dated September 17, 2001.

TVA initiated a study in 2001 to evaluate fish communities in areas immediately upstream and downstream of KIF using RFAI multi-metric evaluation techniques. Beginning in 2011, the EPA requested additional information about the ecological community upstream and downstream of KIF. To meet these requests, TVA broadened the monitoring program to include visual surveys of shoreline wildlife groups. This report presents the results of all biological monitoring and water quality data collected upstream and downstream of KIF during autumn 2015, with appropriate comparisons to data collected at these sites during previous autumn samples.

Plant Description

Kingston Fossil Plant

The KIF facility is located on the right descending bank (RDB) of a peninsula at the confluence of the Emory and Clinch Rivers on Watts Bar Reservoir (Figure 1). Construction of KIF began on April 30, 1951, and the last of nine generation units began commercial operation on December 2, 1955. Total generating capacity is 1,600 megawatts.

The cooling water for KIF's condensers is pumped from the Watts Bar Reservoir pool at Emory River Mile (ERM) 1.9 (Figure 2). At full operating capacity, cooling water flows through the condensers at a rate of 2,154 cubic feet per second (cfs). The condenser cooling water (CCW) discharge point is located across the peninsula at Clinch River Mile (CRM) 2.6 (Figure 2). The average daily flow at this site is approximately 6,200 cfs (based on flow data from 1976 through 2011 at USGS Emory River Gage #03540500 and discharges from TVA's Melton Hill Dam).

Methods

Evaluation of Plant Operating Conditions

Data describing the operation of KIF during the course of biological monitoring—specifically daily averages of power generation, water temperatures at the cooling water system intake and discharge, the intake flow of cooling water and the discharge flow returned to the river—were collected, compiled, analyzed and compared to available historical operational data to assist in the interpretation of thermal plume characteristics and biological community information.

Aquatic Habitat in the Vicinity of KIF

Shoreline and river bottom habitat data presented in this report were collected during autumn 2015. TVA assumes habitat data to be valid for five years, barring any major changes to the river/reservoir (e.g. major flood event). No significant changes have occurred in the river system from the initial characterization, but in the event of a major change to the river/reservoir, habitat would be re-evaluated during the following sample period.

Shoreline Aquatic Habitat Assessment

An integrative multi-metric index (Shoreline Aquatic Habitat Index or SAHI), including several habitat parameters important to resident fish species, was used to measure existing fish habitat quality in the vicinity of KIF. Using the general format developed by Plafkin et al. (1989), seven metrics were established to characterize selected physical habitat attributes important to reservoir resident fish populations which rely heavily on the littoral (shoreline) zone for reproductive success, juvenile development, and adult feeding (Table 1). Habitat Suitability Indices (US Fish and Wildlife Service), along with other sources of information on biology and habitat requirements (Etnier and Starnes 1993), were consulted to develop “reference” criteria or “expected” conditions from a high quality environment for each parameter. Some generalizations were necessary in setting up scoring criteria to cover the various requirements of all species into one index.

When possible, the quality of shoreline aquatic habitat was assessed while traveling parallel to the shoreline in a boat and evaluating the habitat within 10 vertical feet of full pool. Transects were established across the width of Watts Bar reservoir within the fish community sampling areas upstream and downstream of KIF (Figures 3 and 4). At each transect, near-shore aquatic habitat was assessed along sections of shoreline corresponding to the left descending bank (LDB) and right descending bank (RDB). For each shoreline section (16 upstream and 16 downstream of KIF) percentages of aquatic macrophytes in the littoral areas were estimated, then each section was scored by comparing the observed conditions associated with each individual metric to the "reference" conditions and assigning the metric a corresponding value: "Good"-5; "Fair"-3; or "Poor"-1 (Table 1). The scores for each of the seven metric were summed to obtain the SAHI value for the shoreline section, and this value was assigned a habitat quality descriptor based on trisecting the range of potential SAHI values ("Poor" 7-16, "Fair" 17-26, and "Good" 27-35).

River Bottom Habitat

Along each transect described above, a benthic grab sample was collected with a Ponar sampler at each of 10 points equally spaced from the LDB to the RDB. Substrate material collected with the Ponar was emptied into a screen, and percentage composition of each substrate was estimated to determine existing benthic habitat across the width of the river. Water depths (feet) at each sample location were recorded. If no substrate was collected after multiple Ponar drops, it was assumed that the substrate was bedrock. For example, when the Ponar was pulled shut, collectors could feel substrate consistency. If it shut easily and was not embedded in the substrate on numerous drops within the same location, substrate was recorded as bedrock.

Fish Community Sampling Methods and Data Analysis for Sites Upstream and Downstream of KIF

Thermal discharge from KIF enters Watts Bar Reservoir in the Clinch River at CRM 2.6 (Figure 2). To evaluate the fish community in the vicinity of KIF, two sample sites were selected upstream of the plant, one upstream of the intake at Emory River mile (ERM) 2.5, and one upstream of the confluence of the two rivers at CRM 4.4 (Figure 3). One sample site was selected downstream of the discharge, centered at CRM 1.5 (Figure 4). TVA's REH monitoring program uses four additional sample areas on Watts Bar Reservoir: Forebay, TRM 531.0; Transition, TRM 560.8; Tennessee River Inflow, TRM 601; and Clinch River Inflow, CRM 22.0 (Figure 1).

Fish sampling methods included boat electrofishing and gill netting (Hubert, 1996; Reynolds, 1996). Electrofishing methodology consisted of fifteen electrofishing boat runs near the shoreline, each 300 meters long and approximately 10 minutes in duration. The total near-shore area sampled is approximately 4,500 meters (15,000 feet).

Experimental gill nets (so called because of their use for research as opposed to commercial fishing) were used as an additional gear type to collect fish from deeper habitats not effectively sampled by electrofishing. Each experimental gill net consists of five 6.1-meter panels for a total length of 30.5 meters (100.1 feet). The distinguishing characteristic of experimental gill nets is mesh size that varies between panels. For this application, each net has panels with mesh sizes of 2.5, 5.1, 7.6, 10.2, and 12.7 cm. Experimental gill nets are typically set perpendicular to river flow extending from near-shore toward the main channel of the reservoir. Ten overnight experimental gill net sets were used at each area.

Fish collected were identified by species, counted, and examined for anomalies (such as disease, deformations, parasites or hybridization). The resulting data were analyzed using RFAI methodology.

The RFAI uses 12 fish community metrics from four general categories: Species Richness and Composition; Trophic Composition; Abundance; and Fish Health. Individual species can be utilized for more than one metric, though hybrid species and non-indigenous species are excluded from metrics counting numbers of individual species. Together, these 12 metrics provide a balanced evaluation of fish community integrity. The individual metrics are shown below, grouped by category:

Species Richness and Composition

(1) **Total number of species** – Greater numbers of species are considered representative of healthier aquatic ecosystems. As conditions degrade, numbers of species at an area decline.

(2) **Number of centrarchid species** – Sunfish species (excluding black basses) are invertivores and a high diversity of this group is indicative of reduced siltation and suitable sediment quality in littoral areas.

(3) **Number of benthic invertivore species** – Due to the special dietary requirements of this species group and the limitations of their food source in degraded environments, numbers of benthic invertivore species increase with better environmental quality.

(4) **Number of intolerant species –** A group made up of species that are particularly intolerant of physical, chemical, and thermal habitat degradation. Higher numbers of intolerant species suggest the presence of fewer environmental stressors.

(5) **Percentage of tolerant individuals** (excluding young-of-year) – An increased proportion of individuals tolerant of degraded conditions signifies poorer water quality.

(6) **Percent dominance by one species** – Ecological quality is considered reduced if one species inordinately dominates the resident fish community.

(7) **Percentage of non-indigenous species** – Based on the assumption that non-indigenous species reduce the quality of resident fish communities.

(8) **Number of top carnivore species** – Higher diversity of piscivores is indicative of the availability of diverse and plentiful forage species and the presence of suitable habitat.

Trophic Composition

(9) **Percent top carnivores --** A measure of the functional aspect of top carnivores which feed on major planktivore populations.

(10) **Percent omnivores --** Omnivores are less sensitive to environmental stresses due to their ability to vary their diets. As trophic links are disrupted due to degraded conditions, specialist species such as insectivores decline while opportunistic omnivorous species increase in relative abundance.

Abundance

(11) Average number per run (number of individuals) – Based on the assumption that high quality fish assemblages support large numbers of individuals.

Fish Health

(12) Percent anomalies -- Incidence of diseases, lesions, tumors, external parasites, deformities, blindness, and natural hybridization is noted for all fish collected, with higher incidence indicating less favorable environmental conditions.

RFAI methodology addresses all four attributes or characteristics of a "balanced indigenous population" (BIP) defined by the CWA, as described below:

(1) A biotic community characterized by diversity appropriate to the ecoregion: Diversity is addressed by the metrics in the Species Richness and Composition category, especially metric 1 – "Number of species." Determination of reference conditions based on the transition zones of upper mainstem Tennessee River reservoirs (as described below) ensures appropriate species expectations for the ecoregion.

(2) The capacity for the community to sustain itself through cyclic seasonal change: TVA uses an autumn data collection period for biological indicators, both REH and upstream/downstream monitoring. Autumn monitoring is used to document community condition or health after being subjected to the wide variety of stressors throughout the year.

One of the main benefits of using biological indicators is their ability to integrate stressors through time. Examining the condition or health of a community at the end of the "biological year" (i.e., autumn) provides insights into how well the community has dealt with the stresses through an annual seasonal cycle. Likewise, evaluation of the condition of individuals in the community (in this case, individual fish as reflected in Metric 12) provides insights into how well the community can be expected to withstand stressors through winter. Further, multiple sampling years during the permit renewal cycle add to the evidence of whether the autumn monitoring approach has correctly demonstrated the ability of the community to sustain itself through repeated seasonal changes.

(3) The presence of necessary food chain species: Integrity of the food chain is measured by the Trophic Composition metrics, with support from the Abundance metric and Species Richness and Composition metrics. A healthy fish community is comprised of species that utilize complex feeding mechanisms extending into multiple levels of the aquatic food web.

Three dominant fish trophic levels exist within upper mainstem reservoirs; insectivores, omnivores, and top carnivores. To determine the presence of necessary food chain species, these three groups should be well represented within the overall fish community. Other fish trophic levels include benthic invertivores, planktivores, herbivores, and parasitic species. Insectivores include most sunfish, minnows, and silversides. Omnivores include gizzard shad, common carp, carpsuckers, buffalo, and channel and blue catfish. Top carnivores include bass, gar, skipjack herring, crappie, flathead catfish, sauger, and walleye. Benthic invertivores include freshwater drum, suckers, and darters. Planktivores include alewife, threadfin shad, and paddlefish. Herbivores include largescale stonerollers. Lampreys in the genus *Ichthyomyzon* are the only parasitic species occurring in Tennessee River reservoirs.

To establish expected proportions of each trophic guild and the expected number of species included in each guild occurring in transition zones in upper mainstem Tennessee River reservoirs (Chickamauga, Watts Bar, and Fort Loudon reservoirs), data collected from 1993 to 2012 from transition zones in upper mainstem reservoirs were analyzed for each reservoir zone (inflow, transition, forebay). Samples collected in the downstream vicinity of thermal discharges were not included in this analysis so that accurate expectations could be calculated with the assumption that these data represent what should occur in upper mainstem Tennessee River reservoirs absent from point source effects (i.e. power plant discharges). Data from 930 electrofishing runs (a total of 279,000 meters of shoreline sampled) and from 620 overnight experimental gill net sets were included in this analysis for transition areas in upper mainstem Tennessee River reservoirs. From these data, the range of proportional values for each trophic level and the range of the number of species included in each trophic level were trisected. These trisections were intended to show less than expected,

expected and above expected values for trophic level proportions and species occurring within each reservoir zone in upper mainstem Tennessee River reservoirs. The data were also averaged and bound by confidence intervals (95%) to further evaluate expectations for proportions of each trophic level and the number of species representing each trophic level (Table 2).

(4) A lack of domination by pollution-tolerant species: Domination by pollution-tolerant species is measured by metrics 3 ("Number of benthic invertivore species"), 4 ("Number of intolerant species"), 5 ("Percent tolerant individuals"), 6 ("Percent dominance by one species"), and 10 ("Percent omnivores").

Scoring categories are based on "expected" fish community characteristics in the absence of human-induced impacts other than impoundment of the reservoir. These categories were developed from historical REH fish assemblage data representative of transition zones from upper mainstream Tennessee River reservoirs (Hickman and McDonough 1996). Attained values for each of the 12 metrics were compared to the scoring criteria and assigned scores to represent relative degrees of degradation: least degraded (5); intermediately degraded (3); and most degraded (1). Scoring criteria for upper mainstem Tennessee River reservoirs are shown in Table 3.

If a metric was calculated as a percentage (e.g., "Percent tolerant individuals"), the data from electrofishing and gill netting were scored separately and allotted half the total score for that individual metric. Individual metric scores for a sampling area (i.e., upstream or downstream) were summed to obtain the RFAI score for the area.

TVA uses RFAI results to determine maintenance of BIP using two approaches. One is "absolute" in that it compares the RFAI scores and individual metrics to predetermined values. The other is "relative" in that it compares RFAI scores attained downstream to the upstream control site. The "absolute" approach is based on Jennings et al. (1995) who suggested that favorable comparisons of the attained RFAI score from the potential impact zone to a predetermined criterion can be used to identify the presence of normal community structure and function, and hence existence of BIP. For multi-metric indices, TVA uses two criteria to ensure a conservative screening of BIP. First, if an RFAI score reaches 70% of the highest attainable score of 60 (adjusted upward to include sample variability as described below), and second, if fewer than half of RFAI metrics receive a low (1) or moderate (3) score, then community structure and function are considered normal, indicating that BIP had been maintained and no further evaluation would be needed.

RFAI scores range from 12 to 60. Ecological health ratings (12-21 "Very Poor", 22-31 "Poor", 32-40 "Fair", 41-50 "Good", or 51-60 "Excellent") are then applied to scores. As discussed in detail below, the average variation for RFAI scores in TVA reservoirs is 6 (± 3). Therefore, any location that attains a RFAI score of 45 (75% of the highest score) or higher would be considered to have BIP. It must be stressed that scores below this threshold do not necessarily reflect an adversely impacted fish community. The threshold is used to serve as a conservative screening level; i.e., any fish community that meets these criteria is obviously not adversely impacted. RFAI scores below this level would require a more in-depth look to determine if BIP exists. An inspection of individual RFAI metric results and species of fish used in each metric are an initial step to help identify if operation of KIF is a contributing factor. This approach is appropriate because a validated multi-metric index is being used and scoring criteria applicable to the zone of study are available.

A comparison of RFAI scores from the area downstream of KIF to those from the upstream (control) area is one basis for determining if operation of the plant has had any impacts on the resident fish community. The definition of "similar" is integral to accepting the validity of these interpretations. The Quality Assurance (QA) component of the REH monitoring program deals with how well the RFAI scores can be repeated and is accomplished by collecting a second set of samples at 15%-20% of the areas each year. Comparison of paired-sample QA data collected over seven years shows that the difference in RFAI index scores ranges from 0 to 18 points. The mean difference between these 54 paired scores is 4.6 points with 95% confidence limits of 3.4 and 5.8. The 75th percentile of the sample differences is 6, and the 90th percentile is 12. Based on these results, a difference of 6 points or less in the overall RFAI scores is the value selected for defining "similar" scores between upstream and downstream fish communities. That is, if the downstream RFAI score is within 6 points of the upstream score and if there are no major differences in overall fish community composition, then the two locations are considered similar. It is important to bear in mind that differences greater than 6 points can be expected simply due to method variation (25% of the QA paired sample sets exceeded that value). An examination of the 12 metrics (with emphases on fish species used for each metric) is conducted to analyze any difference in scores and the potential for the difference to be thermally related.

Statistical Analyses

In addition to RFAI analyses, data were analyzed using traditional statistical methods. Data from the survey were used to calculate catch per unit effort (CPUE), expressed as number of fish per electrofishing run or fish per net night. CPUE values were calculated by pollution tolerance, trophic guilds (e.g., benthic invertivores, top carnivores, etc.), thermal sensitivity (Yoder et al. 2006), and indigenous status. CPUE, diversity, and species richness values were computed for each electrofishing effort (to maximize sample size; n = 30) and compared upstream and downstream to assess potential effects of power plant discharges.

Diversity was quantified using two commonly applied indices: Shannon diversity index (Shannon 1948) and Simpson diversity index (Simpson 1949). Both indices account for the number of species present, as well as the relative abundance of each species.

Shannon diversity index values were computed using the formula:

$$H' = -\sum_{i=1}^{S}\left(\frac{n_i}{N}\right)\ln\left(\frac{n_i}{N}\right)$$

where:
S = total number of species
N = total number of individuals
n_i = total number of individuals in the i^{th} species

The Simpson diversity index was calculated as follows:

$$D_S = \left(\sum_{i=1}^{S}\left(\frac{n_i}{N}\right)^2\right) - 1$$

where:

S = total number of species

N = total number of individuals

n_i = total number of individuals in the i^{th} species

An independent two-sample *t*-test was used to test for differences in CPUE, species richness, and diversity values upstream and downstream of KIF ($\alpha = 0.05$). Before statistical tests were performed using this method, data were analyzed for normality using the Shapiro-Wilk test (Shapiro and Wilk 1965) and homogeneity of variance using Levene's test (Levene 1960). Non-normal data or data with unequal variances were transformed using either square root conversion or the ln(x+1) transformation. Transformed data were reanalyzed for normal distribution and equal variances. If transformation normalized the data or resulted in homogeneous variances, transformed data were tested using an independent two-sample *t*-test. If transformed data were not normally distributed or had unequal variances, statistical analysis was conducted using the Wilcoxon-Mann-Whitney test (Mann and Whitney 1947; Wilcoxon 1945).

Benthic Macroinvertebrate Community Sampling Methods and Data Analysis for Sites Upstream and Downstream of KIF

To assess the benthic macroinvertebrate community around KIF, three transects were established across the width of the Clinch River. One transect was established upstream of the KIF intake at CRM 3.75 (Figure 3) and was used as a control site for comparison to benthic community composition potentially affected by the KIF thermal effluent. One downstream transect was established at CRM 2.2 within the thermal plume, and a second was established at CRM 1.5, just below the downstream extent of the plume (Figure 4). A Ponar sampler (area per sample 0.06 m^2) was used to collect benthic samples at ten points equally spaced along each transect. When heavier substrate was encountered, a Peterson sampler (area per sample 0.11 m^2) was used. Sediments from each sample were washed on a 533µ screen, and organisms were picked from the screen and from any remaining substrate. Samples were fixed in formalin and sent to an independent consultant who identified each organism collected to the lowest possible taxonomic level.

Benthic samples were evaluated using seven metrics that represent characteristics of the benthic community. Results for each metric were assigned a rating of 1, 3, or 5, based on comparison to reference conditions developed for REH reservoir inflow sample sites (Table 4). For each sample site, the ratings for the seven metrics were then summed to produce an RBI score. Potential RBI scores ranged from 7 to 35. Ecological health ratings derived from the range of potential values (7-12 "Very Poor", 13-18 "Poor", 19-23 "Fair", 24-29 "Good", or 30-35 "Excellent") were then applied to scores. The individual metrics are described below:

(1) **Average number of taxa —** Calculated by averaging the total number of taxa present in each sample at a site. Greater taxa richness indicates better conditions than lower taxa richness.

(2) **Proportion of samples with long-lived organisms —** A presence/absence metric that is evaluated based on the proportion of samples with at least one long-lived organism (*Corbicula, Hexagenia*, mussels, or snails) present. The presence of long-lived taxa is indicative of conditions that allow long-term survival.

(3) **Average number of EPT taxa —** Calculated by averaging the number of *Ephemeroptera* (mayfly), *Plecoptera* (stonefly), and *Trichoptera* (caddis fly) taxa present in each sample at a site. Higher diversity of these taxa indicates good water quality and better habitat conditions.

(4) **Percentage of oligochaetes —** Calculated by averaging the percentage of oligochaetes in each sample at a site. Oligochaetes are considered tolerant organisms, so a higher proportion indicates poorer water quality.

(5) **Percentage as dominant taxa** — Used as an evenness indicator, this metric is calculated by selecting the two most abundant taxa in a sample, summing the number of individuals in those two taxa, dividing that sum by the total number of animals in the sample, and

converting to a percentage for that sample. The percentage is then averaged for the 10 samples at each site. Because the most abundant taxa often differ among the 10 samples at a site, this approach allows more discretion to identify imbalances at a site than developing an average for a single dominant taxon for all samples a site. Dominance of one or two taxa indicates poor conditions.

(6) Average density excluding chironomids and oligochaetes — Calculated by first summing the number of organisms – excluding chironomids and oligochaetes – present in each sample and then averaging these densities for the 10 samples at a site. This metric examines the community, excluding taxa which often dominate under adverse conditions. Higher abundance of taxa other than chironomids and oligochaetes indicates good water quality conditions.

(7) Zero-samples: Proportion of samples containing no organisms — For each site, the proportion of samples which have no organisms are present. “Zero-samples” indicate living conditions unsuitable to support aquatic life (i.e. toxicity, unsuitable substrate, etc.). A site with no zero samples was assigned a score of five. Any site with one or more zero samples was assigned a score of one.

A similar or higher benthic index score at the downstream site compared to the upstream sites was used as the basis for determining absence of impact on the benthic macroinvertebrate community related to KIF’s thermal discharge. The QA component of REH monitoring compared benthic index scores from 49 paired sample sets collected over seven years. Differences between these paired sets ranged from 0 to 14 points, the 75th percentile was four points, the 90th percentile was six points. The mean difference between these 49 paired scores was 3.1 points with 95% confidence limits of 2.2 and 4.1. Based on these results, a difference of four points or less was the value selected for defining “similar” scores between upstream and downstream benthic communities. That is, if the benthic score at the downstream site is within four points of the upstream score, the communities are considered similar. However, differences greater than four points can be expected simply due to method variation (25% of the QA paired sample sets exceeded that value). Any difference in scores of four points or greater between communities is examined on a metric-by-metric basis to determine what caused the difference and the potential for the difference to be thermally related.

Visual Encounter Surveys (Wildlife Observations)

Permanent survey sites were established on both the right and left descending banks at one location upstream of the KIF thermal discharge, centered around CRM 3.5 just below the confluence of the Emory and Clinch Rivers (Figure 3), and at a second location downstream of the discharge, centered around CRM 1.8 (Figure 4). Each survey site spanned a distance of 2,100 m along the shoreline, and the beginning and ending points were marked with GPS for relocation.

Surveys were conducted by steadily traversing the site by boat, at approximately 30 m offshore and parallel to the shoreline, and simultaneously recording observations of wildlife. The sampling frame of each survey generally followed the strip or belt transect concept: from the center-line of each transect landward to an area that included the shoreline and riparian zone (i.e., belt width generally averages 60 m where vision is not obscured), all individuals observed were enumerated. Wildlife observed visually or detected audibly was identified to the lowest taxonomic trophic level, and a direct count of individuals observed per trophic level was recorded. If a flock of a species or a mixed flock of a group of species was observed, numbers of individuals present of each species were estimated. Time was recorded at the start and end points of each site to provide a general measure of effort expended. Variation of observation times among sites was primarily due to the difficulty of approaching some wildlife species without inadvertently flushing them from basking or perching sites.

The principal objective of the surveys was to provide a preliminary set of observations to verify that trophic levels of birds, mammals and reptiles were not affected by thermal effects from the KIF discharge. If expected trophic levels were not represented, further investigation will be used to target particular species and/or species groups (guilds) in an attempt to determine the cause.

Watts Bar Reservoir Flow

Daily average discharges recorded from Melton Hill Dam and the USGS stream gage at ERM 18 at Oakdale, TN were summed to describe the amount of water flowing past KIF and were obtained from TVA's River Operations database and USGS website, respectively.

Thermal Plume Characterization

Physical measurements to characterize and map the KIF thermal plume were collected concurrent with biological field sampling. The plume was characterized under representative thermal maxima and seasonally-expected low flow conditions. Measurements were collected during periods of normal operation of KIF, as reasonably practicable, to capture the thermal plume under existing river flow/reservoir elevation conditions. This effort evaluated potential impacts on recreation and water supply uses and allowed general delineation of the "Primary Study Area" – per the EPA (1977) draft guidance defined as the "*entire geographic area bounded annually by the locus of the 2°C above ambient surface isotherms as these isotherms are distributed throughout an annual period*" – ensuring placement of the biological sampling locations within thermally influenced areas.

However, it is important to emphasize that the ≥2ºC isopleth boundary is not a bright line; it is dynamic, changing geometrically in response to changes in ambient river flows and temperatures and KIF operations. As such, samples collected outside of, but generally proximate to the Primary Study Area boundary cannot be considered free of thermal influence and thus should not be discounted. Every effort was made to collect biological samples in thermally affected areas as guided by the Primary Study Area definition.

