Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant

Documents submitted:
TVA Kingston Fossil Plant Release Site On-Scene Coordinator Report for the Time-Critical Removal Action May 11, 2009 – December 2010
EPA-AO-030

Date Submitted:
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TVA Kingston Fossil Fuel Plant Release Site
On-Scene Coordinator Report for the
Time-Critical Removal Action
May 11, 2009 through December 2010

Harriman, Roane County, Tennessee

Tennessee Valley Authority

Revision	Description	Date
00	OSC Report for TVA Review	December 6, 2010
01	OSC Report for Regulator Review	January 14, 2011
02	OSC Report for Regulator Review	February 14, 2011
03	OSC Report for Regulator Review	March 15, 2011
04	OSC Report for Regulator Review	March 21, 2011
05	OSC Report for Regulator Review	March 25, 2011
06	OSC Report for Regulator Approval	March 31, 2011

Additional information regarding the TVA Kingston Fossil Fuel Plant Release Site and the time-critical removal action can be found on the following websites:

U.S. Environmental Protection Agency (EPA) website:
www.epakingstontva.com/

Tennessee Department of Environmental Conservation (TDEC) website:
http://tennessee.gov/environment/kingston/

Tennessee Valley Authority (TVA) website:
www.tva.gov/kingston

Tennessee Department of Public Health (TDPH) website:
http://health.state.tn.us/coalashspill.htm

Roane County Community Advisory Group (CAG) website:
www.roanecag.org/

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Appendices (Attached)

References (on DVD)

List of Acronyms

$\mu g/m^3$	microgram per cubic meter
AAMP	Ambient Air Monitoring Plan
ACGIH	American Conference of Governmental Industrial Hygienists
ADEM	Alabama Department of Environmental Management
ADPH	Alabama Department of Public Health
AdH	adaptive hydraulics
AHA	activity hazard analysis
AECOM	AECOM Technology Corporation
AQS	Air Quality System (EPA)
Aquarius	Aquarius Marine, Inc.
ATSDR	Agency for Toxic Substances and Disease Registry
Benham	The Benham Companies
BAF	bioaccumulation factor
BOR	U.S. Department of the Interior's Bureau of Reclamation
BTEX	benzene, toluene, ethylbenzene, and xylene
CAG	Community Advisory Group
CAP	Corrective Action Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic foot per second
CIP	Community Involvement Plan
cm/sec	centimeter per second
CRCPD	Conference of Radiation Control Program Directors
CRM	Clinch River Mile
cy	cubic yard
DOE	U.S. Department of Energy
DQO	data quality objective
EDD	electronic data deliverable
EMHS	Emergency Management and Homeland Security
EnSafe	EnSafe, Inc.
EPA	U.S. Environmental Protection Agency
ERDCWES	Engineering Research and Development Center at Waterways Experiment Station
ERM	Emory River Mile
ERP	Emergency Response Plan
ERT	EPA Emergency Response Team of Edison, New Jersey
ESI	Environmental Standards, Inc.
F&AL	fish and aquatic life
FEM	Federal Equivalent Method
FERC	U.S. Federal Energy Regulatory commission
ft	foot
FS	factor of safety
Geosyntec	Geosyntec Consultants, Inc.
gpm	gallon per minute
GPS	global positioning system
GST	Gulf Strike Team
Hard Hat	Hard Hat Services
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSPD	Homeland Security Presidential Directive
ICS	Incident Command Structure

Jacobs	Jacobs Engineering Group Inc.
JIC	Joint Information Center
JSA	job safety analysis
kg	kilogram
LiDAR	light detection and ranging
MACTEC	MACTEC Engineering and Consulting, Inc.
Marshall Miller	Marshall Miller & Associates
MDL	method detection limit
mg/kg	milligram per kilogram
mg/L	milligram per liter
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NERC	North American Electric Reliability commission
NIMS	National Incident Management System
NIOSH	National Institute of Occupational Safety and Health
Norfolk Southern	Norfolk Southern Railroad Company
NPDES	National Pollution Discharge Elimination System
NTU	nephelometric turbidity unit
O&M	operation and maintenance
OExA	EPA Office of External Affairs
OEA	EPA Office of Environmental Accountability
OIG	TVA Office of the Inspector General
ORAU	Oak Ridge Associated Universities
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OSC	On-Scene Coordinator
OTIE	Oneida Total Integrated Enterprises
PAH	polynuclear aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
PEL	permissible exposure limit
PLM	polarized light microscopy
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
Ref.	Reference (documents on DVD)
REL	recommended exposure limit
RFP	request for proposal
RSI	Restoration Services, Inc.
SAP	Sampling and Analysis Plan
SedFlume	high shear stress flume (U.S. Army Corps of Engineers)
SESD	EPA Science and Ecosystems Support Division
SETAC	Society for Environmental Toxicology and Chemistry
Sevenson	Sevenson Environmental Services, Inc.
SOP	Standard Operating Procedure
SOR	safety observation report
SAB	EPA Science Advisory Board, Washington, D.C.
SSRCR	Suggested State Regulations for Control of Radiation
START	Superfund Technical Assessment & Response Team Contracts
Stantec	Stantec Consulting Services, Inc.

SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
SWS	Southern Waste Systems
SWSHP	Site Wide Safety and Health Plan
TCLP	Toxicity Characteristic Leaching Procedure
TDEC	Tennessee Department of Environment and Conservation
TDWS	Tennessee Domestic Water Supply Standard
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TLV	threshold limit value
TML	TransModal Logistics
Trans-Ash	Trans-Ash Inc. USA
TRIR	Total Recordable Incident Rate
TRM	Tennessee River Mile
TSS	total suspended solid
TSS	EPA Technical Services Section of the Superfund Division
TVA	Tennessee Valley Authority
TWA	time weighted average
TWQC	Tennessee Water Quality Criterion
TWRA	Tennessee Wildlife Resources Agency
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
XANES	X-ray absorption near edge structure spectroscopy

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ACKNOWLEDGEMENT

Under penalty of law, I certify that to the best of my knowledge, after appropriate inquiries of all relevant parties involved in the preparation of the report, the information submitted is 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.

Steve McCracken, TVA General Manager, TVA Kingston Fossil Fuel Plant Release Site

Signature ______________ Date 3/31/2011

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EXECUTIVE SUMMARY

On December 22, 2008, approximately 5.4 million cubic yards (cy) of ash material were released into the environment from the Tennessee Valley Authority (TVA) Kingston Fossil Fuel Plant (plant) in Harriman, Roane County, Tennessee. In response to this release, TVA undertook immediate response actions and worked in close coordination with the U.S. Environmental Protection Agency (EPA) Region 4, the Tennessee Department of Environment and Conservation (TDEC), and other agencies to provide for the safety of area residents, to contain released ash and minimize its downriver migration, and to monitor and assess air and water quality. Following the initial response actions, EPA issued a Transfer of Federal Lead Agency Authority memorandum, transferring lead agency authority from EPA to TVA on January 11, 2009. On January 12, 2009, TDEC issued a Commissioner's Order to TVA requiring the comprehensive assessment, cleanup and restoration of areas impacted by the release. On May 11, 2009, an Administrative Order and Agreement on Consent (EPA Order) was signed between EPA and TVA providing the regulatory framework for the cleanup efforts under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). TVA undertook response actions to achieve short-term and transitional mid-term strategic Site objectives defined in the EPA Order as time-critical removal actions. These removal actions were executed within the framework of the Incident Command System (ICS) Unified Command; TVA was the lead agency for the time-critical removal action; the EPA On-Scene Coordinator (OSC) approved all actions in consultation with TDEC. This OSC Report summarizes the time-critical removal actions taken to comply with the EPA Order. Approved work plans and/or reports are available at www.epakingstontva.com.

SUMMARY OF EVENTS

Ash, a by-product of burning coal in power generation plants, contains naturally-occurring metals and radionuclides that are hazardous substances as defined by CERCLA. The ash is washed out of the power generation facilities and sluiced in a water-based slurry to an Ash Pond for settling. Prior to the release, the ash was then dredged from the Ash Pond and piped to long-term unlined storage ponds, also known as dredge cells. The dredge cells were permitted by TDEC as a Class II Solid Waste Landfill under state regulations. When the release occurred, a containment dike surrounding the Class II landfill collapsed, releasing the ash. The wet ash material flowed into area waters, including the Emory River, adjacent tributaries and sloughs, and adjoining shorelines. The material covered approximately 300 acres of Watts Bar Reservoir, including most of the Swan Pond Embayment north of the former Dredge Cell. The area affected by the released ash is known as the TVA Kingston Fossil Fuel Plant Release Site (the Site). The ash deposits filled the navigation channel and affected flood levels by obstructing river flow.

Emergency response actions were taken immediately after the release happened. Actions included closing the Emory River to boat traffic; managing river flows by controlling releases from nearby dams; controlling ash migration by constructing a weir across the Emory River and a dike across the Swan Pond Embayment; repairing damaged railroads, roads, and utilities; collecting cenospheres (floating ash residue) and floating debris from the river; installing storm water management and dust control systems; and stabilizing dikes. Community outreach activities were implemented to provide for immediate safety and housing of affected residents, individual confidential health assessments, and multiple communication formats to provide local residents and officials with information on potential hazards and removal actions being taken.

Time-critical actions began immediately following issuance of the EPA Order on May 11, 2009. These actions included hydraulic and mechanical dredging of ash from the river, mechanical excavation of ash from the Swan Pond Embayment, dewatering and processing of the recovered ash (including water management), loading of the dewatered ash into railcars, transport of the ash via rail offsite, and ultimate disposal of the ash at the Arrowhead Landfill in Perry County, Alabama. Other related actions included cenosphere removal, air monitoring and dust control, surface water monitoring, storm water management, dike stability evaluations and stabilization, and construction of a test embankment to demonstrate the constructability of dry ash stacking.

EFFECTIVENESS OF REMOVAL ACTIONS

A total of 3,511,000 cy of ash and associated sediment were removed from the river during the time-critical removal action. Approximately 4,025,100 tons (3,096,000 cy) of that material was disposed at the Arrowhead Landfill. Approximately 415,000 cy of removed material remains stored on the Site for disposition under the non-time-critical removal action. An estimated 532,000 cy of ash remains in the river system and will be addressed further during the non-time-critical removal action. Details of the removal actions, and improvements approved by the EPA OSC to increase their productivity and effectiveness, are described in Section 2 of this OSC Report.

Effectiveness of Ash Removal. Large-scale dredging of the Emory River began under the time-critical removal action in August, 2009. The objectives, as defined in the EPA Order, were to expeditiously and efficiently prioritize and perform necessary response actions at the Site. Two phases of dredging were completed to meet Site priorities: Phase 1 hydraulic dredging focused on removing the greatest volume of ash in the quickest time frame ("bulk removal"); Phase 2 dredging focused on continued ash removal to the original river bottom to further minimize the potential for ash migration downriver ("precision dredging"). Mechanical dredging using clamshells and backhoes was used in conjunction with hydraulic dredging to remove debris, rock, and/or ash deposits located far upriver. Improvements to dredging production rates were achieved in accordance with EPA OSC approved work plans by adding more dredges and larger dredges. Removal productivity was improved by 75% during Phase 1 and 65% during Phase 2.

Effectiveness of Ash Processing. Ash processing consisted of gravity settlement in a Rim Ditch, Sluice Trench, Ash Pond, and Stilling Pond; removal of ash solids from these settling facilities; then stockpiling and windrowing the material in an area referred to as the Ball Field to dewater the recovered ash. To improve solids settling, sheet pile weirs were constructed across the Rim Ditch to slow the water down, and a polymer was added to the flow between each of the settling facilities. Windrowing was accomplished by moving the ash material from pile to pile to speed drying. Improvements to windrowing included the use of lime to improve drying, particularly for fine-grained material.

The EPA OSC used the plant's existing settling pond permit levels (for coal combustion) as performance criteria for removal action operations. The permit limits for total suspended solids were not exceeded during the time-critical removal action. The free water volume in the Ash Pond and Stilling Pond decreased as ash solids settled out, and was found to be below permit levels in October 2009. The EPA OSC determined that removal of ash from the river is of higher public health and/or environmental consequence than maintaining the free water volume permit level. This determination allowed ash removal action operations to continue at high rates of dredging. To improve solids settling capacity during high rates of dredging and prolonged wet weather, the Ash Pond was dredged, with the discharge diverted from the Rim Ditch to an adjacent Lateral Expansion area and to a series of recessed chamber filter presses in accordance with EPA OSC approved work plans.

Effectiveness of Ash Excavation East of Dike 2. Land-based excavation east of Dike 2 was performed to augment hydraulic dredging and thereby expedite ash removal as required by the EPA Order. Ash was placed in piles to drain by gravity, prior to loading railcars for disposal. To improve ash handling and drying during the prolonged wet weather, lime was added to the ash in the embayment in accordance with EPA OSC approved work plans.

Effectiveness of Temporary Ash Storage. Temporary ash storage was essential during the time-critical removal action; high productivity in ash removal led to increased use of temporary storage. To improve storage capacity, safe stacking heights were regularly monitored and gradually increased within the Ball Field and West Storage areas in accordance with EPA OSC approved work plans. Ash that was too wet for stockpiling, particularly during prolonged wet weather, was placed in several wet ash storage areas in the Dredge Cell and in the Lateral Expansion area, as approved by the EPA OSC.

Effectiveness of Loading. Dry ash having moisture content from 17 to 28% was loaded into railcars in the Ball Field. To improve loading production rates, additional railroad tracks were constructed in the middle of the Ball Field and in the plant's rail yard. These track improvements allowed railcars to be lined in an area separate from the loading area, and railcar transfers to be made without crossing Swan Pond Road. Due to changing material types and prolonged wet weather, excess water built up in the ash. To improve ash loading production rates, a polymer was added on the surface of the ash within the railcars to absorb excess water and target moisture contents were established for specific material types. Loading productivity was improved by 75% as a result of these measures.

Effectiveness of Transportation and Disposal. A fleet of six trains and 680 railcars were dedicated to the Site. Trains varied from 80 to 100 railcars each, with an average of 100 tons of ash per railcar. The ash was transported by rail to the Arrowhead Landfill in Uniontown, Alabama. A total of 414 trains transported nearly 40,000 railcars to Uniontown for disposal of the 4,025,000 tons (3,096,000 cy) of ash.

Effectiveness of Cenosphere and Skimmer Wall Debris Removal. Boats equipped with vacuum trucks, barge-mounted vacuum units and excavators, and associated equipment were used to remove floating cenospheres and debris (primarily wood) from the coves along the Watts Bar Reservoir. Debris from the failed sections of the old skimmer wall, including concrete beams and caissons, and structural rebar were removed from the river.

MONITORING AND ANALYTICAL RESULTS

Samples of ash, surface water, air, groundwater, and biota were collected in association with the time-critical removal action and were subjected to a variety of chemical, radiological, and toxicological analyses to support characterizing the extent of ash deposition, monitoring the containment and remediation operations, and assessing the potential health hazards and ecological impacts. Results of this sampling and analysis are detailed in Section 3 of this OSC Report.

Ash Characterization. The following constituents related to fly ash are hazardous substances as defined by CERCLA: barium, beryllium, arsenic, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, and isotopes of potassium, radium, uranium and thorium. Samples of the ash were routinely analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals, radiological constituents, moisture content, and paint filter tests to meet acceptance criteria at the landfill. Based on these tests, the ash is not characterized as a hazardous waste material under 40 CFR Part 261.

Surface Water Monitoring. Surface water was sampled routinely in the Emory, Clinch, and Tennessee Rivers. Results of routine (non-rainfall event) sampling have indicated that concentrations for some metals were highest in the area of the release, suggesting that dredging operations or residual ash may have contributed to elevated concentrations in the river. Results of rainfall event monitoring are generally similar to non-rainfall event sampling. Results of monitoring within the dredge plume in the Emory River indicated that numerous metals had one or more concentrations that exceeded water quality criteria, demonstrating impact from the dredging activities, but that ash-related constituents rapidly settled out of the water or were rapidly diluted downriver. Results of sampling within the Stilling Pond and from the Swan Pond Embayment indicate impacts due to direct contact with the ash.

Air Monitoring. Ambient air samples were analyzed for particulate air concentrations (PM2.5 and PM10), metals, and crystalline silica. Regional air quality conditions triggered Site action levels for PM2.5 to be exceeded on five occasions, but monitoring showed that the Site did not contribute to local airborne PM2.5 for any of those events. Mobile real-time monitoring recorded more than 150,000 instantaneous measurements of PM10; no 24-hour average concentration was found to exceed Site action levels.

Groundwater Monitoring. TVA collected groundwater samples from one bedrock well and five shallow wells during the time-critical removal action. Results for the single bedrock well showed that no analyte exceeded its maximum contaminant level (MCL) for domestic water supply. Results for shallow groundwater wells showed that arsenic exceeded its MCL of 10 μg/L three times (out of 51 samples) in one well downgradient of the Ball Field.

Biota Monitoring. Samples of fish were collected from the Emory and Clinch Rivers. Results indicated no trend in metals concentrations between river locations and no trend in metals bioaccumulation from 2009 to 2010. Surface water and sediment toxicity studies were conducted to determine whether ash-related constituents are harmful to benthic invertebrates. Results of whole ash toxicity tests indicated adverse effects on survival, growth, and/or biomass. Results of water toxicity tests indicated adverse effects on survival for some of the samples.

SAFETY AND HEALTH

Details of the safety and health program are provided in Section 4 of this OSC Report. Through the end of the time-critical removal action, 130 safety and health incidents were reported, including recordable injuries, first aid incidents, and near-misses. Five serious incidents occurred: a fatality occurred to a truck driver while unloading dredge pipe; a worker suffered amputation of four fingers as a result of getting his hand caught in a pulley; a tug boat captain broke an arm after slipping on a ladder; a crane operator experienced lacerations and fractures to his head and face from an uncontrolled crane rigging striking the crane cab; and a worker fell from an elevated platform on the filter press equipment, resulting in a fractured hip and injured liver.

Personal industrial hygiene monitoring was conducted using personal air sampling pumps with filters. Samples were analyzed for metals, radionuclides, carbon monoxide, respirable dust, total dust, and forms of silica. Results are summarized in Section 4.

Reportable environmental events included spills of chemicals that may negatively impact human health or the environment. During the time-critical removal action, there were 36 environmental events; none were serious. Most events involved release of small quantities of hydraulic fluid from dredges, excavators, or other heavy equipment.

PUBLIC INFORMATION AND COMMUNITY RELATIONS ACTIVITIES

EPA and TVA established community involvement programs to facilitate communication with the surrounding community. Communication tools were used to interact with the community and expand understanding about the Site. These communication tools included establishing an Administrative Record and Information Repository, websites and electronic media, a Community Outreach and Learning Center, and a Community Advisory Group. TVA established an Economic Development Foundation to provide more than $40 million in economic development funds for locally identified projects. TVA placed public notices announcing public comment periods in the local newspaper and by email, held availability sessions and public meetings, prepared responsiveness summaries for each public comment period, issued fact sheets, newsletters, and handouts, and erected road signs and electronic message boards. EPA and

TVA maintained active media relations and identified opportunities to speak to local government bodies, schools, and civic/community organizations.

RESOURCES COMMITTED

TVA has recorded an estimate in the amount of $1.2 billion for the total cost of cleanup related to the release. Costs incurred since the event, through the time-critical removal action, totaled $580 million. EPA costs incurred have totaled $5 million.

DIFFICULTIES ENCOUNTERED, MEASURES TAKEN, AND CONCLUSIONS

Recommendations to Prevent Recurrence. Measures to prevent a recurrence of the discharge or release were identified in the *Non-Time-Critical Removal Action for the Embayment/Dredge Cell* and included: (1) stable fill geometry using compacted earthen berms on stable foundations and lower height of fill; (2) controlled fill rates using construction methods that would not result in excess porewater pressures; (3) stabilized foundation soils to support internal pressures from the landfilled ash; and (4) controlled ash fill constructed using dewatered ash, compacted in thin lifts and at optimum moisture content to achieve higher shear strength.

The TVA Office of Inspector General has reviewed TVA's ash management practices. TVA management has begun to reassess its management program and has taken several actions, including: organizational changes to address management and accountability issues; development of programmatic documents specifying operational, maintenance, engineering and construction policies and procedures; changes to improve the corporate culture which had de-emphasized the importance of ash management; and steps to assess ash storage facilities against dam safety guidelines.

A TDEC Advisory Board prepared reports of lessons learned from the Dredge Cell failure. TVA has taken steps to address the recommendations by the TDEC Advisory Board. These steps include organizational and management oversight and governance to emphasize life-cycle design through programmatic application of engineering design principles. Safety monitoring has been improved through instrumentation and Dam Safety oversight, inspections and rigorous maintenance practices have been implemented at all of TVA's coal combustion facilities.

Operational Difficulties. Measures were taken during the time-critical removal action to expedite ash removal and mitigate other operational difficulties, as described in Section 7 of this OSC Report. The following summarizes the conclusions.

- Measures to expedite removal of ash from east of Dike 2 improved removal productivity by 75% during Phase 1 and 65% during Phase 2. The total quantity of ash removed was approximately 3,511,000 cy. An estimated 532,000 cy remains in the river system. Approximately 90% of the retrievable ash in the Emory River was removed during a 14-month period (March 2009 through June 2010). Approximately 85% of that (3,000,000) was removed in a 10-month period during the time-critical removal action. While not sustaining the EPA OSC's stated target removal rate of 15,000 cy/workday for Phase 1 and 10,000 cy/workday for Phase 2, the action did achieve expeditious and efficient removal of the material east of Dike 2 as safely as possible. Potential flooding was minimized and migration was significantly reduced as ash was rapidly removed.