Depth profiles of temperature from the river surface to the bottom were collected at points along transects crossing the plume. One transect was located proximate to the thermal discharge point; subsequent downstream transects were concentrated in the near field area of the plume where the change in plume temperature was expected to be most rapid. The distance between transects in the remainder of the Primary Study Area increased with distance downstream (or away from the discharge point). The farthest downstream transect was just outside of the Primary Study Area. A transect upstream of the discharge, in an area not affected by the thermal plume, was included for determining ambient temperature conditions. The total number of transects needed to fully characterize and delineate the plume was determined in the field.

Collection of temperature profiles along a given transect began at or near the shoreline from which the discharge originated and continued until the far shore was reached. Measurements across a transect were typically conducted at points 10%, 30%, 50%, 70%, and 90% from the originating shoreline, though the number of measurement points along transects was sometimes increased in proportion to the magnitude of the temperature change across a given transect. The distances between transects, and between measurement points along each transect, depended on the size of the discharge plume.

Temperature data were compiled and analyzed to present the horizontal and vertical dimensions of the KIF thermal plume using spatial analysis techniques to yield plume cross-sections, which can be used to demonstrate the existence of a zone of passage for fish and other aquatic species under and/or around the plume.

Water Quality Parameters at Fish Sampling Sites during RFAI Samples

Water quality conditions were measured using a Hydrolab® that provided readings for water temperature (°C), conductivity (µS/cm), dissolved oxygen (ppm), and pH. Within each of the electrofishing sample reaches upstream and downstream of KIF, transects were established across the river at the most upstream boundary, at mid-reach, and at the most downstream boundary. Along each transect, samples were collected at the RDB, in mid-channel, and at the LDB by recording readings at one- to two-meter intervals along a vertical gradient from just above the bottom of the river to approximately 0.3 meters from the surface.

Water Supply and Recreational Use Support Evaluation

Water temperature data collected as part of the thermal mapping, and collection of supporting water quality information were used to evaluate potential thermal impacts to water supply and recreational uses in the vicinity (within 10 river miles downstream) of KIF. Locations of public water supply intakes and/or established public recreational areas (if any) were determined and their position(s) were mapped relative to the KIF thermal plume. The existence of any relevant water temperature data collected by the owners of these water supply intake(s) will be determined; and if available, requested to augment the data collected in the field. As necessary (limited or no available owner-supplied temperature data), direct measurements of water temperature may also be conducted specifically at these locations to evaluate potential thermal effects of the KIF discharge.

Results and Discussion

Evaluation of Plant Operating Conditions

Relevant KIF operational data—mean daily temperatures at the CCW intake and discharge, mean daily flow through the CCW system, and mean daily power generation by the fossil units at KIF—were compiled from 2010 through 2015.

During 2015, biological monitoring was conducted upstream and downstream of KIF on October 13, 14, and 15. Daily mean generation on these dates ranged from 163 to 168 MW; mean daily flow through the condenser circulating water (CCW) system ranged from 410 to 458 mgd (634 to 709 cfs); average intake temperatures ranged from 66.0 to 66.7 °F; and average discharge temperatures ranged from 65.4 to 65.7 °F (Figure 5, Table 5).

During 2015, daily mean generation ranged from 0 to 1380 MW and averaged 90% of historic daily means. Daily intake temperatures ranged from 33.3 to 80.5 °F and on average showed no variance from historic daily means; discharge temperatures ranged from 37.9 to 91.2 °F and averaged 96% of historic daily means. Daily flow through the CCW system was, on average 68% of historic daily flows, ranging from 249 to 1357 mgd (385 to 2100 cfs) (Figure 6).

Aquatic Habitat in the Vicinity of KIF

Shoreline Aquatic Habitat Assessment

Of the sixteen shoreline sections assessed upstream, 13 sections (81%) rated “Fair” and three sections (19%) rated “Good.” The average rating for sections along both banks was “Fair”. No aquatic macrophytes were observed upstream (Table 6).

Downstream, three sections (19%) rated “Good”, four sections (25%) rated “Poor”, and the remaining nine sections (56%) rated “Fair”. The average rating for sections along both banks was “Fair”. Aquatic macrophytes were not found along the right bank but were observed in two shoreline sections on the left bank. Average coverage along the left bank was 13% (Table 7).

River Bottom Habitat

Relative locations of all sixteen transects are shown in Figure 7. Figures 8-11 display substrate percentages at each sample point along the eight transects upstream of KIF. Figures 12-15 display substrate percentages at each sample point along the eight transects downstream of KIF.

Twelve substrate types were identified in samples collected along the eight transects upstream of KIF. The two most prevalent types were silt (42.9%) and detritus (22.6%). Mollusk shell (8.9%) and gravel (8.8%) were observed in similar proportions. Samples collected along the eight transects downstream of KIF contained eight substrate types. The two most prevalent were silt (66.9%) and detritus (11.0%). Gravel (7.2%) and mollusk shell (6.9%) were observed in similar proportions (Table 8).

Fish Community

Fish community samples resulted in RFAI scores of 43 (“Good”) for the upstream site and 47 (“Good”) for the downstream site (Table 9). The difference of four points indicates that the fish communities were similar during autumn 2015.

Below, the two communities are compared in further detail, utilizing each of the four characteristics of a BIP. Discussion of this comparison includes the metrics appropriate for each characteristic.

(1) A biotic community characterized by diversity appropriate to the ecoregion:

Total number of species (highest rating requires >29)

Thirty-three indigenous species were collected upstream, and 36 were collected downstream, earning both the highest score (5) (Table 9). Two indigenous species collected upstream, black redhorse (five specimens) and chestnut lamprey (one specimen), were not found downstream during 2015 (Tables 10 and 11). In records since 2001, black redhorse was collected at the upstream site in every sample and was collected downstream during 2011, 2012, and 2013; chestnut lamprey was collected upstream in only one other sample (2010) and was collected downstream only during 2010 (Table 12). During 2015, five indigenous species collected downstream were not found upstream: white crappie (two specimens), bullhead minnow (seven), quillback (one), black buffalo (one), and snubnose darter (two) (Tables 10 and 11). In records since 2001, white crappie and black buffalo have been collected at both sites during several previous samples; bullhead minnow was previously collected downstream during 2013 and upstream during 2011 and 2007. Quillback has previously been collected downstream during only one other sample (2012) and upstream only during 2003. Snubnose darter has never previously been collected at the downstream site and was only collected upstream during 2001 (Table 12). It is also noted that greenside darter, collected at both sites during 2015, has not been collected previously at either site in records since 2001 (Tables 10, 11, 12).

The non-indigenous species common carp, striped bass, yellow perch, and Mississippi silverside were collected at both sites during 2015. Redbreast sunfish was collected downstream but was not observed upstream (Tables 10 and 11).

Total number of centrarchid species (highest rating requires >4)

Six centrarchid species were collected upstream, and seven species were collected downstream. Both sites received the highest score (5). Black crappie, bluegill, green sunfish, longear sunfish, redear sunfish, and warmouth were collected at both sites; white crappie was collected only downstream (Table 9).

Total number of benthic invertivore species (highest rating requires >7)

Six benthic invertivore species were collected upstream and five species downstream, producing mid-range scores (3) for both sites. Freshwater drum, golden redhorse, logperch, northern hogsucker, and spotted sucker were collected at both sites, while black redhorse was collected only upstream (Table 9).

Number of intolerant species (highest rating requires > 4)

Both sites received the highest score (5). Eight intolerant species were collected upstream, seven species were collected downstream. Black redhorse was collected only upstream (Table 9).

Percent non-indigenous species (highest rating requires < 3%, electrofishing; < 5%, gill netting)

Both sites earned lowest scores for both portions of the sample. Large collections of Mississippi silverside (21.6% upstream, 12.1% downstream) depressed the scores for the electrofishing collections at both sites. Two other species were collected by electrofishing upstream in smaller proportions [common carp (1.4%), and yellow perch (0.2%)], and four other species were collected downstream in smaller proportions [common carp (0.4%), redbreast sunfish (0.1%), striped bass and yellow perch (<0.1% each)]. Gill net samples at both sites contained two non-indigenous species in similar proportions: striped bass (12.3% upstream, 7.1% downstream), and common carp (1.5% upstream, 2.1% downstream) (Table 9).

Number of top carnivore species (highest rating requires > 7)

Eleven top carnivore species were collected upstream. The same eleven species, plus white crappie, were collected downstream. Both sites earned highest scores (5) (Table 9).

Summary

Both sites received identical scores for the six metrics discussed. Both received highest scores for “Number of indigenous species”, “Number of intolerant species”, and “Number of top carnivore species”, and midrange scores for “Number of centrarchid species” and “Number of benthic invertivore species”. Both sites received lowest scores for “Percent non-indigenous species” due to large numbers of Mississippi silverside collected by electrofishing and to large numbers of striped bass collected in gill nets.

(2) The capacity for the community to sustain itself through cyclic seasonal change:

During autumn 2015, sampling generated total RFAI scores of 43 (“Good”) for the upstream site and 47 (“Good”) for the downstream site. Autumn RFAI sampling has been conducted at the sites upstream and downstream of KIF during odd years since 2001 and additionally during 2010 and 2012. The average score over this period for the upstream site is 42 (“Good”) and for the downstream site is 40 (“Fair”) (Table 13).

The composition of an autumn sample is often indicative of the ability of the fish community to withstand the stresses of an annual seasonal cycle. During 2015, 36 species were collected upstream, and 33 species were collected downstream. From 2001 through 2015, the number of indigenous species collected upstream has ranged from 27 (2011 and 2012) to 34 (2003) with an average of 30 species. The number collected downstream has ranged from 24 (2007) to 36 (2015) with an average of 31 (Figure 16).

Average number per run (highest rating requires > 210 for electrofishing, > 24 for gill netting)

With an average of 87.8 fish collected per electrofishing run, the upstream site earned the lowest partial score, while the the downstream site earned a midrange partial score with an average of 142.9 fish per run. Both sites earned midrange scores for the gill netting portion of the sample: collections upstream averaged 13.0 fish per net-night; collections downstream averaged 14.1 fish per net-night (Table 9).

Percentage of anomalies (highest rating requires < 2% for electrofishing, 2% for gill netting)

The percentage of anomalies (i.e. visible lesions, bacterial and fungal infections, parasites, muscular and skeletal deformities, and hybridization) in a sample can also be an indicator of the ability of the fish community to sustain itself over an annual seasonal cycle. Both sites received the highest scores for both portions of the collection. Upstream, 0.2% of the electrofishing collection exhibited anomalies; no anomalies were observed in the gill net collection. Downstream, anomalies were observed in 0.2% of the electrofishing collection and 0.7% of the gill net collection (Tables 9).

Summary

During 2015, collections at both the upstream and downstream site exhibited low percentages of anomalies. The total RFAI score and the total number of indigenous species collected were greater downstream than upstream, and electrofishing efforts downstream collected a greater average number of fish per run than those upstream. Calculated over the history of sampling around KIF, the average numbers of indigenous species collected at the two sites were similar. The average RFAI scores over this history were higher for the upstream site than for the downstream site, but the averages differed by only two points, indicating similarity over the long term.

(3) The presence of necessary food chain species:

For each of the sampling sites upstream and downstream of KIF, the proportion of the total sample made up by each trophic guild was estimated from the collection data (Tables 10 and 11). In Table 2, these estimated proportions and the number of species observed within each trophic guild are compared with the expected values for transition zones in upper mainstem Tennessee River reservoirs.

In the community upstream of KIF, proportions of benthic invertivores, insectivores, omnivores and planktivores exceeded expectations while the proportion of top carnivores was poorer than expected. Numbers of benthic invertivore species, insectivore species, and top carnivore species exceeded expectations, and numbers of omnivore and planktivore species were within expected ranges. Additionally, one species of specialized insectivore and one parasitic species were observed. In the community downstream of KIF, the proportions of benthic invertivores and insectivores were within expected ranges, and the proportion of omnivores was better (lower) than expecations. The proportions of top carnivores and of planktivores were poorer than expected. Two species of specialized insectivores were observed (Table 2).

In direct comparison, the two sites exhibited similar proportions of top carnivores, omnivores, and specialized insectivores, but the upstream site had a higher proportion of benthic invertivores and a much higher proportion of insectivores, due primarily to a large collection of bluegill (540 individuals, 37.3%) that was not matched downstream. One species of planktivore – threadfin shad – was collected in unusually large numbers downstream and dominated the trophic composition (46.1%) of the downstream community. Collections at both sites included similar numbers of species of all the major trophic guilds (Table 2).

Percent top carnivores (highest rating requires >11% for electrofishing, >52% for gill netting) The upstream site earned midrange scores for both portions of the sample. Seven top carnivore species comprised 10.0% of the electrofishing sample, largemouth bass (8.5%) being most prevalent. Ten top carnivore species comprised 48.5% of the gill net sample, walleye (16.9%) and striped bass (12.3%) being most prevalent. At the downstream site, seven species comprised 6.3% of the electrofishing catch, generating a midrange score. Largemouth bass was most prevalent, making up 5.6% of the total. Twelve species comprised 61.7% of the gill net catch, generating the highest score. White bass (21.3%) and skipjack herring (15.6%) were the most prevalent species; striped bass and walleye each comprised 7.1% of the total (Table 9).

Percent omnivores (highest rating requires < 22%)
Both sites earned highest scores for the electrofishing portion of the sample. Six omnivore species were collected by electrofishing at each site, comprising 4.4% of the upstream sample and 9.0% of the downstream sample. Both sites earned midrange scores for the gill net catch: five species of omnivore were collected upstream, making up 36.2% of the gill net sample; six species were collected downstream, making up 29.8% of the sample (Table 9).

Summary

Collections at both sites included similar numbers of species representing each trophic guild. However, insectivores were notably more abundant upstream, while the downstream site was dominated by planktivores due to a large collection of threadfin shad. The downstream site earned a slightly higher score than upstream for "Percent top carnivores", but both sites earned identical scores for "Percent omnivores".

(4) A lack of domination by pollution-tolerant species:

Number of benthic invertivore species (highest rating requires > 7)

Six benthic invertivore species were collected upstream and five species downstream. Both sites received mid-range scores (3) (Table 9).

Number of intolerant species (highest rating requires > 4)

Both sites received the highest score (5). Eight intolerant species were collected upstream; seven species were collected downstream (Table 9).

Percentage of tolerant individuals (highest rating requires <31% for electrofishing; <16% for gill netting)

The upsteam site earned midrange scores for both portions of the sample. Tolerant individuals of seven species made up 58.9% of the electrofishing sample, and four species comprised 17.7% of the gill net sample. The downstream site earned highest scores for both portions of the sample. Nine tolerant species comprised 29.9% of the electrofishing catch, and four species comprised 10.6% of the gill net catch. Bluegill was most prevalent tolerant species collected by electrofishing at both sites, constituting 40.9% of the upstream sample and 12.3% of the downstream sample. Gizzard shad was most prevalent in gill net samples at both sites, constituting 13.8% of the catch upstream and 6.4% of that downstream (Table 9).

Percent dominance by one species (highest rating requires <20% for electrofishing; <14% for gill netting)

Both sites earned the lowest score for the electrofishing portion and midrange scores for the gill net portion of the sample. Bluegill comprised 40.9% of the electrofishing sample upstream, and threadfin shad made up 49.1% of the sample downstream. Walleye comprised 16.9% of the gill net sample upstream, and white bass comprised 21.3% of the sample downstream (Table 9).

Percentage of omnivores (highest rating requires <22% for electrofishing; <23% for gill netting)

Both sites earned highest scores for the electrofishing portion and midrange scores for the gill net portion of the sample. Omnivores comprised 4.4% of the electrofishing catch and 36.2% of the gill net catch upstream; omnivores comprised 9.0% of the electrofishing catch and 29.8% of the gill net catch downstream (Table 9).

Summary

Both sites earned identical scores for four of the five metrics discussed. Both exhibited moderate numbers of benthic invertivore species, high diversity of intolerant species, moderate dominance by single species and moderate proportions of omnivores. The upstream site exhibited a higher proportion of tolerant individuals than that downstream.

Statistical Analyses of Electrofishing Samples

Neither the Simpson nor the Shannon index indicated significant difference in fish community diversity between the upstream and downstream sites (Table 14).

Potential differences in species richness between the two communities were also analyzed by parsing the data into nine species parameters. Statistical tests of these parameters indicated that significantly more benthic invertivore species and more thermally sensitive species were collected per run upstream, and that more insectivore species were collected per run downstream. The same nine parameters were also tested for differences in abundance (numbers of individuals per run, or CPUE), and results indicated that more individual benthic invertivores were collected per run upstream (Table 14).

Fish Community Summary

Resident important species (RIS) are defined in EPA guidance as those species which are representative in terms of their biological requirements of a balanced, indigenous community of fish, shellfish, and wildlife in the body of water into which the discharge is made (EPA and NRC, 1977). RIS often include non-indigenous species. Thirty-eight RIS were collected at the site upstream of KIF; 41 were collected at the downstream site (Tables 10 and 11).

Species that experience avoidance behavior or mortality at water temperatures equal to or greater than 32.2°C (90°F) are designated as "thermally sensitive" (Yoder et al., 2006). Two thermally sensitive species, greenside darter and logperch, were collected at both sites (Tables 10 and 11). The aquatic nuisance (non-indigenous) species common carp, striped bass, yellow perch, and Mississippi silverside were collected at both sites. One additional aquatic nuisance species, redbreast sunfish, was collected only downstream. Commercially valuable species are defined as those that may be harvested and sold commercially for food or bait in Tennessee (TWRA, 2012). Recreationally valuable species are those that are targeted by anglers or are used as bait. Among the RIS collected upstream were 14 commercially valuable species and 23 recreationally valuable species, compared to 16 commercially valuable and 23 recreationally valuable species downstream (Tables 10 and 11).

Total RFAI scores for the sampling sites upstream and downstream of KIF differed by four points during 2015, indicating that the two sites exhibited similar ecological structure and balance. As previously discussed, RFAI scores have an intrinsic variability of ± 3 points. This variability comes from several sources, including annual variations in air temperature and stream flow; variations in pollutant loadings from nonpoint sources; changes in habitat, such as extent and density of aquatic vegetation; natural population cycles and movements of the species being measured (TWRC, 2006). Another source of variability arises from the fact that nearly any practical measurement, lethal or non-lethal, of a biological community is a sample rather than a measurement of the entire population.

The effects of these sources of variability could generate a difference in scores due simply to method variation. Accordingly, a thorough comparison of the fish communities upstream and downstream of KIF was conducted by examining each of the twelve individual RFAI metrics as a component of the appropriate characteristic of a BIP.

Measures of diversity were similar for both communities: both exhibited high diversity of indigenous species, intolerant species, and top carnivore species; both exhibited moderate diversity of centrarchid and benthic invertivore species; and both communities had high proportions of non-indigenous species, primarily Mississippi silverside and striped bass. Both communities were relatively free of anomalies and showed similar sustainability over annual cycles, but trophic composition of the two sites differed: the upstream site included a greater proportion of insectivores than that downstream, due primarily to a large collection of bluegill, while the downstream site was dominated by planktivores (threadfin shad). Both sites exhibited relatively low dominance by pollution tolerant species, though the upstream site included a higher proportion of tolerant individuals than the downstream site.

Statistical tests indicated that the two communities were similar in total diversity, but that the upstream site showed greater species richness of thermally sensitive species, and greater richness and abundance of benthic invertivore species. The downstream site showed greater richness of insectivore species.

It is therefore concluded that the fish community downstream of the KIF discharge was similar in ecological structure and balance to the control community upstream of the intake, and that the downstream community was not adversely affected by operation of KIF during 2015.

To provide additional information about the health of the fish community throughout Watts Bar reservoir, Table 13 compares RFAI scores for the sites upstream and downstream of KIF with those from additional REH sites in the reservoir. For all the REH sites, scores averaged over the duration of sampling are rated as “Good”. It is noted, however, that the aquatic communities at these sites are not subject to thermal effects from KIF and are not used in determination of BIP in relation to KIF.

Benthic Macroinvertebrate Community

As mentioned previously, to assess the condition of the benthic macroinvertebrate community around KIF, sampling was conducted at three sites in autumn 2015. RBI metrics for all three sites were scored using evaluation criteria for lab-processed samples collected in the transition zone (Table 4). Both downstream locations, just downstream of the lower boundary of the thermal plume at CRM 1.5 and within the thermal plume at CRM 2.2, produced RBI total scores of 33 ("Excellent"). Data from control site CRM 3.75, upstream of the facility, produced an overall RBI score of 31 ("Excellent") (Table 15).

A difference of 4 points or less was used to define "similar" conditions between the three sites. Because the RBI scores for the two downstream sites were within 4 points of the RBI score for the upstream control site, conditions among the three sites were considered "similar", supporting the conclusion that the two downstream sites were not adversely affected by the thermal effluent from KIF in 2015.

Results for the autumn 2015 benthic macroinvertebrate sampling can be found in Tables 15 and 16. Autumn 2015 results were compared between the downstream (CRM's 1.5 and 2.2) and upstream (CRM 3.75) sites and are briefly discussed below for each RBI metric.

Average number of taxa (> 6.6 required for highest score)

In autumn 2015, averages of 14 and 14.6 taxa were observed for sites downstream of KIF. The control site upstream of KIF averaged 16.6 taxa per sample. All three sites received the highest score of 5 for this metric (Table 15).

Proportion of samples with long-lived organisms (> 0.9 required for highest score)

The metric "proportion of samples with long-lived organisms" received the highest score of 5 at both downstream sites with 100% containing long-lived organisms (proportion of 1.0). The proportion of samples with long-lived organisms was 100% at the upstream site which also received the highest score for the metric (Table 15).

Average number of EPT taxa (> 1.4 required for highest score)

An average of 1.4 EPT taxa was collected at CRM 1.5, just downstream of the lower boundary of the thermal plume, and upstream of KIF at CRM 3.75, an average of 1.0 EPT taxa was collected. Both sites received the mid-range score of 3. Within the plume at CRM 2.2, an average of 1.5 EPT taxa was collected resulting in the highest score (Table 15).

Average proportion of oligochaete individuals (< 11.0 % required for highest score)

Oligochaetes are considered tolerant organisms; therefore, a lower proportion of oligochaetes may be indicative of better water quality. The site just downstream of the lower boundary of the thermal plume, CRM 1.5, had an average of 7.5% oligochaetes and received the highest score. The site within the plume, CRM 2.2, and the upstream control site, CRM 3.75, had slightly higher proportions of oligochaetes, 11.3% and 11% respectively, resulting in the mid-range score for both sites (Table 15).

Proportion of total abundance comprised by two most abundant taxa (< 77.8 % required for highest score)

The two dominant taxa made up 72.5% and 72.8% of the samples at the downstream sites, CRM 1.5 and TRM 2.2 respectively. Total abundance of the two dominant taxa was considered similar at the upstream control site and made up 66.3% of the samples. All three sites received the highest score (Table 15). Burrowing mayflies, *Hexagenia* sp., and Sphaeriid clams, *Musculium transversum*, were most abundant at CRMs 1.5 and 3.75. Burrowing mayflies (*Hexagenia* sp.) and unspecified Tubificinae worms were most abundant at CRM 2.2 (Table 16).

Average density excluding chironomids and oligochaetes (> 609.9/m^2 required for highest score)

At the downstream sites, average densities excluding chironomids and oligochaetes were 1495/m^2 and 1373.3/m^2. Both sites received the highest score. Average density (exclusive of chironomids and oligochaetes) at the upstream control site was 1681.7/m^2, also resulting in the highest score (Table 15).

Proportion of samples containing no organisms (0 required for highest score)

In autumn 2015, there were no samples at any site which were void of organisms. All three sites received the highest score (Table 15).

Benthic Macroinvertebrate Community Summary

Monitoring results for autumn 2015 support the conclusion that a BIP of benthic macroinvertebrates was maintained downstream of KIF. The site just downstream of the lower boundary of the thermal plume, CRM 1.5, and the site within the plume, CRM 2.2, both received RBI total scores of 33. The upstream control site, CRM 3.75, received an RBI total score of 31. RBI total scores for all three sites rated "Excellent" (Table 15).

Because the RBI total scores for the two downstream sites were within 4 points of the RBI total score for the upstream control site, conditions among the three sites were considered "similar", supporting the conclusion that the two downstream sites were not adversely affected by the thermal effluent from KIF in 2015.

Visual Encounter Survey (Wildlife Observations)

During autumn 2015, observations of shoreline wildlife upstream of KIF included 116 birds of 18 species, 14 turtles of two species, and seven mammals of two species. Observations downstream included 279 birds of 17 species and one mammal. Eleven species of birds (American crow, American robin, blue jay, Canada goose, cardinal, Carolina chickadee, double-crested cormorant, European starling, great blue heron, mockingbird, red-headed woodpecker), one species of turtle (map turtle), and one species of mammal (Eastern grey squirrel) were observed at both stations. Six bird species (mallard, pied-billed grebe, wood duck, Carolina wren, yellow-shafted flicker, and ring-billed gull) two turtle species (common slider and painted turtle), and white-tailed deer were observed only upstream. Seven bird species (American coot, cliff swallow, common grackle, rock dove, turkey vulture, downy woodpecker, and Eastern phoebe) and red-eared turtle were observed only downstream (Table 17).

Table 18 compares the wildlife species observed during autumn surveys conducted along the same transects since 2011. Some species – American crow, Carolina chickadee, double-crested cormorant, great blue heron, mallard, and map turtle, for example – were observed both upstream and downstream during most years and can be considered common. Others were observed intermittently, along a single transect or during only one sample year. It is important to note that a Visual Encounter Survey provides a preliminary near shore wildlife assessment to determine if the thermally affected area downstream of a power plant has adversely affected the bird, reptile, or mammal communities. Using the methods described for these surveys, determination of the presence and diversity of small, perching bird species, reptiles and mammals is made difficult by their typical behaviors. Other factors contributing to the limited observations of some taxa include ecological status (e.g. top-level predators – raptors such as red-tailed hawk, osprey, bald eagle, etc. – are less abundant than species at lower trophic levels), and migratory habits. The diversity of bird groups recorded indicates that a healthy ecological community has existed both upstream and downstream of KIF since 2011 and that the shoreline wildlife community downstream has not been adversely affected by operation of the plant. If, after any survey an adverse environmental impact is suspected, sampling strategies of a more quantitative nature, such as trapping or netting, active search, investigation of mammal tracks along shoreline areas, long-term observation from blinds, or the use of cameras will be proposed to more accurately estimate the presence and diversity of these groups.

Watts Bar Reservoir Flow near KIF

The sums of average daily flows from Melton Hill Dam and the USGS stream gage at Emory River Mile (ERM 18) at Oakdale, TN during 2015 are shown in Figure 17. Average daily flows during 2015 were similar to historical mean flows during September and October; flows were generally lower than historical flows during February, May, June, and November and were higher than historical flows during the remaining months.

Thermal Plume Characterization

Temperature profiles collected during a previous 316(a) demonstration study (TVA, 1978) indicated the KIF thermal plume rarely extended downstream of CRM 1.4. This is a result of the plant's selective withdrawal of cold water from the Clinch River. Cold water from Norris Reservoir upstream, which flows under the warmer Emory River at their confluence, is diverted toward the intake channel by a submerged dam near CRM 3.9, which is about 0.5 mile downstream of the mouth of the Emory River. As a result, during summer months the thermal effluent of the KIF plant is approximately the same temperature as the surface waters in the vicinity of the discharge (TVA, 1975).

During the 2015 sampling event, water temperatures were similar at all transects from the confluence to CRM 1.5 downstream of the discharge, with no plume temperatures detected. Highest temperatures were recorded at the surface at all transects (Table 19).

Water Quality Parameters at Fish Sampling Sites during RFAI Samples

In depth profiles collected within the upstream reach on the Clinch River, temperatures ranged from 64.3 to 69.6 °F, pH values ranged from 7.1 to 8.0, conductivity ranged from 217.5 to 264.3 µS/cm, and dissolved oxygen concentration (DO) ranged from 8.4 to 11.2 mg/L (Table 20).

For profiles collected in the downstream sample reach, temperatures ranged from 65.2 °F to 71.0 °F, and surface temperatures of all profiles fell between 70.5 and 71.0 °F. Acidity ranged from pH 7.1 to 7.8. Conductivity ranged from 173.8 to 280.8 µS/cm. The highest conductivity values, observed at the upstream and midreach transects, were similar to those of the upstream profiles. Lowest conductivity values were observed at the downstream boundary transect. DO concentrations ranged from 7.2 to 10.0 mg/L, with the lowest values occurring at the downstream boundary transect (Table 20).

Summary

Generally, values of the water quality parameters for all profiles collected were within expected seasonal ranges and were similar upstream and downstream. In the downstream profiles, slight elevation of surface water temperatures from the KIF thermal effluent is evident, but conductivity values indicate that a zone of passage for fish and other aquatic wildlife exists around the KIF discharge.

Water Supply and Recreational Use Support Evaluation

We are not aware of any domestic water supply intakes located within approximately 10 river miles downstream of the KIF thermal discharge (TDEC 2015, pers. comm.).

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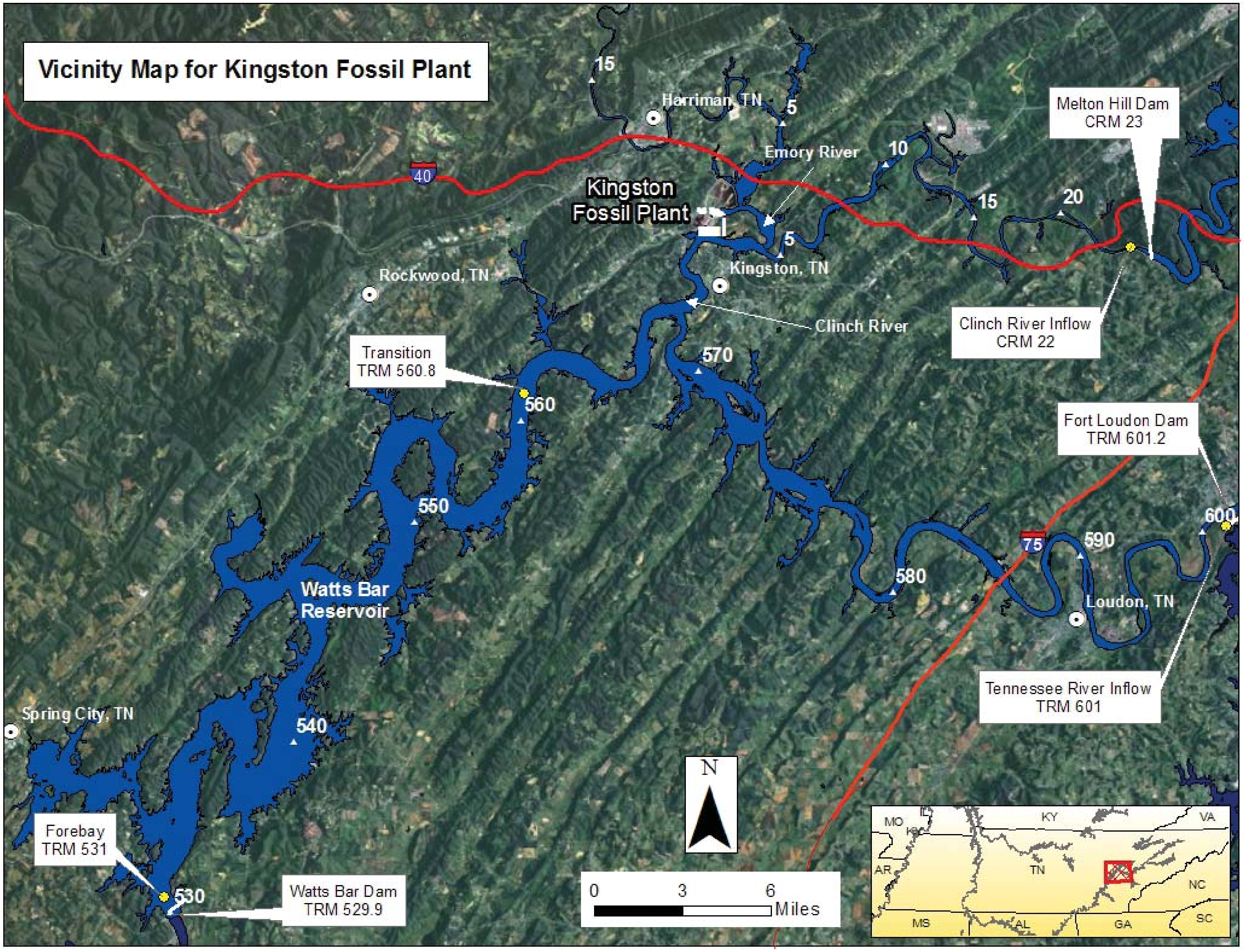


Figure 1. Location of Kingston Fossil Plant on Watts Bar Reservoir at the confluence of the Emory and Clinch Rivers, showing relative locations of Reservoir Ecological Health (REH) Program monitoring sites

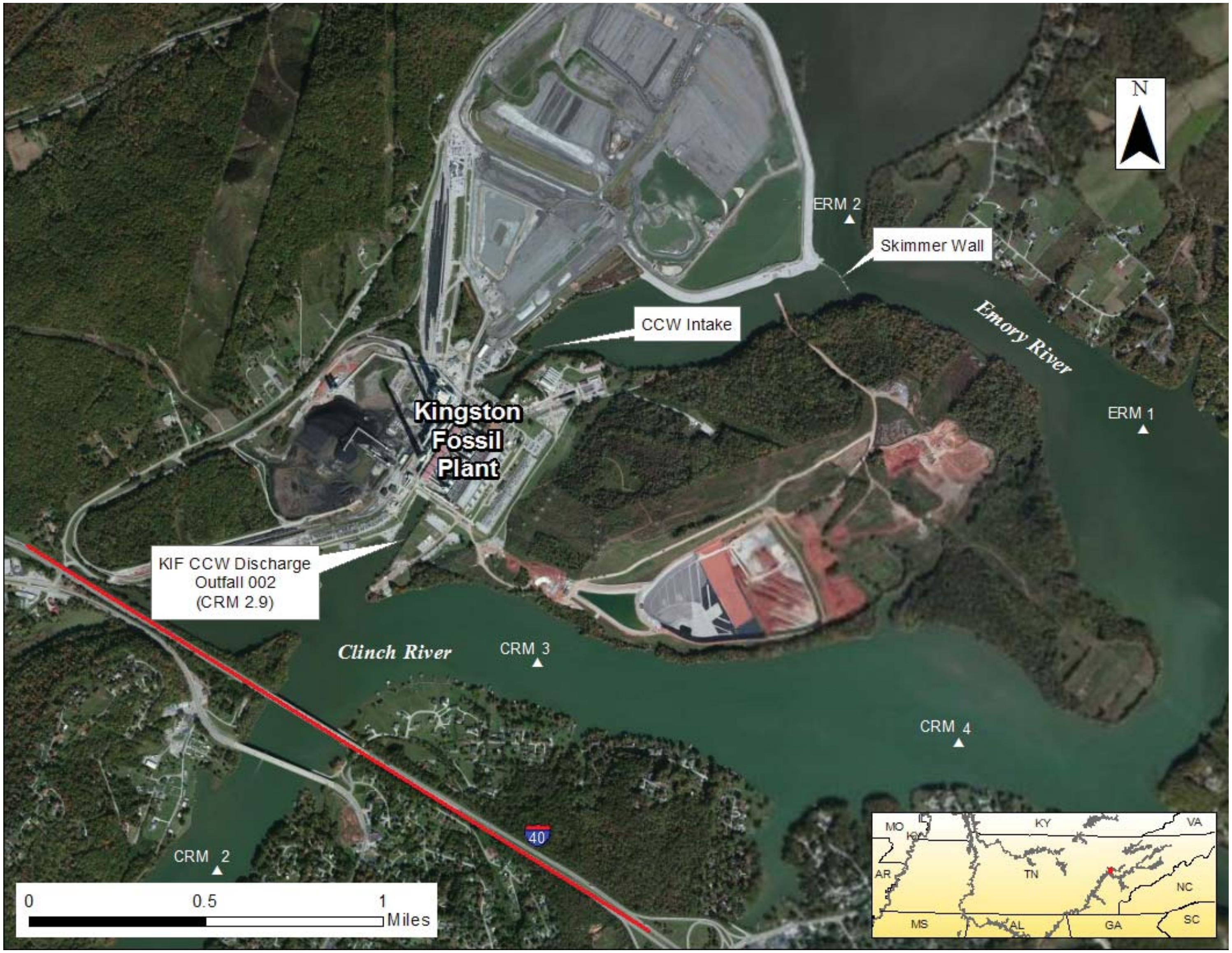


Figure 2. Site map for Kingston Fossil Plant, showing skimmer wall and condenser cooling water (CCW) intake and discharge (Outfall 002)

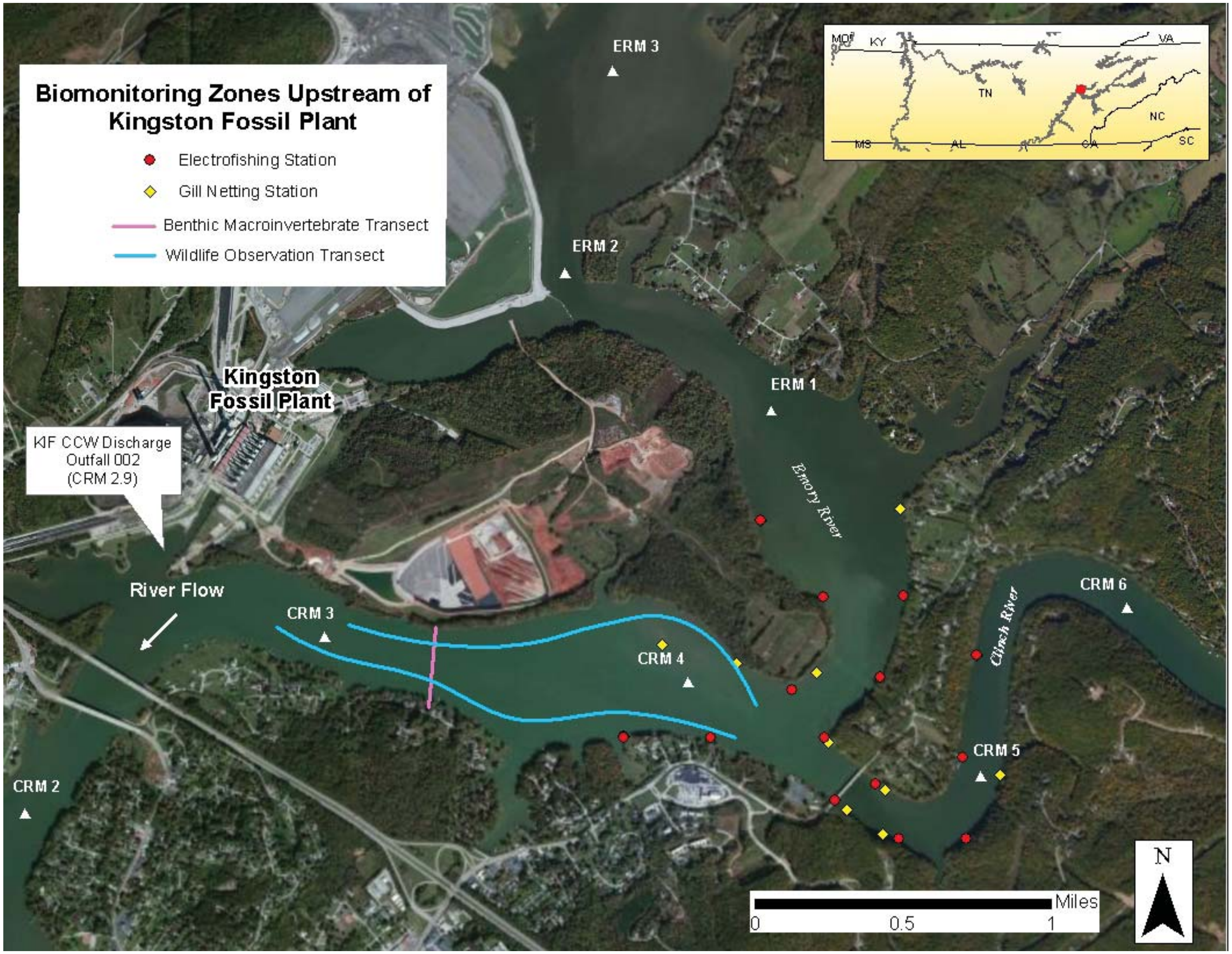


Figure 3. Biological monitoring zones upstream of Kingston Fossil Plant

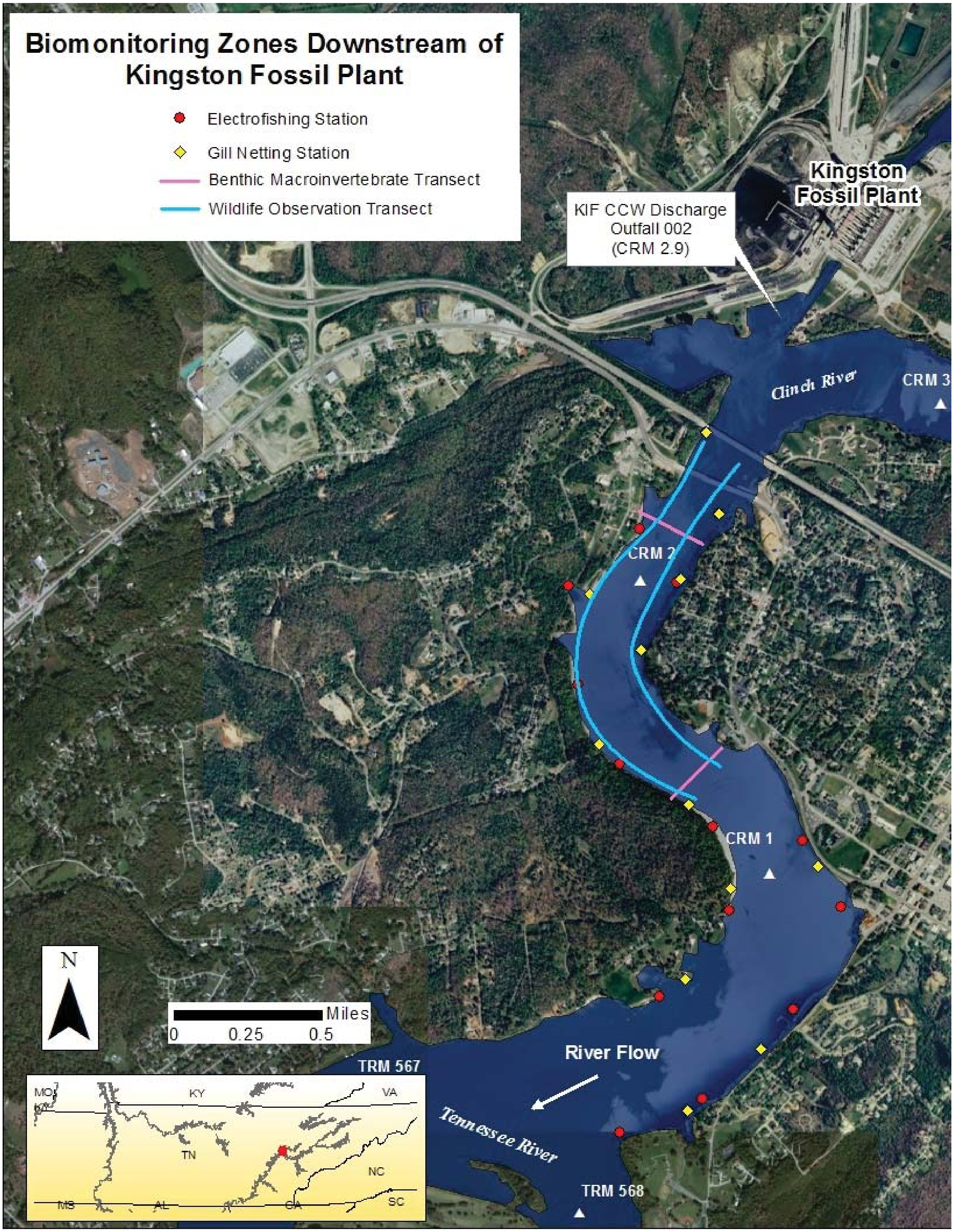
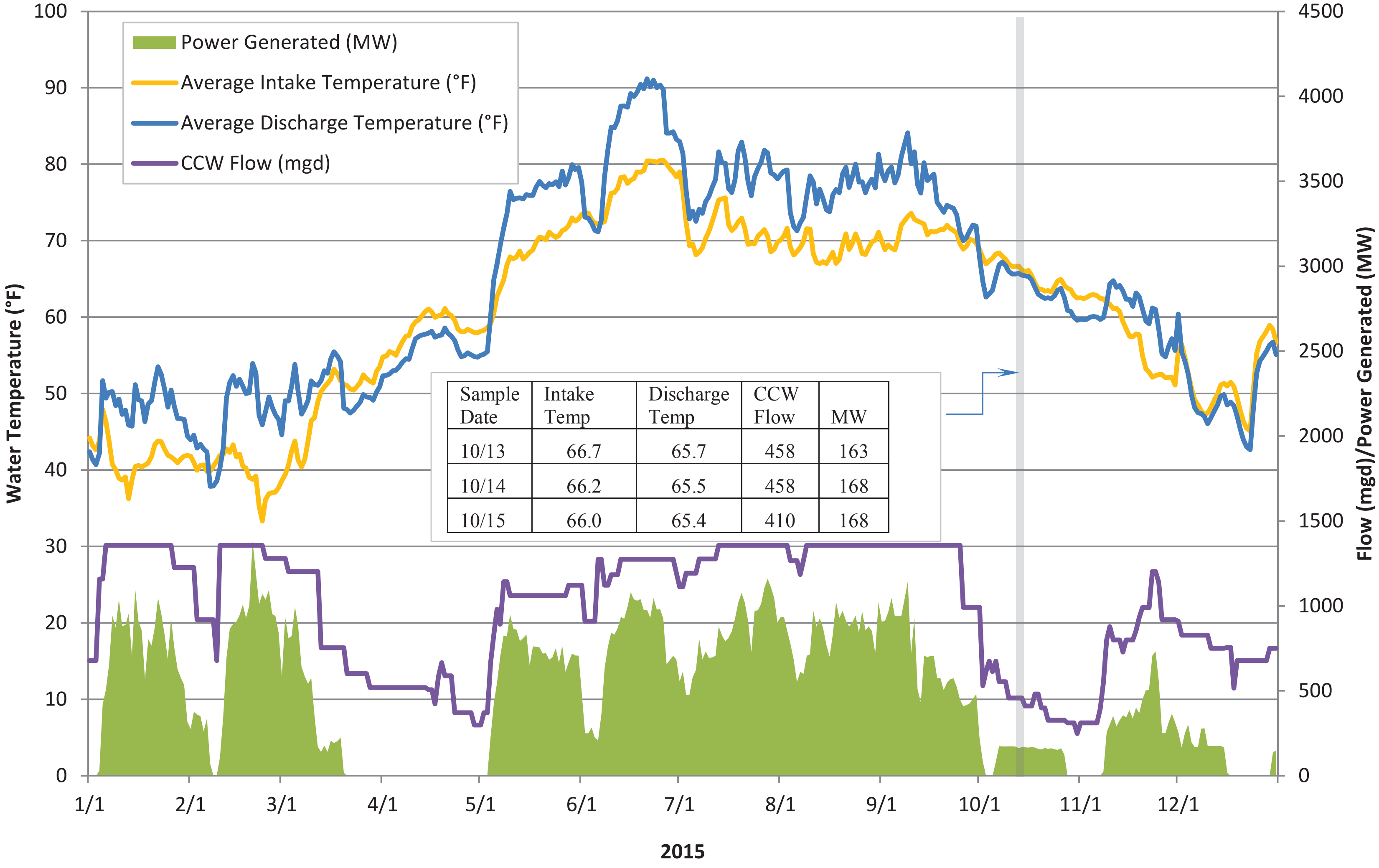


Figure 4. Biological monitoring zones downstream of Kingston Fossil Plant



Sample Date	Intake Temp	Discharge Temp	CCW Flow	MW
10/13	66.7	65.7	458	163
10/14	66.2	65.5	458	168
10/15	66.0	65.4	410	168

Figure 5. **Daily average intake and discharge temperatures and flow through the condenser cooling water (CCW) system, and daily average power generated by Kingston Fossil Plant during 2015**