- Measures to mitigate the accumulation of ash fines in the Ash Pond (best management practices for the Rim Ditch and Sluice Trench, use of the Lateral Expansion area for solids settling, and use of filter presses for dredge fine processing) overcame significant obstacles to dredging production. The removal action successfully met the objectives of the EPA Order by safely, efficiently and expeditiously handling the increased fines that resulted from high ash removal productivity rates.

- Measures to mitigate difficulties in wet ash handling and storage (wet storage areas, lime stabilization, polymer absorption in railcars, relic area ash) overcame obstacles presented by inclement weather in an efficient and expeditious fashion, as safely as possible and supported increased rates of productivity.

- Dredge operations were halted during severe high flow conditions to protect worker safety and health. Despite these impacts, the time-critical removal action successfully met the removal action objectives within the required time frame.

- Measures to maintain aggressive removal rates and maintain TVA's power system reliability requirements resulted, through coordination with the Kingston plant, in maintaining a reliable power grid without impacting high removal productivity.

- Measures taken to select a disposal facility (analysis of disposal options, consideration of environmental justice, inspections and follow-up enforcement) were effective in identifying an acceptable receiving facility and addressing community concerns.

- Measures to maintain a high productivity in loading, transport, and disposal (rail spurs within the Ball Field for loading, additional rail tracks for lining railcars, contractual modifications to extend or align work shifts, and polymer absorption in railcars) improved the number of railcars loaded per shift, increasing the loading, transport, and disposal productivity 75%. This improvement together with the efficient management of temporarily stored ash allowed ash management to keep pace with ash removal.

- Measures to control fugitive dust (best management practices, Flexterra®, selective vegetative cover, blading techniques, road wetting, rigorous decontamination) were successful, as evidenced by the air quality monitoring results.

- Measures to remove ash in an open, relatively uncontained, river system included accelerating productivity rates to expeditiously and efficiently remove the ash, conducting substantial monitoring and sampling in the river system, and removing cenospheres. These measures successfully mitigated downriver migration. Water quality was impacted in the immediate range of dredging activities, but dissipated downriver. Recreational users downriver were not significantly affected.

- Measures to maintain stability of the dikes, including the buttressing of Dike C, reduced potential risk due to slope failure or piping failure due to seepage through the structure.

- Demands of real-time execution during times of high production operations distracted the Unified Command from focusing on future planning and anticipating problems. Future multi-party Unified Command responses should establish a "potential future obstacles planning group" separate from the senior managers involved in day-to-day operations. This group's primary function should be to anticipate potential future obstacles and create a short list of viable and effective ready-to-implement contingent actions. While this difficulty existed, the project did expeditiously and effectively react to obstacles and challenges that arose during the time-critical removal action.

Environmental Difficulties. Measures were taken to overcome obstacles in environmental sampling, as described in Section 7 of this OSC Report. The following summarizes the conclusions.

- Several attempts were made to reformat EPA's SCRIBE database to accommodate large quantities of data and function as a multi-user database. After these attempts failed to produce a usable format, SCRIBE was replaced with EQuIS to fulfill the database needs of the Site.

- Measures were taken to expeditiously and efficiently collect and analyze air, water, legacy sediments, and radium in ash. The Unified Command pursed decision-quality data on an as-needed basis while maintaining a robust media sampling strategy. While there were limited improvements in reducing the amount of non-essential data, the need to demonstrate proof of the negative (that hazards do not exist) persisted.

- EPA conducted comparative analysis of results for surface water quality, which indicated a 98% correlation to TVA data, validating the reliability of both their sampling methodology and analytical results. Overall, audits conducted by EPA on the air monitoring system validated TVA-derived sampling, analysis, and subsequent data and made corrective actions and improvements where necessary. Proactive incorporation of non-governmental organizations and other agency concerns created a management environment that encouraged legitimate and qualified independent investigations.

Safety and Health Difficulties. Measures were taken to transition the Site to be compliant with CERCLA-required OSHA HAZWOPER, and to integrate the program, policies, and procedures of the Unified Command structure with those of TVA's corporate structure. These measures were significant factors in improving the Site safety record, as described in Section 4 of the OSC Report.

Community Involvement Difficulties. Measures were taken by the Unified Command to improve community involvement and create transparency to the public in ongoing Site decisions and execution. Frequent updates and access-on-demand allowed information to be effectively communicated in a timely manner. The use of website e-services and face-to-face communications were an effective component of these actions.

Transition Difficulties Avoided. Measures were taken to expedite a smooth transition from time-critical to non-time-critical removal actions. The EPA OSC approved work plans under time-critical authority and consistent with non-time-critical removal objectives, which authorized recontouring of the Dredge Cell, consolidating ash in the North Embayment, and constructing a bridge on Swan Pond Circle Road. The Unified Command exercised appropriate forethought in implementing actions using time-critical authority that provided for smooth and expeditious transition. As a result, non-time-critical removal of ash from the embayment was initiated in August 2010.

Voluntary Actions. TVA undertook other voluntary initiatives beyond those required by CERCLA under the EPA Order concurrent with time-critical removal actions. These voluntary actions were taken to improve the quality of life of Roane County citizens potentially impacted by the release and included providing $40 million in funding to the Roane County Economic Development Foundation, purchasing 185 properties to create a buffer to Site operations, enhancements to water distribution lines to extend capacity and service, and paving of over 10 miles of roadways.

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1 SUMMARY OF EVENTS

1.1 SITE CONDITIONS AND BACKGROUND

On December 22, 2008, approximately 5.4 million cubic yards (cy) of ash material were released into the environment from the Tennessee Valley Authority (TVA) Kingston Fossil Plant (plant) in Harriman, Roane County, Tennessee. In response to this release, An Incident Command System (ICS) Unified Command structure was implemented consisting of the U.S. Environmental Protection Agency (EPA) Region 4 as the lead agency, the Tennessee Department of Environment and Conservation (TDEC), and TVA. TVA undertook immediate response actions and worked in close coordination with the EPA, TDEC, and other agencies to provide for the safety of area residents, to contain released ash and minimize its downriver migration, and to monitor and assess air and water quality. Following the initial response actions, EPA issued a *Transfer of Federal Lead Agency Authority* memorandum, transferring lead agency authority from EPA to TVA on January 11, 2009 (Ref. 1.1). On January 12, 2009, TDEC issued a Commissioner's Order to TVA requiring the comprehensive assessment, cleanup and restoration of areas impacted by the release (Ref. 22.2). On May 11, 2009, an Administrative Order and Agreement on Consent (EPA Order) (Ref. 24.2) was signed between EPA and TVA providing the regulatory framework for the removal actions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Ref. 24.2). TVA undertook time-critical actions to achieve short-term strategic Site objectives defined in the EPA Order. This On-Scene Coordinator (OSC) Report summarizes the time-critical removal actions taken to comply with the EPA Order. This report has been prepared in conformance with the requirements of EPA's Office of Solid Waste and Emergency Response Directive No. 9360.3-03 (Ref. 21.4 and Ref. 21.6).

The Kingston plant is located just off Swan Pond Road in Harriman, Roane County, Tennessee, near the city of Kingston (Figure 1). Construction of the plant began in 1951 and was completed in 1955. The plant typically generates 10 billion kilowatt-hours of electric power each year, enough to supply the needs of about 670,000 homes in the Tennessee Valley. The plant consumes approximately 14,000 tons of coal per day when operating at full power (nine coal-fired units). To maintain system reliability under winter conditions during the time-critical removal action, the plant was required to provide contingency plans to startup power generation units to reach a predicted 28,000 kwH load demand, as discussed in Section 2.1.1.2.

Ash material is a by-product of burning pulverized coal in fossil fuel power generation plants. The Kingston plant can produce about 1,000 dry tons, or approximately 1,200 cy of ash per day when operating at full power. Ash material consists of both bottom ash and fly ash. Bottom ash is a coarse-grained material that is carried out of the bottom of the plant's production furnaces. Fly ash is a fine powdery material that is removed from the plant's exhaust stream by electrostatic precipitators. The bottom ash and fly ash are then sluiced as a water-based slurry to an Ash Pond for settling. Prior to the release, the ash was then dredged from the Ash Pond and piped to long-term unlined storage ponds, also known as dredge cells.

The dredge cells were permitted by TDEC on September 26, 2000, as a Class II Solid Waste Landfill under state regulations. The three permitted dredge cells (Cells 1, 2, and 3) that failed during the release (referred to as the Dredge Cell) covered approximately 127 acres and stored approximately 16.2 million cy of both fly and bottom ash at the time of the release. A fourth permitted dredge cell (referred to as the Lateral Expansion area, or Cell 4) was being constructed at the time in the northern half of the Ash Pond. Together, the Ash Pond and Lateral Expansion area covered approximately 120 acres and contained approximately 4.0 million cy of ash at the time of the release (Ref. 24.12). The Dredge Cell, Ash Pond, and Lateral Expansion areas therefore contained a combined total of approximately 20 million cy.

Ash is also present in other areas of the Kingston plant, having been generated from historical ash processing operations. The Ball Field is a triangular-shaped area located immediately north of the plant and south of the Dredge Cell; the Ball Field was one of the first ash settling pond areas at the Kingston plant, and has at least 40 ft of underlying ash deposits. The area was later used for metals treatment ponds, and for community use as a soccer field and baseball diamond prior to the release. A larger ash settling pond was constructed in 1961, after the Ball Field had been filled with ash and capped. The new ash settling pond consists of the Lateral Expansion, Stilling Pond and Ash Pond areas (Figure 2). The intermediate dike separating the Ash Pond and Stilling Pond was installed between 1976 and 1984. The Lateral Expansion remained part of the Ash Pond until 2008 when TDEC permitted the northern half of the Ash Pond as a storage area. The "Stilling Pond" is a triangular-shaped area located immediately east of the Ash Pond and Lateral Expansion area; the Stilling Pond is used for final treatment of plant wastewaters prior to discharge under the Kingston plant's National Pollutant Discharge Elimination System (NPDES) permit; the Stilling Pond also has approximately 40 ft of underlying ash deposits. Quantities of ash present in the Ball Field and Stilling Pond areas are estimated to be less than 5 million cy. The Dredge Cell, Ash Pond, and Lateral Expansion, Ball Field and Stilling Pond areas therefore contained a combined total of approximately 24 million cy.

The Kingston plant is located on the Emory River close to the confluence of the Clinch and Tennessee Rivers. The Emory River at the Kingston plant is impounded by Watts Bar Dam. Watts Bar Dam was built in 1942 across the Tennessee River at river mile marker 529.9, which subsequently caused the Emory River to back up and flood shallow land that is now covered by the Ball Field, Dredge Cell, Ash Pond, Lateral Expansion, and Stilling Pond. Swan Pond Embayment and its adjacent sloughs (Church Slough, Berkshire Slough, and Swan Pond Slough) were created as shallow backwater areas of the Emory River due to this damming. The normal summer and winter pool levels of Watts Bar Reservoir in the vicinity of Kingston Plant are 741 and 735 feet mean sea level (msl), respectively. The Emory River originates upstream on the Cumberland Plateau and its flows into Watts Bar Reservoir are not controlled. Flows in the nearby Clinch River arm of Watts Bar Reservoir are controlled by Melton Hill Dam.

1.1.1 Initial Situation

On Monday, December 22, 2008, a containment dike surrounding a portion of the Class II landfill collapsed, releasing approximately 5.4 million cy of fly ash and bottom ash. The wet ash material flowed into area waters, including the Emory River, adjacent tributaries and sloughs, and adjoining shorelines. The released material covered about 300 acres of adjacent parts of Watts Bar Reservoir, including most of Swan Pond Embayment and reservoir shore lands. The EPA Order defines the Site as those areas of the TVA Kingston Fossil Fuel Plant in Roane County, Tennessee, where ash and other waste material from the December 22, 2008 release has been deposited, stored, disposed of, or placed, or has migrated or come to be located is considered the Site. Most of the released ash was on property under TVA's custody and control. Figure 2 illustrates the area prior to the dike failure, and Figure 3 shows the area on December 30, 2008, after the dike failure. No injuries occurred; however, 40 properties were directly affected by ash deposits or water surge. Three houses were severely damaged and were later demolished. Swan Pond Road, Swan Pond Circle, and portions of the rail line serving the plant were covered with ash. Water, electrical, and gas services to the adjacent area were interrupted.

1.1.2 Location of Hazardous Substance(s)

The ash material contains naturally-occurring metals and radionuclides that are hazardous substances as defined by CERCLA Section 101(14). The ash from the Ash Pond and Dredge Cells was tested for naturally-occurring inorganics after the dike failure occurred in December 2008. Coal, in its natural state, contains various inorganic constituents that can be concentrated and retained in the ash after burning the coal for power production. The specific chemical composition of fly ash depends on the source of the coal. The plant mostly uses eastern bituminous coal but also has used coal from Illinois and blends low-sulfur Western coal to reduce emissions. Ash is primarily composed of fine silica particles. Oxides of silicon, aluminum, iron, and calcium, chemically combined in an amorphous form, comprise 95 to 99% of fly ash. Ash contains variable amounts of magnesium, titanium, sulfur, sodium, and potassium. Ash also contains trace amounts (less than 1%) of other constituents that occur naturally in coal, such as arsenic, barium, beryllium, boron, copper, lead, mercury, nickel, selenium, thallium, vanadium, and zinc (Ref. 13.2.1). In addition, ash contains naturally-occurring radionuclides, such as isotopes of uranium and thorium, their short-lived daughter products (such as radium), and potassium-40. Analytical data for ash and naturally-occurring soils in the region are discussed in Section 3.

The released ash extended through several miles of riverways. The main area affected by the failure of the Dredge Cell was in the area nearest the plant, extending from Emory River Mile (ERM) 1.5 to 3.5. The magnitude of the ash deposits in this area varied from approximately 5 feet (ft) in thickness to completely filling in the navigation channel (greater than 30 ft in thickness) and completely filling in Swan Pond Embayment. Ash deposit thicknesses decreased with distance upriver and downriver from the original release. Several different field sampling surveys (bathymetric and Eckman dredge surveys) were performed by TVA in January and February 2009, prior to the time-critical removal action to characterize the spatial extent of ash deposition (Ref. 22.3). Results indicated that initially, the ash may have traveled upriver as far as ERM 5.75 and as far downriver as Tennessee River Mile (TRM) 564. Ash deposits were up to a foot in thickness in some depositional areas in the Clinch River. Ash deposits less than one inch in thickness were originally observed in the Tennessee River at the mouth of the Clinch River.

Since that time, further downriver migration of ash has occurred into the Clinch and Tennessee Rivers. Two large rainfalls in January 2009 and in May 2009 resulted in Emory River flows of 26,000 cubic feet per second (cfs) and 69,000 cfs, respectively. Normal river flow is approximately 1,000 cfs. Surveys following each of these rainfall events showed ash moved downriver. In addition, depression areas in the ash showed filling and other areas showed scouring from high flows. However, scouring and filling did not occur everywhere. For example, steep banks from dredging were still evident in some locations, even after the high flow event in May 2009.

EPA retained the U.S. Army Corps of Engineers (USACE) Engineering Research and Development Center at Waterways Experiment Station (ERDCWES) to run a quantitative two-dimensional hydrodynamic and sediment fate and transport model, known as Adaptive Hydraulics (AdH). Information on AdH can be found at the following website: http://adh.usace.army.mil/. ERDCWES also conducted tests to characterize the resistance of fly ash to erosion in a laboratory flume (SedFlume). Information on the SedFlume can be found at: http://chl.erdc.usace.army.mil/chl.aspx?p=s&a=articles!630.

Based on ERDCWES modeling (Ref. 24.14), it is estimated that during the high flow event in May 2009, up to an additional 75,000 to 200,000 cy of ash moved from the Emory River into the Clinch River and as far downriver as TRM 562. The primary deposition area for fine particles is predicted to be between TRM 562 and 568. Subsequent high flow events had lesser amounts of ash movement, as the ash became more dense on the river bottom and as ash was removed by dredging. Results of ERDCWES modeling are summarized in Table 1-1.

These results were verified for the May 2009 flood event. The EPA OSC requested nature and extent survey of the Emory, Clinch, and Tennessee Rivers. Results of that survey are reported in the *Eckman Dredge and Visual Observation Survey for Portions of the Lower Emory River, Clinch River, and Tennessee River, Tennessee Valley Authority, May 22 and June 2, 2009, Report of Results* (Ref. 11.3.2). The survey results showed that the ash thickness had increased in the lower Emory River with most of the ash deposition in the main river channel, that a trace amount of ash had moved one mile further down the Tennessee River, and that a significant amount of natural river sediment had also moved during the flood event. Additional investigations were performed in the summer of 2009 in accordance with the EPAOSC approved *Work Plan, Ash Migration Investigation Using Sub-bottom Profiler* (Ref. 7.2.1). The measured differences in sediment elevations representing pre- and post-flood conditions are shown on Figure 4. Additional information regarding this Phase 1 survey following the May 2009 flood event, including generated results that were transmitted to the EPA OSC, is provided in the *Time-Critical Removal Action Completion Report for River System Phase II Nature and Extent of Ash Investigation* (Ref. 7.3.4).

Table 1-1. Results of Modeling of Ash Transport During Selected Flood Events

Flood Event	Peak Flow	Estimated Volume of Ash Transported Downriver
January 2009	26,000 cfs	Not modeled
May 2009	70,000 cfs	119,000 cy
December 2009	50,000 cfs	4,160 cy
January 2010	60,000 cfs	8,820 cy
May 2010	50,000 cfs	1,870 cy

Note: Source of information from ERDCWES (Scott 2010).

The magnitude of ash deposition as a result of the release affected flood levels within the Emory River by obstructing river flow. Prior to the failure of the Dredge Cell, the predicted 100-year flood elevations for this reach of the Emory River ranged from elevation 747.6 ft above msl at ERM 1.5 to 749.4 ft above msl for ERM 3.5. The 100-year flood levels following the release were predicted to rise by 2.3 to 2.9 ft, thereby causing a potential for greater upriver flooding (13.2.1).

As time-critical dredging neared completion in March, 2010, TVA contracted with Dr. Rollin Hotchkiss of Brigham Young University and his colleagues at Aquaveo, LLC, to perform a flood-frequency and hydrologic analysis of the Emory River. The purpose of that analysis was to evaluate whether the time-critical dredging had returned predicted flood elevations to pre-spill levels. This study incorporated river bathymetry that was developed during the time-critical removal action, included detailed modeling in the vicinity of bridges, and assumed concurrent floods on the Clinch and Tennessee Rivers. The model was calibrated to observed water surface elevations in a 1973 flood that approximated the 100-year recurrence interval flood. The results of this modeling indicate that predicted water surface elevations for the 100-year flood in the Emory River are equal to or less than those prior to the release (Ref. 24.13).

1.1.3 Cause of Release or Discharge

On January 8, 2009, TVA hired AECOM Technology Corporation (AECOM) to begin a root cause analysis of the Dredge Cell failure to determine the most probable cause(s) and location of failure at the Site. AECOM conducted interviews, reviewed files, performed site reconnaissance, drilled test borings, advanced piezocone probes, collected undisturbed samples, logged test pits and trenches, performed laboratory testing, and conducted seepage and stability analyses to define the probable failure mode leading up to the sudden failure. AECOM published a Root Cause Analysis Report where more information can be found (Ref. 25.2).

AECOM reviewed twelve failure modes to identify the most probable mechanisms or factors that contributed to the failure. AECOM's conclusion was that the Dredge Cell impoundment was on the verge of failure with no visible signs of distress reported that would have indicated that a deep-seated failure was about to occur. Rapid failure of the active Dredge Cell 2 was progressive in nature due to four concurrent factors:

1. Fill Geometry – AECOM analyzed actual TVA surveyed slopes for the dredge cells. Dikes A through D2 were built on high-void-ratio sluiced wet ash and underlying sensitive silt ("slimes") layer. The dikes were located 200 ft back from the original containment Dike C, and thus did not benefit from the more stable foundations present under the original Dike C, which was founded on silt and clay alluvium with no slimes present.

2. Increased Fill Rates – The dredge cell footprint at Cell 2 was becoming smaller with each dike rising. More cell dike height was required to store the same annualized volume of generated ash and thus the elevation of the ash was increasing more rapidly compared to earlier years. The added height of ash behind the upstream dike construction added load to the wet ash and to the underlying sensitive silt situated over the former flood plain alluvium clays and silts.

3. Soft Foundation Soils – Creep failure of the submerged loose slimes was occurring under the load of 40 to 85 ft of loose wet ash. Creep deformations caused a reduction in the available strength of the slimes. The slimes deposited early during the Ash Pond history had high water contents, unusually high liquidity indices, and relatively low undrained shear strengths as determined from strain-controlled undrained direct simple shear tests and field vane shear tests.

4. Loose Wet Ash – The initial loose, sluiced ash was deposited under water, with a resulting high void ratio and with little benefit from consolidation or densification under the surcharge weight of ash placed above the initial deposits. As a result, the ash remained very loose and became highly contractive, leading to low undrained shear strength with a very sensitive structure. Once cell loading stresses exceeded the peak undrained shear strength, the available strength decreased rapidly towards an undrained steady state shear strength, which may have been as low as 100 pounds per square foot.