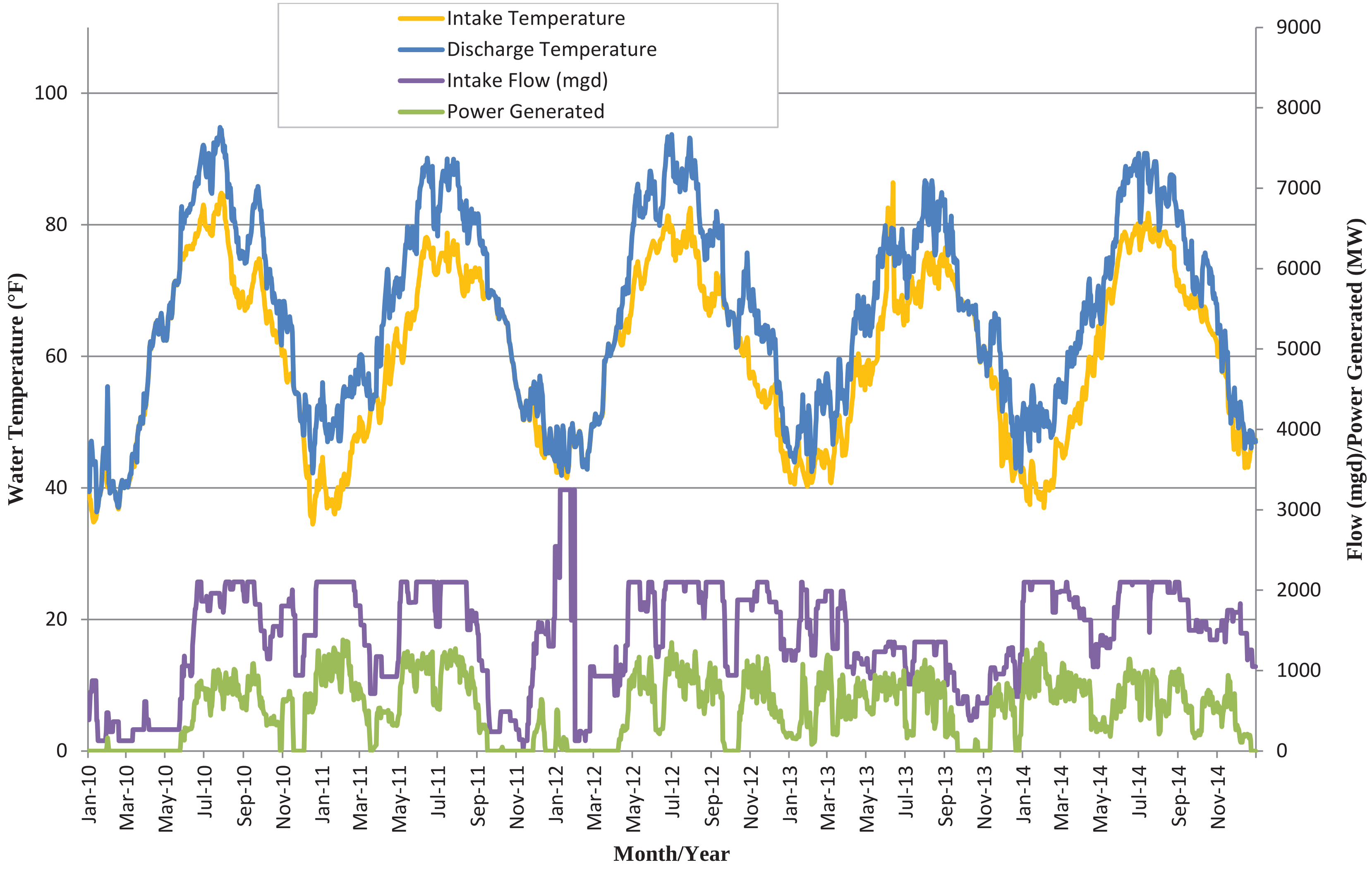


Figure 6. Daily average intake and discharge temperatures and flow through the condenser cooling water (CCW) system, and daily average power generated by Kingston Fossil Plant from 2010 through 2014

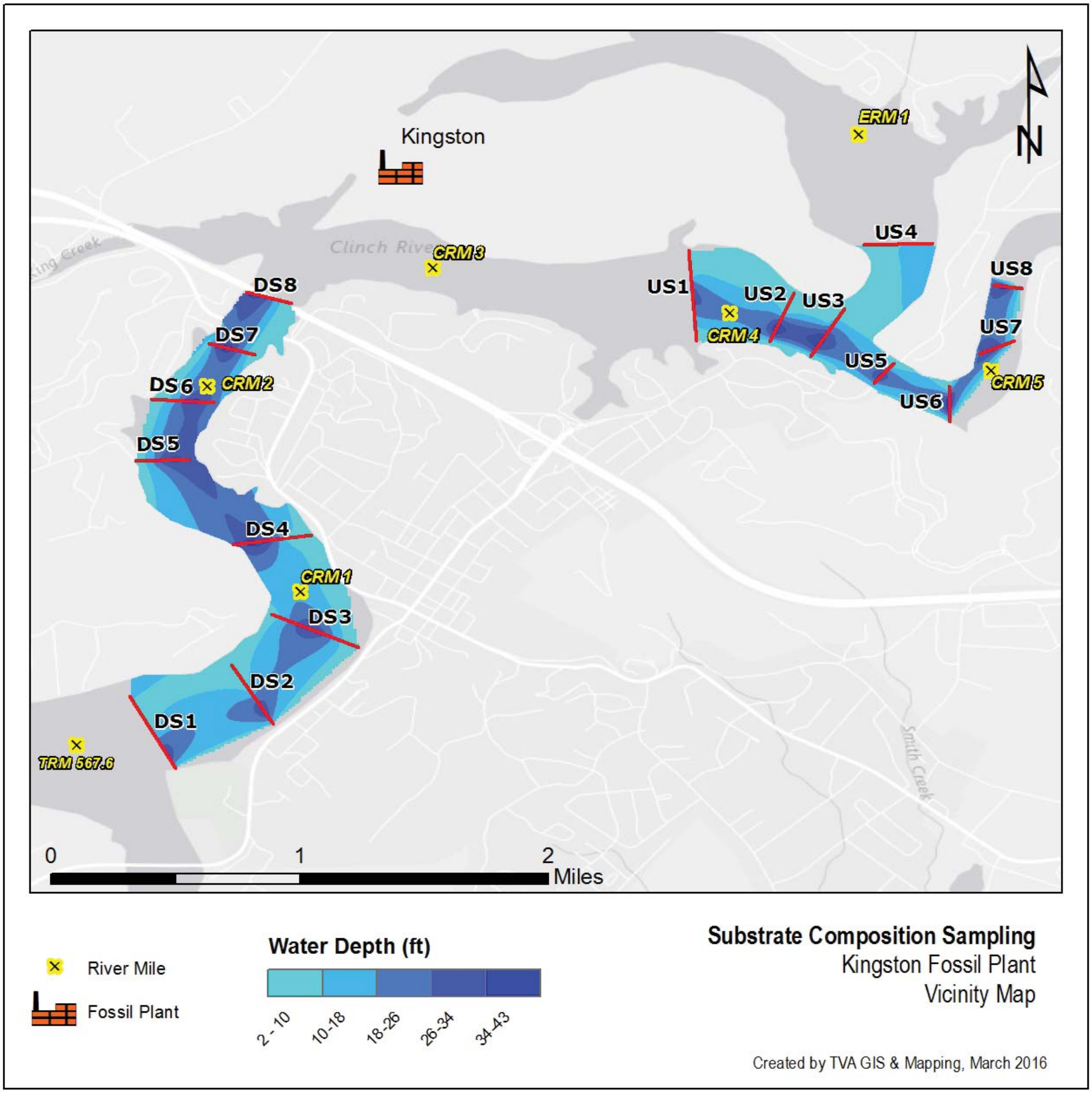


Figure 7. Locations of transects used to characterize shoreline and river bottom habitat upstream and downstream of Kingston Fossil Plant, and water depths within the two sample reaches

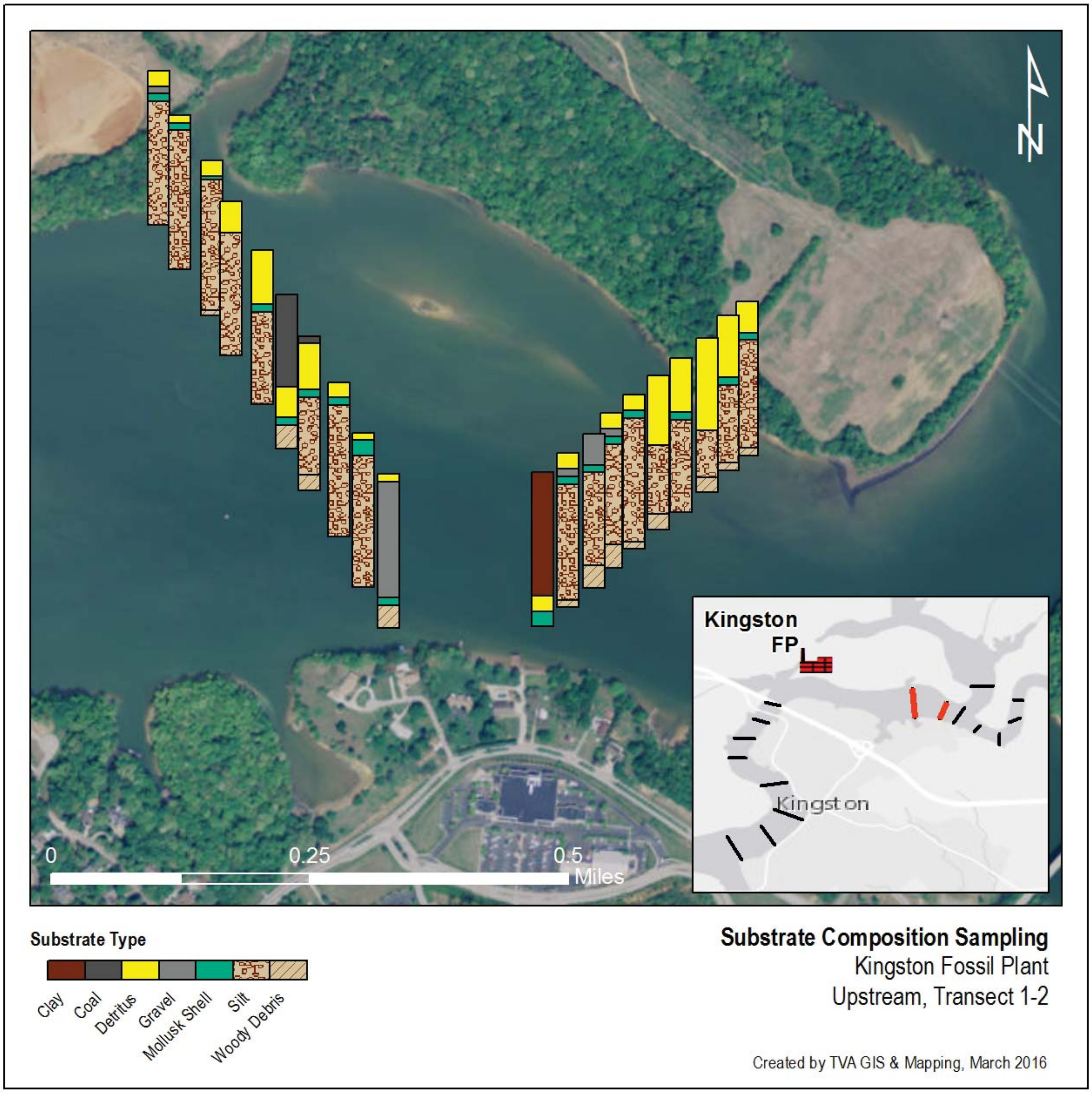


Figure 8. Composition of substrate samples collected at ten points equally spaced along each of transects 1 and 2 upstream of Kingston Fossil Plant

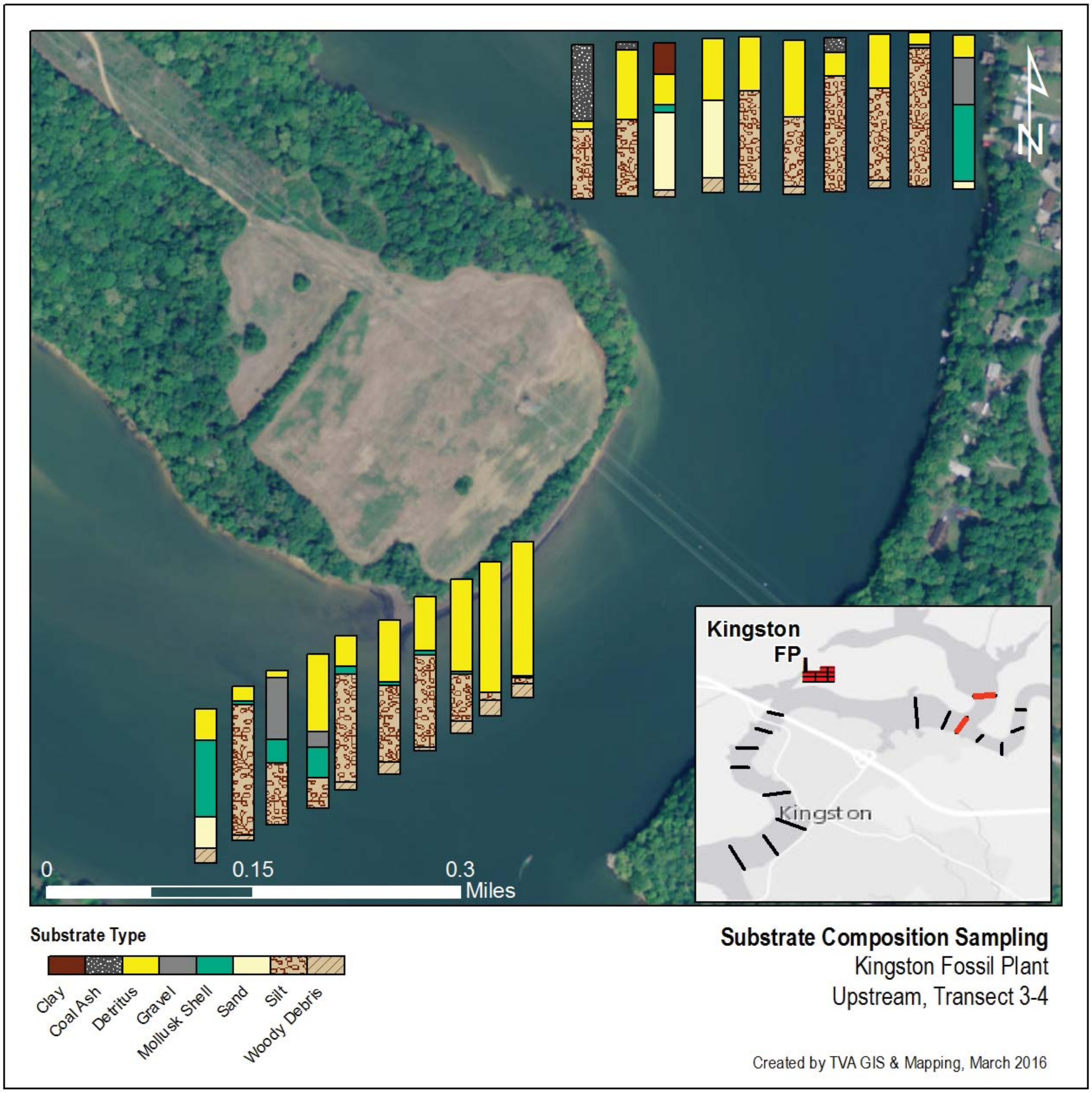


Figure 9. Composition of substrate samples collected at ten points equally spaced along each of transects 3 and 4 upstream of Kingston Fossil Plant

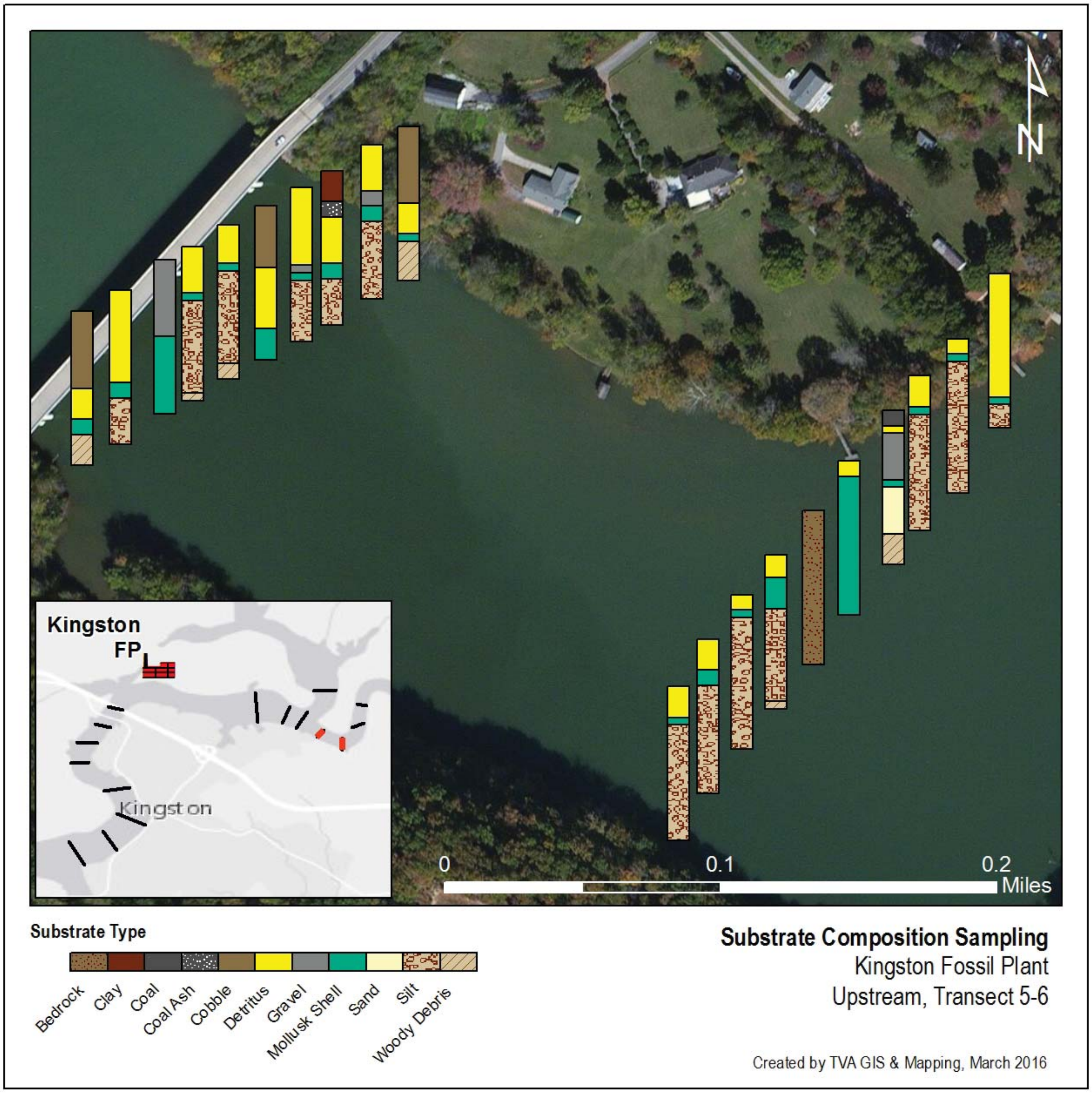


Figure 10. Composition of substrate samples collected at ten points equally spaced along each of transects 5 and 6 upstream of Kingston Fossil Plant

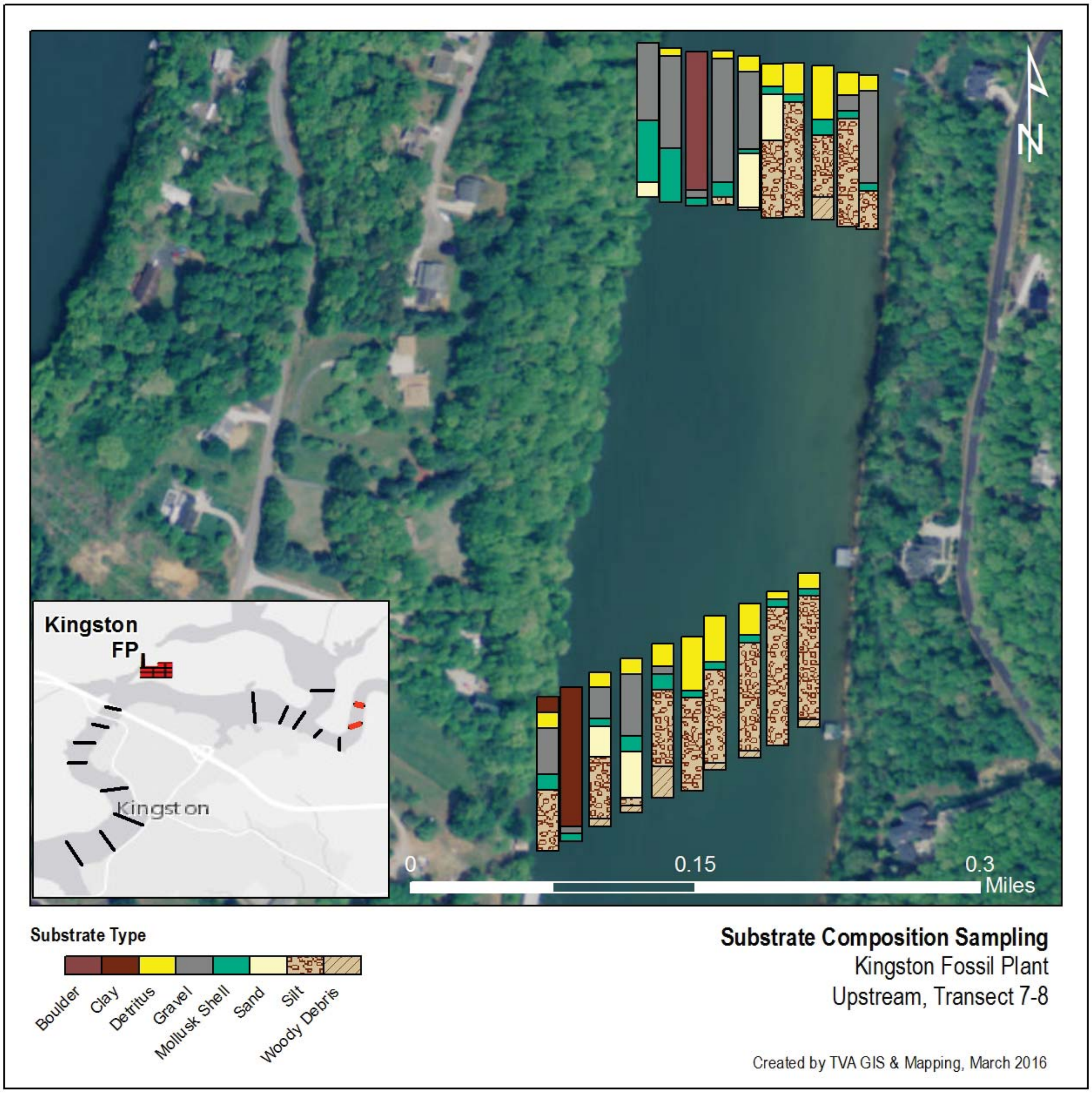


Figure 11. Composition of substrate samples collected at ten points equally spaced along each of transects 7 and 8 upstream of Kingston Fossil Plant

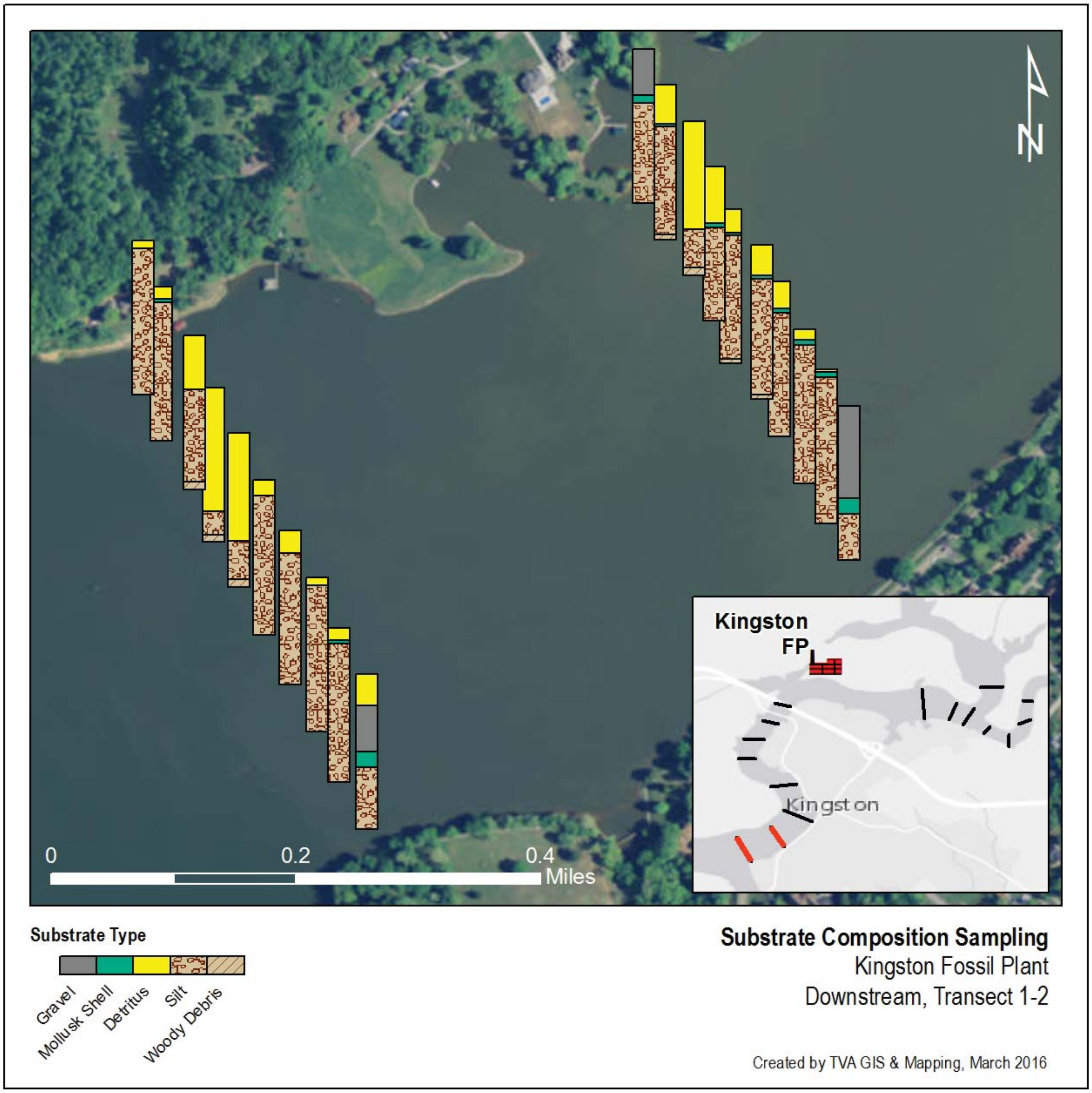


Figure 12. Composition of substrate samples collected at ten points equally spaced along each of transects 1 and 2 downstream of Kingston Fossil Plant

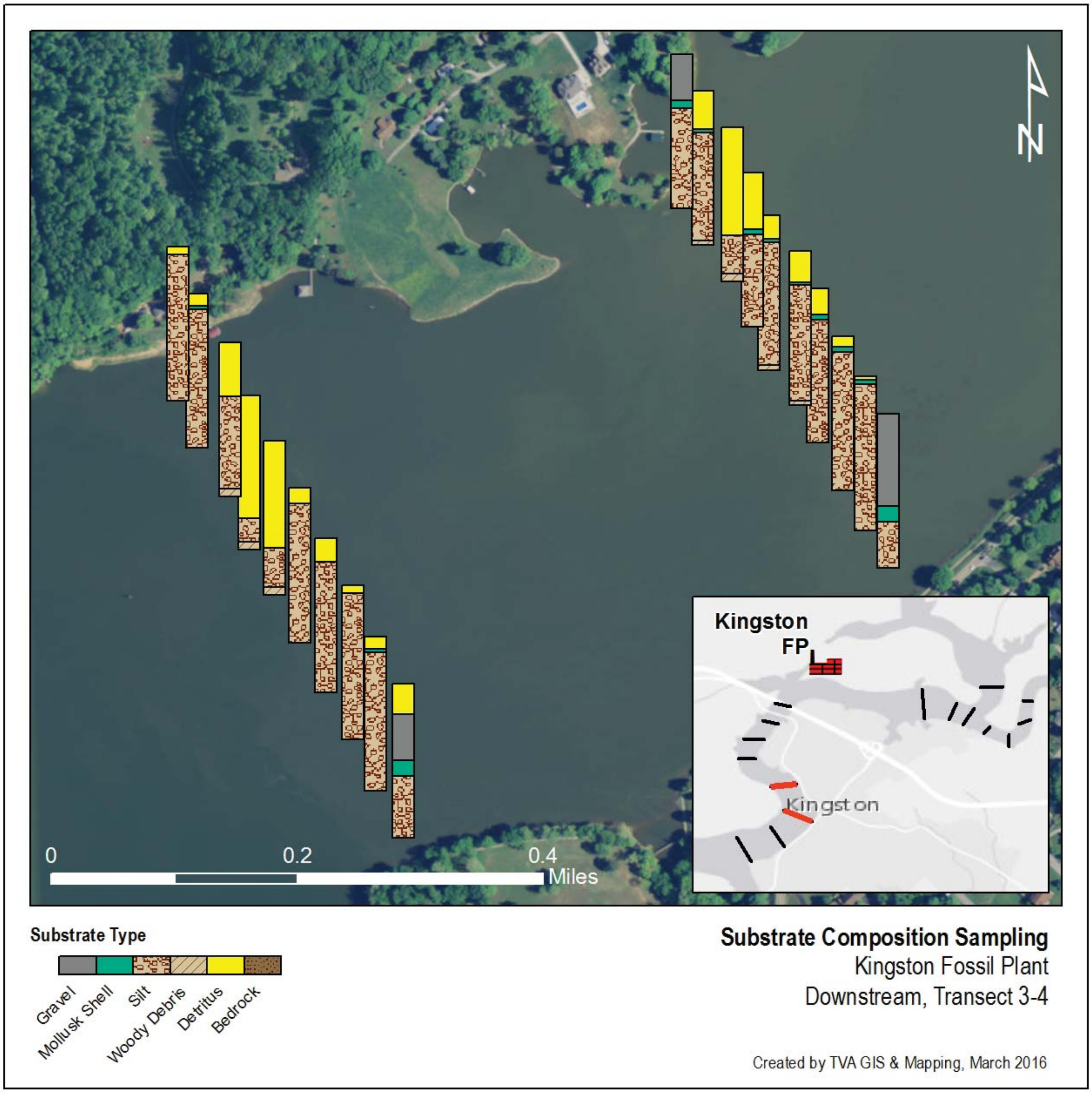


Figure 13. Composition of substrate samples collected at ten points equally spaced along each of transects 3 and 4 downstream of Kingston Fossil Plant

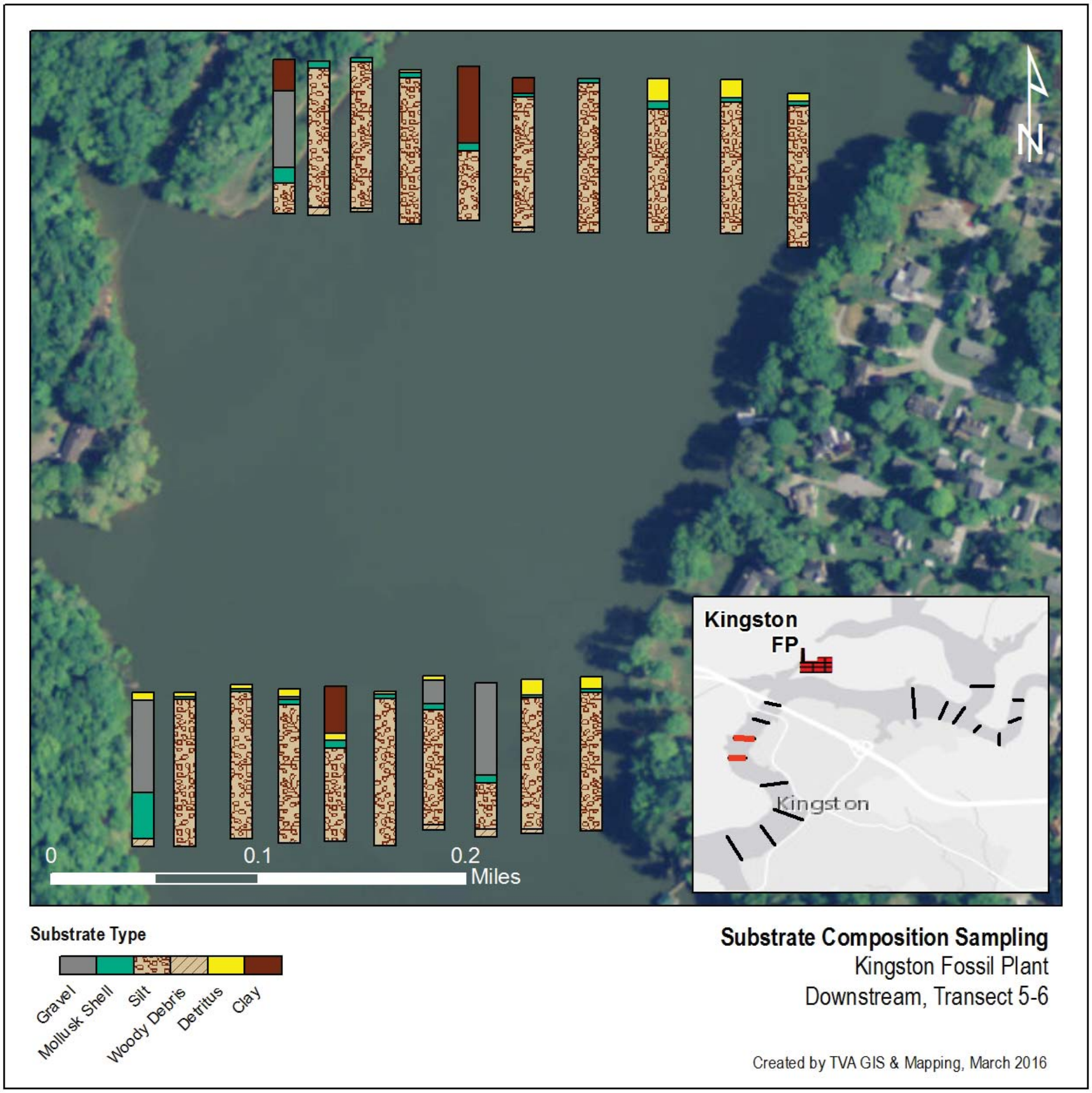


Figure 14. Composition of substrate samples collected at ten points equally spaced along each of transects 5 and 6 downstream of Kingston Fossil Plant

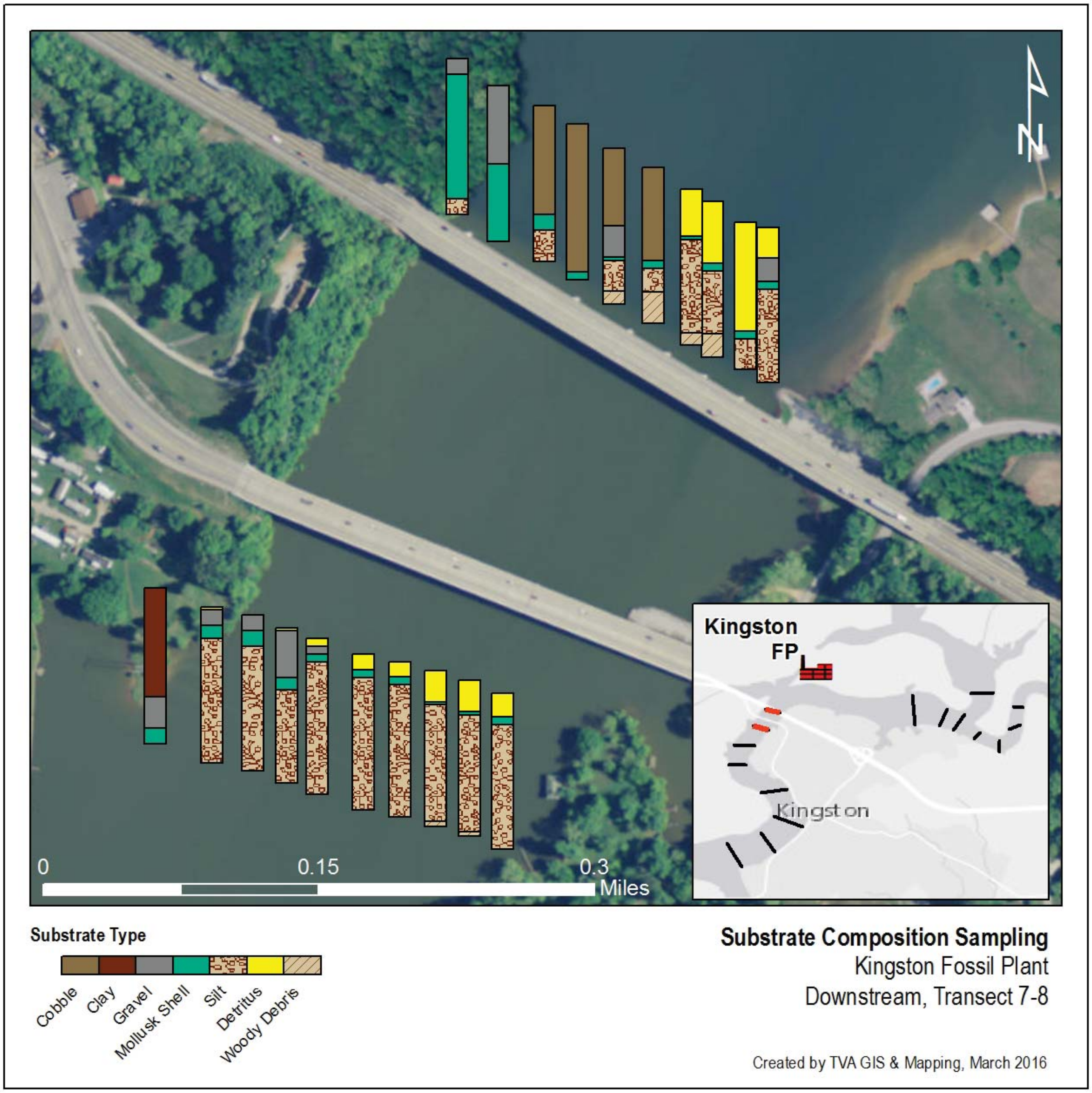


Figure 15. Composition of substrate samples collected at ten points equally spaced along each of transects 7 and 8 downstream of Kingston Fossil Plant

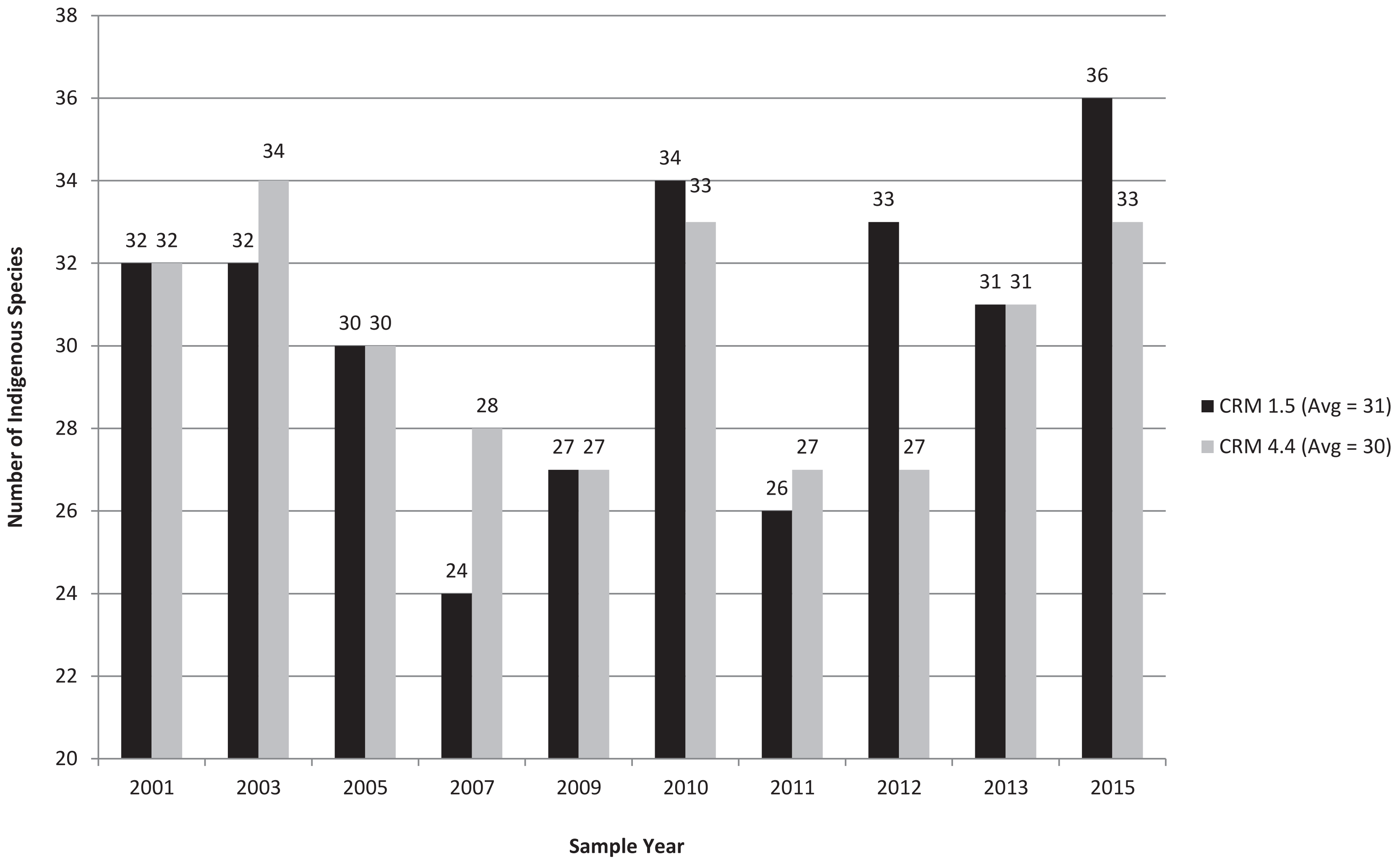


Figure 16. Numbers of indigenous fish species collected during autumn RFAI samples upstream and downstream of KIF from 2001 through 2015

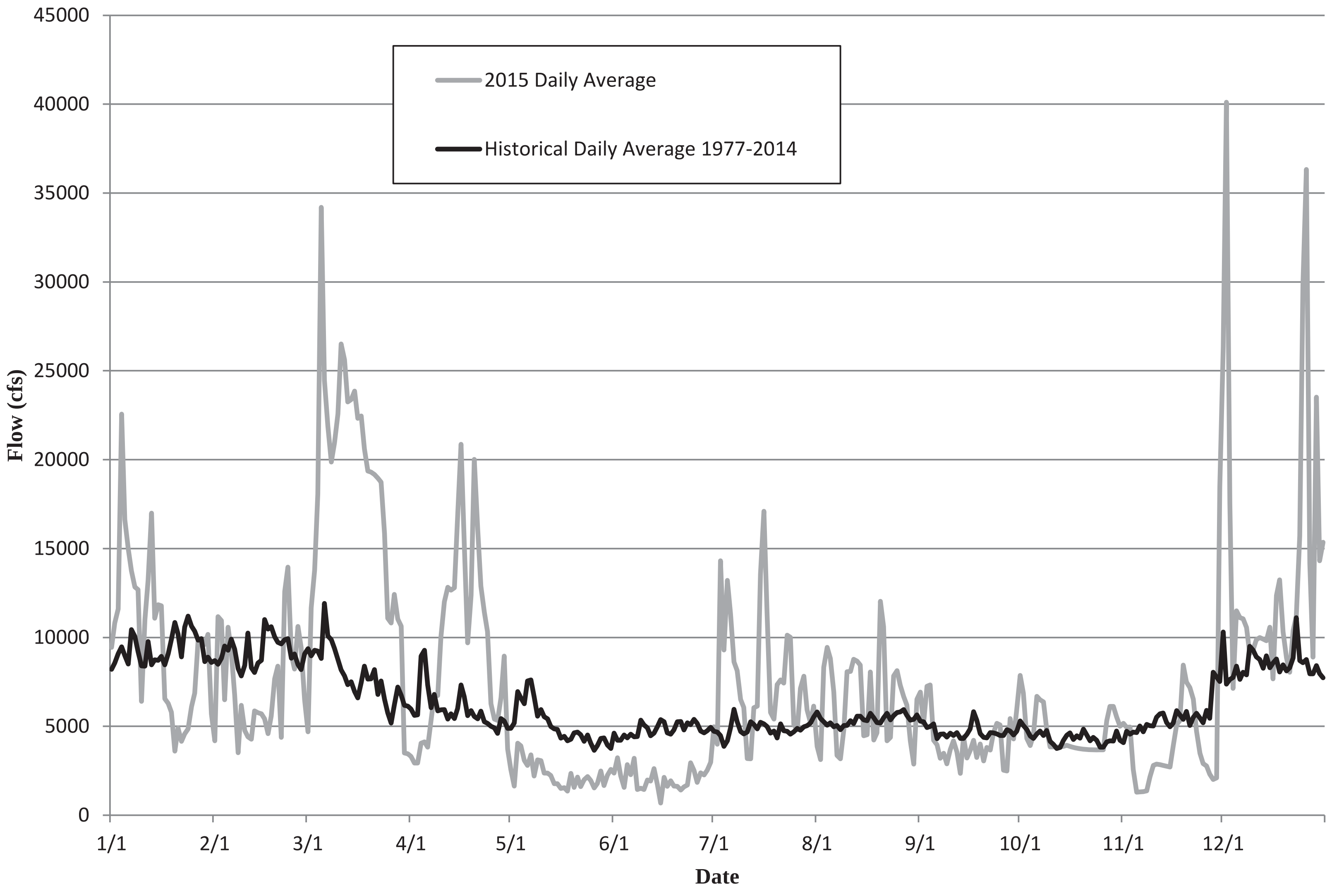


Figure 17. Daily mean flows past Kingston Fossil Plant during 2015, and historic total daily mean flows averaged from 1977-2014

Table 1. Shoreline Aquatic Habitat Index (SAHI) metrics and scoring criteria

Metric	Scoring Criteria	Score
Cover	Stable cover (boulders, rootwads, brush, logs, aquatic vegetation, artificial structures) in 25 to 75 % of the drawdown zone	5
	Stable cover in 10 to 25 % or > 75 % of the drawdown zone	3
	Stable Cover in < 10 % of the drawdown zone	1
Substrate	Percent of drawdown zone with gravel substrate > 40	5
	Percent of drawdown zone with gravel substrate between 10 and 40	3
	Percent substrate gravel < 10	1
Erosion	Little or no evidence of erosion or bank failure. Most bank surfaces stabilized by woody vegetation.	5
	Areas of erosion small and infrequent. Potential for increased erosion due to less desirable vegetation cover (grasses) on > 25 % of bank surfaces.	3
	Areas of erosion extensive, exposed or collapsing banks occur along > 30% of shoreline.	1
Canopy Cover	Tree or shrub canopy > 60 % along adjacent bank	5
	Tree or shrub canopy 30 to 60 % along adjacent bank	3
	Tree or shrub canopy < 30 % along adjacent bank	1
Riparian Zone	Width buffered > 18 meters	5
	Width buffered between 6 and 18 meters	3
	Width buffered < 6 meters	1
Habitat	Habitat diversity optimum. All major habitats (logs, brush, native vegetation, boulders, gravel) present in proportions characteristic of high quality, sufficient to support all life history aspects of target species. Ready access to deeper sanctuary areas present.	5
	Habitat diversity less than optimum. Most major habitats present, but proportion of one is less than desirable, reducing species diversity. No ready access to deeper sanctuary areas.	3
	Habitat diversity is nearly lacking. One habitat dominates, leading to lower species diversity. No ready access to deeper sanctuary areas.	1
Gradient	Drawdown zone gradient abrupt (> 1 meter per 10 meters). Less than 10 percent of shoreline with abrupt gradient due to dredging.	5
	Drawdown zone gradient abrupt. (> 1 meter per 10 meters) in 10 to 40 % of the shoreline resulting from dredging. Rip-rap used to stabilize bank along > 10 % of the shoreline.	3
	Drawdown zone gradient abrupt in > 40 % of the shoreline resulting from dredging. Seawalls used to stabilize bank along > 10 % of the shoreline.	1

Table 2. Expected trophic guild proportions* and expected numbers of fish species* in upper mainstem Tennessee River reservoir transition zones, compared to values observed during Autumn 2015 monitoring at Kingston Fossil Plant

	Transition Zones in Upper Mainstem Tennessee River								Observed Upstream of KIF (CRM 4.4) – Autumn 2015		Observed Downstream of KIF (CRM 1.5) – Autumn 2015	
	Proportion (%)				Number of species							
	Trisected range [a]			Average [b]	Trisected range [a]			Average [b]				
Trophic Guild	-	Expected	+		-	Expected	+		Proportion (%)	Number of Species	Proportion (%)	Number of Species
Benthic Invertivore	< 2.6	2.6 to 5.3	> 5.3	3.2 ± 0.2	< 2	2 to 4	> 4	3.9 ± 0.2	10.8	6	3.2	5
Insectivore	< 25.3	25.3 to 50.7	> 50.7	46.6 ± 2.3	< 4	4 to 9	> 9	9.8 ± 0.5	67.8	11	30.5	12
Top Carnivore	< 18.8	18.8 to 37.6	> 37.6	17.1 ± 0.9	< 5	5 to 9	> 9	10.9 ± 0.5	13.5	12	9.8	13
Omnivore	> 40.3	20.2 to 40.3	< 20.2	28.5 ± 1.4	> 6	3 to 6	< 3	6.8 ± 0.3	7.3	6	10.3	8
Planktivore	> 21.0	10.5 to 21.0	< 10.5	3.1 ± 0.2	0	1	> 1	1.1 ± 0.1	0.6	1	46.1	1
Herbivore	< 0.2	0.2 to 0.4	> 0.4	0.2 ± 0.0	0	1	> 1	1.1 ± 0.1	--	--	--	--
Specialized Insectivore	--	--	--	--	--	--	--	--	0.1	1	0.1	2
Parasitic	--	--	--	--	--	--	--	--	0.1	1	--	--