The TVA Office of the Inspector General (OIG) hired Marshall Miller & Associates (Marshall Miller) to conduct an independent peer review of AECOM's root cause analysis and a review of TVA's ash management practices. OIG and Marshall Miller conducted interviews with selected TVA management, engineering, plant operations, and consultant personnel; performed walkdowns of seven fossil fuel plants; reviewed available annual inspection reports of TVA waste disposal facilities; reviewed historical documentation pertaining to TVA ash storage; and attended TVA meetings. The TVA OIG published an Inspection Report where more information can be found (Ref. 25.3). The findings of the OIG Inspection Report included the following:

- AECOM overemphasized the "slimes" layer as a trigger for the release, which could limit corrective actions; all four factors identified by AECOM contributed significantly to the failure.

- TVA failed to investigate and report management practices or policies and procedures that contributed to the release by allowing conditions to advance to the critical stage that precipitated the release.

- TVA could have possibly prevented the release if it had taken recommended corrective actions. TVA was aware of "red flags" that were raised over a long period of time signaling the need for safety modifications; specifically, a 1985 internal memorandum by a TVA engineer and two 2004 reports by external engineering consultants.

- TVA's Enterprise Risk Management program did not adequately address known risks associated with ash ponds. TVA's program, begun in 1999, had not identified ash management as a risk, even though risks associated with ash management were known internally as early as 1987. TVA did not place the ash ponds under its Dam Safety Program.

- The culture at TVA's fossil fuel plants impacted ash management and is likely to be resistant to the kinds of reforms necessary to avoid other safety failures. The culture relegated ash to the status of garbage at a landfill rather than treating it as a potential hazard to the public and the environment. This resulted in a failure to implement recommended corrective actions, the lack of policies and procedures, poor maintenance, lack of specialized training, multiple organizational structure changes, inadequate communication, and failure to follow engineering best practices.

- TVA has recently acted to address certain ash management weaknesses. TVA management has begun to reassess its management program and has taken several actions to improve its organizational effectiveness, including: organizational changes to address management and accountability issues; changes designed to alter the corporate culture which had de-emphasized the importance of ash management; and steps to assess ash storage facilities against dam safety guidelines.

In November 2009, a TDEC Advisory Board published its report of lessons learned from the Dredge Cell failure (Ref. 25.4). The report outlined the primary issues found at the plant, discussed the ongoing evaluation of other TVA facilities, weighed in on AECOM's root cause analysis, and made several recommendations for future management of coal ash in Tennessee. The Advisory Board reviewed available information, attended TVA briefings, performed site visits, and assessed TVA processes. The Advisory Board hired The Benham Companies (Benham) to conduct a more detailed review of the Phase I investigations conducted by Stantec Consulting Services, Inc. (Stantec) of TVA's coal combustion waste facilities throughout the TVA complex. Findings and recommendations of the TDEC Advisory Board included the following:

- Emphasis should be on improved life-cycle design requirements by employing: thorough engineering design principles; effective engineering safety monitoring, inspection, and follow-up maintenance; and an engineering philosophy and long-term plan that can be safely followed and modified as needed, as these types of facilities evolve.

- The Kingston dredge cells were at a critical state of failure regardless of the presence of AECOM's emphasized layer of weak foundation material. The lack of engineering design for the raising of the cells, the inadequately understood material properties, pore pressure dissipation properties and material consolidation mechanisms of the ash, the methods of placement of the ash, the staged upstream construction, and the dredging activities all contributed to the condition of the pre-failure structure.

- There was an apparent lack of understanding or consideration of the evolutionary process of the construction at the plant. Additionally, there was no on-going, consistent method of design evaluation, documentation and communication to manage the evolutionary process. The Kingston ash storage structure lacked design continuity and effective structural stability oversight by TVA management throughout its history. The quality of engineering design, construction, inspection, and maintenance did not incorporate the standard of care and understanding required for this type of structure.

- TVA policies and procedures should be improved in inspection process/inspector qualifications; emergency response; operation and maintenance; and engineering analysis.

1.1.4 Injury/Possible Injury to Natural Resources

1.1.4.1 Notification of Natural Resource Trustees

The natural resource trustees were notified immediately after the release. TVA itself is one of the natural resource trustees for Watts Bar Reservoir, along with the State of Tennessee and the U.S. Fish and Wildlife Service (USFWS).

1.1.4.2 Assessment of Pre-Spill Natural Resource Conditions

The following assessment of pre-spill natural resource conditions and immediate impacts from the release have been summarized largely from Section 2.1.6, Natural Resources, of the *Corrective Action Plan (CAP) for the TVA Kingston Fossil Plant Ash Release* (Ref. 22.3). The CAP was a requirement of the TDEC Commissioners Order.

Fish and Aquatic Life

Existing information from various TVA and Tennessee Wildlife Resources Agency (TWRA) projects and surveys were used to develop an estimate of the aquatic community prior to the release. These included TVA fish and benthic surveys conducted as part of the TVA Reservoir Vital Signs Monitoring Program; TVA fish, mussel, wetlands, and avian surveys conducted in support of permit requirements and National Environmental Policy Act assessments for the plant and other TVA projects in the vicinity, and TWRA fish and mussel surveys and creel data.

Fish. TVA has systematically monitored the ecological conditions of its reservoirs since 1990 as part of the Vital Signs Monitoring Program. The fish assemblage in the Clinch River in Watts Bar Reservoir has consistently rated “good” on a “Good—Fair—Poor” evaluation system that incorporates several different fish community measures, except for lower scores in 2007 related to drought conditions that continued into 2008. The quality of the Watts Bar Reservoir sport fishery has consistently rated at or above the valley-wide average.

Recognizing the paucity of available data on fish tissue contamination in the Emory River and the time for ash constituents to bio-concentrate into the adult fish, TWRA, TVA, and Oak Ridge National Laboratory (ORNL) began collecting fish for tissue analysis in early January 2009, to establish baseline concentrations and for comparison with available historical data for Tennessee Valley waters. Tissue samples were split for analysis by State of Tennessee Environmental Laboratory, an ORNL subcontract laboratory, Pace Analytical Laboratory, and TVA Central Laboratories.

Additional surveys conducted in 2009 focused on higher trophic level fish (channel catfish, largemouth bass, bluegill, and sunfish), but included other species as the opportunity arose. They also included gizzard and threadfin shad as representatives of lower trophic level fish. In addition to bioaccumulation, analyses included assessments of fish reproductive competence and overall indicators of fish health, including measures of short-term responses to stress such as physiological bio-indicators (blood enzymes, liver somatic index, etc.) and measures of longer-term responses such as histopathology and physical deformities. The objective of these investigations was to establish baseline conditions for use in subsequent evaluations of any trends in bioaccumulation and fish condition or any relationships between exposure to ash, concentrations of chemicals in fish tissues, and biological/ecological effects.

Mussels. Prior to the ash release, the mussel fauna in the Emory River near the plant had been substantially altered by the impoundment of Watts Bar Reservoir, by impacts from mining in the headwaters, and by municipal and industrial wastewater discharges further upriver (Ref. 6.3.8). Six mussel species (giant floater, fragile papershell, pistolgrip, pimpleback, wartyback, and three-horn wartyback) and a common aquatic snail (horn snail) were found in a pre-spill survey of this area. All of these species, except pistolgrip, are generally tolerant of reservoir conditions and could have been expected to occur in the area affected by the ash release in small numbers due to the low dissolved oxygen conditions that occasionally develop in summer in the impounded part of the Emory River.

Aquatic Worms and Insect Larvae. Reservoir bottom sediments provide habitat for a variety of aquatic worms and the larval form of many aquatic insects. The abundance and diversity depend on factors such as the physical properties of the sediments, presence or absence of dissolved oxygen in the overlying water, and abundance of food. In an area such as the Emory River arm of Watts Bar Reservoir, mayfly and caddisfly larvae, and a variety of midges and chironomids, among other benthic fauna would be expected to occur.

Wetlands

Wetland acreage affected by the ash release was determined using land use and land cover data. The data were derived from a baseline stereo-analysis of 1:12000 color-infrared aerial photography dated January 7, 2003. Recent (2006 and 2008) National Agriculture Imagery Program digital imagery was then used to augment the base data where features had changed over the course of time. Classification is based on the standard Anderson system (Ref. 21.1), modified to capture additional detail. Acreage calculations are based on the area of each individual polygon classified in the interpretation process.

This analysis determined that approximately 2.5 acres of wetlands were affected by the ash release. Habitat types as described by Cowardin et al. (Ref. 21.2) are listed in Table 1-2.

Table 1-2. Affected Pre-Spill Wetlands

Wetland Type	Acreage by Type
Palustrine Emergent Wetland	1.55
Palustrine Forested Wetland	0.65
Palustrine Scrub-shrub wetland	0.30
Total Acreage	**2.5**

In addition, wetland habitats in the vicinity of the plant have been monitored as part of a larger study associated with the 2004 TVA Reservoir Operations Study and Environmental Impact Statement (Ref. 21.5). There are two wetland study sites within the Swan Pond Embayment area north of the Dredge Cell. Baseline data were collected on these sites in 2004 and 2006. One scrub-shrub and one forested wetland plot were part of the original Reservoir Operations Study design (Ref. 21.5). The Swan Pond sites were chosen because they were high quality wetland sites on TVA land, which ensured long-term access to these sites.

Terrestrial Animals

TVA has monitored avian resources at the plant for many years. Shorebird and waterfowl information at the Site has been collected systematically for five years. The remaining Ash Pond and Stilling Pond, not damaged during the ash release, are used by a variety of shorebirds, waterfowl, gulls, and other species. TVA collected a series of reports from ORNL that describe avian, reptile, and other terrestrial animal resources in the vicinity. TVA has also mapped and continues to examine additional wildlife resources near the plant.

Other Ecological Habitat Types

Other ecological habitats, largely riparian interfaces between upland (terrestrial) habitats and the aquatic habitats (reservoir and river tributaries) were present in the area prior to the release. These riparian zones can be important habitats for a variety of wildlife species. Riparian zones were identified by using a 25-yard wide buffer of pre-spill hydrology along the shoreline. Stereo interpretation of 2003 imagery, augmented with non-stereo interpretation of 2006 digital imagery was used to estimate acres of riparian habitat (Table 1-3). Wetland components of riparian zone vegetation are described above.

Table 1-3. Affected Pre-Spill Riparian Zones

Riparian Zone Type	Acreage by Type
Residential Wooded/Grass mix	8.9
Grass Cover– Fair and Poor Condition	8.1
Forest	38.1
Total Acreage	**55.1**

Much of the riparian zone adjacent to the former Dredge Cell consisted of short grasses and a thin marginal strip of trees along the shorelines. This habitat and the residential grasses offered minimal wildlife benefits. Forested habitat along the embayment, east of the former Dredge Cell represented better wildlife habitat. A large mudflat was also present in Watts Bar Reservoir prior to the release. This mudflat was exposed when reservoir levels were reduced during winter months. Four islands were present near the site. One island was used by a large colony of great blue herons and black-crowned night-herons. The islands also provided nesting habitat for Canada geese.

1.1.4.3 Assessment of Immediate Spill Impacts on Natural Resources

The ash released into the Swan Pond Embayment and Emory River covered aquatic habitats in this portion of Watts Bar Reservoir. Ash deposits in the most severely affected portion of the reservoir ranged from approximately five feet deep to complete filling of the Swan Pond Embayment and the Emory River adjacent to the mouth of the embayment. Ash also was transported into the Clinch and Tennessee Rivers by subsequent rainfall events.

Fish and Aquatic Life

Bottom-dwelling animals (mussels, snails, insects, crayfish, etc.) in areas where large amounts (>6 inches) of ash were deposited were likely unable to escape the release and were smothered by ash deposits. Fish in the area were stranded on adjacent shorelines and experienced physical trauma due to the ash, debris, and high levels of suspended solids in the water during and immediately after the release. Approximately 200 to 300 dead fish (including threadfin shad, freshwater drum, smallmouth buffalo, largemouth bass, and sunfish) were observed immediately following the release, most on stream banks where they were stranded by the initial surge of water caused by the release.

Review of information from TVA fish community and benthic community assessments conducted the week of January 20, 2009, indicated that except for the area most affected by the ash release, fish and benthic invertebrates were present in numbers and conditions typically observed for similar water bodies. Subsequent surveys continue to confirm that the release appears to have had minimal impacts on the numbers and species of aquatic organisms present (Table 1-3). TVA and ORNL are conducting annual spring and fall fisheries surveys to assess whether the released ash is causing any bioaccumulation, health, or reproductive competence effects on fish. These surveys will continue through at least calendar year

2011 and will be addressed under the Non-Time-Critical Sampling and Analysis Plan for the River System.

Table 1-4. Summary of Fish Community Survey Results, 2001-2010

Site	Year	Season	Total # of Fish Collected	Electrofishing Catch Rate (no./hr)	Gill netting Catch (Average no./net)	Number of Species	Percent Anomalies
ERM 2.5	2010	Autumn	1672	401.9	13.6	40	1.5%
	2009	Autumn	1405	279.6	10.7	35	4.1%*
CRM 4.4	2010	Autumn	1784	452.0	10.1	38	1.0%
	2009	Autumn	1581	366.5	10.6	32	2.8%*
	2009	Winter	395	62.5	18.6	26	1.5%
	2007	Autumn	775	224.0	9.2	32	0.4%
	2005	Autumn	1167	360.9	10.9	34	1.4%
	2003	Autumn	1116	354.1	21.6	37	0.2%
	2001	Autumn	1137	287.8	21.3	36	1.4%
CRM 1.5	2010	Autumn	1910	440.6	17.3	38	1.1%
	2009	Autumn	2211	495.7	7.9	32	4.1%*
	2009	Winter	2025	562.7	9.9	29	0.2%
	2007	Autumn	858	263.6	7.7	28	0.1%
	2005	Autumn	1137	327.3	16.7	34	0.5%
	2003	Autumn	967	329.5	14.3	35	0.1%
	2001	Autumn	1402	405.6	23.1	36	0.9%

Note: *Higher percent of anomalies largely due to increased numbers of bluegill infected with common parasite(s) (i.e., trematodes in eyes).

Wetlands

Land use and land cover imagery analyzed post-spill indicates the 2.51 acres of wetlands present within the release footprint were filled entirely by ash, thus eliminating these areas.

Terrestrial Animals

It appears that low levels of immediate wildlife mortality were associated with the ash release. A great blue heron carcass was found at the Site. The specimen exhibited a broken leg and it is presumed that the bird died from injuries related to the release. The carcass was collected by USFWS. A small great blue heron colony is located on an island near the release; although ash was deposited around the shoreline, the island remained intact. The large great blue heron and black-crowned night-heron colony located on a larger island east of the release remained intact and is being used as a sample locality for further site evaluation. The Stilling Pond used by shorebirds and waterfowl was not affected by the release; however ash removal operations have reduced shorebird and waterfowl activity at the ponds. Other islands near the release remain intact and were not impacted.

Although observations are not available to document the magnitude of impact, various species of wildlife may have been affected, as several wetland and riparian habitats used by these species were destroyed or seriously modified. Samples of mammals, spring breeding frogs and aquatic turtles, and bird resources demonstrate that these organisms still occur in the area. In 2009, TVA began systematic sampling of terrestrial animals near the release. Semi-aquatic mammals, turtles, spring breeding amphibians, and eggs from osprey and great blue herons were sampled for trace element exposure. Multiple tree swallow colonies were established at the Site and at various reference locations in the region. Tree swallow nestlings and eggs were also sampled. In 2010, TVA expanded many of these studies to include additional sample locations and to increase sample sizes. Sampling and analysis continues for this study under the *Non-Time-Critical Removal Action for the River System, Sampling and Analysis Plan (SAP)* (Ref. 11.2.16).

Other Ecological Habitat Types

Habitat losses were estimated using various sources of information, including pre- and post-spill land use and land cover analyses, the amount of wetted area in the adjacent aquatic habitats at the time of the release, Shoreline Aquatic Habitat Index surveys performed by TVA, and other available historical data. Extent of damage to terrestrial habitats, largely riparian interfaces between upland habitats and the reservoir and its tributaries, was assessed with aerial photography immediately after the release and photography showing mitigated sites up to 23 July, 2010 (Table 1-5). The riparian interface was identified using a 25-yard buffer along the shoreline.

Table 1-5. Post-Spill Riparian Zones

Riparian Zone Type	Acreage by Type December 2008	Acreage by Type July 2010
Residential Wooded/Grass mix	5.60	8.84
Grass Cover– Fair and Poor Condition	1.85	14.83
Forest	15.85	15.99
Disturbed area/bare ground/ash	41.53	8.54
Rip-rap, gravel, dirt, infrastructure	-	12.85
Total Acreage	**64.83**	**61.05**

All riparian types were impacted by the release; their overall acreage was changed by the release, and by removal actions. The marginal strip of forest habitat was heavily impacted. Much of the disturbed riparian areas were forested, however these areas were mostly comprised of a thin stand of tree species that are abundant in the area. The North Embayment area (also referred to as Berkshire Slough) was largely filled by ash and has been replaced by narrow stream corridor. The riparian zone in this area has been largely replaced by grasses, rip-rap and other erosion control measures. These areas offer little wildlife benefit. A small slough north of the Dredge Cell, referred to as Church Slough, and the East Embayment area (also referred to as Swan Pond Slough) have been cleared of ash and have vegetation regrowth and wildlife activity. The island with the large heron colony remains intact and ash removal operations have not disturbed heron reproduction at this site. Osprey and Canada geese also continue to breed in proximity to the Site. Tree swallow colonies continue to produce viable eggs and young.

1.1.5 Efforts to Obtain Response by Responsible Parties

1.1.5.1 Incident Notification

EPA was the lead federal agency during the emergency response. TVA and Roane County Office of Emergency Management and Homeland Security (EMHS) responded immediately to the release. On December 22, 2008, the National Response Center and EPA Region 4 were notified by TVA of the release. An OSC responded to the release the same day. An ICS response organization was activated to manage the emergency phase of the release under Unified Command, with EPA acting as the lead federal agency for the environmental response. Members of the Unified Command included TVA, EPA Region 4, TDEC, Roane County EMHS, Tennessee Emergency Management Agency, and Tennessee Department of Health. The U.S. Coast Guard (USCG), USFWS, and USACE were also informed of the release. In addition, TVA staff also contacted the office of the State Historic Preservation Officer and federally-recognized tribes and informed them that there may have been impacts to known cultural resources. A decision was made by the Unified Command that the release would transition from the emergency phase to long-term recovery effective January 11, 2009. At that time, EPA transferred the lead federal agency role to TVA (Ref. 1.1).

TVA's OIG released the *Kingston Fossil Plant Ash Slide Interim Report* on June 12, 2009 which reviewed TVA's emergency response actions. The OIG found that TVA had not implemented National Incident Management System (NIMS) in accordance with Homeland Security Presidential Directive (HSPD)-5 which hampered communications and delayed certain emergency response actions following the release. An emergency response plan (ERP) specific to the plant had been enacted at the time the release occurred; however, TVA executive management switched to using the Agency ERP after acquiring additional information pertaining to the magnitude of the release. The executives responding to the release had not completed NIMS training as required by TVA. TVA's lack of familiarity with NIMS terminology and concepts was an obstacle and hindered coordinating operations and information with other agencies working within the Unified Command set up under EPA. TVA hired a contractor to assist TVA in implementing NIMS during the emergency response to better coordinate with the other agencies. An estimated 12-hour delay in Unified Command decision making occurred due to TVA's inability to immediately work under the NIMS plan. Information was delayed pertaining to lifting the evacuation and distributing information on health, safety, and environmental concerns. The OIG recommended TVA management should:

- Consider taking all necessary actions needed for full implementation of NIMS including, but not limited to, modifying all ERPs to include NIMS principles and language.
- Ensure employees complete all emergency response training as required by TVA and NIMS.
- Consider implementing the best practices identified by the Director of Roane County Emergency Management.

1.1.5.2 TDEC Commissioner's Order

On January 12, 2009, TDEC issued a Commissioner's Order, Case No. OGC09-0001 requiring action be taken as necessary to respond to the emergency under Tennessee Code Annotated §69-3-109 B0 (1), the Water Quality Control Act (Ref. 22.2). The TDEC Order required TVA to develop plans for environmental assessment, monitoring, protection of water supplies, ash management, and health and safety. TDEC was the approving agency for the cleanup activities at the Site until the start of the time-critical removal action.

In March 2009, TVA issued a CAP, in response to the TDEC Commissioner's Order (Ref. 22.3). The CAP included the following elements: 1) a plan for the comprehensive assessment of soil, surface water, and groundwater; remediation of affected media; and, restoration of all natural resources damaged as a result of the coal ash release; 2) a plan for monitoring the air and water in the area during the cleanup process; 3) a plan to ensure that public and private water supplies are protected from contamination and that alternative water supplies are provided if contamination is detected; 4) a plan addressing both the short term and long term management of coal ash at the plant, including remediation and stabilization of the failed ash waste cells, proper management of the recovered ash, and a revised closure plan for the Class II ash disposal facility; and, 5) a plan to address any health or safety hazards posed by the ash to workers and the public.

1.1.5.3 Emergency Response and Initial Recovery Actions

Considerable activity occurred at the Site immediately after the release, as described in the following paragraphs. These activities occurred under the ICS, Unified Command structure. EPA was the lead agency, which included approval authority, until January 11, 2009. TDEC then became the approval authority until May 11, 2009, when the EPA Order was issued. The TDEC Commissioner's Order remained in effect, but TDEC agreed that work performed under the EPA Order, in consultation with TDEC, would satisfy portions of the TDEC Order.