**Expected values were calculated from data collected over 750 electrofishing runs and 500 overnight experimental gill net sets in transition areas of upper mainstem Tennessee River Reservoirs.*

[a] *Trisected ranges are intended to show below expected (-), expected, and above expected (+) values for trophic level proportions and species occurring within the transition zones in upper mainstem Tennessee River reservoirs.*

[b] *Average expected values are bound by 95% confidence intervals.*

Table 3. RFAI scoring criteria (2002) for forebay, transition, and inflow sections of upper mainstem reservoirs in the Tennessee River system

		Scoring Criteria								
		Forebay			Transition			Inflow		
Metric	Gear	1	3	5	1	3	5	1	3	5
1. Total number of indigenous species	Combined	<14	14-27	>27	<15	15-29	>29	<14	14-27	>27
2. Number of centrarchid species	Combined	<2	2-4	>4	<2	2-4	>4	<3	3-4	>4
3. Number of benthic invertivores	Combined	<4	4-7	>7	<4	4-7	>7	<3	3-6	>6
4. Number of intolerant species	Combined	<2	2-4	>4	<2	2-4	>4	<2	2-4	>4
5. Percent of tolerant individuals	Electrofishing	>62%	31-62%	<31%	>62%	31-62%	<31%	>58%	29-58%	<29%
	Gill netting	>28%	14-28%	<14%	>32%	16-32%	<16%			
6. Percent dominance by one species	Electrofishing	>50%	25-50%	<25%	>40%	20-40%	<20%	>46%	23-46%	<23%
	Gill netting	>29%	15-29%	<15%	>28%	14-28%	<14%			
7. Percent of non-indigenous species	Electrofishing	>4%	2-4%	<2%	>6%	3-6%	<3%	>17%	8-17%	<8%
	Gill netting	>16%	8-16%	<8%	>9%	5-9%	<5%			
8. Number of top carnivore species	Combined	<4	4-7	>7	<4	4-7	>7	<3	3-6	>6
9. Percent of individuals as top carnivores	Electrofishing	<5%	5-10%	>10%	<6%	6-11%	>11%	<11%	11-22%	>22%
	Gill netting	<25%	25-50%	>50%	<26%	26-52%	>52%			
10. Percent of individuals as omnivores	Electrofishing	>49%	24-49%	<24%	>44%	22-44%	<22%	>55%	27-55%	<27%
	Gill netting	>34%	17-34%	<17%	>46%	23-46%	<23%			
11. Average number per run	Electrofishing	<121	121-241	>241	<105	105-210	>210	<51	51-102	>102
	Gill netting	<12	12-24	>24	<12	12-24	>24			
12. Percent of individuals with anomalies	Electrofishing	>5%	2-5%	<2%	>5%	2-5%	<2%	>5%	2-5%	<2%
	Gill netting	>5%	2-5%	<2%	>5%	2-5%	<2%			

**Upper mainstem reservoirs include Chickamauga, Fort Loudon, Melton Hill, Nickajack, Tellico, and Watts Bar. Transition scoring criteria were used for sites upstream and downstream of Kingston Fossil Plant.*

Table 4. Scoring criteria for laboratory-processed benthic macroinvertebrate community samples from inflow, transition, and forebay sections of mainstem Tennessee River reservoirs

Benthic Community Metrics	Scoring Criteria								
	Inflow			Transition Zone			Forebay		
	1	3	5	1	3	5	1	3	5
1. Average number of taxa	<4.2	4.2-8.3	>8.3	<3.3	3.3-6.6	>6.6	<2.8	2.8-5.5	>5.5
2. Proportion of samples with long-lived organisms	<0.6	0.6-0.8	>0.8	<0.6	0.6-0.9	>0.9	<0.6	0.6-0.8	>0.8
3. Average number of EPT taxa	<0.9	0.9-1.9	>1.9	<0.6	0.6-1.4	>1.4	<0.6	0.6-0.9	>0.9
4. Average proportion of oligochaete individuals	>23.9	23.9-12.0	<12.0	>21.9	21.9-11.0	<11.0	>41.9	41.9-21.0	<21.0
5. Average proportion of total abundance comprised by the two most abundant taxa	>86.2	86.2-73.1	<73.1	>87.9	87.9-77.8	<77.8	>90.3	90.3-81.7	<81.7
6. Average density excluding chironomids and oligochaetes	<400.0	400.0-799.9	>799.9	<305.0	305.0-609.9	>609.9	<125.0	125.0-249.9	>249.9
7. Zero Samples: proportion of samples containing no organisms	>0	-	0	>0	-	0	>0	-	0

Transition scoring criteria were used to score sites upstream and downstream of KIF.

Table 5. Daily average intake and discharge temperatures (°F) and flow rates (mgd) of the condenser circulating water (CCW) system, and the daily average generation (MW) at Kingston Fossil Plant during 2015

Date	Intake Temp	Discharge Temp	Flow	MW	Date	Intake Temp	Discharge Temp	Flow	MW	Date	Intake Temp	Discharge Temp	Flow	MW
1/1/2015	44.20	42.37	679	0.5	2/26/2015	37.04	48.23	1279	953.0	4/23/2015	59.56	56.94	372	0.4
1/2/2015	43.17	41.35	679	0.5	2/27/2015	37.10	47.24	1279	940.9	4/24/2015	58.41	55.72	372	0.4
1/3/2015	42.62	40.70	679	0.5	2/28/2015	37.72	46.63	1279	841.9	4/25/2015	58.08	54.83	372	0.4
1/4/2015	43.81	42.21	1158	29.9	3/1/2015	38.59	44.63	1279	584.8	4/26/2015	58.10	54.93	372	0.4
1/5/2015	47.94	51.70	1158	418.1	3/2/2015	39.41	49.08	1279	935.4	4/27/2015	58.40	55.34	372	0.4
1/6/2015	46.36	49.40	1357	506.0	3/3/2015	40.63	49.03	1202	809.7	4/28/2015	58.20	55.10	372	0.4
1/7/2015	43.79	50.20	1357	657.6	3/4/2015	42.54	51.00	1202	822.9	4/29/2015	57.99	54.83	299	0.4
1/8/2015	40.77	50.24	1357	942.8	3/5/2015	43.80	53.84	1202	996.0	4/30/2015	57.95	54.76	299	0.4
1/9/2015	40.02	48.42	1357	871.9	3/6/2015	41.32	50.31	1202	878.9	5/1/2015	58.16	55.01	299	0.3
1/10/2015	38.92	49.28	1357	1039.3	3/7/2015	40.39	47.31	1202	643.7	5/2/2015	58.27	55.14	372	0.7
1/11/2015	38.69	47.28	1357	881.3	3/8/2015	41.40	48.10	1202	586.2	5/3/2015	58.64	55.49	372	0.7
1/12/2015	39.11	47.85	1357	888.2	3/9/2015	43.76	49.11	1202	542.1	5/4/2015	59.15	60.13	665	225.8
1/13/2015	36.26	45.89	1357	954.3	3/10/2015	46.46	51.67	1202	575.7	5/5/2015	60.51	64.93	831	424.2
1/14/2015	38.75	45.73	1357	705.7	3/11/2015	46.83	51.20	1202	353.5	5/6/2015	62.73	66.88	980	550.5
1/15/2015	40.48	51.18	1357	1099.8	3/12/2015	48.96	51.09	1202	172.1	5/7/2015	63.77	69.38	892	706.3
1/16/2015	40.59	49.20	1357	909.9	3/13/2015	50.24	51.70	754	140.2	5/8/2015	64.86	71.63	1142	825.5
1/17/2015	40.39	49.02	1357	854.9	3/14/2015	50.86	52.98	754	178.5	5/9/2015	66.85	73.51	1142	820.8
1/18/2015	40.64	46.34	1357	566.8	3/15/2015	51.32	52.67	754	141.1	5/10/2015	67.87	76.43	1060	950.0
1/19/2015	40.93	48.59	1357	804.8	3/16/2015	51.87	54.52	754	207.1	5/11/2015	67.65	75.36	1060	866.9
1/20/2015	41.78	49.11	1357	766.5	3/17/2015	53.20	55.45	754	193.3	5/12/2015	67.89	75.53	1060	859.0
1/21/2015	43.35	51.52	1357	875.3	3/18/2015	52.60	54.90	754	203.8	5/13/2015	68.64	75.60	1060	793.6
1/22/2015	43.78	53.52	1357	1047.8	3/19/2015	51.70	54.14	754	226.4	5/14/2015	67.61	75.47	1060	810.3
1/23/2015	43.72	52.52	1357	954.0	3/20/2015	51.20	48.08	754	17.4	5/15/2015	67.97	76.04	1060	832.8
1/24/2015	42.77	50.66	1357	833.4	3/21/2015	51.04	47.91	601	0.4	5/16/2015	68.47	75.92	1060	650.7
1/25/2015	41.92	48.21	1357	686.7	3/22/2015	50.59	47.47	601	0.4	5/17/2015	68.78	75.94	1060	761.8
1/26/2015	41.73	50.46	1357	928.1	3/23/2015	50.46	47.85	601	0.4	5/18/2015	69.76	77.00	1060	759.8
1/27/2015	41.36	48.33	1226	751.9	3/24/2015	50.92	48.36	601	0.7	5/19/2015	70.48	77.75	1060	756.1
1/28/2015	40.95	46.75	1226	627.1	3/25/2015	51.39	48.84	601	0.6	5/20/2015	70.36	77.26	1060	719.9
1/29/2015	41.45	46.73	1226	577.0	3/26/2015	52.46	49.88	601	0.5	5/21/2015	70.12	76.94	1060	721.9
1/30/2015	41.82	46.62	1226	535.4	3/27/2015	51.98	49.54	601	0.5	5/22/2015	71.12	77.45	1060	683.5
1/31/2015	41.88	44.44	1226	318.7	3/28/2015	51.60	49.49	520	0.4	5/23/2015	70.75	77.33	1060	698.7
2/1/2015	41.84	43.96	1226	275.5	3/29/2015	51.38	49.14	520	0.4	5/24/2015	70.42	77.69	1060	751.5
2/2/2015	40.99	44.56	1226	376.8	3/30/2015	52.86	50.18	520	0.5	5/25/2015	70.68	77.08	1060	665.1
2/3/2015	39.98	42.88	919	360.5	3/31/2015	53.52	50.90	520	0.4	5/26/2015	71.29	79.10	1060	765.1
2/4/2015	40.59	43.35	919	351.4	4/1/2015	54.81	52.31	520	0.5	5/27/2015	71.50	77.27	1060	612.5
2/5/2015	40.68	42.74	919	262.2	4/2/2015	54.91	52.40	520	0.4	5/28/2015	71.99	78.31	1122	670.2
2/6/2015	39.85	42.35	919	337.7	4/3/2015	55.50	52.58	520	0.4	5/29/2015	72.99	79.93	1122	720.2
2/7/2015	39.83	37.88	919	70.8	4/4/2015	55.33	52.97	520	0.4	5/30/2015	72.56	79.31	1122	708.2
2/8/2015	40.51	37.90	919	0.5	4/5/2015	55.00	53.06	520	0.4	5/31/2015	72.84	79.56	1122	707.4
2/9/2015	41.21	38.58	679	0.7	4/6/2015	55.96	53.49	520	0.4	6/1/2015	73.45	77.59	1122	483.5
2/10/2015	41.93	40.32	1357	109.8	4/7/2015	56.83	54.13	520	0.4	6/2/2015	73.73	73.09	909	250.3
2/11/2015	42.05	42.91	1357	346.7	4/8/2015	57.49	54.56	520	0.4	6/3/2015	73.56	72.92	909	250.8
2/12/2015	42.78	49.41	1357	694.3	4/9/2015	57.59	54.48	520	0.3	6/4/2015	72.70	72.27	909	283.9
2/13/2015	42.30	51.41	1357	864.2	4/10/2015	58.82	55.92	520	0.3	6/5/2015	72.27	71.34	909	223.7
2/14/2015	43.30	52.35	1357	892.7	4/11/2015	59.37	57.19	520	0.4	6/6/2015	72.23	71.18	1274	210.1
2/15/2015	41.71	50.97	1357	906.5	4/12/2015	59.67	57.51	520	0.4	6/7/2015	72.34	72.70	1274	361.7
2/16/2015	42.06	51.85	1357	945.6	4/13/2015	60.23	57.68	520	0.4	6/8/2015	72.48	78.34	1122	634.1
2/17/2015	40.52	50.99	1357	1007.9	4/14/2015	60.75	57.78	520	0.4	6/9/2015	74.42	82.00	1122	759.3
2/18/2015	40.25	50.00	1357	929.6	4/15/2015	61.08	57.91	507	0.4	6/10/2015	76.21	84.82	1184	842.7
2/19/2015	39.02	50.11	1357	1002.1	4/16/2015	60.68	58.15	507	0.4	6/11/2015	76.30	84.78	1184	831.3
2/20/2015	38.80	53.93	1357	1379.9	4/17/2015	59.97	57.39	424	0.4	6/12/2015	76.82	85.72	1184	869.4
2/21/2015	39.22	52.72	1357	1197.3	4/18/2015	60.18	57.55	585	0.4	6/13/2015	78.28	87.59	1274	935.8
2/22/2015	35.33	47.17	1357	1011.0	4/19/2015	60.27	57.67	666	0.4	6/14/2015	78.37	87.64	1274	924.4
2/23/2015	33.34	45.91	1357	1070.7	4/20/2015	61.14	58.59	588	0.4	6/15/2015	77.50	87.47	1274	993.3
2/24/2015	36.13	47.62	1279	1036.6	4/21/2015	60.46	57.88	588	0.4	6/16/2015	77.93	89.24	1274	1080.6
2/25/2015	36.89	49.55	1279	1093.5	4/22/2015	60.21	57.53	588	0.4	6/17/2015	78.11	88.85	1274	1038.4

Table 5. (Continued).

Date	Intake Temp	Discharge Temp	Flow	MW	Date	Intake Temp	Discharge Temp	Flow	MW	Date	Intake Temp	Discharge Temp	Flow	MW
6/18/2015	78.99	89.44	1274	1030.9	8/23/2015	69.64	78.33	1357	905.0	10/28/2015	63.80	60.88	311	0.9
6/19/2015	78.98	90.44	1274	1040.2	8/24/2015	70.89	80.01	1357	942.9	10/29/2015	63.58	60.75	311	0.4
6/20/2015	79.17	89.87	1274	975.1	8/25/2015	69.82	77.69	1357	842.7	10/30/2015	62.85	59.98	311	0.3
6/21/2015	80.42	91.16	1274	978.0	8/26/2015	68.29	77.69	1357	969.0	10/31/2015	62.49	59.58	249	0.3
6/22/2015	80.43	90.12	1274	930.4	8/27/2015	68.18	76.29	1357	857.8	11/1/2015	62.52	59.75	311	0.5
6/23/2015	80.40	90.99	1274	1046.3	8/28/2015	69.05	77.39	1357	879.9	11/2/2015	62.41	59.67	311	0.3
6/24/2015	80.25	90.02	1274	977.8	8/29/2015	69.85	78.05	1357	851.8	11/3/2015	62.61	59.73	311	0.3
6/25/2015	80.49	90.38	1274	982.4	8/30/2015	70.08	76.89	1357	720.5	11/4/2015	62.88	60.00	311	0.4
6/26/2015	80.51	89.78	1274	924.5	8/31/2015	71.11	81.30	1357	1021.9	11/5/2015	62.95	60.10	311	0.3
6/27/2015	80.06	84.09	1274	655.6	9/1/2015	69.96	78.90	1357	907.3	11/6/2015	62.81	60.03	311	0.3
6/28/2015	79.47	84.07	1274	681.5	9/2/2015	68.81	77.85	1357	911.5	11/7/2015	62.48	59.71	393	0.4
6/29/2015	78.93	84.23	1274	706.3	9/3/2015	69.44	79.14	1357	964.2	11/8/2015	62.37	59.93	547	24.8
6/30/2015	78.37	83.27	1193	685.5	9/4/2015	69.04	79.63	1357	1046.7	11/9/2015	61.95	61.72	800	257.3
7/1/2015	79.00	82.96	1112	555.7	9/5/2015	68.78	77.57	1357	941.9	11/10/2015	61.67	64.33	878	304.9
7/2/2015	76.63	81.45	1112	614.7	9/6/2015	70.16	78.58	1357	942.2	11/11/2015	61.09	64.77	800	352.5
7/3/2015	72.46	76.70	1193	476.3	9/7/2015	72.04	80.95	1357	940.1	11/12/2015	61.17	63.89	800	291.4
7/4/2015	69.35	72.85	1193	476.8	9/8/2015	72.59	82.57	1357	1040.6	11/13/2015	60.70	64.13	800	328.0
7/5/2015	69.55	73.84	1193	580.9	9/9/2015	73.16	84.09	1357	1143.0	11/14/2015	59.43	63.42	728	356.0
7/6/2015	68.17	72.54	1193	622.5	9/10/2015	73.59	80.05	1357	714.4	11/15/2015	58.48	62.36	800	345.0
7/7/2015	68.52	74.10	1276	807.6	9/11/2015	72.82	81.62	1357	928.7	11/16/2015	57.49	62.31	800	386.6
7/8/2015	69.07	73.59	1276	685.1	9/12/2015	72.58	77.32	1357	508.5	11/17/2015	57.44	61.41	800	337.6
7/9/2015	70.30	75.10	1276	732.4	9/13/2015	72.37	76.24	1357	432.0	11/18/2015	57.82	63.15	854	400.8
7/10/2015	71.29	75.81	1276	693.7	9/14/2015	72.19	80.18	1357	708.0	11/19/2015	57.70	62.66	931	369.8
7/11/2015	72.48	77.02	1276	697.2	9/15/2015	70.76	77.88	1357	697.3	11/20/2015	55.00	61.11	990	450.6
7/12/2015	73.84	78.00	1276	706.0	9/16/2015	71.25	78.31	1357	706.6	11/21/2015	53.21	59.50	990	502.2
7/13/2015	75.33	81.61	1357	878.7	9/17/2015	71.15	78.69	1357	703.3	11/22/2015	52.79	59.15	990	506.8
7/14/2015	75.47	80.23	1357	826.8	9/18/2015	71.24	75.02	1357	574.3	11/23/2015	52.16	61.18	1202	706.8
7/15/2015	75.60	80.14	1357	791.3	9/19/2015	71.43	74.44	1357	575.4	11/24/2015	52.35	60.99	1202	732.9
7/16/2015	72.11	76.82	1357	812.5	9/20/2015	71.49	73.71	1357	504.5	11/25/2015	52.48	58.42	1140	554.3
7/17/2015	71.35	76.32	1357	850.6	9/21/2015	72.00	74.62	1357	547.4	11/26/2015	52.50	55.23	919	251.9
7/18/2015	71.74	77.97	1357	926.8	9/22/2015	71.60	74.42	1357	568.1	11/27/2015	52.08	54.80	919	250.0
7/19/2015	72.47	81.75	1357	1020.0	9/23/2015	71.33	74.23	1357	574.6	11/28/2015	52.12	56.15	919	313.6
7/20/2015	72.96	82.88	1357	1076.7	9/24/2015	71.00	73.39	1357	524.0	11/29/2015	52.13	57.19	919	365.2
7/21/2015	71.61	80.91	1357	1019.4	9/25/2015	69.58	71.07	1357	449.8	11/30/2015	51.14	55.65	919	314.6
7/22/2015	69.53	77.71	1357	912.7	9/26/2015	68.91	70.01	992	409.4	12/1/2015	55.55	60.40	910	256.9
7/23/2015	69.63	75.90	1357	729.5	9/27/2015	69.26	70.44	992	416.6	12/2/2015	56.41	55.40	828	167.5
7/24/2015	69.59	78.35	1357	971.2	9/28/2015	70.14	71.32	992	426.5	12/3/2015	54.70	54.20	828	250.1
7/25/2015	70.61	79.47	1357	974.0	9/29/2015	70.09	72.04	992	454.6	12/4/2015	52.70	52.54	828	302.3
7/26/2015	70.98	80.29	1357	1012.3	9/30/2015	69.71	71.89	992	481.8	12/5/2015	50.78	49.90	828	198.3
7/27/2015	71.45	81.83	1357	1106.6	10/1/2015	68.85	67.73	992	222.4	12/6/2015	49.23	48.19	828	169.7
7/28/2015	70.60	81.48	1357	1160.4	10/2/2015	67.77	64.66	530	84.2	12/7/2015	48.51	47.48	828	167.5
7/29/2015	68.56	78.84	1357	1110.5	10/3/2015	66.96	62.62	613	0.4	12/8/2015	47.71	47.39	828	277.1
7/30/2015	68.91	78.61	1357	1047.8	10/4/2015	67.34	63.06	675	0.3	12/9/2015	47.27	46.97	828	280.1
7/31/2015	69.83	78.08	1357	904.0	10/5/2015	67.72	63.49	613	0.4	12/10/2015	47.44	46.06	828	175.5
8/1/2015	70.08	78.66	1357	934.5	10/6/2015	68.27	65.32	675	82.9	12/11/2015	48.20	46.81	751	175.4
8/2/2015	70.62	79.09	1357	935.6	10/7/2015	68.41	66.85	554	174.3	12/12/2015	49.17	47.75	751	175.2
8/3/2015	71.64	79.25	1357	854.4	10/8/2015	67.96	67.22	554	173.0	12/13/2015	49.95	48.53	751	176.1
8/4/2015	69.18	73.66	1267	775.7	10/9/2015	67.61	66.74	554	172.6	12/14/2015	51.13	49.69	751	176.1
8/5/2015	68.12	71.85	1267	683.5	10/10/2015	66.96	66.00	458	173.5	12/15/2015	51.33	49.87	751	166.6
8/6/2015	68.58	71.30	1267	552.1	10/11/2015	66.61	65.65	458	173.2	12/16/2015	50.99	48.50	756	19.1
8/7/2015	69.09	72.32	1185	612.2	10/12/2015	66.63	65.65	458	172.2	12/17/2015	51.48	48.88	756	0.4
8/8/2015	69.93	73.05	1267	599.8	10/13/2015	66.70	65.71	458	163.0	12/18/2015	50.92	48.41	516	0.4
8/9/2015	71.57	75.78	1357	706.4	10/14/2015	66.17	65.49	458	168.4	12/19/2015	49.50	47.05	679	0.4
8/10/2015	71.51	78.49	1357	715.4	10/15/2015	65.98	65.38	410	168.0	12/20/2015	47.79	45.35	679	0.4
8/11/2015	68.29	77.68	1357	973.2	10/16/2015	66.09	65.33	410	166.1	12/21/2015	46.35	43.93	679	0.4
8/12/2015	67.19	74.79	1357	878.4	10/17/2015	65.45	64.85	410	169.2	12/22/2015	45.45	43.03	679	0.4
8/13/2015	67.00	76.73	1357	927.9	10/18/2015	64.50	63.90	482	166.4	12/23/2015	45.10	42.67	679	0.4
8/14/2015	67.25	75.53	1357	871.4	10/19/2015	63.68	63.01	482	158.2	12/24/2015	50.55	48.06	679	0.5
8/15/2015	67.00	74.03	1357	773.0	10/20/2015	63.65	62.70	399	155.1	12/25/2015	55.17	52.64	679	0.5
8/16/2015	67.71	73.79	1357	702.8	10/21/2015	63.41	62.45	399	163.4	12/26/2015	56.79	54.23	679	0.5
8/17/2015	68.47	75.99	1357	832.8	10/22/2015	63.48	62.51	327	158.7	12/27/2015	57.44	54.86	679	0.5
8/18/2015	67.04	76.69	1357	1024.6	10/23/2015	63.31	62.42	327	162.0	12/28/2015	58.15	55.56	679	0.5
8/19/2015	67.54	76.28	1357	930.1	10/24/2015	63.97	62.78	327	155.8	12/29/2015	58.94	56.36	751	0.5
8/20/2015	69.48	78.79	1357	970.8	10/25/2015	64.73	63.51	327	153.1	12/30/2015	58.39	56.73	751	137.4
8/21/2015	70.90	79.59	1357	914.5	10/26/2015	64.93	63.74	327	162.3	12/31/2015	56.70	55.11	751	150.3
8/22/2015	68.85	76.97	1357	878.6	10/27/2015	64.18	62.58	327	125.6					

Table 6. Shoreline aquatic habitat index (SAHI) scores for shoreline sections assessed within the RFAI sample reach upstream of Kingston Fossil Plant, autumn 2015

Left Descending Bank	Transects								Avg.
	1	2	3	4	5	6	7	8	
Aquatic Macrophytes	0%	0%	0%	0%	0%	0%	0%	0%	0%
SAHI Variables									
Cover	5	3	3	5	5	1	3	1	3.3
Substrate	5	1	1	1	3	5	5	5	3.3
Erosion	1	5	5	1	3	5	5	5	3.8
Canopy Cover	5	5	1	5	5	5	5	5	4.5
Riparian Zone	1	1	1	1	3	5	5	5	2.8
Habitat	5	3	1	5	3	1	3	1	2.8
Slope	3	1	5	3	3	1	5	5	3.3
Total	**25**	**19**	**17**	**21**	**25**	**23**	**31**	**27**	**23.5**
Rating	**Fair**	**Fair**	**Fair**	**Fair**	**Fair**	**Fair**	**Good**	**Good**	**Fair**

Right Descending Bank	Transects								Avg.
	1	2	3	4	5	6	7	8	
Aquatic Macrophytes	0%	0%	0%	0%	0%	0%	0%	0%	0%
SAHI Variables									
Cover	3	3	1	5	5	3	5	5	3.8
Substrate	1	1	1	1	1	3	3	3	1.8
Erosion	3	3	5	1	5	5	3	3	3.5
Canopy Cover	5	5	5	5	5	3	3	5	4.5
Riparian Zone	5	5	5	5	5	1	1	5	4.0
Habitat	3	3	1	3	3	3	3	3	2.8
Slope	3	5	5	5	3	5	1	1	3.5
Total	**23**	**25**	**23**	**25**	**27**	**23**	**19**	**25**	**23.75**
Rating	**Fair**	**Fair**	**Fair**	**Fair**	**Good**	**Fair**	**Fair**	**Fair**	**Fair**

Scoring criteria: poor (7-16), fair (17-26), good (27-35)

Table 7. Shoreline aquatic habitat index (SAHI) scores for shoreline sections assessed within the RFAI sample reach downstream of Kingston Fossil Plant, autumn 2015

	Transects								
Left Descending Bank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Avg.**
Aquatic Macrophytes	0%	40%	60%	0%	0%	0%	0%	0%	13%
SAHI Variables									
Cover	3	5	1	5	5	5	5	1	3.8
Substrate	5	5	5	1	3	1	5	1	3.3
Erosion	5	5	5	5	3	5	3	5	4.5
Canopy Cover	5	1	1	1	5	3	1	1	2.3
Riparian Zone	5	1	1	1	3	1	1	1	1.8
Habitat	1	3	3	3	3	5	3	1	2.8
Slope	3	3	3	3	1	1	5	5	3.0
Total	**27**	**23**	**19**	**19**	**23**	**21**	**23**	**15**	**21.3**
Rating	**Good**	**Fair**	**Fair**	**Fair**	**Fair**	**Fair**	**Fair**	**Poor**	**Fair**

	Transects								
Right Descending Bank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Avg.**
Aquatic Macrophytes	0%	0%	0%	0%	0%	0%	0%	0%	0%
SAHI Variables									
Cover	1	3	5	5	3	1	1	3	2.8
Substrate	5	5	3	3	5	5	3	1	3.8
Erosion	5	1	5	5	5	5	3	5	4.3
Canopy Cover	1	3	1	5	5	3	1	5	3.0
Riparian Zone	1	1	1	5	5	3	1	5	2.8
Habitat	1	1	3	3	3	1	1	3	2.0
Slope	1	1	1	1	1	5	5	1	2.0
Total	**15**	**15**	**19**	**27**	**27**	**23**	**15**	**23**	**20.5**
Rating	**Poor**	**Poor**	**Fair**	**Good**	**Good**	**Fair**	**Poor**	**Fair**	**Fair**

[*] *Scoring criteria: poor (7-16), fair (17-26), good (27-35)*

Table 8. Substrate composition and average water depth (ft) per transect upstream and downstream of Kingston Fossil Plant, Autumn 2015

	% Substrate per transect upstream of KIF								
Substrate Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Avg.**
Silt	26.5	49.5	46.5	27.0	42.5	36.4	53.5	61.5	**42.9**
Detritus	11.5	14.5	19.0	30.5	26.8	41.1	24..0	15.0	**22.6**
Mollusk Shell	12.3	6.5	15.0	13.0	5.5	10.0	4.5	4.7	**8.9**
Gravel	31.5	10.0	3.0	6.5	3.2	5.0	3.0	8.0	**8.8**
Wood	1.7	4.5	2.5	6.0	3.0	5.5	7.0	4.3	**4.3**
Sand	7.5	5.0	3.0	0.0	10.5	2.0	0.0	0.0	**3.5**
Clay	0.0	10.0	0.0	2.0	2.0	0.0	8.0	0.0	**2.8**
Cobble	0.0	0.0	0.0	14.0	0.0	0.0	0.0	0.0	**1.8**
Bedrock	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	**1.3**
Boulder	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.1**
Coal	0.0	0.0	1.0	0.0	0.0	0.0	0.0	6.5	**0.9**
Coal Ash	0.0	0.0	0.0	1.0	6.5	0.0	0.0	0.0	**0.9**
Average depth (ft)	22.7	22.7	20.3	22.2	9.9	17.4	15.4	12.2	**17.9**
Actual depth range: 1.8 to 40.2 ft									

	% Substrate per transect downstream of KIF								
Substrate Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Avg.**
Silt	68.5	67.0	77.0	77.0	71.5	78.4	70.5	25.0	**66.9**
Detritus	25.6	19.3	5.4	5.5	4.4	3.4	8.4	16.0	**11.0**
Gravel	3.0	9.0	9.0	0.5	13.7	5.0	7.5	9.5	**7.2**
Mollusk Shell	1.4	3.3	5.6	11.6	5.8	4.2	6.0	16.9	**6.9**
Cobble	0.0	0.0	0.0	4.0	0.0	0.0	0.0	27.5	**3.9**
Clay	0.0	0.0	0.0	0.0	3.0	8.0	7.0	0.0	**2.3**
Wood	1.5	1.4	1.5	1.4	1.6	1.0	0.6	5.1	**1.8**
Submerged Vegetation	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	**0.2**
Average depth (ft)	16.3	15.8	16.7	21.8	23.9	18.5	23.1	21.0	**19.6**
Actual depth range: 1.6 to 45.0 ft									

Table 9. Individual metric scores and the overall RFAI scores at sites upstream (CRM 4.4) and downstream (CRM 1.5) of Kingston Fossil Plant during Autumn 2015

Autumn 2015		**CRM 4.4**		**CRM 1.5**	
Metric		**Observations**	**Score**	**Observations**	**Score**
A. Species richness and composition					
1. Number of indigenous species (Tables 10 and 11)	Combined	**33**	**5**	**36**	**5**
2. Number of centrarchid species (less *Micropterus*)	Combined	**6** Black crappie Bluegill Green sunfish Longear sunfish Redear sunfish Warmouth	**5**	**7** Black crappie Bluegill Green sunfish Longear sunfish Redear sunfish Warmouth White crappie	**5**
3. Number of benthic invertivore species	Combined	**6** Black redhorse Freshwater drum Golden redhorse Logperch Northern hog sucker Spotted sucker	**3**	**5** Freshwater drum Golden redhorse Logperch Northern hog sucker Spotted sucker	**3**
4. Number of intolerant species	Combined	**8** Black redhorse Brook silverside Longear sunfish Northern hog sucker Rock bass Skipjack herring Smallmouth bass Spotted sucker	**5**	**7** Brook silverside Longear sunfish Northern hog sucker Rock bass Skipjack herring Smallmouth bass Spotted sucker	**5**

Table 9. (Continued)

Autumn 2015 Metric		CRM 4.4 Observations		Score	CRM 1.5 Observations		Score
5. Percent tolerant individuals	Electrofishing	**58.9%**		**1.5**	**29.9%**		**2.5**
		Bluegill	40.9%		Bluegill	12.3%	
		Bluntnose minnow	0.1%		Bluntnose minnow	0.1%	
		Common carp	1.4%		Common carp	0.4%	
		Gizzard shad	2.1%		Gizzard shad	7.4%	
		Green sunfish	0.2%		Green sunfish	0.3%	
		Largemouth bass	8.5%		Largemouth bass	5.6%	
		Spotfin shiner	5.8%		Redbreast sunfish	0.1%	
					Spotfin shiner	3.5%	
					White crappie	<0.1%	
	Gill Netting	**17.7%**		**1.5**	**10.6%**		**2.5**
		Bluegill	0.8%		Bluegill	0.7%	
		Common carp	1.5%		Common carp	2.1%	
		Gizzard shad	13.8%		Gizzard shad	6.4%	
		Largemouth bass	1.5%		Largemouth bass	0.7%	
6. Percent dominance by one species	Electrofishing	**40.9%**		**0.5**	**49.1%**		**0.5**
		Bluegill			Threadfin		
	Gill Netting	**16.9%**		**1.5**	**21.3%**		**1.5**
		Walleye			White bass		
7. Percent non-indigenous species	Electrofishing	**23.1%**		**0.5**	**12.7%**		**0.5**
		Common carp	1.4%		Common carp	0.4%	
		Mississippi silverside	21.6%		Mississippi silverside	12.1%	
		Yellow perch	0.2%		Redbreast sunfish	0.1%	
					Striped bass	<0.1%	
					Yellow perch	<0.1%	
	Gill Netting	**13.8%**		**0.5**	**9.2%**		**0.5**
		Common carp	1.5%		Common carp	2.1%	
		Striped bass	12.3%		Striped bass	7.1%	

Table 9. (Continued)

Autumn 2015 Metric		CRM 4.4 Observations		Score	CRM 1.5 Observations		Score
8. Number of top carnivore species	Combined	**11** Black crappie Flathead catfish Largemouth bass Rock bass Sauger Skipjack herring Smallmouth bass Spotted bass Walleye White bass Yellow bass		**5**	**12** Black crappie Flathead catfish Largemouth bass Rock bass Sauger Skipjack herring Smallmouth bass Spotted bass Walleye White bass White crappie Yellow bass		**5**
B. Trophic composition							
9. Percent top carnivores	Electrofishing	**10.0%** Black crappie Flathead catfish Largemouth bass Sauger Smallmouth bass Spotted bass White bass	 0.1% 0.1% 8.5% 0.1% 0.8% 0.4% 0.1%	**1.5**	**6.3%** Black crappie Flathead catfish Largemouth bass Smallmouth bass Striped bass White bass White crappie	 0.1% <0.1% 5.6% 0.4% <0.1% 0.1% <0.1%	**1.5**
	Gill Netting	**48.5%** Black crappie Flathead catfish Largemouth bass Rock bass Sauger Skipjack herring Striped bass Walleye White bass Yellow bass	 0.8% 0.8% 1.5% 2.3% 0.8% 4.6% 12.3% 16.9% 6.9% 1.5%	**1.5**	**61.7%** Flathead catfish Largemouth bass Rock bass Sauger Skipjack herring Smallmouth bass Spotted bass Striped bass Walleye White bass White crappie Yellow bass	 1.4% 0.7% 0.7% 0.7% 15.6% 0.7% 2.1% 7.1% 7.1% 21.3% 0.7% 3.5%	**2.5**

Table 9. (Continued)

Autumn 2015		**CRM 4.4**			**CRM 1.5**		
Metric		**Observations**		**Score**	**Observations**		**Score**
10. Percent omnivores	Electrofishing	**4.4%**		**2.5**	**9.0%**		**2.5**
		Blue catfish	0.1%		Black buffalo	<0.1%	
		Bluntnose minnow	0.1%		Bluntnose minnow	0.1%	
		Channel catfish	0.5%		Channel catfish	0.5%	
		Common carp	1.4%		Common carp	0.4%	
		Gizzard shad	2.1%		Gizzard shad	7.4%	
		Smallmouth buffalo	0.3%		Smallmouth buffalo	0.6%	
	Gill Netting	**36.2%**		**1.5**	**29.8%**		**1.5**
		Blue catfish	8.5%		Blue catfish	9.2%	
		Channel catfish	6.2%		Channel catfish	3.5%	
		Common carp	1.5%		Common carp	2.1%	
		Gizzard shad	13.8%		Gizzard shad	6.4%	
		Smallmouth buffalo	6.2%		Quillback	0.7%	
					Smallmouth buffalo	7.8%	
C. Fish abundance and health							
11. Average number per run	Electrofishing	**87.8**		**0.5**	**142.9**		**1.5**
	Gill Netting	**13.0**		**1.5**	**14.10**		**1.5**
12. Percent anomalies	Electrofishing	**0.2%**		**2.5**	**0.2%**		**2.5**
	Gill Netting	**0.0%**		**2.5**	**0.7%**		**2.5**
Overall RFAI Score				**43** **Good**			**47** **Good**

Table 10. Species collected, ecological and recreational designations, and corresponding electrofishing (EF) and gill net (GN) catch per unit effort in the Clinch River upstream (CRM 4.4) of Kingston Fossil Plant discharge – Autumn 2015

Common Name	Scientific name	Trophic level	Indigenous species	Tolerance	Thermally Sensitive Species	Comm. Valuable Species	Rec. Valuable Species	EF Catch Per Run	EF Catch Per Hour	Total Fish EF	GN Catch Per Net	Total Fish GN	Total fish Combined	Percent Composition
Gizzard shad	*Dorosoma cepedianum*	OM	X	TOL	.	X	X	1.80	6.67	27	1.80	18	45	3.11
Common carp*	*Cyprinus carpio*	OM	.	TOL	.	X	.	1.20	4.44	18	0.20	2	20	1.38
Spotfin shiner	*Cyprinella spiloptera*	IN	X	TOL	.	.	.	5.13	19.01	77	.	.	77	5.32
Bluntnose minnow	*Pimephales notatus*	OM	X	TOL	.	.	.	0.07	0.25	1	.	.	1	0.07
Green sunfish	*Lepomis cyanellus*	IN	X	TOL	.	.	X	0.13	0.49	2	.	.	2	0.14
Bluegill	*Lepomis macrochirus*	IN	X	TOL	.	.	X	35.93	133.09	539	0.10	1	540	37.32
Largemouth bass	*Micropterus salmoides*	TC	X	TOL	.	.	X	7.47	27.65	112	0.20	2	114	7.88
Skipjack herring	*Alosa chrysochloris*	TC	X	INT	.	X	.	.	.	.	0.60	6	6	0.41
Northern hog sucker	*Hypentelium nigricans*	BI	X	INT	.	.	.	0.33	1.23	5	.	.	5	0.35
Spotted sucker	*Minytrema melanops*	BI	X	INT	X	X	.	2.73	10.12	41	0.10	1	42	2.90
Black redhorse	*Moxostoma duquesnei*	BI	X	INT	.	.	.	0.20	0.74	3	0.20	2	5	0.35
Rock bass	*Ambloplites rupestris*	TC	X	INT	.	.	X	.	.	.	0.30	3	3	0.21
Longear sunfish	*Lepomis megalotis*	IN	X	INT	.	.	X	0.13	0.49	2	.	.	2	0.14
Smallmouth bass	*Micropterus dolomieu*	TC	X	INT	.	.	X	0.73	2.72	11	.	.	11	0.76
Brook silverside	*Labidesthes sicculus*	IN	X	INT	.	X	.	0.27	0.99	4	.	.	4	0.28
Lake sturgeon	*Acipenser fulvescens*	IN	X	.	.	.	X	.	.	.	0.30	3	3	0.21
Threadfin shad	*Dorosoma petenense*	PK	X	.	.	X	X	.	.	.	0.80	8	8	0.55
Smallmouth buffalo	*Ictiobus bubalus*	OM	X	.	.	X	.	0.27	0.99	4	0.80	8	12	0.83
Golden redhorse	*Moxostoma erythrurum*	BI	X	.	.	X	.	0.07	0.25	1	0.10	1	2	0.14
Blue catfish	*Ictalurus furcatus*	OM	X	.	.	X	X	0.07	0.25	1	1.10	11	12	0.83
Channel catfish	*Ictalurus punctatus*	OM	X	.	.	X	X	0.47	1.73	7	0.80	8	15	1.04
Flathead catfish	*Pylodictis olivaris*	TC	X	.	.	X	X	0.07	0.25	1	0.10	1	2	0.14
White bass	*Morone chrysops*	TC	X	.	.	.	X	0.07	0.25	1	0.90	9	10	0.69
Yellow bass	*Morone mississippiensis*	TC	X	.	.	X	X	.	.	.	0.20	2	2	0.14
Striped bass*	*Morone saxatilis*	TC	.	.	.	.	X	.	.	.	1.60	16	16	1.11
Warmouth	*Lepomis gulosus*	IN	X	.	.	.	X	0.07	0.25	1	.	.	1	0.07
Redear sunfish	*Lepomis microlophus*	IN	X	.	.	.	X	4.27	15.80	64	0.10	1	65	4.49
Hybrid sunfish	*Hybrid lepomis spp.*	IN	X	.	.	.	X	0.07	0.25	1	.	.	1	0.07
Spotted bass	*Micropterus punctulatus*	TC	X	.	.	.	X	0.33	1.23	5	.	.	5	0.35
Black crappie	*Pomoxis nigromaculatus*	TC	X	.	.	.	X	0.07	0.25	1	0.10	1	2	0.14
Greenside darter	*Etheostoma blennioides*	SP	X	.	X	.	.	0.07	0.25	1	.	.	1	0.07
Yellow perch*	*Perca flavescens*	IN	.	.	.	.	X	0.13	0.49	2	.	.	2	0.14
Logperch	*Percina caprodes*	BI	X	.	X	.	.	6.53	24.20	98	.	.	98	6.77
Sauger	*Sander canadense*	TC	X	.	.	.	X	0.07	0.25	1	0.10	1	2	0.14

Table 10. (CRM 4.4, Continued).

Common Name	Scientific name	Trophic level	Indigenous species	Tolerance	Thermally Sensitive Species	Comm. Valuable Species	Rec. Valuable Species	EF Catch Per Run	EF Catch Per Hour	Total Fish EF	GN Catch Per Net	Total Fish GN	Total fish Combined	Percent Composition
Walleye	*Sander vitreum*	TC	X	.	.	.	X	.	.	.	2.20	22	22	1.52
Freshwater drum	*Aplodinotus grunniens*	BI	X	.	.	X	.	0.07	0.25	1	0.30	3	4	0.28
Mississippi silverside*	*Menidia audens*	IN	.	.	.	X	.	18.93	70.12	284	.	.	284	19.63
Chestnut lamprey	*Ichthyomyzon castaneus*	PS	X	.	.	.	.	0.07	0.25	1	.	.	1	0.07
Total			**34**		**2**	**14**	**23**	**87.82**	**325.2**	**1,317**	**13**	**130**	**1,447**	**100.00**
Number of Samples								**15**			**10**			
Species Collected								**31**			**23**			

Trophic level: benthic invertivore (BI), insectivore (IN), omnivore (OM), top carnivore (TC); Tolerance: tolerant species (TOL), intolerant species (INT);
Comm.-Commercially, Rec.-Recreationally. An asterisk (*) next to the common name denotes an aquatic nuisance species. All species are considered representative important species.
No species collected have a Federal Threatened or Endangered status.

Table 11. Species collected, ecological and recreational designations, and corresponding electrofishing (EF) and gill net (GN) catch per unit effort in the Clinch River downstream (CRM 1.5) of Kingston Fossil Plant discharge – Autumn 2015

Common Name	Scientific name	Trophic level	Indigenous species	Tolerance	Thermally Sensitive Species	Comm. Valuable Species	Rec. Valuable Species	EF Catch Per Run	EF Catch Per Hour	Total Fish EF	GN Catch Per Net	Total Fish GN	Total fish Combined	Percent Composition
Gizzard shad	*Dorosoma cepedianum*	OM	X	TOL	.	X	X	10.60	41.19	159	0.90	9	168	7.35
Common carp*	*Cyprinus carpio*	OM	.	TOL	.	X	.	0.53	2.07	8	0.30	3	11	0.48
Spotfin shiner	*Cyprinella spiloptera*	IN	X	TOL	.	.	.	5.07	19.69	76	.	.	76	3.33
Bluntnose minnow	*Pimephales notatus*	OM	X	TOL	.	.	X	0.20	0.78	3	.	.	3	0.13
Redbreast sunfish*	*Lepomis auritus*	IN	.	TOL	.	.	X	0.20	0.78	3	.	.	3	0.13
Green sunfish	*Lepomis cyanellus*	IN	X	TOL	.	.	X	0.47	1.81	7	.	.	7	0.31
Bluegill	*Lepomis macrochirus*	IN	X	TOL	.	.	X	17.60	68.39	264	0.10	1	265	11.60
Largemouth bass	*Micropterus salmoides*	TC	X	TOL	.	.	X	8.07	31.35	121	0.10	1	122	5.34
White crappie	*Pomoxis annularis*	TC	X	TOL	.	.	X	0.07	0.26	1	0.10	1	2	0.09
Skipjack herring	*Alosa chrysochloris*	TC	X	INT	.	X	.	.	.	.	2.20	22	22	0.96
Northern hog sucker	*Hypentelium nigricans*	BI	X	INT	.	.	.	0.13	0.52	2	.	.	2	0.09
Spotted sucker	*Minytrema melanops*	BI	X	INT	X	X	.	0.67	2.59	10	.	.	10	0.44
Rock bass	*Ambloplites rupestris*	TC	X	INT	.	.	X	.	.	.	0.10	1	1	0.04
Longear sunfish	*Lepomis megalotis*	IN	X	INT	.	.	X	1.07	4.15	16	.	.	16	0.70
Smallmouth bass	*Micropterus dolomieu*	TC	X	INT	.	.	X	0.53	2.07	8	0.10	1	9	0.39
Brook silverside	*Labidesthes sicculus*	IN	X	INT	.	X	.	1.73	6.74	26	.	.	26	1.14
Lake sturgeon	*Acipenser fulvescens*	IN	X	.	.	.	.	.	.	.	0.10	1	1	0.04
Threadfin shad	*Dorosoma petenense*	PK	X	.	.	X	.	70.13	272.54	1052	0.10	1	1,053	46.08
Bullhead minnow	*Pimephales vigilax*	IN	X	.	.	.	.	0.47	1.81	7	.	.	7	0.31
Quillback	*Carpiodes cyprinus*	OM	X	.	.	.	.	.	.	.	0.10	1	1	0.04
Smallmouth buffalo	*Ictiobus bubalus*	OM	X	.	.	X	.	0.87	3.37	13	1.10	11	24	1.05
Black buffalo	*Ictiobus niger*	OM	X	.	.	.	.	0.07	0.26	1	.	.	1	0.04
Golden redhorse	*Moxostoma erythrurum*	BI	X	.	.	X	.	0.07	0.26	1	.	.	1	0.04
Blue catfish	*Ictalurus furcatus*	OM	X	.	.	X	X	.	.	.	1.30	13	13	0.57
Channel catfish	*Ictalurus punctatus*	OM	X	.	.	X	X	0.67	2.59	10	0.50	5	15	0.66
Flathead catfish	*Pylodictis olivaris*	TC	X	.	.	X	X	0.07	0.26	1	0.20	2	3	0.13
White bass	*Morone chrysops*	TC	X	.	.	.	X	0.13	0.52	2	3.00	30	32	1.40
Yellow bass	*Morone mississippiensis*	TC	X	.	.	.	.	.	.	.	0.50	5	5	0.22
Striped bass*	*Morone saxatilis*	TC	.	.	.	.	X	0.07	0.26	1	1.00	10	11	0.48
Warmouth	*Lepomis gulosus*	IN	X	.	.	.	X	0.13	0.52	2	.	.	2	0.09
Redear sunfish	*Lepomis microlophus*	IN	X	.	.	.	X	2.00	7.77	30	0.40	4	34	1.49
Spotted bass	*Micropterus punctulatus*	TC	X	.	.	.	X	0.00	0.00	.	0.30	3	3	0.13
Black crappie	*Pomoxis nigromaculatus*	TC	X	.	.	.	X	0.13	0.52	2	.	.	2	0.09
Greenside darter	*Etheostoma blennioides*	SP	X	.	.	.	.	0.07	0.26	1	.	.	1	0.04
Snubnose darter	*Etheostoma simoterum*	SP	X	.	.	.	.	0.13	0.52	2	.	.	2	0.09
Yellow perch*	*Perca flavescens*	IN	.	.	.	.	.	0.07	0.26	1	.	.	1	0.04

Table 11. (CRM 1.5, Continued).

Common Name	Scientific name	Trophic level	Indigenous species	Tolerance	Thermally Sensitive Species	Comm. Valuable Species	Rec. Valuable Species	EF Catch Per Run	EF Catch Per Hour	Total Fish EF	GN Catch Per Net	Total Fish GN	Total fish Combined	Percent Composition
Logperch	*Percina caprodes*	BI	X	.	X	.	.	3.47	13.47	52	.	.	52	2.28
Sauger	*Stizostedion canadense*	TC	X	.	.	.	X	.	.	.	0.10	1	1	0.04
Walleye	*Stizostedion vitreum*	TC	X	.	.	.	X	.	.	.	1.00	10	10	0.44
Freshwater drum	*Aplodinotus grunniens*	BI	X	.	.	X	.	0.20	0.78	3	0.50	5	8	0.35
Mississippi silverside*	*Menidia audens*	IN	.	.	.	X	.	17.27	67.10	259	.	.	259	11.33
Total			**36**		**2**	**16**	**23**	**142.96**	**555.46**	**2,144**	**14.1**	**141**	**2,285**	**100.00**
Number of Samples								**15**			**10**			
Species Collected								**32**			**23**			

Trophic level: benthic invertivore (BI), insectivore (IN), omnivore (OM), top carnivore (TC); Tolerance: tolerant species (TOL), intolerant species (INT);
Comm.-Commercially, Rec.-Recreationally. An asterisk (*) next to the common name denotes an aquatic nuisance species. All species are considered representative important species.
No species collected have a Federal Threatened or Endangered status.