River Closure

The Emory River, between ERM 0 and ERM 4, was initially closed by TWRA to all boats not associated with the emergency response and removal action. This area of the river was patrolled by TVA Police marine units. The river was reopened as of February 4, 2009, but later reclosed (August 11, 2009) to support the major dredging operations under the time-critical removal action.

River Flow Management

In the early days following the release, TVA managed the flows of the Clinch and Tennessee Rivers in the Kingston area by controlling the releases from Melton Hill, Fort Loudoun, and Watts Bar dams (Ref. 22.3). This flow management was designed to minimize the downriver movement of released ash and to prevent backflow of water potentially containing ash from the Clinch River upstream into the Tennessee River. This backflow could have occurred if the flow in the Tennessee River were to be less than that in the Clinch and Emory Rivers. By managing the river flow to prevent such backflow, TVA reduced the risk of ash migration to the City of Kingston municipal water supply intake, which is located on the Tennessee River about 0.5 miles upstream from its confluence with the Clinch River. River flow management also helped to relieve upriver flooding concerns by lowering the river levels during periods of high rainfall.

Ash Migration Control

To reduce downriver migration of ash and dike material immediately after the release, TVA constructed two temporary rock structures (Figure 5) (Ref. 22.3).

Weir 1 was built east to west across the Emory River, just north of the intake channel skimmer wall, to reduce potential ash migration further downriver in the Emory River. Weir 1 was built by placing shotrock on the bottom of the river, and was completed on January 5, 2009. This underwater weir was approximately 615 ft long. The top elevation of this weir was at 730 ft msl, 11 and 5 ft below the normal summer and winter reservoir pool elevations, respectively. A 50-ft section in the middle of the weir had a top elevation of 728 ft msl (lower than the rest of the weir) to allow deeper-draft boats to travel over the weir without becoming caught in the shotrock.

Dike 2 was built north to south across the Swan Pond Embayment to minimize the migration of ash from the embayment into the Emory River and to serve as a haul road. Dike 2 was built by excavating a trench through the released ash and placing shotrock, riprap, and smaller-sized rock on top of foundations silts and sands. It is estimated that approximately 90,000 tons of rock were used in building the dike. This aboveground dike was approximately 1,400 ft long. The top elevation of the dike was at 752 ft msl; a 300-ft-wide spillway section had a top elevation of 745 ft msl. The dike had an average height of 12 ft and an average width of 30 ft at the top. The dike was sloped at 2:1 on both sides, although the slopes varied from 3:1 to 1.5:1.

A shorter dike, referred to as Bob Summers Road, was built east to west across the East Embayment. That dike was built for similar reasons as Dike 2; namely, to minimize the migration of ash from the East Embayment into the Emory River and to serve as a haul road. The dike was approximately 360 ft long and constructed similar to Dike 2.

Infrastructure Repair

Shortly after the ash release, TVA began removing ash from the railroad and Swan Pond Road (Ref. 22.3). Ash was removed from the railway and roadway by heavy equipment and placed back onsite. The damaged 3,000-foot portion of the railroad was rebuilt along the original alignment, and the railroad was reopened to rail traffic on January 8, 2009. The damaged 1,500-ft portion of Swan Pond Circle Road was rebuilt and the road reopened to traffic on March 23, 2009. Similarly, the damaged 4,750-ft portion of Swan Pond Road was rebuilt and the road reopened to traffic on April 17, 2009. Water and gas utilities were restored on December 28, 2008, and electricity was restored on December 24, 2008.

Cenosphere Containment and Removal

Cenosphere containment and removal was performed in accordance with the TDEC approved *Long Term Cenosphere Recovery Plan* (Ref. 17.1). TVA managed cenospheres (floating ash residue) by containing them with floating booms and then removing them with vacuum trucks (often on a barge), backhoes, and hand tools throughout the Site and the adjacent Emory, Clinch, and Tennessee Rivers (Ref. 22.3). A crew was available to respond to concerned citizens and remove cenospheres and river debris from private property. Private docks damaged during the release were also removed with the river debris. The removed cenospheres were then transported by truck to a holding area adjoining the Ash Pond. By May 14, 2010, approximately 13,788,000 gallons of cenosphere liquid had been removed.

Storm Water Management

During the emergency response, temporary drainage ditches were dug through the ash in Swan Pond Embayment in accordance with the TDEC approved *Kingston Fossil Plant (KIF) Interim Drainage and Controls Plan* (Ref. 17.2). These ditches extended from the three sloughs (Church Slough, Berkshire Slough, and Swan Pond Slough) and connected to the Emory River channel. Backhoes were used daily to keep these ditches clear of ash to prevent flooding the sloughs.

Construction of storm water management systems, including clean water diversion ditches and ash water collection and settling basins, was initiated as part of the TDEC Commissioner's Order. TVA submitted a *Stormwater Pollution Prevention Plan* (SWPPP) to TDEC on January 31, 2009, and TDEC subsequently approved the SWPPP on February 2, 2009 (Ref. 17.6). Their completion was accelerated under the time-critical removal action. These systems were designed and constructed to allow clean water to bypass the ash and to allow dirty water flowing across the ash to settle out before exiting the embayment.

A series of clean water ditches were installed in the Swan Pond Embayment west of Dike 2 to bypass upgradient surface water around the ash. Nearly 5,900 linear ft of ditches, 4-ft deep and 16 to 20 ft across were constructed through the north and middle portions of the Swan Pond Embayment. The ditches were lined and covered in rock to reduce bank erosion.

Several settling basins were constructed immediately west of Dike 2 to serve as a treatment system for storm water that runs off the ash in the Dredge Cell and embayment. The basins, roughly 5 acres in size, were built with 20-ft wide top berms, 2:1 side slopes, and 10-ft depth. The basins were lined and covered in rock to reduce bank erosion and allow for removal of accumulated sediment. It is estimated that approximately 40,000 tons of rock were used to build the basins.

Dust Control

Inhalation of air-borne silica is the primary human health risk due to ash exposure (Ref. 22.3). Control measures were taken to reduce dust generation. The undisturbed portion of the Dredge Cell and existing dike walls were quickly treated with a water-soluble vinyl acrylic emulsion, a nontoxic liquid dust suppression agent that TVA previously used at the Kingston plant and other fossil plants. In an attempt to establish a temporary vegetative cover, the exposed ash was seeded using a helicopter by first spreading a mixture of grass seed and fertilizer, followed by straw. The grass seed consisted of a mixture of winter rye (25 pounds/acre) and 12-24-24 fertilizer (400 pounds /acre). Approximately 213 acres were initially seeded in this manner. Areas that could not be easily accessed by air were treated using an amphibious vehicle. Portions of these areas were also treated with an erosion control mulch, which was applied using a truck mounted sprayer or a sled-mounted sprayer towed by an amphibious vehicle.

Monitoring

Monitoring was conducted in accordance with the *Kingston Fossil Plant Fly Ash Pond Incident Environmental Sampling Plan* (Ref. 10.1.2), and the TDEC approved CAP (Ref. 22.3). Several routine monitoring programs were put in place to monitor river water, drinking water, and air quality near and adjacent to the Site. Some groundwater and ash quality sampling also occurred prior to the time-critical removal action. Results of such monitoring are discussed in Chapter 3.

Stabilization of Failed Dredge Cells

The dikes remaining around the Dredge Cell and Ash Pond after the release were evaluated for safety and measures were taken to stabilize them (Ref. 22.3). A fall safety zone next to a high wall of 1.5 times the exposed height of the high wall was established. This value provided a safe working zone for equipment operators and on-ground personnel. A 100-ft clear zone was left between the fall safety zone and Swan Pond Road to provide additional protection.

Dike C forms the perimeter containment for the Ash Pond and final Stilling Pond structures (Figure 5). Dike D is the containment structure separating the Ash Pond from the adjacent Dredge Cell. Immediately following the release, engineering teams visually assessed the conditions of the two dikes. The area of highest concern was the northern limit of Dike D at the intersection of Dike C. The observed conditions included indications of strain along Dike D in the form of tension or compression cracks in both the longitudinal (parallel) and transverse (perpendicular) directions as well as a steep scarp line formed on the western side of Dike D which developed during the Dredge Cell failure.

Response actions included a formal monitoring program to assess additional distress, seepage, or other changed conditions. In addition, a clay soil cap was constructed over the area of concern to reduce the potential for surface water infiltration associated with rainfall events. A geotechnical instrumentation program was implemented including installation of slope inclinometers and piezometers. A Dike D buttress mitigation plan was executed which consisted of zoned embankment construction along the Dike D scarp line. The operational Ash Pond pool was also lowered roughly 2 ft to reduce hydraulic loads on the dikes.

Dredging Pilot Program

Dredging in the Emory River was conducted in accordance with the TDEC approved *Phase 1 Emory River Dredging Plan, Kingston Fossil Plant Ash Recovery Project* (Ref. 11.2.1). The Phase I Emory River Dredging Plan called for a pilot dredging program to determine the dredging production that would be sustainable on a continuous basis. Hydraulic dredging of the Emory River began on March 20, 2009, with one 10-inch dredge (named Emory). A second 10-inch dredge (named Clyde) was added on March 30, 2009, and a third 10-inch dredge (named Luzon) was added on April 6, 2009. These dredges were historically used by TVA in calm water conditions within the ash settling ponds, not for river dredging; however, they were readily available for use. Through July 20, 2009, these three dredges had removed approximately 350,000 cy from the river, and averaged between 1,300 and 1,600 cy/day production. This is based on pumping rates of 4,000 gallons per minute (gpm) for each of the dredges and a production rate of 113 cy/hour for each dredge. Operational efficiencies (time available versus actual time elapsed) of the three dredges were about 54%. The three dredges experienced significant mechanical failures, some of which were attributable to difficulties removing debris-laden ash from the river. Debris could not be removed in advance of the dredges because the water on top of the ash was too shallow for debris removal operations. Mechanical failures, such as punctured seals on the cutter head and a cracked cutter head housing demonstrate the effect of the debris. The age and condition of the dredges also impacted production.

Dredged ash was managed in the former Ball Field area in accordance with the TDEC approved *Proposed Procedures for Construction, Operation, and Performance Monitoring, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, TN* (Ref. 10.2.2). Dredged ash was managed in stockpiles and windrows within the Ball Field ash processing area until the material was sufficiently dry (e.g., >50% solids) to allow stockpiling of the dewatered ash within the Ball Field temporary ash disposal area.

An initial construction activity was necessary to bring the Ball Field area into a condition suitable for drying ash, in accordance with the TDEC approved *Request for Use of Wick Drains in Ash Processing Area* (Ref. 10.2.2). After regrading the area and filling the old chemical retention ponds, a granular drainage blanket was placed that served a dual function as a drainage layer and a demarcation layer to delineate the interface between the existing ground surface and the temporarily stored ash. The granular drainage blanket was comprised (from top to bottom) of a non-woven geotextile filter/separator, nominal 12-inch thick layer of gravel, a woven geotextile separator/reinforcement, and locally regraded ground surface soils. Prefabricated vertical drains, also known as wick drains, were installed on a 10-ft triangular grid spacing to expedite consolidation of the underlying ash and clayey foundation soils.

Instrumentation was used to monitor the development and dissipation of pore pressures in the foundation materials, as well as to assess the vertical and horizontal deformations of the foundation materials in response to the loading imposed by ash stockpiling. The following describes the type, location, and role of each instrument:

- Piezometers – Low-displacement piezoelectric, strain gauge, or vibrating wire piezometers were used to monitor pore pressures within the foundation ash and clayey foundation soils, and thereby confirm the dissipation of excess pore pressures that developed as a result of the stockpiling. Data from the piezometers were automatically fed to a relay station and real time results were available on-line via a shared website provided by Geosyntec.

- Slope Inclinometers – Slope inclinometers were plastic well casings anchored below the clayey foundation soil stratum and were used to monitor lateral spreading and to provide an early warning of potential slope instability. The slope inclinometer equipment were conventional column units that were read manually at 2-ft intervals each week by MACTEC.

- Settlement Monitoring Poles – Electronic/hydraulic settlement gauges were used initially to monitor vertical time rate and magnitude of settlement of the fill, and corresponding consolidation of the underlying foundation materials. Due to frequent damage to the settlement gauge system (mostly the hydraulic pressurized line feeding the transducers), settlement poles were installed to replace them. Three settlement monitoring poles were set at the top of the demarcation layer. Each week, a fixed point elevation was determined with a GPS survey instrument on each of the three settlement poles by TVA.

Ash processing was performed in accordance with the TDEC approved *Ash Processing Area Construction and Operation Plan* (Ref. 10.1.2). Ash processing consisted of gravity settlement in the Rim Ditch, Sluice Trench and Ash Pond, removal of ash solids from these settling facilities, then stockpiling and windrowing the material in the Ball Field ash processing area to dewater the recovered ash. During the first 10 days of the pilot dredging operations, total suspended solids (TSS) in the discharge from the Stilling Pond to the intake channel began to approach NPDES permitted limits. To mitigate potential TSS problems, polymer was added to the discharge from the Ash Pond to the Stilling Pond in accordance with the TDEC approved *Request for Authorization to use Polymers to Enhance Treatment of Dredge Return Water* (Ref. 11.3.1). To increase free water volume and thereby facilitate gravity settling, approximately 49,000 cy of ash material were removed from the Ash Pond and/or Stilling Pond between April 17 and May 8, 2009. The pilot dredging program concluded that the 10-inch dredges were ineffective in removing bulk debris or debris-laden ash from the river, but were suitable for use in dredging the Ash Pond and/or Stilling Pond. The pilot dredging program continued after the EPA Order, and improvements were made as discussed in Section 2.1.

Community Outreach

This section presents community outreach activities conducted during the emergency response; activities conducted during the time-critical removal action are discussed in Section 5.

Within hours of the ash release, TVA community outreach personnel assisted the evacuation response. The initial focus was the immediate safety and housing of affected residents and other needs as a result of the release. TVA set up a hotline, purchased meal cards and bottled water, and reserved 30 hotel rooms for residents the first day of the ash release. In days following, TVA moved 24 families to interim housing.

TVA established an Outreach Team of TVA employees and retirees within three days of the release. Their purpose was to relay pertinent information to the community and convey the community's concerns back to TVA so they could be addressed. Team members also delivered bottled water to residents from December 22, 2008, through January 2009 and took air filters to concerned residents from January through March 2009.

On January 6, 2009, TVA opened the TVA Community Outreach Center (865-632-1700) at 509 North Kentucky Street in downtown Kingston, Tennessee. There, community members could file claims, ask questions, share concerns, or report problems. TVA also introduced an information phone line community members could call for the latest information (865-717-4006, now discontinued) and a toll-free number (800-257-2675) for residents to file their claims for assessment of property damages with Crawford & Company, a third party insurance adjustment firm hired by TVA to handle claims. TVA assisted more than 1,700 families who contacted Outreach personnel with questions or concerns, and TVA has recorded more than 500 individual claims. TVA Realty Services worked with the Outreach team to coordinate the potential purchase of approximately 185 properties in the affected area. TVA's guidelines for property purchase were based on whether the property was impacted from the release or the recovery efforts. To date, 174 properties have been purchased.

During the Emergency Response, TVA Outreach functions also included issuing access passes to those with homes on Swan Pond Road, Swan Pond Circle Road, and Lakeshore Drive as TVA Police monitored and patrolled the areas; removing marine vehicles from damaged docks in the impacted Emory River area and renting slips for recreational storage in unaffected nearby areas; installing new mailboxes for some residents south of the plant so they would not have to cross the street to obtain their mail (a safety precaution due to an increase in truck traffic); and delivering Tennessee Department of Health information to marinas and campgrounds on reservoirs near the affected area.

The Unified Command response staff set up a Joint Information Center (JIC) in Kingston to provide a location for press briefings and other meetings between Site leadership and the media. TVA, EPA, Roane County, and TDEC all coordinated media activities through the JIC. The JIC, which was located in the Roane County Rescue Squad Building at 2735 Roane State Highway in Harriman, opened on December 28, 2008, and closed on January 11, 2009. A Local Information Center, which was located at 20917 Roane State Highway in Harriman, was opened on January 12, 2009, and closed on April 30, 2009.

Communication efforts included 13 news releases, numerous media tours and five press briefings during the first 30 days and daily fact sheets for the first two weeks. Updates were placed in the local newspaper, the *Roane County News*. TVA held two open house public meetings in January and March 2009 to provide information and answer questions about the ash release; attended three local government meetings of the city councils of Kingston and Harriman and the Roane County Commission to answer questions about the release and the response; conducted three Unified Command technical briefings in the local area; provided testimony to a U.S. Senate committee and the Tennessee General Assembly; and provided management representatives as guests on local radio and television programs. In addition, over 50 federal, state, and local officials visited the Site to gain a better understanding. Material Safety Data Sheets and handouts were made available to local residents to inform them of potential hazards and actions they could take to minimize those risks. TVA mailed letters directly to local residents about various topics, including flood survey information or status reports on property claims.

On December 29, 2008, Roane County Executive Mike Farmer announced that Roane County in conjunction with the cities of Harriman, Kingston, Rockwood, Oliver Springs, and members of the affected public, had formed the Long Term Recovery Committee. The purpose of this committee, which is comprised of local elected officials and residents, is to ensure all stakeholders are engaged in the long-term recovery efforts in Roane County. TVA officials attend these meetings to present project updates and respond to questions and concerns from committee members and the community.

TVA established a dedicated website, www.tva.gov/kingston to provide frequent updates, frequently asked questions, and links to related websites posted by EPA, TDEC, and others. Sampling data collected by TVA, TDEC, and EPA and associated summary reports were provided on their respective websites.

TVA's OIG released the Kingston Fossil Plant Ash Slide Interim Report on June 12, 2009 which reviewed TVA's response to media and the affected Roane County community during the emergency response actions (Ref. 25.1). The OIG found that TVA's actions for responding quickly to media and public inquiries resulted in releases of inaccurate and inconsistent information. Information provided to the media and the public after the release was inaccurate in several instances. Specifically, the amount of ash that had been released was changed several times. TVA management based the initial estimates on historical records prior to an aerial survey being conducted. TVA management commented that information provided to the media was reviewed for factual accuracy prior to release; however, the OIG's review of statements provided to the media by TVA identified several inaccuracies and inconsistent information. The OIG recommended TVA management should:

- Avoid accusations against TVA of engaging in defensive "spin," TVA should consider establishing a clearly defined protocol that requires verification from more than once source before releasing a statement to the media.
- TVA should scrutinize press releases to determine if enough information is available to issue a reliable statement. The test for TVA press releases should be, "Is it the transparent truth?"
- Documentation should be maintained to verify that this process was followed and the media statement was approved by an appropriate TVA official.

1.1.5.4 EPA Administrative Order and Agreement on Consent

On May 11, 2009, an EPA *Administrative Order and Agreement on Consent* (EPA Order) was signed between EPA and TVA providing the regulatory framework for the removal actions under CERCLA (Ref. 13.2.1). The parties agreed to expeditiously and efficiently prioritize and conduct response actions.

The objectives of the time-critical removal action are documented in the EPA Order. As stated in the Order, "The Parties therefore agree that the short-term strategic objectives for the Site are to:

- prevent the coal ash release from negatively impacting public health and the environment;
- contain and remove coal ash from the Emory River and the area east of Dike 2 as appropriate to restore flow and minimize further downriver migration of the ash material; and
- ensure that coal ash material recovered during these efforts is properly managed pending ultimate disposal decisions or, to the extent required by limited storage capacity, properly disposed."

Mid-term strategic objectives include removing any remaining coal ash from the Emory River and the area east of Dike 2 to the maximum extent practicable, as determined by EPA in consult with TDEC and TVA, pending further site assessment. Mid-term objectives are being addressed under separate non-time-critical removal actions following completion of the time-critical actions.

An Action Memorandum for the time-critical removal action was approved on August 4, 2009 and noted that dredging would take place in two programs or phases (Ref. 24.5). "The initial dredging program covered under this Action Memorandum, which is intended to address the time critical actions under the EPA Agreement, will focus on reopening the original Emory River navigation channel. Currently, nearly one mile of the channel is blocked by the ash material and debris. Opening the channel reduces the potential for upstream flooding. It may also reduce the potential for downriver ash migration as the flow channel widens, reducing the potential for scouring. This initial phase of dredging is anticipated to recover around 1.5 million cy of ash. As a second priority, the river channel will be recontoured, removing additional ash down to native sediment where practicable."

1.2 ORGANIZATION OF THE RESPONSE

1.2.1 Phases of Response

The time-critical removal actions were focused on removing ash from the Emory River. Actions included removing ash in the embayment east of Dike 2 with land-based equipment and dredging ash out of the river. The dredging efforts were broken into two phases: Phase 1 to open the river channel, and Phase 2 to limit future migration of ash. Ash was removed by rail to a landfill in Alabama. Efforts during this time also included continued dust management and storm water management. These activities are described in more detail below.

1.2.2 Role of Government Agencies and Contractors

The organization of the time-critical removal action was via the ICS under a Unified Command, as shown on the EPA website located at http://www.epakingstontva.com and Ref. 1.3. While TVA retained responsibility as the lead Federal agency, EPA retailed approval authority over the actions taken to clean up the Site in consultation with TDEC. TDEC also retained authority in specific areas, such as final closure of the failed Dredge Cell. In addition, other agencies were involved such as the USCG, Bureau of Reclamation, the Agency for Toxic Substances and Disease Registry, USACE, and the Tennessee Department of Health.