Table 12. Fish species collected during sampling of the Reservoir Fish Assemblage Index sites upstream and downstream of Kingston Fossil Plant in Watts Bar Reservoir from 2001 through 2015

	CRM 4.4-US									CRM 1.5-DS								
Species	**2015**	**2013**	**2012**	**2011**	**2010**	**2007**	**2005**	**2003**	**2001**	**2015**	**2013**	**2012**	**2011**	**2010**	**2007**	**2005**	**2003**	**2001**
Longnose gar				X		X		X						X	X	X	X	
Gizzard shad	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Common carp*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Golden shiner						X		X	X								X	X
Spotfin shiner	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Striped shiner														X				
Bluntnose minnow	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X
River carpsucker																		X
Redbreast sunfish*		X	X	X	X				X	X	X	X	X	X	X	X	X	X
Green sunfish	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bluegill	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Largemouth bass	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Muskellunge				X														
White crappie					X		X	X	X	X		X	X	X		X	X	X
Skipjack herring	X	X	X		X		X	X	X	X		X		X		X	X	X
Northern hog sucker	X	X		X						X	X	X				X		
Spotted sucker	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Black redhorse	X	X	X	X	X	X	X	X	X		X	X	X					
Rock bass	X									X	X	X	X	X				
Longear sunfish	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Smallmouth bass	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brook silverside	X	X			X	X	X	X	X	X	X	X		X	X	X	X	X
Lake sturgeon	X	X	X	X	X					X	X	X	X	X				
Paddlefish					X									X	X		X	X
Spotted gar		X	X		X			X			X			X	X	X	X	X
Threadfin shad	X	X	X	X		X		X	X	X	X	X	X	X		X	X	X
Mooneye								X								X	X	
Bullhead minnow				X		X				X	X							
Largescale stoneroller											X			X				
Steelcolor shiner											X	X				X		
River redhorse							X											
Emerald shiner							X		X								X	X
Quillback								X		X		X						
River carpsucker							X											
Smallmouth buffalo	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 12. (Continued)

	CRM 4.4-US									CRM 1.5-DS								
Species	**2015**	**2013**	**2012**	**2011**	**2010**	**2007**	**2005**	**2003**	**2001**	**2015**	**2013**	**2012**	**2011**	**2010**	**2007**	**2005**	**2003**	**2001**
Black buffalo		X		X	X		X	X	X	X		X		X		X		X
Silver redhorse		X					X											
Golden redhorse	X	X	X		X	X	X	X	X	X				X	X		X	
Blue catfish	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Channel catfish	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Flathead catfish	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
White bass	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X
Yellow bass	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Striped bass*	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hybrid striped x white							X											X
Warmouth	X	X	X	X	X			X	X	X	X	X	X					X
Redear sunfish	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hybrid sunfish	X								X				X					
Spotted bass	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Hybrid bass		X			X													
Black crappie	X		X		X		X	X	X	X			X	X	X		X	X
Greenside darter	X									X								
Snubnose darter									X	X								
Redline darter		X																
Yellow perch*	X	X		X	X	X	X	X	X	X		X					X	X
Logperch	X	X			X	X	X	X	X	X	X	X		X		X	X	X
Sauger	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Walleye	X	X	X	X	X	X				X	X	X			X			
Freshwater drum	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mississippi silverside*	X	X	X	X	X	X	X			X	X	X	X	X	X	X		
Chestnut lamprey	X				X									X				

Table 13. Summary of RFAI scores from areas located directly upstream and downstream of Kingston Fossil Plant during autumn 2015, compared to scores from sampling conducted during autumn 1993-2013 as part of the Reservoir Ecological Health Monitoring Program in Watts Bar Reservoir*

Site	Location	1993	1994	1996	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2015	Avg.
Clinch River Inflow	CRM 22	38	46	48	36	---	44	---	42	---	38	---	40	---	44	44	44	---	42	---	---	**42**
Tennessee River Inflow	TRM 601	38	50	42	46	---	46	---	46	---	44	---	50	---	46	44	48	---	48	---	---	**46**
Upstream of KIF	CRM 4.4	---	---	---	---	---	---	45	---	42	---	44	---	36	---	38	42	44	43	44	43	**42**
Downstream of KIF	CRM 1.5	---	---	---	---	---	---	42	---	44	---	41	---	34	---	36	42	36	41	41	47	**40**
Transition	TRM 560.8	50	47	44	44	---	46	---	39	---	46	---	40	---	38	36	42	---	41	---	---	**43**
Forebay	TRM 531	44	45	42	38	36	42	38	37	44	39	45	40	35	35	43	39	42	43	46	39	**41**

RFAI Score Range: 12-21 (“Very Poor”), 22-31 (“Poor”), 32-40 (“Fair”), 41-50 (“Good”), or 51-60 (“Excellent”)

*Some scores have changed when compared to previous reports. Redbreast sunfish has been declared non-indigenous, which may have affected scores for metrics 1 and 7.

Table 14. Statistical comparisons of the fish community samples collected upstream and downstream of KIF during 2015

Parameter	Mean		Standard Deviation		t-test Statistic $^{\beta}$	z-test Statistic $^{\gamma}$	P-value	Significant Difference?
	Upstream (CURM 107)	Downstream (CURM 102)	Upstream (CURM 107)	Downstream (CURM 102)				
Species (per run)								
Total (species richness)	12.4	13.4	3.4	3.5	0.79	--	0.43	No
Benthic invertivores	2.9	1.7	1.0	1.0	--	-2.79	0.01	Yes
Insectivores	4.0	5.6	1.4	1.5	3.00	--	0.01	Yes
Omnivores	2.9	3.6	1.5	1.4	1.26	--	0.21	No
Top carnivores	4.2	4.0	2.3	2.1	-0.25	--	0.80	No
Non-indigenous	1.9	2.0	1.0	0.8	--	0.31	0.76	No
Tolerant	4.1	4.6	0.9	1.1	1.50	--	0.13	No
Intolerant	2.4	2.5	0.9	1.4	--	0.02	0.98	No
Thermally Sensitive	1.1	0.7	0.3	0.5	--	-2.50	0.01	Yes
CPUE (per run)								
Total	5.5	9.3	2.6	8.1	--	1.24	0.21	No
Benthic invertivores	0.7	0.4	0.5	0.3	--	-2.12	0.03	Yes
Insectivores	4.4	3.2	3.0	2.8	--	-1.53	0.12	No
Omnivores	0.6	1.2	0.5	1.2	--	1.14	0.25	No
Top carnivores	1.2	1.3	0.7	0.8	0.35	--	0.73	No
Non-indigenous	1.5	1.3	2.3	1.4	--	0.35	0.72	No
Tolerant	3.6	3.0	2.0	1.8	-0.87	--	0.38	No
Intolerant	0.4	0.5	0.3	0.3	--	0.43	0.66	No
Thermally Sensitive	0.4	0.2	0.5	0.2	--	-1.33	0.18	No
Simpson Diversity Index	7.1	7.3	2.9	3.1	0.83	--	0.22	No
Shannon Diversity Index	0.8	0.7	0.1	0.2	--	-0.12	0.90	No

β - Comparing two population means from normally distributed independent samples. $n_1=n_2=15$, degree of freedom=$n_1+n_2-2=28$, $\alpha=0.05$, $t_{\alpha/2}=2.048$. H_o: $\mu_1=\mu_2$; H_o rejected if $t>t_{\alpha/2}$.
γ - Non-parametric Wilcoxon Rank Sum test on large independent samples. $\alpha=0.05$, $z_{\alpha/2}=1.96$. H_o: two sampled populations have identical probability distributions. H_o rejected if $P<\alpha$ or $|z|>z_{\alpha/2}$.

Table 15. Comparison of RBI metric ratings and total scores for laboratory-processed samples collected upstream and downstream of Kingston Fossil Plant, Watts Bar Reservoir, autumn 2015

	Downstream CRM 1.5		**Downstream CRM 2.2**		**Upstream CRM 3.75**	
Metric	**Obs**	**Rating**	**Obs**	**Rating**	**Obs**	**Rating**
1. Average number of taxa	14	5	14.6	5	16.6	5
2. Proportion of samples with long-lived organisms	1	5	1	5	1	5
3. Average number of EPT taxa	1.4	3	1.5	5	1	3
4. Average proportion of oligochaete individuals	7.5	5	11.3	3	11	3
5. Average proportion of total abundance comprised by the two most abundant taxa	72.5	5	72.8	5	66.3	5
6. Average density excluding chironomids and oligochaetes	1495	5	1373.3	5	1681.7	5
7. Zero-samples – proportion of samples containing no organisms	0	5	0	5	0	5
Benthic Index Score		**33**		**33**		**31**
Ecological Health Rating		**Excellent**		**Excellent**		**Excellent**

Reservoir Benthic Index Scores: 7-12 (“Very Poor”), 13-18 (“Poor”), 19-23 (“Fair”), 24-29 (“Good”), 30-35 (“Excellent)

Table 16a. Mean density per square meter of benthic taxa collected downstream and upstream of Kingston Fossil Plant (KIF), autumn 2015. All taxa listed contributed to individual RBI metrics and total scores

Taxa	**KIF Downstream CRM 1.5**	**KIF Downstream CRM 2.2**	**KIF Upstream CRM 3.75**
ANNELIDA			
Hirudinea	2	---	---
Arhynchobdellida			
Erpobdellidae	2	---	---
Rhynchobdellida			
Glossiphoniidae	3	2	---
Actinobdella inequiannulata	3	3	8
Actinobdella sp.	---	2	---
Helobdella elongata	12	---	---
Helobdella stagnalis	50	65	55
Oligochaeta			
Haplotaxida			
Naididae			
Naidinae	---	---	3
Dero sp.	---	---	3
Tubificinae whc	3	23	63
Tubificinae wohc	163	138	150
Branchiura sowerbyi	---	37	7
Limnodrilus cervix	---	3	---
Limnodrilus hoffmeisteri	2	5	10
ARTHROPODA			
Crustacea			
Malacostraca			
Amphipoda			
Gammaridae			
Gammarus sp.	---	3	10
Hexapoda			
Insecta			
Diptera			
Ceratopogonidae	8	3	7
Chironomidae			
Ablabesmyia annulata	80	43	73
Chironomus sp.	62	10	90
Coelotanypus sp.	35	45	35
Cryptochironomus sp.	33	10	28
Cryptotendipes sp.	2	---	---

Table 16a. (Continued)

Taxa	KIF Downstream CRM 1.5	KIF Downstream CRM 2.2	KIF Upstream CRM 3.75
Dicrotendipes sp.	52	15	47
Epoicocladius flavens	3	10	13
Fissimentum sp.	5	32	---
Glyptotendipes sp.	20	---	---
Microchironomus sp.	---	---	2
Microtendipes pedellus gp.	2	---	8
Paralauterborniella nigrohalteralis	---	2	---
Parametriocnemus sp.	---	---	2
Polypedilum halterale gp.	8	23	28
Procladius sp.	47	43	83
Stictochironomus caffrarius gp.	17	33	12
Tanytarsus sp.	---	8	8
Ephemeroptera			
Ephemeridae			
Hexagenia sp. <10mm	683	697	427
Hexagenia sp. >10mm	257	183	117
Caenidae			
Caenis sp.	8	2	---
Megaloptera			
Sialidae			
Sialis sp.	---	---	2
Odonata			
Gomphidae			
Stylurus sp.	---	2	---
Trichoptera			
Leptoceridae			
Oecetis sp.	3	5	2
Polycentropodidae			
Cyrnellus fraternus	---	2	---
MOLLUSCA			
Bivalvia			
Unionoida			
Unionidae	---	5	---
Veneroida			
Corbiculidae			
Corbicula fluminea <10mm	55	123	35
Corbicula fluminea >10mm	20	27	20

Table 16a. (Continued)

Taxa	KIF Downstream CRM 1.5	KIF Downstream CRM 2.2	KIF Upstream CRM 3.75
Dreissenidae			
Dreissena polymorpha	3	2	3
Sphaeriidae	2	15	---
Musculium transversum	290	132	832
Pisidium sp.	---	15	15
Sphaerium sp.	---	2	---
Gastropoda			
Architaenioglossa			
Viviparidae			
Viviparus sp.	3	---	5
Neotaenioglossa			
Hydrobiidae	---	---	10
Amnicola limosa	3	20	73
Pleuroceridae			
Pleurocera canaliculata	10	2	5
NEMATODA	17	5	3
PLATYHELMINTHES			
Trepaxonemata			
Neoophora			
Planariidae			
Dugesia tigrina	---	---	5
Number of Samples	10	10	10
Mean-Density per meter²	1968	1797	2300
Taxa Richness	29	33	32
Sum of area sampled (meter²)	0.6	0.6	0.6

Table 16b. Mean density per square meter of benthic taxa collected but not included in individual RBI metrics or total scores for sites upstream and downstream of Kingston Fossil Plant, autumn 2015

Taxa	KIF Downstream CRM 1.5	KIF Downstream CRM 2.2	KIF Upstream CRM 3.75
ARTHROPODA			
Chelicerata			
Arachnida			
Trombidiformes			
Arrenuridae			
Arrenurus sp.	---	7	3
Krendowskiidae			
Krendowskia sp.	---	---	2
Limnesiidae			
Limnesia sp.	2	2	---
Unionicolidae			
Neumania sp.	---	5	13
Unionicola sp.	3	5	20
Crustacea			
Branchiopoda			
Diplostraca			
Sididae			
Sida crystallina	---	---	2
Maxillopoda			
Cyclopoida			
Cyclopidae			
Mesocyclops edax	25	72	43
Ostracoda			
Podocopida			
Candonidae			
Candona sp.	60	58	48
Hexapoda			
Insecta			
Diptera			
Chaoboridae			
Chaoborus punctipennis	27	43	10
Number of Samples	10	10	10
Mean-Density per meter^2	117	192	142
Taxa Richness	7	7	8
Sum of area sampled (meter^2)	0.6	0.6	0.6

Table 17. Wildlife observed along 2100 m transects parallel to the Clinch River shoreline, upstream and downstream of Kingston Fossil Plant, October 2015

October 2015							
Survey Site		**Birds**	**Obs.**	**Reptile/Amphibian**	**Obs.**	**Mammals**	**Obs.**
CRM 4.4 (US)	RDB	Pied-billed grebe	1	Map turtle	13	White-tailed deer	3
		Mockingbird	2	Slider	1		
		Redheaded woodpecker	1				
		American crow	17				
		American robin	1				
		Unspecified perching bird	2				
		Double-crested cormorant	28				
		Great blue heron	2				
		Wood duck	9				
		Mallard	2				
		Blue jay	19				
		Cardinal	2				
	LDB	Blue jay	5	Map turtle	9	Eastern grey squirrel	4
		American crow	7	Painted turtle	2		
		Great blue heron	1				
		Unspecified perching bird	2				
		Yellow-shafted flicker	1				
		Ring-billed gull	1				
		Canada goose	4				
		Carolina wren	4				
		Carolina chickadee	1				
		European starling	4				
CRM 1.5 (DS)	RDB	American crow	3	Map turtle	6		
		Turkey vulture	10	Redear turtle	1		
		Mockingbird	3				
		Carolina chickadee	3				
		Blue jay	3				
		Cliff swallow	10				
		Canada goose	8				
		Rock dove	120				
		Unspecified perching bird	5				
		European starling	3				
		Common grackle	2				
		Double-crested cormorant	2				
		American coot	1				
CRM 1.5 (DS)	LDB	Double-crested cormorant	63			Eastern grey squirrel	1
		Canada goose	10				
		Blue jay	17				
		Great blue heron	4				
		Carolina chickadee	1				
		Redheaded woodpecker	1				
		Downy woodpecker	1				
		Common grackle	1				
		Eastern phoebe	1				
		American crow	3				
		Mockingbird	4				

Table 18. Wildlife observed during visual surveys conducted upstream and downstream of Kingston Fossil Plant, 2011 through 2015

	CRM 4.4 RDB Observed				CRM 4.4 LDB Observed				CRM 1.5 RDB Observed				CRM 1.5 LDB Observed			
	2011	2012	2013	2015	2011	2012	2013	2015	2011	2012	2013	2015	2011	2012	2013	2015
Birds																
American coot	30		1			40			1			1	35	1		
American crow		3	12	17	12	6	4	7	2	5	1	3	2		4	3
American goldfinch															2	
American robin				1												
Belted kingfisher	1		1				1		1		1					
Black duck		7														
Black vulture							1				1					
Blue jay		1	3	19			3	5				3			1	17
Canada goose						9		4		6		8				10
Cardinal				2												
Carolina chickadee			5			2	1	1			4	3			2	1
Carolina wren								4								
Cliff swallow												10				
Common grackle												2				1
Domestic duck													1	1		
Domestic goose						1										
Double-crested cormorant		4	4	28							6	2			1	63
Downy woodpecker			2												1	1
Eastern bluebird						1									1	
Eastern kingbird										1						
Eastern phoebe			1													1
European starling								4				3				
Great blue heron	3	4	5	2	2	4	4	1	1	2	2		1	4	2	4
Little blue heron													1			
Mallard	1	6	1	2	6	4	8			1			2	22	2	
Mockingbird			4	2			7				1	3			1	4
Mourning Dove							2									
Osprey													1			
Pied-billed grebe				1							1			3		
Red-headed woodpecker				1												1
Red-tailed hawk			1													
Red-winged blackbird							6									
Ring-billed gull								1								
Rock dove									26	30		120		3	3	
Ruby-throated hummingbird		1														
Rufous-sided towhee							1									

Table 18 (continued).

	CRM 4.4 RDB				CRM 4.4 LDB				CRM 1.5 RDB				CRM 1.5 LDB			
	Observed				Observed				Observed				Observed			
	2011	2012	2013	2015	2011	2012	2013	2015	2011	2012	2013	2015	2011	2012	2013	2015
Turkey vulture											1	10		1		
Unspecified duck	8															
Unspecified perching bird	1	2	5	2		2	5	2			4	5			7	
Western kingbird															1	
Wood duck			1	9									2			
Yellow-shafted flicker			6					1								
Reptile/Amphibian																
Eastern spiny softshell turtle											1					
Common slider				1												
Map turtle			5	13			10	9			49	6			1	
Painted turtle								2			1					
Red-eared turtle												1				
Unspecified turtle									3							
Mammals																
Eastern grey squirrel	1	1				2	1	4					1		4	1
White-tailed deer				3			1									

Table 19. Water temperature (°F) depth profiles collected to determine the extent of the thermal plume from Kingston Fossil Plant during 2015

Depth (m)	**Ambient-CRM 3.1**					**Discharge-CRM 2.6**					***Below Discharge-CRM 1.5**				
October 2015	10%	30%	50%	70%	90%	10%	30%	50%	70%	90%	10%	30%	50%	70%	90%
0.3	21.4	21.4	21.4	21.4	21.4	21.7	21.6	21.6	21.7	21.7	21.8	21.6	21.6	21.8	21.4
1.5	21.3	21.3	21.3	21.3	21.4	21.7	21.6	21.6	21.6	21.6	21.5	21.4	21.4	21.4	21.3
3	21.2	21.1	21.1	21.2	21.4	21.6	21.6	21.5	21.3		21.4	21.4	21.3	21.3	
4						21.5					21.1				
5		19.8	20.0	20.1			20.6	21.3				20.6	21.1	21.2	
7		18.8	18.6	18.4			19.0	19.3					18.9	19.1	
9		18.5	18.4	18.4			18.5	18.6					18.5	18.5	
10			18.4												
11							18.4	18.4					18.5	18.5	
12							18.4						18.5	18.5	

*No plume temperatures were detected.

Table 20. Water quality parameters collected along vertical depth profiles at transects within the RFAI sample reaches upstream and downstream of Kingston Fossil Plant during 2015

October, 2015	LDB						Mid-channel						RDB					
CRM 4.4	**Depth**	**°C**	**°F**	**pH**	**Cond**	**DO**	**Depth**	**°C**	**°F**	**pH**	**Cond**	**DO**	**Depth**	**°C**	**°F**	**pH**	**Cond**	**DO**
Upstream Boundary	0.3	19.2	66.6	7.6	244.9	10.5	0.3	19.8	67.6	7.9	245.6	11.2	0.3	19	66.8	8	248	11
	1	19.2	66.6	7.3	243.8	9.9	1.5	19.2	66.6	7.8	248.5	10.7	1.5	19	66.4	8	250	11
							3	18.7	65.7	7.5	257.1	9.7	3	19	66.2	8	252	10
							5	18.5	65.2	7.3	261.6	9.4	5	19	65.6	7	260	10
							7	18.3	65.0	7.2	263.4	9.0	5.8	19	65.5	7	261	10
							9	18.0	64.4	7.1	263.8	8.5						
							11.3	17.9	64.3	7.1	263.4	8.4						
Mid-station	0.3	20.3	68.5	8.0	221.5	10.8	0.3	20.2	68.4	8.0	217.5	10.8	0.3	20.0	68.0	7.5	227.0	10.5
	1.5	20.1	68.1	7.9	224.2	10.4	1.5	19.8	67.6	7.8	238.3	10.4						
	2.4	20.0	67.9	7.8	229.9	20.0	3	19.7	67.5	7.7	242.9	10.3						
							5	18.3	65.0	7.2	260.0	8.6						
							7	18.0	64.4	7.1	264.2	8.6						
							9	18.0	64.4	7.1	264.0	8.6						
							10	18.0	64.4	7.1	264.3	8.8						
Downstream Boundary	0.3	20.8	69.4	7.5	244.0	10.0	0.3	20.9	69.5	7.7	244.4	10.0	0.3	20.8	69.4	7.7	244.5	10.0
	1.5	20.5	68.8	7.3	245.0	10.0	1.5	20.8	69.5	7.6	244.3	9.9	1.5	20.8	69.4	7.7	244.7	9.9
							2.5	20.8	69.4	7.6	244.7	9.9	3	20.7	69.3	7.6	245.2	9.8
													3.8	20.7	69.3	7.6	245.5	9.7

Table 20. (Continued)

	LDB						Mid-channel						RDB					
CRM 1.5	**Depth**	**°C**	**°F**	**pH**	**Cond**	**DO**	**Depth**	**°C**	**°F**	**pH**	**Cond**	**DO**	**Depth**	**°C**	**°F**	**pH**	**Cond**	**DO**
Upstream Boundary	0.3	21.6	70.9	7.5	257.9	8.9	0.3	21.5	70.7	7.8	244.7	10.0	0.3	21.5	70.8	7.8	251.6	9.8
	1.5	21.6	70.8	7.5	258.6	9.0	1.5	21.5	70.6	7.8	245.4	9.9	1.5	21.5	70.7	7.7	254.7	9.7
	2.4	21.6	70.8	7.5	257.5	9.0	3	21.4	70.5	7.7	248.6	9.6	3	21.5	70.6	7.7	258.0	9.5
							5	21.1	69.9	7.7	257.9	9.5	5	21.0	69.8	7.6	261.2	9.4
							5.9	20.9	69.6	7.6	255.4	9.4	7	19.3	66.7	7.5	273.0	9.3
													9	18.7	65.7	7.4	279.0	9.1
													10	18.5	65.3	7.4	280.7	8.9
													12	18.4	65.2	7.4	280.8	8.9
Mid-station	0.3	21.4	70.5	7.8	205.2	8.8	0.3	21.5	70.7	7.8	217.0	9.2	0.3	21.4	70.5	7.7	226.1	9.3
	1.5	21.4	70.5	7.7	205.4	8.8	1.5	21.3	70.3	7.7	212.5	8.9	1.5	21.3	70.4	7.6	225.6	9.2
							3	21.2	70.2	7.6	207.3	8.6	3	21.2	70.2	7.5	226.1	8.9
							5	20.8	69.5	7.5	210.6	8.8	5	20.9	69.7	7.4	236.5	8.9
							7	18.8	65.9	7.2	274.9	9.2	7	19.4	66.9	7.2	270.0	9.0
							9	18.6	65.5	7.4	279.5	8.9	8	19.0	66.1	7.1	275.6	9.0
							11	18.5	65.4	7.4	280.8	8.8						
Downstream Boundary	0.3	21.7	71.0	7.3	173.8	7.5	0.3	21.6	70.9	7.4	179.8	7.3	0.3	21.5	70.7	7.5	175.7	7.6
	1.5	21.5	70.8	7.2	174.8	7.5	1.5	21.5	70.8	7.3	179.7	7.2	1.5	21.3	70.4	7.5	176.7	7.4
							3	21.5	70.8	7.3	180.3	7.3	3	21.3	70.3	7.5	181.8	7.5

Abbreviations: °C – Temperature (degrees Celsius), °F – Temperature (degrees Fahrenheit), Cond – Conductivity, DO – Dissolved Oxygen