Three persons served as the Incident Commanders within the Unified Command, one for each of the agencies: EPA, TVA, and TDEC. Two persons have served as the Incident Commander for TVA. TVA initially identified Mike Scott as the Project Coordinator under the EPA Order and Anda Ray as the first Incident Commander. This role was transitioned to Steve McCracken, the onsite General Manager, on May 1, 2010. EPA's Incident Commander was OSC, Leo Francendese, who was responsible for ensuring that the requirements of the EPA Order were met. TDEC's Incident Commander was Deputy Commissioner Paul Sloan. In addition, Barbara Scott served as the onsite TDEC representative, who worked in consultation with the OSC.

In addition to the three main agencies mentioned, substantial contractor support was included in the organization. For TVA, contractors were as follows: TVA's Civil Projects Group (Civil Projects), Sevenson Environmental Services, Inc. (Sevenson), MACTEC Engineering and Consulting, Inc. (MACTEC), Norfolk Southern Railroad Company (Norfolk Southern), Phillips and Jordan, Inc. (Phillips and Jordan), Jacobs Engineering Group Inc. (Jacobs), Restoration Services, Inc., (RSI), Environmental Standards, Inc (ESI), Geosyntec Consultants, Inc., (Geosyntec), and Stantec Engineering (Stantec). Civil Projects was responsible for land-based ash removal east of Dike 2 and maintenance of the site. Sevenson was responsible for dredging and processing the ash. MACTEC was responsible for loading railcars. Norfolk Southern provided transportation services to haul the ash to the offsite landfill, while Phillips and Jordan managed the landfill in Uniontown, Alabama. Jacobs, as TVA's agent, had responsibility for the planning and construction management associated with the time-critical removal action. There were several support functions that both TVA and Jacobs personnel provided, such as public interface and environmental evaluation, that occurred concurrently with the implementation of the action. RSI supported the sampling of environmental media, while ESI supported the data management and data quality assurance of sampling and analytical activities. Geosyntec and Stantec provided geotechnical engineering expertise.

The following groups supported EPA time-critical response actions: EPA Superfund Technical Assessment & Response Team Contracts (START) contractors (Tetra Tech EM, Inc. and Oneida Total Integrated Enterprises [OTIE]); EPA Region 4 Air, Pesticides and Toxics Division; EPA Region 4 Office of External Affairs (OExA); EPA Region 4 Technical Services Section (TSS) of the Superfund Division; EPA Region 4 Science and Ecosystems Support Division (SESD), EPA Emergency Response Team of Edison, New Jersey (ERT), EPA's Science Advisory Board, DC (SAB), EPA Region 4 Resource Conservation and Recovery Act Division (RCRA), EPA Region 4 Office of Environmental Accountability (OEA), EPA Region 4 Water Protection Division, EPA Region 4 Office of Congressional and Intergovernmental Affairs, EPA Region 4 Federal Facilities Branch, USCG Gulf Strike Team (GST), U.S. Department of the Interior's Bureau of Reclamation (BOR), Agency for Toxic Substances and Disease Registry (ATSDR), and U.S. Army Corp of Engineers (USACE). The role of each of these organizations is discussed in Section 2.3.

As per the EPA Order, the mission of the Unified Command was to "expeditiously and efficiently prioritize and perform necessary response actions at the Site." Incident objectives for the Unified Command reiterated the strategic goals of the EPA Order. The operational period command emphasis included the following (Ref. 24.3):

- Protect the public, workers, and the environment through safe work and sanitation practices, environmental monitoring, and transparent communications;
- Maximize fly ash dust control and minimize fly ash migration on land and water through proper engineering and administrative controls and personal protective equipment (PPE) if necessary;
- Safely and efficiently remove fly ash and related debris from the Emory River;
- Minimize contamination of fresh water by accelerating completion of clean and dirty drainage systems in Swan Pond embayment;
- Plan for safe and proper ash loading, transport, and disposal; and
- Approve additional work plans to complete time-critical and non-time-critical removal actions.

1.3 CHRONOLOGICAL NARRATIVE OF RESPONSE ACTIONS

1.3.1 Threat Abatement Actions Taken

The released ash filled most of the Swan Pond Embayment to the north of the former Dredge Cell and Ash Pond area and an adjacent section of the Emory River. Emergency response actions taken as initial threat abatement measures are described in Section 1.3.1.

Time-critical actions began following issuance of the EPA Order on May 11, 2009. The following time-critical actions, which are discussed in detail in Section 2, were taken for threat abatement to meet the short-term strategic objectives for the Site.

- Dredging. Hydraulic dredging using cutter head suction dredges continued to be used during the time-critical removal action. TVA contracted with Sevenson, who began hydraulic dredging on August 5, 2009. Phase 1dredging activities to clear the river channel began August 5, 2009 and were completed by February 1, 2010. Phase 2 dredging activities to minimize future ash migration, which utilized both hydraulic and mechanical dredging techniques, were completed by June 30, 2010; the Emory River was reopened for public use on May 29, 2010, after the completion of Phase 2 dredging. Dredging demobilized from the Site in phases; demobilization was completed by September 3, 2010.

- Mechanical Excavation. Ash was removed from the Swan Pond Embayment area east of Dike 2 using land-based and amphibious mechanical excavators (backhoes). Mechanical excavation began on June 13, 2009 and was completed by May 4, 2010.

- Dewatering/Ash Processing. Dewatering and ash processing activities were conducted concurrent with the dredging and mechanical excavation, and ended (under the time-critical removal action) with the final shipment of ash offsite. Dewatering of hydraulically-dredged ash was conducted through use of gravity settling in the Rim Ditch, Sluice Trench, and Ash Pond, followed by windrowing and air drying in the Ball Field. Stockpiling of relatively dry (low moisture content) excavated ash was conducted in the West Storage Area and Test Embankment; stockpiling of wetter excavated ash was conducted temporarily in the Dredge Cell. Dredging of the Ash Pond to restore free water volume was begun in August 2009, with dredged materials originally discharging to the Rim Ditch. Beginning January 11, 2010, these dredged materials were conveyed to a series of recessed chamber filter presses for dewatering. After April 15, 2010, Ash Pond dredged materials were discharged to the Rim Ditch or Lateral Expansion area for dewatering and wet ash stockpiling.

- Loading/Transport/Disposal. Loading ash into railcars began on June 29, 2009. Transport of the ash via rail to Alabama, and ultimate disposal at the Arrowhead Landfill in Perry County Alabama, began on July 2, 2009. Loading, transport, and disposal continued until a total of 414 trains with approximately 4.0 million tons of material had been transported and disposed offsite in Alabama; the last train departed from the Site on December 1, 2010.

- Other Related Actions. Throughout the time-critical removal actions, TVA continued other related routine actions, including cenosphere removal, air monitoring and dust control, surface water monitoring, and storm water management. Dike stability evaluations and inspections were routinely conducted; construction of a rock buttress along Dike C was begun on December 7, 2009, to reinforce the dike stability against shallow surface slumping. Removal of debris from a former skimmer wall that was damaged during the release began on April 5, 2010, and was completed on August 4, 2010. A TDEC approved Test Embankment to demonstrate the ability to stack dry ash effectively within the Dredge Cell was begun on July 14, 2009, and was completed on April 1, 2010.

1.3.2 Treatment/Disposal/Alternative Technology Approaches Pursued

1.3.2.1 Dredging Technology Alternatives

Several technologies were evaluated for removing ash from the river, including suction hydraulic dredging, bottom-crawling dredging devices, mechanical dredging, and vacuuming (Ref. 11.2.14). Technologies were evaluated as to their effectiveness in meeting the goal of ash removal to the river bottom by spring 2010, ease of implementing the technology, including availability of equipment in the time frame required, and cost. Cost was a qualitative evaluation.

Suction Hydraulic Dredging

Cutter head suction dredges were put in use at the Site once pilot dredging began during the emergency response, and were therefore readily available. Cutter head suction dredges are a traditional dredging technology, so that their effectiveness and production capacity are well demonstrated. Maximum production rates depend on pipeline discharge velocity, cross-sectional area, and percent sediment. Typical production rates range from 60 to 300 cy/hour for a 10-inch dredge and 310 to 1,365 cy/hour for a 20-inch dredge (Ref. 21.3). Other types of suction dredges could include a plain suction dredger (no cutter tool on the end of the suction pipe to disturb the material), a trailing suction hopper dredge which loads the dredge spoils into a hopper (storage area that empties from the bottom) on the vessel, an auger suction (like the cutter head but with a Archimedean screw as the cutting tool), and an air-lift (air blown into the pipe rises, dragging water with it). These technologies would have had varying challenges. A cutting device was necessary to disturb the ash, or the suction would not have been sufficient to lift the ash, particularly once the ash had become dense in the river. The air lift dredge would not likely have had enough power to disturb the ash and would have had smaller capacity, since this is typically a smaller type of dredge. Using a hopper dredge would have required bringing new equipment onsite and developing a different ash handling system than the Rim Ditch/Sluice Trench operation. The auger suction dredge would have been most similar to the cutter head suction dredge, but would not have introduced any benefit over the cutter head dredges that were already onsite. For these reasons, suction hydraulic dredging from the water surface with cutter heads was the method selected for use on the Emory River. Conventional hydraulic dredging was expected to cost between $5 and $10 per cy.

Bottom-Crawling Dredging Devices

These dredges are designed to remove thin layers of fine-grained materials with an accuracy of 2 to 4 inches. The machines can move forward, backward, and sideways using a screw propulsion technology, and are remotely controlled. They have two dredge hoods, located at each end of the dredge. The dredge fluidizes the bottom material with a low-pressure supply pump. This allows selective removal of fine-grained sediments into an enclosed hood for slurry pipeline transport to shore. The hoods are designed to allow sand material to fall back to the bottom and only fine-grained sediment is removed. These devices have been used effectively to separate sand from fine-grained sediment, and can remove up to 100 cy/hour. They would have been less productive than the hydraulic dredges in larger areas due to their lower capacity. Their availability was uncertain. They would have been comparable in price to the hydraulic dredges planned. Other than separation, there would have been no advantage to these devices over more traditional hydraulic dredges, except for small areas. Because of the additional time required to mobilize this equipment, the potentially lower productivity, and no technical advantage, these devices were not considered further.

Mechanical Dredging

Mechanical dredging would use clamshells or excavators on barges or circulating buckets attached to a wheel or chain. Because much less water would be captured when using mechanical dredges, this would have lessened the dependency on the Rim Ditch, Sluice Trench, and Ash Pond system for dewatering. Excavators were already available onsite that could have reached the required depth in the river. Equipped with the same depth-finding system as the hydraulic dredges, mechanical dredges could be just as accurate. However, mechanical dredging could have increased the rates of suspension of ash and resultant turbidity in the river. Because barges would have been required to move the recovered ash to shore, the limiting factor in production would have been the ash movement to shore. At the unloading facility, much of the free water excavated with the fly ash (likely to be 40 to 50% of the volume) would have to be removed (drained) prior to unloading and disposing of the fly ash. To assist in dewatering the ash, the free water could be allowed to overflow the barge; however, the total suspended solids downriver of the barge would likely be found unacceptable. Once the ash was moved to the shore, it would have had to have been moved to the Ball Field by truck, at additional cost. Mechanical dredging equipment would be able to handle debris (i.e., trees) when encountered and would not have to wait for separate debris handling.

For comparable removal rates in similar materials, mechanical dredging would be approximately twice the cost of hydraulic dredging. Because the dewatering costs were low, hydraulic dredging was more cost-effective, outweighing any reduced water handling costs that might have been realized from mechanical dredging. Mechanical dredging was expected to cost between $15 and $20 per cy (as compared to $5 to 10 per cy for conventional hydraulic dredging). For these reasons, mechanical dredging was not selected as the primary means of ash removal from the river. However, mechanical dredging was selected for use in removing debris and ash in selected areas; in particular, areas too separated from other dredging locations or too far from the discharge point in the Rim Ditch to economically deploy return pipes or overcome high head losses.

Vacuuming

Emergency response activities to remove cenospheres from the river used vacuum trucks that were placed on barges to allow access to the center of the river. Similar vacuum systems were considered for ash removal from the river bottom. The vacuum hoses are flexible and therefore must be used either in shallow areas where personnel can guide them, or in areas where personnel can use scuba equipment to guide them. In either case, the production rates using vacuum systems would have been low; as a result, vacuuming could not have removed the ash in the time frame required. Significant numbers of trips would have been required from barge to shore to offload the trucks. A larger vacuum system could have been designed, but the ash was so dense in areas that a cutting device would have been necessary to first break the ash to allow the suction to work (similar to a plain suction dredge). Vacuuming would not have been effective because it could not remove the dense ash,. The cost would also have been very high for the high volume of ash to be removed. For these reasons, vacuuming was not considered further.

1.3.2.2 Dewatering Technology Alternatives

Several technologies were evaluated for dewatering and drying the ash once it had been removed from the river (Ref. 11.3.3). These technologies included gravity settling, belt filter press filtration, recessed chamber filter press filtration, centrifuge dewatering, container dewatering, geotextile tube dewatering, windrowing, vibrating screen dewatering, thermal drying, and absorbent desiccation. Technologies were evaluated as to their effectiveness in meeting the goal of dewatering the ash to a moisture content of 20 to 30%, ease of implementation, including availability of equipment in the time frame required, and cost. Cost was a qualitative evaluation.

Gravity Settling

Gravity settling uses a settling basin dewatering process where solids settle to the bottom of the basin under the influence of gravity. The rate of settlement depends on the grain size and specific gravity of the solids material. During the pilot dredging program, a long narrow trench (Rim Ditch) was used as the settling basin for dredged materials. Long-stick backhoes (excavators) removed the accumulated solids as they settled and before they substantially changed the trench settling characteristics. Based on a flocculent settling rate of 11 inches/hour for fly ash (a value measured at a non-TVA site), the Rim Ditch settling basin maximum loading/dredge flow rate was calculated to be 11.8 million gallons per day without considering the overflow capacity present in the Sluice Trench. To accommodate higher flows, the cross-sectional area of the Rim Ditch was increased by 50% by increasing the depth to 15 ft for the first 1,000 ft of the Rim Ditch (Ref. 11.3.3). Another gravity settling operation was also used during the time-critical removal action; Ash Pond dredge effluent was discharged into the Lateral Expansion area, where fines could be effectively settled from the water.

Gravity settling was effective for removing sand and silt-sized particles present in the ash, achieving approximately 35 to 40% solids in the accumulated sediment, and up to 5,000 milligrams per liter (mg/L) TSS in the effluent. Subsequent treatment would be required to dewater the dredged ash and clarify the effluent to achieve objectives. Estimated costs, assuming 6 to 8 excavators for ash removal from the Rim Ditch, were approximately $1 to 1.5 million over a six-month operations and maintenance (O&M) period.

A modular gravity settling system manufactured by Genesis Fluid Solutions for dewatering dredged slurry was considered for use at the Site. The Genesis system uses polymer flocculation to enhance clarification to remove solids and produce turbidity levels in the effluent less than 30 mg/L. The unit operates at a continuous flow of 2,500 to 5,000 gpm, generating solids at a rate of 150 to 250 cy/hour, so that no batching is required. Solids are reportedly stackable and pass the paint filter test. Performance of the unit using predominantly fly ash is uncertain, given that 80% of the solids are fine-grained silt and clay. Bench-scale testing by Genesis showed that a combination of polymers could be used to achieve a conveyable mass (50% solids) and clarified water (<30 nephelometric turbidity units [NTUs]). Cost of each unit was $97,500 to mobilize to the Site and $11,700/day to operate, roughly $4/cy operating costs. The uncertainties in performance led to a decision to not use this technology.

Belt Filter Press Filtration

Most belt filter press operations can be divided into three general stages: 1) initial de-watering, which makes the sludge pulp; 2) pressing or medium pressure filtration, which conditions the sludge for high pressure filtration quality; and 3) high pressure filtration, which raises the dry solids content in the sludge cake. Dredged fly ash material would be pumped into the top of the belt filter press, where it would be mixed with polymer, and dropped onto the moving filter belt. From this flocculation zone the material would enter a gravity drainage zone, where a large rotating drum would agitate the floc and drain approximately 70% of the free water. The resulting capture rate can be as high as 99%. Pressure would then be applied in a low pressure wedge zone, which would begin squeezing the remaining water out of the sludge. Further dewatering would occur in the medium pressure zone where two large perforated drums of decreasing size would apply the pressure. Rollers would perform the final de-watering in the high pressure zone. The sludge cake (filtered solids) would then exit the machine. Water spray bars placed above the returning belt would continuously wash the belt with clear water to keep it from binding.

Belt filter presses were expected to achieve 50 to 60% solids in the filter cake, requiring subsequent treatment to dewater the dredged ash and clarify the effluent to achieve objectives. While effective for removing sand and silt-sized particles, belt filter presses have been most commonly applied in wastewater sludge processing. A typical belt filter press can process approximately 700 gpm. Gravity thickening would likely be required as a pretreatment step. If available, equipment could be rented and operated at a rate of about $3,500/day (roughly $9/cy operating cost). However, rental presses were not available in sufficient quantities, so that only about 20% of the required capacity could have been met. Purchase of units would have required a long lead time; 16 months or more, to procure sufficient numbers of belt filter presses. For these reasons, filter presses were not selected as the primary means for dewatering the ash removed from the river..

Recessed Chamber Filter Press Filtration

The filter press consists of a number of chamber filter plates (or recessed filter plate pack) mounted vertically. Using a hydraulic ram, the recessed filter plate pack is compressed tightly together between the fixed feed head and a third head known as the moving or follower head, thus forming a compact filtering unit. The filter cake chambers are formed either by mating two recessed chamber plates or by sandwiching two flush plates between a cake frame. By retracting the moving head, each individual filter plate would be separated from its adjacent neighbor allowing the filter cake to fall freely from the chambers. Filtrate drains to the fixed end of the filter press. A recessed chamber press would likely produce a filter cake of 70 to 80% solids that could be directly loaded and transported without further dewatering. The water from recessed chamber presses would have contained few solids and would have had relatively low TSS (likely less than 1,000 mg/L). Production rates of a typical recessed chamber press would be approximately 1,200 cy/day to produce filter cake containing 80% solids. In order to process 12,000 cy/day of solids, up to 10 presses would have been needed.

Total equipment costs would have been controlled by the cost of the recessed chamber filter presses which would also likely have had the longest lead time for delivery. Cost to supply and operate the units would be approximately $15 to 20/ton ($20 to 25/cy). Total cost to process 12,000 cy/day for six months were therefore estimated to be $30 to 40M. Cost of ancillary foundations, roof cover, piping, mechanical, and electrical could have placed the value of the installation at between $100 and $150M and 12 to 18 months to get the system up and running (Ref. 24.4). This technology was not selected for implementation at the Site due to the cost and schedule constraints. However, filter presses were later used onsite for dewatering a portion of the fine materials dredged from the Ash Pond.

Centrifuge Dewatering

A centrifuge ("hydrocyclone") is a rotating assembly that uses centrifugal force to separate solids from liquids. The dredged fly ash material would be fed into the centrifuge; material with higher specific gravity (solids) would settle on the inside wall of the rotating assembly, while lighter material (liquids) would remain towards the core of the rotating assembly. Solids would be compacted and dewatered by the centrifugal force and released through discharge ports as underflow. Liquids would be released at the opposite end as overflow.

The use of a hydrocyclone was evaluated in pilot testing (Ref. 24.4) under two scenarios. Under scenario 1 simulation, the dredge slurry would be pumped directly through hydrocyclones. The percent solids (by weight) would increase from 11% in the dredged material to 38% in the underflow solids fraction, with 0.7% solids in the effluent fraction. In this case, the hydrocyclone would be expected to generally achieve the same results as gravity settling in the Rim Ditch. Each hydrocyclone could process approximately 175 gpm of dredge slurry; for an operating dredge rate of 21,000 gpm, approximately 120 hydrocyclones would have been needed. Strainers would have been required upstream of each distribution stand to remove any gravel or debris greater than 0.75 inches. The expected capital costs associated with this system was $1.7 million. Operational costs were estimated at less than $1,000/day, which would amount to less than $0.1M over a six-month O&M period. However, approximately 1-1½ years would have been required to procure the total number of hydrocyclones needed for full production.

Under scenario 2 simulation, the ash slurry accumulated in the Rim Ditch would be pumped through hydrocyclones rather than being removed by mechanical dredging (using backhoes). The percent solids (by weight) would increase from 35% in material removed from the Rim Ditch to 55% in the underflow solids fraction, with a residual 28.1% solids in the effluent fraction. The pilot test results indicated that the hydrocyclone generally performed within these simulated parameters, increasing percent solids from 40 to 57.8%. Each hydrocyclone could process approximately 175 gpm of residuals having 40% solids (650 cy/day); for an operating output of 12,000 cy/day, approximately 21 cyclones would be needed. The expected capital costs associated with this system was $0.3 million; O&M costs were estimated at less than $0.1 million over a six-month period. This technology was not selected for implementation at the Site due to the low percent solids that could be produced and the long lead time that would have been needed to procure this equipment.

Container Dewatering

The roll-off style container filter is a method for separating and dewatering sludges, slurries, and waste streams. The dredged fly ash material would be pumped into the roll-off container; liquids would drain through filter media panels and out of the container via discharge ports. Roll-off container filters are round-bottom with 3-inch drainage ports and gasketed watertight doors. They are available in 20, 25, 30 and 40 cy capacities. A center panel can be added to increase the drainage surface area. Gravity and vacuum style container filters are constructed so that the bottom filter drains into a cavity that is separated from the cavity to which the wall (vertical) filters drain. This allows for a vacuum to be pulled on the bottom filter while simultaneously draining by gravity through the wall (vertical) filters. This style is particularly useful in applications where the sludge being dewatered makes a permeable cake and dewatering time is crucial. Other options increase the filter area for the vertically oriented filters. Units can be equipped with a closed roof, tarp, or open roof options. Polymer flocculation would typically be required prior to filtering to allow the fly ash to drain. Roll-off container filters were available from E-Tank®, Flo Trend® Systems, Inc., and Water Tanks.com.

Although vacuum filter containers could have been effective for dewatering sand and silt-sized particles, including fly ash, both the time needed to dewater and ultimate performance would have been highly uncertain. Assuming that it would be possible to attain 80% solids in the filter cake in as short as two weeks, to process 12,000 cy/day of solids would have required more than 6,300 containers for onsite storage at any given time. Even if this quantity were available to rent; at a cost of $1,500/month, rental costs alone would have exceeded $50 to 60 million over a six-month O&M period. Purchase would have been three times this cost and would have involved long lead times of more than two years. For these reasons, container dewatering was not selected.

Geotextile Tube Dewatering

Geotextile tube containers are constructed of high-strength, permeable geotextiles designed for containment and dewatering of high moisture content sludge and sediment. They are available in a variety of custom sizes, depending on volume and space requirements, and can be as large as 90 ft circumference by 300 ft long. Dredged fly ash material would have been pumped into the geotextile tube. The geotextile fabric would confine the fine-grained material; water would drain from the container through small pores in the geotextile. Volume reduction would allow for repeated filling of the geotextile tube; however, once full the geotextile tube could not be reused. After the final cycle of filling and dewatering, solids remaining in the tube could continue to become dense due to desiccation as residual water vapor escaped through the fabric. When full, the geotextile tube and contents would have been disposed at a landfill. Volume reduction can be as high as 90% and over 95% of solids can be captured. The geotextile tube safely contains the fly ash, minimizing airborne particle contamination.

The use of geotextile tubes was evaluated in pilot testing for the Site (Ref. 24.4). Two Maccaferri MacTube MTOS400 bags were tested, each 50-ft long, and having a 30-foot circumference, which correlates to an approximately 5-ft high filled tube containing a volume of approximately 130 cy. One geotextile tube was filled with the hydrocyclone solids fraction, and the other with Rim Ditch slurry. Core samples were then obtained from each geotextile tube after 24, 48, and 96 hours and analyzed for water content. Results indicate that the percent solids (by weight) increased from 38 to 40% in incoming material to just 43 to 46% in the solids fraction in four days. Assuming that 70% solids could have been achieved in 29 days, and that the tubes would have been refilled once, more than 270 active tubes would have been required onsite at any given time. Given the dimensions of the tubes and assuming that tubes would not be stacked on top of one another, this would have required geotextile tubes lined up over an area approximately 1,800-ft long by 950-ft wide (32 acres), which would have been larger than the Ball Field. Because the geotextile tubes are not reusable, in order to process the full Phase 1 dredge volume of 1.5 million cy, a total of 1,400 tubes would have been needed, for a cost of approximately $10 to 12 million ($7/cy) for the material cost only. For final disposal, the tubes would have been cut open and the dewatered ash loaded into railcars for shipment to the landfill. Geotextile tubes were considered impractical, because of the large number required and large storage area required.

Windrowing

Windrowing involves air-drying of the solids remaining after initial ash processing to further increase the percent solids (lower the moisture content). The material is spread over a drying area, allowed to dry naturally through evaporation, and progressively moved, or “windrowed”, using bulldozers to turn over the drying layer so as to optimize the rate of evaporation throughout the solids mass. Tall windrowing with excavators was the technology used for second stage dewatering in the Ball Field. Ash was plowed, turned, and windrowed over a period of three days (without rain) to lower the moisture content 20 to 30%. Estimated cost, assuming 3 dozers, 3 loaders, and 9 haul vehicles was approximately $2 to 3 million over a six-month O&M period (about $2/cy).

Vibrating Screen Dewatering

High-frequency urethane deck separators are relatively low energy, low-cost dewatering equipment. Feed materials would need pretreatment to approximately 20 to 30% solids. Although their performance was uncertain, vibrating screens likely could have achieved 65 to 70% solids so as to pass paint filter test. The output materials would likely have needed subsequent drying for optimum material handling. Throughput capacity is approximately 300 tons/hour (230 cy/hour), so that approximately 6 units would have been needed to process 12,000 cy/day. Vibrating screen capital equipment costs would have been approximately $100,000 each, with about 8 to 10 weeks for delivery; operating and power costs would have been around $4,500/day. Total costs would therefore have been approximately $1.1 to 1.2 million.

A self-contained dredge slurry separation system manufactured by Triflo International, Inc. combines hydrocyclone separation with vibrating screen dewatering to remove solids down to the 25 micron size. The unit operates at a continuous 2,000 gpm, so that no batching is required. Solids are reportedly stackable and pass the paint filter test. Performance of the unit using predominantly fly ash is uncertain, given that 80% of the solids are fine-grained silt and clay. A pilot test could have been used to determine effectiveness of the unit. Cost of each unit is $400,000; to process 21,000 gpm at least 10 units would have been needed, for a total capital cost of $4 million. This technology was not selected as it showed no improvements over the gravity settling and windrowing operation.

Thermal Drying.

Thermal drying (also known as desorption) involves delivering thermal energy to the solids remaining after initial ash processing in order to evaporate the water. Thermal drying can increase the percent solids from 40% to more than 95%, and could therefore have been effective for drying residuals removed from Rim Ditch following gravity settling, and achieving ash dewatering operation objectives. Throughput is estimated at roughly 60 tons (55 cy) per hour per unit as a maximum processing rate; a total of 18 rotary desorber units would have been required. Mobilization of up to 18 units would likely have required six months or more. Fuel represents a substantial portion of the operational costs. Costs of O&M for 18 units for six months were estimated at approximately $30 to 40/cy, or $45 to 60 million. This was considered too expensive.

Absorbent Desiccation

Water-absorbing materials can be added to the ash remaining after initial dewatering so as to reduce the free water content and thereby pass the paint filter test criteria and fully meet the ash dewatering operation objectives. Absorbents are capable of solidifying and stabilizing the wet fly ash, achieving moisture contents less than 20%, depending on the nature of the absorbent and the amount of absorbent added. Various types of absorbents could be used:

- Pozzolanic absorbents such as lime, lime kiln dust, cement, cement kiln dust, or lime spray dryer ash react with water to form complex cementitious compounds upon curing. Drying is also accomplished through bulking of the solids volume, hydration, and evaporation using the heat generated during the exothermic reactions. A November 2009 treatability study using lime kiln dust showed that the resultant ash would not leach metals and that after five days, the ash did not harden to a point that it was not loadable. Treatment costs were estimated at $13/cy of ash for material, equipment, and labor. The amount of lime added was between 6 and 9% by weight. Both quick lime, lime kiln dust, and lime pellets were used onsite to dry ash from various areas.

- Natural clay absorbents such as Attapulgite, bentonite, or montmorillonite absorb or swell when in contact with water. Clay absorbents would typically absorb 5 times their weight in water, and at full saturation may swell to 12 to 15 times their original volume, which would increase the total volume of processed ash material, reducing the effective quantity of ash that could be shipped offsite daily.

- Polymeric absorbents are various chemically manufactured polymers specifically formulated for absorbent properties. They can absorb up to 500 times their weight in water with nominal or negligible increase in waste volume or weight. Polymeric absorbents were considered advantageous relative to other absorbents because of their high absorptive capacity and low waste volume/weight. Material costs would be high ($1.25 to 1.85/ pound), and material processing would be further complicated by the need to obtain thorough mixing into the wet ash. Assuming a 300:1 water absorption capacity, approximately 18,000 pounds/day of absorbent would have been needed to reduce the moisture content by 20% in 12,000 cy/day of fly ash. Cost of the polymeric absorbent would amount to about $3 to 5 million. The primary cost impact of absorbents is that, in addition to the material costs, the weight of water would also be shipped offsite for disposal at $40/ton of water, amounting to $10 to 15 million over a six-month O&M period. Therefore, drying technologies that remove the water are preferred over absorbent technologies for routine ash processing. A polymer was added into the railcars to remove excess water when conditions did not allow for air drying.

1.3.2.3 Shipping/Disposal Alternatives

Shipping and disposal alternatives were evaluated in the EPA OSC approved *Offsite Ash Disposal Options Analysis* (Ref. 8.1.2). The EPA Order (Section XVII, Paragraph 45) required that the disposal facility be operating in compliance with RCRA Subtitle D permitting requirements for operation and disposal of industrial wastes, which at a minimum shall include the use of a synthetic liner, leachate collection system, groundwater monitoring, financial assurance, and closure and post-closure care. Disposal actions taken during the time-critical removal action are discussed in Section 2.1.1.7.

On February 23, 2009 TVA issued a Request for Proposal (RFP) to identify offsite disposal options for consideration. Options requested for proposal included appropriately permitted facilities that were immediately available to receive and dispose/store the ash material and that were accessible by barge, truck, and/or rail. Responses to the RFP included options for disposal of the material in Class I landfills or Class II industrial landfills and beneficial reuse of the ash as structural fill in mine or quarry reclamation projects. TVA received about 25 proposals that were screened based on cost and technical and operational criteria (Ref. 8.1.2). As a result of the procurement process, four sites accessible by rail and four sites accessible by truck were identified as being available for ash disposal.

Other alternatives were considered, including construction of ash monofills within the Phase II Roane County Landfill, Crab Orchard Quarry, Crossville Coal Mine, or TVA property. Because these sites were not permitted landfills, they did not meet TVA's need for a disposal site that was immediately available, and were consequently eliminated from further evaluation.

Several approved (permitted) Class I landfills were considered. As part of the permitting process, Class I landfills must be located, designed constructed, operated, and maintained such that the fill areas meet minimum buffer zone standards relative to property lines, residences, down gradient wells, and water bodies. Additionally, Class I landfills must have state-approved management plans to address storm water and erosion control; leachate collection, disposal, and monitoring for those parameters listed in the Toxicity Characteristic Leaching Procedure (TCLP); wastes screening; and monitoring including groundwater, surface water, and leachate. Other requirements include dust control, litter control, flood protection as needed, fire safety, and a landfill gas management system. Class I landfills with rail access that were immediately available to receive ash from the Site are listed in Table 1-6.

The Arrowhead Landfill, located in Uniontown, Perry County, Alabama, was the selected landfill because it was an existing permitted facility with existing rail access within reasonable distance from the Site and because the proposed disposal price was the lowest of the acceptable landfills. Although the Veolia-Taylor County landfill was an existing permitted facility with existing rail access within reasonable distance from the Site, the landfill was not selected because the proposed disposal price was higher than that for the Arrowhead Landfill. TVA eliminated the Hazleton Site from consideration, as the operator was unable to commit to installing a liner for placement of ash material, as required by the EPA Order. The East Carbon Landfill was eliminated from further evaluation because of the long distance for rail travel, nearly 5 times as far as the closer rail sites.

Table 1-6. Disposal Sites with Rail Access

Operator	Facility	Type	State	Rail Distance (miles)	Total Ash Capacity (cy)	Max. Daily Capacity (cy)
Phillips and Jordan, Inc.	Arrowhead Landfill	Class 1, Subtitle D Landfill	Alabama	327	11,000,000	13,800 by mid July 2009
Veolia Environmental Services	Veolia-Taylor County Landfill	Class 1, Subtitle D Landfill	Georgia	340	48,000,000	Unlimited
Hazleton Creek Properties, LLC	Hazleton Mine Reclamation Project	Beneficial Reuse/Structural fill, abandoned coal mine	Pennsylvania	660	5,000,000	8,000
East Carbon Development Company Environmental	East Carbon Landfill	Class V, Subtitle D Landfill	Utah	1700	280,000,000	6,500

Several local Class I landfills had been identified for ash transport by truck for disposal. At the Class I landfills, except for Chestnut Ridge, material would be mixed with other waste material or used as layering material. At Chestnut Ridge, the material would be managed separately. Table 1-7 contains the characteristics of the local landfills with truck access.

Only the Chestnut Ridge Landfill could have accepted all the dredged ash at the necessary daily rate. For most of these landfills, TVA would have had to use two or more landfills simultaneously because of limited storage or daily operating capacity, which would have reduced the number of vehicles traveling a particular route, thus mitigating potential traffic congestion, noise, and diesel emissions.

These truck-access landfills were not selected for disposal of ash from the Site because rail transport was considered safer based on transportation safety statistics for rail vs. truck transport. Truck transport would have further stressed local roadway traffic and caused further disruption to the local community. In addition, regulators had expressed concern about the loss of Class I landfill capacity in Tennessee, if local truck-access landfills were to be consumed by the large volumes of ash from the Site.

Table 1-7. Local Disposal Sites with Truck Access

Operator	Facility	Type	State	Road Distance (miles)	Total Ash Capacity (cy)	Max. Daily Capacity
Waste Management	Chestnut Ridge Landfill	Class 1, Subtitle D landfill	Tennessee	50	Up to 5,000,000 with volume guarantee	8,500 tons
Waste Connections	Meadow Branch Landfill	Class 1, Subtitle D landfill	Tennessee	57	2,000,000	500 cy
Waste Connections	Volunteer Regional Landfill	Class 1, Subtitle D landfill	Tennessee	58	5,000,000	500 cy
Santek Environmental	Rhea County Landfill	Class 1, Subtitle D landfill	Tennessee	37	not reported	500 cy

1.3.3 Structural Integrity Assessments of Other TVA Facilities

In accordance with the EPA Order (Section XI, Paragraph 33) and the January 12, 2009, TDEC Commissioner's Order, Stantec conducted structural integrity assessments of existing coal ash impoundments and landfills at TVA's eleven coal-fired power plants. Results of those assessments were documented in the EPA OSC approved *Phase 1 Facility Assessment for Coal Combustion Product Impoundments and Disposal Facilities in AL, KY, and TN* (Ref. 9.1). The results were presented in a series of three separate reports, one for Alabama facilities, one for Kentucky facilities, and one for Tennessee facilities.

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2 EFFECTIVENESS OF REMOVAL ACTIONS

2.1 ACTIONS TAKEN BY TVA

2.1.1 Summary of Actions Taken

Operations conducted under the time-critical removal action included ash removal from the river; ash processing; excavation of ash east of Dike 2; ash staging and storage; ash loading, transportation, and disposal; dust suppression; cenosphere removal; skimmer wall debris removal; and reinforcement of Dike C. These activities are summarized in the following sections. Detailed documentation of the contractor activities occurring during the time-critical removal actions were captured in contractor daily reports, as presented in Ref. 29. Additional documentation exists in the EPA Pollution Reports (POLREPS), presented in Ref. 27, and the TVA Weekly Reports, presented in Ref. 28. Photographs of the progress of the time-critical removal action are presented in Appendix A.

2.1.1.1 Ash Removal from the River

Hydraulic dredging in the river began during an initial dredging pilot program prior to the EPA Order, as discussed in Section 1.1.5.3. The *Phase 1 Emory River Dredging Plan for the Kingston Fossil Plant Ash Recovery Project* was prepared in February 2009 (Ref. 11.2.1). Pilot dredging began on March 20, 2009, and continued until July 20, 2009 (during the time-critical removal action). Dredging was conducted in the river near Weir 1, skimmer wall, and mid-channel. Trans-Ash Inc. USA (Trans-Ash) operated three 10-inch dredges, (named Emory, Clyde, and Luzon); the volume of material hydraulically dredged by Trans-Ash was estimated by multiplying the dredge production time (in hours) by an assumed 113 cy/hour production rate for the 10-inch dredges.

The EPA Order required that TVA move in a more expeditious manner as it pertained to ash removal from the river. In order to gain more production capacity information and to accelerate the cleanup,, the Trans-Ash dredges were augmented using a 10-inch TVA dredge; approximately 20,000 cy were removed between May 19 and July 12, 2009, using the 10-inch TVA dredge. To improve the production rates, a 14-inch TVA dredge was moved to the Emory River and started dredging on June 16, 2009, in accordance with the EPA OSC approved *Relocation of the TVA Dredge Work Plan* (Ref. 11.2.3). Between June 16 and July 20, 2009, the 14-inch TVA dredge had a total production of 118,022 cy, with a daily average production of 4,500 cy/day. The 14-inch dredge exceeded the combined production of the three 10-inch dredges by 13% during five days when all four were dredging on a 20-hour/day operation. and augment the Trans-Ash dredges, The volume of material hydraulically dredged by the TVA dredges was estimated by multiplying the daily travel distance of the dredge, by the vertical cut observed on the boom, and by the cut width (90-ft swing of the boom). The means used by both Trans-Ash and TVA to estimate volumes during the pilot was very uncertain. Together, nearly 468,000 cy of material were estimated to have been removed by hydraulic dredging. Appendix B presents daily statistics on what each dredge produced during the dredging pilot program (March 2009 through July 2009). EPA's histograms of the dredging production rates are presented in Figures 6, 7, and 8. As shown on the histograms, while production rates as high as 10,000 cy/day were achieved for about a month, typical production rates were approximately 5,000 cy/day during this pilot study.

Time-critical dredging was conducted under the EPA OSC approved work plan, *Revised Emory River Dredging Plan, Kingston Fossil Plant Ash Recovery Project* (Ref. 11.2.7). Large-scale dredging of the Emory River began under the time-critical removal action after the dredging pilot study had been completed and Sevenson had been procured as the dredging contractor. The original Dredging Plan (Shaw 2009) was revised in July 2009 (Ref. 11.2.7) to describe Sevenson's approach to the dredging. The dredging pilot study demonstrated that larger dredges were needed to meet the productivity objectives of the EPA Order; therefore, to improve the production rates, the revised dredging plan included use of 16-inch and 20-inch dredges.

In accordance with the short-term strategic objectives for the Site as required in the EPA Order, TVA was required to expeditiously and efficiently prioritize and perform the necessary response actions at the Site. Five reaches of the river (referred to as Segments 1 through 5 in Figure 9) were identified in the dredging plan to guide the dredging and to meet dredging priorities. The priorities of the dredging, as established in the EPA OSC approved work plan, were identified as follows:

- Priority 1: Clear the Emory River channel to the pre-slide sediments to restore flow to the channel, to minimize flooding, and to minimize further migration of the ash. The reach of the river targeted for satisfying priority 1 actions is depicted as Segments 1, 2, 3, and 5 in Figure 13.

- Priority 2: Clear the remaining ash within the river and intake channel to prevent further migration of the ash while minimizing disturbance of legacy, native sediments. The reach of the river targeted for satisfying priority 2 actions included Segment 4 down to the mouth of the Emory River, north of Segment 5, the area of ash deposition east of Segment 1, the intake channel, and the ash and debris at the skimmer wall.

Dredging was conducted in two phases to meet the two priorities. In Phase 1 dredging, the river channel was opened by removing ash in Segments 1, 2, 3, and 5 using hydraulic dredging with mechanical debris removal. This dredging was bulk removal with no effort made to precision-dredge near or to the river bottom. The bulk of the ash in the river was up to 30 feet deep, located within the reach of the river from approximately ERM 3.0 (0.5 miles upriver of the release) to ERM 1.0 (1.5 miles downriver), as shown on Figure 13.

Phase 2 dredging focused on returning the river channel to its original (pre-spill) depths while minimizing disturbance of legacy sediment. The original dredge area was from the mouth of the Clinch River to the northern most extent of ash present (eventually found just south of ERM 6.0) including the intake channel. However, because of concerns about legacy contaminated sediment from the U.S. Department of Energy (DOE) Oak Ridge Reservation, underlying sediment sampling was conducted and where trace amounts of cesium-137 were found (ERM 0.0 to ERM 1.8 and in the intake channel), the area was removed from the scope of the time-critical removal action by the OSC (Ref. 11.3.7). Further evaluation of this area will be conducted as part of the *Non-Time-Critical Removal Action for the River System, Sampling and Analysis Plan (SAP)* (Ref. 11.2.16).

During dredging operations, turbidity was expected to increase in the immediate area of the dredging. Control practices such as engineering controls (silt curtains) and operational controls (i.e., reduce cutter head speed, reduce rate of advance, reverse cutter head rotation) were implemented to minimize suspended solids from the dredging operations. Monitoring was conducted to confirm turbidity levels downstream of the dredging; results of this monitoring are discussed in Section 3.

Phase 1 Hydraulic Dredging

The river dredging operation was originally divided into five segments as defined on Figure 9. Cross sections are shown on Figures 9a and 9b. The segments are described as follows.

- Segment 1 was approximately 3,000-ft long by 600-ft wide, located directly east of the ash release along the Emory River navigation channel, and contained approximately 1,009,000 cy of ash.

- Segment 2 was approximately 800-ft long by 600-ft wide, located immediately south (downriver) of Segment 1 along the Emory River navigation channel to Weir 1, and contained approximately 168,000 cy of ash.

- Segment 3 was approximately 440-ft long by 500-ft wide, located immediately south of Segment 2 along the Emory River navigation channel, including Weir 1. Segment 3 contained approximately 99,000 cy of ash and stone (riprap).

- Segment 4 was approximately one mile long by 500-ft wide, located immediately south (downriver) of Segment 3 along the Emory River navigation channel, and contained approximately 122,000 cy of ash.

- Segment 5 was approximately 3,010-ft long by 600-ft wide, located immediately north (upriver) of Segment 1 along the Emory River navigation channel, and contained approximately 533,000 cy of ash.

- Above Segment 5, ash was deposited along the river channel to near ERM 6.0. This reach of the Emory River was approximately 2.8 miles long and contained approximately 206,000 cy of ash.

- Below Segment 4, ash was deposited along the Emory River to near its confluence with the Clinch River. This reach of the Emory River was approximately 1.5 miles long and contained approximately 122,000 cy of ash.

- Ash was also deposited in the shallow area east of Segment 1. This area was approximately 1,000-ft long by 500-ft wide and contained approximately 50,000 cy of ash.

The approximate total volume of ash present in these segments (as measured by TVA using a bathymetric survey in early May 2009) was estimated to be 2,309,000 cy.

Sevenson began Phase 1 production dredging in August 2009, and focused on removing the greatest volume of ash in the quickest time frame to reduce the potential for upstream flooding by clearing the river channel and to minimize downriver migration risk. Initially, the dredges were directed to cut to an elevation of 710 ft msl. After several months of production dredging, this approach resulted in leaving large volumes of ash in some areas of the river, while overdredging native sediments in other areas of the river. To improve the production removal of ash rather than native sediment, a grid-based dredge plan was developed in November 2009, (Ref. 11.2.14) that divided each dredge segment into 125-ft by 125-ft grid sections, with the elevation of the final dredge cut in each grid section being an average of the pre-spill river bottom contour. The pre-spill river bottom contours were based on a USACE 2007 survey. The average final contour best represented the expected elevation of the top of native sediment. It provided a balance between dredging non-ash material and leaving ash behind. This concept of a "flat bottom" grid set at the average river bottom was used from early November 2009 through January 2010. Figure 13 illustrates the flat bottom elevations that were used for production dredging for Segments 1, 2, 3, and 5. The flat bottom elevation focused on areas with deep deposits to allow removal of the greatest volume of ash in the quickest time frame with the equipment available onsite.

At the end of Phase 1 dredging, Sevenson had removed a total of 1.5 million cy of ash from the river, which cleared the river channel and minimized downriver migration. As described in Section 1.1.2, results of ERDCWES modeling of ash transport during selected flood events demonstrated a significant decline in the downriver migration potential between May 2009 and January 2010. The volume of material hydraulically dredged by Sevenson was estimated by comparing bathymetric survey information of the river bottom before and after dredging in a given grid area. Appendix B presents daily statistics on what volume each dredge produced and where it was operating during Sevenson's Phase 1 dredging (August 2009 through January 2010). EPA's histogram of the dredging production rates during Phase 1 dredging is presented in Figures 6 and 7. As shown on the histogram, while maximum dredging production rates as high as 15,000 to 20,000 cy/day could be achieved on several days between August and November 2009, production rates were only 10,000 cy/day between November 2009 and January 2010. Production was limited by the lack of safe temporary land-based storage capacity and wet weather impacts on ash processing operations, as discussed in Section 2.1.1.2.

After August 1, 2009, Sevenson operated up to three dredges, primarily in Segments 1, 2, 3, and 5. The dredges were a 14-inch (McKenzie), 16-inch (Kylee), and 20-inch (Little Rock/Sandpiper). The 16-inch (Kylee) dredge was added in October 2009 to improve productivity and thereby expedite ash removal, as required by the EPA Order. Productivity of each dredge improved gradually over an eight-week period following dredge mobilization. Once Phase I dredging had reached routine operations, average productivity rates for each dredge as listed in Table 2-1 were achieved. These rates were comparable to typical rates expected for dredges of this size (Ref. 24.3). The dredges were therefore effective in achieving expected ash removal rates.

Table 2-1. Phase 1 Hydraulic Dredging Productivity Rates

Dredge Size (Name)	Maximum Productivity (cy/hour)	Average Productivity (cy/hour)	Typical Productivity[a] (cy/hour)	Volume Removed (cy)
10-inch Trans-Ash (Emory, Clyde, Luzon)	113[b]	113[b]	60-300	350,000
14-inch TVA	562	344	160-700	118,000
14-inch Sevenson (McKenzie)	333	159	160-700	285,000
16-inch Sevenson (Kylee)	451	230	240-875	394,000
20-inch Sevenson (Little Rock/Sandpiper)	1,694	480	310-1,365	814,000

Notes:
[a] USACE 1983.
[b] Production rate assumed at 113 cy/hour.

Difficulties were experienced in maintaining the minimum target average of 15,000 cy/workday removal rate, as described in the EPA OSC memorandum re: *Time Critical Removal Action Status Memo for the TVA Kingston Fly Ash Release* (Ref. 24.9). The EPA OSC identified significant obstacles to dredging production, including ash recovery systems, wet ash materials handling, and loading/transport. Improvements were made to those systems as described in sections 2.1.1.2, 2.1.1.4, and 2.1.1.5. These improvements were implemented to meet the objectives of the EPA Order to expeditiously remove the ash from the Emory River as safely as possible. The memo summarized progress to date concerning the expedited actions taken and reiterated the goal of removing an average of 15,000 cy/workday.

In mid-January, 2010, the large 20-inch dredge was moved downriver into Segment 4 in accordance with the EPA OSC approved *Time-Critical Concurrence to move the 20-inch dredge into Segment 4* (Ref. 11.4.1). Because ash levels upriver had been sufficiently reduced by that time, opportunities for this large dredge to reach its full production capacity had become limited. By moving the dredge downriver of Weir 1, ash removal production rates could be improved.

Total volume of ash removed during Phase 1 hydraulic dredging (including the pilot program) was 1.96 million cy. Between March and July 2009, the four TVA/Trans-Ash dredges averaged approximately 4,900 cy/day; between August 2009 and January 2010, the three larger Sevenson dredges averaged approximately 10,700 cy/day during active dredge operations. The improved dredge production rates helped in achieving the expedited removal required by the EPA Order.

Phase 2 Hydraulic Dredging

The Phase 2 dredging was conducted under the EPA OSC approved work plan, *Dredge Plan Addendum – Completion of Time-Critical Removal Action* (Ref. 11.2.14). Phase 2 production dredging began in February 2010, and focused on dredging to the pre-spill river bottom contours (based on a USACE 2007 survey) to further minimize the potential for future ash migration down river. This Phase 2 dredging was considered "precision" dredging, since thinner layers of ash were to be removed and the dredging was to be conducted with specialized equipment that could allow for final cuts to the pre-spill river bottom elevations. Additional data collection in the form of surveys or vibracore samples was necessary in some areas of the river to better define the extent of ash to be removed. This information was considered in the development of the final Dredge Plan Addendum (Ref. 11.2.14). The additional data collection is presented in the EPA OSC approved *Time-Critical Removal Action Completion Report for River System Phase II Nature and Extent of Ash Investigation* (Ref. 7.3.4). These data were used to guide the completion of Phase 2 ash removal from the Emory River.

Time-critical dredging objectives and limitations were further discussed in the EPA OSC's Dredging Determination memorandum (Ref. 11.3.7). The goal was to remove as much coal ash as possible during this phase of the cleanup, particularly while dredges were mobilized and site operations were in place to handle the ash removal and potential offsite disposal. The ICS Unified Command understood that under any reasonable circumstance, some ash would remain. It was recognized that due to challenges in accurately identifying the river bottom contour and the imprecision of dredges that some ash may be left behind in some segments at the end of the time-critical removal action. The extent of this ash and potential human health and ecological risks from exposure to the ash will be assessed as part of future non-time-critical removal actions.

With that understanding and with the stated time-critical objective of minimizing migration, the OSC established a dredging strategy that balanced ash removal against native sediment removal. It was determined that positioning the cutter head at the pre-spill river bed elevation would entrain the highest percentage of fly ash, while minimizing the uptake of native sediment. Field adjustments were made by incrementally raising or lowering the cutter head in response to changing field conditions such as encountering bedrock or native material. This strategy minimized the disturbance of native sediment and maximized the removal of ash.

It is important to note that the original river bottom contours were defined by the USACE 2007 pre-slide bathymetric survey, which was not complete in all areas. The spacing interval of survey lines in this survey was approximately 500 ft. This spacing was not detailed enough to provide sufficient information for determining pre-spill bathymetry for each dredge grid. Therefore, despite a computerized file of the anticipated river bottom elevation being available to the dredge operators, they frequently reached river bottom at a higher elevation. Efforts were made to avoid excessively overdredging the river bottom through visual observations of the dredge effluent. When it appeared that conditions in the river resulted in a final elevation that was higher than originally anticipated, a change to the dredge plan was documented through a concurrence form.

A portion of the Emory River in Segment 4 and Below Segment 4 was not dredged under the time-critical removal action. Cesuim-137 has been found at low levels in underlying sediment samples taken from ERM 0.0 to 1.8. In addition, cesium-137 has been found in the sediments in the plant intake channel. Cesium-137 is a result of historical releases from DOE facilities on the Oak Ridge Reservation. Although the levels are low, the impact of sediment with radiological contamination becoming mixed with the ash requires further evaluation. Therefore, these areas were deferred from the time-critical removal action and will be assessed as part of future non-time-critical removal actions.

As a result, priority areas for Phase 2 dredging were established in Segments 1 through 5 (less portions of Segment 4 impacted by cesium-137) and in the reach north of Segment 5 to ERM 6.0 (Above Segment 5 and Above Above Segment 5). The volume of ash to be removed from these priority areas was estimated to be 780,000 cy.

The dredges used a cutter head with variable speed operation and with a boom long enough to reach the final depth required. The cutter head was positioned with a global positioning system (GPS) operated onboard to maintain dredging within the specified limits (the main channel of the Emory River as defined by USACE and channel depth limits).

Dredging operations were staffed and operated 24 hours/day, seven days/week. The seventh day was generally used for dredge maintenance and dredging progress review although a few times it was used for dredging to achieve project schedules. In the upper reaches of the dredging activities, the dredges were operated fewer hours per day to avoid impacts on nearby residents. Light plants were installed on land and on barges in the work area. To the extent possible, these lights were positioned and aimed to reduce glare on inhabited residential homes. To reduce noise, the dredges and booster pumps used hospital-grade mufflers as well as sound reduction enclosures for some equipment. Noise was monitored during both day and night shifts, at the beginning of new or different operations, and periodically throughout the dredging activities. In response to neighborhood concerns, work was reduced to only day shifts in certain areas.

Figure 15 illustrates the paths that the various dredges took, working within the boundaries set in the dredge plan and dredge plan addendum. During Phase 2, a more methodical approach was taken because of the larger extent to be covered and the precision required. Results of the previous day's bathymetric survey and planned dredge paths were reviewed daily to check that the retrievable ash was removed to the estimated pre-spill bottom contours. Appendix B presents daily statistics on what volume each dredge produced and where it was operating during Phase 2 (February through June 2010).

Beginning February 2, 2010, Sevenson operated up to five dredges. The dredges were a 14-inch (Addison), 14-inch (Adelyn), 14-inch (McKenzie), 16-inch (Kylee), and 16-inch (Shirley). Productivity of each dredge remained relatively constant following dredge mobilization. Average productivity rates for each dredge as listed in Table 2-2 were achieved. These rates were less than typical rates expected for dredges of this size (Ref. 21.3), and less than Phase 1 dredging. This is because the precision dredging required frequent adjustment of dredge sweep and dredge location along each dredge path. Maximizing the operational space available by using five dredges allowed the project to meet the goals in an expeditious and efficient manner despite lower than typical rates of production. The dredges were therefore effective in achieving expected ash removal rates.

Table 2-2. Phase 2 Hydraulic Dredging Productivity Rates

Dredge Size (Name)	Maximum Productivity (cy/hour)	Average Productivity (cy/hour)	Typical Productivity[a] (cy/hour)	Total Volume Removed (cy)
14-inch Sevenson (Addison)	353	98	160-700	138,000
14-inch Sevenson (Adelyn)	290	73	160-700	55,000
14-inch Sevenson (McKenzie)	318	88	160-700	116,000
16-inch Sevenson (Kylee)	472	142	240-875	209,000
16-inch Sevenson (Shirley)	543	154	240-875	231,000

Note: [a] USACE 1983.

EPA's histogram of the dredging production rates during Phase 2 dredging is presented in Figures 7 and 8. As shown on the histogram, dredging production rates using three dredges in January and February 2010 averaged 5,000 to 7,000 cy/day. To improve the production rate, two more dredges were added in March; production rates as high as 10,000 cy/day could be achieved between March and May 2010. A production rate of 10,000 cy/workday was in line with the expectations of the EPA OSC as illustrated in the EPA histogram (Figures 7 and 8). Additional dredges in the river were not feasible due to the small space available for operating the five dredges and their pipelines.

Productivity was restricted due to the longer time needed to relocate dredge pipelines as the dredges advanced along a dredge path. Mechanical breakdowns and structural repairs of the larger dredges also limited their productivity. Total volume of ash removed during Phase 2 hydraulic dredging was approximately 749,000 cy, averaging approximately 6,000 cy/day during active dredge operations. The combined removal rate of all five dredges used during Phase 2 dredging was therefore much less than the combined removal rate of the three dredges used during Phase 1 dredging. This is because of the slower productivity achievable with precision dredging. The addition of two more dredges in March was a significant improvement allowing TVA to expedite the removal of remaining ash as per the EPA OSC Dredge Determination Memo.

Precision was improved during Phase 2 dredging by use of an eTrak system on three of the dredges to control the cutter heads to the target river bottom elevations. Both swing and target depths were automated so that dredged elevations were within approximately one foot of the target elevations. Additional precision was not feasible due to inherent mechanical limitations of cables and hydraulics at the end of a 50-ft boom, with boat tilt and wave action.

Figures 12 through 14 illustrate the estimated thickness of ash material remaining after completion of Phase 2 from each dredge segment. These figures were compiled by comparing bathymetric survey data obtained following dredging, pre-spill bathymetric survey data, and vibracore samples.

The Emory River was reopened for public use on May 29, 2010, after the completion of Phase 2 dredging. Demobilization of the pipes and dredges was performed in accordance with the EPA OSC approved *Dredge Demobilization Work Plan* (Ref. 16.2). Demobilization of Sevenson support services equipment (office trailers, maintenance shed, CONEX boxes, and miscellaneous small equipment and materials) was performed over time as the equipment was no longer needed, in accordance with the EPA OSC approved *Support Services Equipment Demobilization Work Plan* (Ref. 16.6).

Mechanical Dredging

Mechanical dredging was used during the Phase 1 pilot dredging operations. A barge-mounted excavator removed material from the river, and placed it on a separate dredge barge for transport to shore. Initially, this dredging was limited to debris removal in support of hydraulic dredging. It was expanded in an attempt to open a narrow channel through ash within the original Emory River channel and to expedite the removal as per the EPA Order. Mechanical dredging of the narrow access channel was conducted in accordance with the EPA OSC approved *Access Channel Construction and Debris Removal Operations Work Plan* (Ref. 11.2.5). This narrow channel was not completed prior to the end of pilot dredging.

During Phase 1 pilot dredging (between June 20 and July 20, 2009), Southern Shores Development, Inc., (as subcontractor to Trans-Ash) operated a mechanical dredge in the Emory River, primarily in Segments 1, 2, and 3. The volume of material mechanically dredged by Southern Shores was estimated by counting the number of truck loads used to unload the barge and multiplying by an assumed 18 to 22 cy per truck load. Daily removal rates varied widely from day to day, ranging between 260 and 1,480 cy/day, and averaging 819 cy/day. Total volume of ash removed during Phase 1 pilot dredging was approximately 18,840 cy.

During Phase 2 dredging, mechanical dredging, using clamshells and backhoes, was used in conjunction with hydraulic dredging to remove debris, rock, and/or ash deposits located far upriver. Debris (e.g., trees, debris from demolished structures, boulders, large rocks, and any other dense or large objects that hinder hydraulic dredging operations) was present in the ash. Weir 1, in particular, had a large amount (12,000 cy) of rock present that was removed in Phase 2 by mechanical dredging. Some deposits of ash were located so far upriver that the amount of piping and pumping that would have been needed to move the ash caused hydraulic dredging to become less cost effective. Mechanical dredging was therefore used near the end of Phase 2 dredging by removing remote ash deposits in the area known as Above Above Segment 5 and to remove ash deposits around the north dock.

The ash, rock, or debris was removed and deposited onto material barges surrounded with turbidity curtains. Barge offloading was conducted in accordance with the EPA OSC approved *Construction/Implementation of Barge Offloading Area Work Plan* (Ref. 11.2.4). The recovered material was off-loaded at either the north or the south dock and hauled by truck to final disposition locations. Non-rock debris was hauled to a debris processing station located on the peninsula near the Gypsum Pond construction site. Rock was typically used onsite for roads (although some rock was hauled to the Ball Field for offsite disposal and some rock was hauled to the Lateral Expansion area for disposal). The recovered ash was hauled initially to the Sluice Trench area for processing and later to the Lateral Expansion area, once that area had been approved for ash processing. Disposal in the Lateral Expansion area was performed in accordance with the EPA OSC approved *Storage of Mechanically Dredged Ash Work Plan* (Ref. 10.1.22).

Between March 13 and May 27, 2010, Sevenson operated a mechanical dredge in the Emory River. Mechanical excavation began with the removal of Weir 1 ash and rock in accordance with the EPA OSC approved *Weir 1 Removal Work Plan* (Ref. 11.2.13). The Emory River channel had been cleared sufficiently by that time, so that Weir 1 was no longer needed to control downriver migration of ash. Consultation with Steve Scott of ERDCWES concurred that the weir was no longer needed. Material offloading was modified in accordance with the EPA OSC approved *Time-Critical Concurrence to modify the Weir 1 Work Plan offloading practice* (Ref. 11.4.3). Because river levels were low at that time, access at the offloading point was limited; therefore, the initial rock removed from Weir 1 was used to build a temporary pad into the river. The pad was later removed.

Productivity of the dredge varied widely from day to day, depending on the material being removed and the volume of ash being removed from any given area. Removal rates ranged between 200 and 1,210 cy/day and averaged approximately 570 cy/day during active dredge operations. A total of 259 barges were unloaded, with an assumed capacity of approximately 110 cy/barge load. Productivity of mechanical excavation was restricted by barge availability due to the time needed to transport the loads to shore and unload each barge. Total volume of ash removed by Sevenson during Phase 2 mechanical dredging was approximately 30,000 cy.

The simultaneous use of mechanical dredging with hydraulic dredging improved the ability to expeditiously and efficiently remove ash from the Emory River. In addition, the use of this method allowed ash removal from the upper reaches of the river as well as smaller, more isolated areas such as Bob Summers Road. Between April 7 and August 19, 2010, Aquarius Marine, Inc. (Aquarius) also operated a mechanical dredge in the Emory River. While primarily involved in debris removal near the former skimmer wall, Aquarius also mechanically dredged ash material from areas Above Segment 5, Above Above Segment 5, and from the East Embayment beneath Bob Summers Road. Aquarius removal rates averaged around 135 cy/day. Total volume of ash removed by Aquarius was approximately 15,000 cy. Demobilization of Aquarius equipment was performed in accordance with the EPA OSC approved *Aquarius Debris Removal Demobilization Plan* (Ref. 16.5). Demobilization and decontamination of Aquarius barges was performed in accordance with the EPA OSC approved *Aquarius Debris Removal Demobilization Plan Decontamination of AM501 and AM594* (Ref. 16.9).

In December 2009, a submerged excavator that had been transported into the Emory River during the ash release was removed in accordance with the.EPA approved *Excavator Removal from the Emory River Work Plan* (Ref. 11.2.11). The excavator was lifted from the water by crane, washed, and placed on a barge, offloaded at the south dock to a flatbed truck, and transported to a TVA repair facility.

Bathymetric Surveying and Vibracore Sampling

Bathymetric surveys were performed routinely to track dredging progress. Additional surveys were conducted prior to the pilot study; after the May 2009 rainfall event; and after the completion of Phase 2 dredging. Sevenson completed vertical echo-sounding survey data collection for pre- and post-removal of ash in the Emory River. Survey equipment and accuracy were as described in the memorandum *Accuracy of Dredge Control Data Surface* (Ref. 11.3.6). GPS survey data collection was accomplished using Hemisphere GPS™ R100 Differential GPS survey equipment with a minimum horizontal accuracy of ± 0.02 meters (0.06 ft). Echo-sounding data was collected with a Knudsen Engineering™ Sounder 1612 with a vertical accuracy of 0.01 meters (0.03 ft) per ± 0.1% of depth and a KEL771 28/200kHz dual frequency transducer with a 29°/8° beam width. The survey data were used to plot average river bottom elevations; the accuracy of the plotted elevation surfaces decreased as the distance from the measured elevation point increased. For this reason, bathymetric surveys were completed on a repeatable 25-ft grid (both on cross-channel and along stream lines) unique to each individual work segment. Figure 15 shows the location where the surveys were conducted.

The primary control datum for the pre-spill sediment surface is the USACE navigational channel survey of the Emory River performed in 2007. The data were tightly spaced river sediment elevations along cross-channel lines spaced 300 to 500 ft along the river channel. The predicted pre-spill surface datum was checked using vibracore sampling at multiple points and showed correlation within one foot. The vibracore data were also used to develop pre-spill sediment surfaces in areas without USACE bathymetric data.

The bathymetric survey results were compared to the assumed pre-spill river bottom elevations (USACE 2007 bathymetric survey) to estimate the thickness of any material deposits above the pre-spill river bottom. These surveys were used routinely during operations to assess the performance of the dredges and to guide precision dredging operations. Figures 12 through 14 illustrate the estimated thickness of material remaining after completion of Phase 2 dredging, based on the final bathymetric survey information composited across the Site. Bathymetric information was supplemented with results of vibracore sampling to support that this material either 1) was not ash or 2) was native sediment or natural river bottom beneath sediments (i.e. rock outcrop).

Vibracore sampling was performed both prior to dredging to estimate the thicknesses of ash to be removed and after dredging to confirm that that ash had been sufficiently removed. Vibracore sampling was also performed to collect samples of ash for chemical or radiological analysis. Vibracore samples were taken using a VibeCore-D vibrating core sampler, as manufactured by Specialty Devices, Inc. The VibeCore-D tubes are approximately 3 inches in diameter (2.75 inches for clear polyacrylic tubes and 3 inches for metal tubes). Polyacrylic tubes (5 to 6 ft in length) were predominantly used, because they would allow samplers to get a good visual description of the cores and accurate depth intervals without having to extrude the samples. For qualitative purposes, vibracore samples were analyzed using polarized light microscopy (PLM) testing to describe the proportion of sediment versus ash within a sample; if the proportion of ash was 50% or greater within the sample, the sample was designated as being ash. This designation was not meant to define what is or is not ash, but instead was used as a field guide for faster and more efficient data collection to adjust daily dredge paths. Metal tubes were used for samples over 6 ft in depth. Two vibracore sampling boats were typically used, although a third boat was used sparingly when needed. The locations of vibracore samples taken after the final dredging in any given area are shown on Figure 22.

The bathymetric survey results, together with the vibracore sampling results, were used to demonstrate completion of dredging with EPA approval, in consultation with TDEC. This information is provided in detail on the concurrence forms (Appendix C).

<u>Concurrence Form Process</u>

Upon completion of dredging in an area, supporting information was compiled to document completion. There were three ways in which an area of the river was considered to have been completed: 1) the dredge reached the target elevations as documented either by the bathymetric survey or by the onboard dredge computer illustrating elevation of the cutter head; 2) the dredge reached a hard bottom (defined as cuts less than 6 to 12 inches per pass) as indicated on logs prepared by the dredge operator; and 3) the dredge reached native material as shown by the color and consistency of the dredging effluent. Completion was confirmed based on results of vibracore sampling.

After the supporting information was gathered, the concurrence form was submitted to EPA for review and approval. EPA consulted with TDEC prior to granting approval. Copies of the concurrence forms are presented in Appendix C. An independent quality assurance review of over 20% of the approved forms showed no significant findings on the accuracy of the forms or their supporting information.

2.1.1.2 Ash Processing

Ash processing consisted of gravity settlement in the Rim Ditch/Sluice Trench and Ash Pond, removal of ash solids from these settling facilities, then stockpiling and windrowing the material in the Ball Field Ash Processing Area to dewater the recovered ash. Ash processing was conducted in accordance with best management practices as described in the draft *Kingston Fly Ash Recovery Project, Dredged Fly Ash Dewatering Operation, Work Plan* (Ref. 11.2.8). Monitoring of water quality parameters for operational control was conducted in accordance with best management practices as described in the draft *Kingston*

Fly Ash Recovery Project, Monitoring of Water Discharged During Dredged Fly Ash Dewatering Operations (Ref. 11.2.9).

Power generation system reliability requirements impacted ash processing facilities, as described in the EPA OSC memorandum: *TVA Kingston Generation Needs for Reliable System Operations* (Ref. 24.11). Since 1968, the North American Electric Reliability commission (NERC) has been committed to ensuring the reliability of the bulk power system in North America. As of June 18, 2007, the U.S. Federal Energy Regulatory commission (FERC) granted NERC the legal authority to enforce reliability standards with all U.S. users, owners, and operators of the bulk operating system, and made compliance with those standards mandatory and enforceable. NERC's status as a self-regulatory organization means that it is a non-government organization which has statutory responsibility to regulate the bulk power system. Consistent with NERC contingency plans, TVA requires N-1 contingency planning for reliable operating systems (Ref. 24.10).

The ash processing facilities used the existing Sluice Trench and Ash Pond/Stilling Pond system that had been in use by the plant for processing of ash from power generation operations. During most of the time-critical removal action, the plant was not generating power and its units were shut down. In December, 2009, power generation at the Kingston plant was needed to prevent the Bull Run plant from being overloaded, which could have resulted in blackouts in Kingston and surrounding communities. To maintain system reliability during winter conditions, the Kingston plant was required to provide contingency plans to startup of power generation units to reach a predicted 28,000 kwH load demand. Ash processing for the dredging operations was impacted due to the additional water volume increase in the Sluice Trench and Ash Pond/Stilling Pond. Modifications to these systems, including use of the Lateral Expansion area and filter presses for ash processing, were used to alleviate the impact on the dredging operations, allowing the dredges to remain in operation while units at the Kingston plant were online (Ref. 24.11).

The main ash processing activities were completed near the end of June 2010. Heavy equipment associated with the Ball Field, Rim Ditch, and Sluice Trench ash processing operations were demobilized at that time in accordance with EPA OSC approved *Heavy Equipment Demobilization Work Plan* (Ref. 16.4).

<u>Ball Field Monitoring</u>

The Ball Field ash processing area was constructed prior to the EPA Order, in response to the TDEC Commissioner's Order, with EPA review, as described in Section 1.1.5.3. Geotechnical instrumentation installed during Ball Field construction consisted of piezometers, slope inclinometers, and settlement monitoring poles. This instrumentation system was monitoring weekly throughout the time-critical removal action. A customized data acquisition system including vibrating wire transducers was installed at the Site. Both short-range radios and an internet interface were connected to the data acquisition system; the customized software allowed review of real-time geotechnical instrumentation information via the internet.

The monitoring program was implemented during the staging of materials in the Ball Field area; the inclinometers were monitored by MACTEC and maintained by Jacobs. Several difficulties were encountered during the operation of this monitoring program, including: 1) numerous repairs and replacements of the instrumentation system due to the active construction at the Site, often resulting in periods of time in which data were not collected; 2) anomalous readings at several of the piezometers which were attributed to electrical noise rather than a response to construction activities; and 3) inconsistency of monitoring procedures for the inclinometers resulting in movement trends that appeared random and were difficult to attribute to construction activities.

The monitoring results were reported on a weekly basis. The monitoring included pore pressures in the piezometers, settlement of the settlement plates/poles, horizontal displacements at inclinometers, and filling rates. Geosyntec reviewed the weekly monitoring results for significant changes and assisted in the interpretation of the monitoring data by correlating to nearby construction activities. No significant or unexpected changes in the data were observed that would indicate a significant response or potential instability due to the ongoing construction activity. Similarly, no foundation instabilities were observed or reported during the materials handling operations in the Ball Field during the period monitored.

Rim Ditch Operation

Ash processing was performed to make the ash removed from the river suitable for offsite transportation and disposal. Because the majority of the ash removed from the river was hydraulically dredged, it was initially conveyed via pipeline as a dredge slurry that was approximately 15% solids by weight. Between August 26 and September 18, 2009, samples were collected of the dredge slurry discharge to the Rim Ditch and by Hard Hat Services in a field laboratory for percent solids. Values ranged from 6.9 to 23.9% solids by weight, with an average of 14.3% and a median value of 15.2%. During this time period, two dredges were operating in the Emory River (14-inch and 20-inch) and one dredge was operating in the Ash Pond (14-inch). The percent solids varied according to numerous factors such as depth of dredge cut, location of dredging, the specific dredge being used, etc. In comparison, the ash material loaded for offsite transport and disposal had a solids content of greater than 70% by weight and usually around 80%. Therefore, substantial dewatering was required to dry the ash slurry sufficiently for offsite transport and disposal.

Hard Hat Services (Hard Hat) reviewed and evaluated the pilot dredging operations and fly ash separation (settling) performance in the Rim Ditch and Sluice Trench (Ref. 24.4). Hard Hat conducted a follow-on review and evaluation in September 2009 following the start of full-scale dredging operations (Ref. 24.8). These evaluations were used to define the physical properties of the dredge slurry and optimize the settling performance.

Structural improvements to the Rim Ditch were made in accordance with EPA OSC approved work plan *Rim Ditch Structural Improvements Work Plan* (Ref. 10.1.5). During the pilot dredging program, the scouring action of the dredge slurry and the excavation activities from the Rim Ditch had eroded the west bank of the ditch. Structural improvements were deemed necessary. In addition, the path along the northwest side of the ditch was not structurally capable of supporting the weight of equipment planned to be used to remove ash from the ditch. A new working platform with an adjacent sheet pile wall was constructed. The platform consisted of a geogrid, geotextile material, structural fill, and wooden crane mats. In the first 800 ft of the Rim Ditch, 40-ft long AZ19-700 sheet piles were installed to buttress the working platform. In the last 1,000 ft of the ditch, 25-ft long piles were installed.

Hydraulic improvements to the Rim Ditch were made in accordance with EPA OSC approved work plan *Rim Ditch Hydraulic Improvements Work Plan* (Ref. 10.1.4). The Rim Ditch (Figure 16) was approximately 1,800-ft long and operated under a flow rate of approximately 21,000 gpm. Two sheet pile weirs were constructed across the Rim Ditch to slow down the water flow and improve solids settling. The weirs were installed in two locations, approximately 200 ft and 800 ft from the northern end of the Rim Ditch (where the dredge pipelines entered the ditch). These weirs divided the Rim Ditch into three cells. Cell configurations and retention times are listed in Table 2-3.

Table 2-3. Rim Ditch Cell Configuration and Retention Times

Cell	Length (ft)	Width (ft)	Max. Depth (ft)	Max. Volume (million gallon)	Max. Retention Time (min.)	Operational Retention Time (min.)
1	200	40	15	0.9	45	34
2	600	40	15	2.7	135	101
3	1,000	35	10	2.7	135	101

Slurry pipelines from the first three dredges were situated to discharge at the extreme north end of the Rim Ditch. As additional dredges were added, the discharge locations were moved to the beginning of Cell 2 to spread out the discharge area.

Effluent from the Rim Ditch discharged directly to the Sluice Trench through the Crossover Ditch. To evaluate the effectiveness of the ash removal within the Rim Ditch, a sample of the effluent was collected daily and analyzed for TSS. A 90% capture rate was targeted for the Rim Ditch, for a TSS goal of 30,000 mg/L. However, this removal goal was generally not achieved due to high rates of flow and high percentage of fines. The TSS in the Rim Ditch effluent averaged approximately 60,000 mg/L, and values as high as 750,000 mg/L were reported. To improve solids settlement and control the TSS exiting the Rim Ditch, a polymer addition station was constructed at the Crossover Ditch. Polymer was added to maintain a concentration of 4 mg/L as a primary treatment process to improve subsequent solids settlement within the Sluice Trench.

Sevenson used long reach excavators (Komatsu PC-600 excavators with 3.5-cy bucket and PC-400 excavators with 2.2-cy buckets) along the northwest side of the Rim Ditch to remove settled ash from the ditch at a rate equal to solids loading from the incoming dredge slurry. The excavators were used to remove the ash from the ditch and place it behind them in a trough, opposite the ditch, to allow primary dewatering.

The Rim Ditch was excavated by Sevenson for 214 days between August 7, 2009 and June 30, 2010, and nearly 1.2 million cy of ash was removed. The yardage is based on truck counts from daily reports. The sheet piling wall within the Rim Ditch was removed in August 2010, in accordance with the EPA OSC approved *Work Plan for Removal of Cantilevered Sheet Piling Wall* (Ref. 16.7).

Sluice Trench Operation

The Sluice Trench was approximately 1,900-ft long by up to 60-ft wide and 8-ft deep, for a total working volume of 8.5 million gallons. The dredge discharge water flowed from the Rim Ditch into the Sluice Trench where it combined with the plant discharges. With a total flow rate in the Sluice Trench of up to 45,000 gpm, retention time was estimated at 185 minutes when fully excavated, or 150 minutes assuming 25% of the storage volume was lost due to accumulated ash and sediment.

Ash removal from the Sluice Trench was initially performed using both cranes with clamshell buckets and a dragline. Long-reach excavators were added to locations with narrow access areas or when additional equipment was needed to expeditiously remove ash. Ash was excavated primarily onto the east side of the Sluice Trench, but occasionally it was excavated onto the west side.

The Sluice Trench was excavated for 182 days between August 7, 2009 and June 30, 2010, and nearly 500,000 cy of ash was removed. The yardage was based on truck counts from daily reports from Sevenson and TVA Civil Projects.

Effluent from the Sluice Trench discharged directly to the Ash Pond through three 36-inch culverts. To evaluate the effectiveness of the ash removal within the Sluice Trench, a sample of the effluent was collected daily and analyzed for TSS. Although a 28-day average value for TSS below 350 mg/L was targeted, this target value was never achieved. The TSS in the Sluice Trench effluent averaged approximately 33,000 mg/L, and values as high as 600,000 mg/L were reported. The target value could not be achieved due to the high flow rate and loss of storage volume due to irregular dipping; solids carryover from the Sluice Trench to the Ash Pond was therefore controlled by dredging from the Ash Pond and recirculated the Ash Pond dredge material back to Rim Ditch. To improve solids settlement and control the TSS exiting the Sluice Trench, a polymer addition station was constructed at the culvert discharge point from the Sluice Trench into the Ash Pond. Polymer was added to maintain a concentration of 4 mg/L as a primary treatment process to improve solids settlement within the Ash Pond and succeeded in keeping a high percentage of the ash leaving the Sluice Trench from reaching the Stilling Pond.

Once the ash removed from either the Rim Ditch or Sluice Trench had drained by gravity, the ash was placed in a windrow within the Ball Field area to continue the drying process. Windrowing was accomplished by successively moving and turning over the material from pile to pile to speed drying. Ash was moved into temporary storage in the Ball Field or directly to load trains when the material met the solids content required for offsite transportation and disposal.

In January 2010, the haul road adjacent to the sluice trench was improved in accordance with the EPA OSC approved *Work Plan for New Road Construction along Sluice Trench* (Ref. 10.1.14). The road was widened and moved eastward to provide additional area for dewatering ash removed from the Sluice Trench, eliminate congestion, and provide a safer area for haul trucks to maneuver.

Ash Pond and Stilling Pond Operation

The Ash Pond and the Stilling Pond together provided greater than 24 hours of additional retention time for gravity settling following solids removal in the Sluice Trench. The EPA OSC used the plant's NPDES permit levels that are required for its coal combustion activities as performance criteria for removal action operations. Although not established for dredging operations, the NPDES permit for coal combustion generation sets a limit for the TSS of the discharge to the intake channel from the ponds (29.9 mg/L monthly average and 92.2 mg/L daily maximum) and sets a minimum required free water volume for the combined ponds (102 million gallons). The Ash Pond is separated from the Stilling Pond by an intermediate dike and discharges to the Stilling Pond through five vertical decant towers or weirs. The Stilling Pond discharges to the plant intake channel (an arm of Watts Bar Reservoir) through five vertical decant towers or weirs and has an additional overflow weir to maintain freeboard on the Dike C structure surrounding the Stilling Pond.

Ash Pond operations were designed to remove the accumulating ash and maintain as much retention time in the pond as possible. The free water volume decreased as ash solids were transported into the ponds from the Sluice Trench effluent and were subsequently deposited (primarily in the Ash Pond). The free water volume was found to be below the permit level when surveyed on October 29, 2009, due to the high rate of solids settling during active time-critical dredging operations (nearly 3,250 cy/day).

In accordance with the National Contingency Plan (NCP) 300.415 (j) and paragraph 34 of the EPA Order, the EPA OSC evaluated the free water volume permit level. That evaluation was documented in a memorandum from the EPA OSC to TVA, *OSC Determination Concerning Permit Requirements to Maintain the Free Water Volume of the Settling Pond at the Kingston Fly Ash Release Time Critical Removal Action* (Ref. 6.3.7). The EPA OSC determined that the free water volume permit level acts as a redundant mechanism for compliance with TSS permit levels at the discharge from the Stilling Pond, and noted that discharge levels for TSS had consistently met the permit levels and in fact had generally maintained a low teens level. Based on the urgency and scope of the removal action and the extent to which actions were being taken by TVA to comply with permit levels and other environmental laws, the EPA OSC determined that the response actions had attained the applicable or relevant and appropriate requirements. The EPA OSC noted that loss of production concerning removal of ash from the river is of higher public health and/or environmental consequence than maintaining the free water volume permit level. The EPA OSC consulted with TDEC and received the support of the State in making this determination.

The EPA OSC determination regarding the NPDES free water volume requirement allowed TVA to continue high rates of dredging (Ref. 6.3.7). Hydraulic dredging of the ash was conducted throughout the report period with discharge to the Rim Ditch (from August 6, 2009 to February 9, 2010, and intermittently thereafter), the Lateral Expansion operation (from December 19, 2009 to March 2, 2010 and again from May 5, 2010 to June 22, 2010), or the filter press operation (from January 11 to April 15, 2010).

During the report period, the TVA 14-inch dredge removed an estimated 641,000 cy, the TVA 12-inch dredge removed an estimated 120,000 cy, and the TVA 10-inch dredge removed an estimated 203,000 cy from the Ash Pond. The Ash Pond dredging totaled an estimated 965,000 cy as reported by Sevenson and TVA's Civil Projects. Ash Pond and Stilling Pond survey data indicate that the free water volume available in February 2009 was 184% of the permit level and in July 2010 at the end of the time-critical removal action was 71% of the permit level; approximately 540,000 cy of ash accumulated during that period. The overall operations were successful in maintaining enough retention time to lower the TSS to permit levels throughout the period.

In February 2010, mechanical excavation of ash was implemented in accordance with the EPA OSC approved *Ash Pond Mechanical Dredging Work Plan* (Ref. 10.1.17). Mechanical excavation improved the removal production rates by augmenting the hydraulic dredge. Increasing the ash removal helped increase the free water volume. The excavated ash was hauled by truck to the Sluice Trench area for dewatering. In March, 2010, the excavated ash was also allowed to be hauled to an area abutting Dike D, in accordance with the EPA OSC approved *Time-Critical Concurrence to allow Ash Pond material stacking on Dike D* (Ref. 10.3.1).

Ash Pond effluent was monitored throughout the report period with daily sampling for TSS, real time continuous readings on pH, temperature, and turbidity. To improve solids settlement and control the TSS exiting the Ash Pond, a polymer station was installed on the intermediate dike near the decant weirs to treat the Ash Pond effluent as it enters the Stilling Pond. The station was upgraded for continuous operation in January 2010 when TSS levels approached permit levels during high dredging rates (over 15,000 gpm) and high plant operation (over 22,000 gpm). Polymer addition was adjusted dependent on the flow rate through the pond. The rate of flow was derived from the pond level as read on a staff gauge located near the decant tower. Real time measurements of key parameters (e.g., pH and turbidity) were achieved by the installation of "HydroLab" units at three locations. These readings were available via the Internet throughout the period to allow response if conditions changed.

Solids settling within the Ash Pond was effective at achieving over 99% removal. The TSS in the Ash Pond effluent averaged approximately 84 mg/L, although values as high as 500 mg/L were reported. The TSS in the Stilling Pond effluent averaged 10 mg/L; the highest recorded daily maximum TSS for the Stilling Pond effluent was 34 mg/L, which was well below the permit daily maximum limit of 92.2 mg/L. The highest recorded average monthly (28 day) TSS for the Stilling Pond effluent was 13.8 mg/L, which was well below the permit average monthly limit of 29.9 mg/L. Therefore, the Ash Pond and Stilling

Pond were effective in removing ash from the effluent and in complying with TSS levels in the plant discharge.

Polymer Addition

In February 2009, TVA began testing several polymers to enhance solids removal in the Sluice Trench, Ash Pond, and Stilling Pond to ensure compliance with TSS levels at the plant's outfall. Competing vendor polymers were tested to determine sediment settling effectiveness. A TVA contract toxicity testing laboratory also performed 96-hour chronic aquatic toxicity tests to verify that the polymers were non-toxic to aquatic organisms.

The product selected by TVA was Kemira Water Solutions, Inc. PAX-XL19 coagulant, a polyaluminum chloride solution. The polymer is designed to achieve extremely high levels of turbidity removal with minimal pH adjustment required.

Polymer dosing was initiated March 25, 2009, prior to the EPA Order. At that time, the primary polymer dosing station was established at the discharge point of the Ash Pond to the Stilling Pond. To improve solids settlement and control TSS, polymer stations were installed in accordance with best management practices described in the draft *Kingston Fossil Plant Interim TSS Management Plan* (Ref. 10.1.24). Two additional stations were then established, the first between the Sluice Trench and the Ash Pond and the second at the crossover channel from the Rim Ditch to the Sluice Trench. Dosing rates varied at each station based on the number of dredges operating, visual pond conditions, turbidity data, and daily TSS results as determined in a Jacobs field laboratory.

The daily polymer dosing details at each station are provided in Appendix D. The average polymer dosing rate from March 2009 to July 2010 was 4.1 mg/L at the Ash Pond to Stilling Pond dosing station. Figure F-1 contains a plot (March 2009 through November 2010) of the measured TSS at the Stilling Pond outfall versus polymer dosing rates at the dosing station between the Ash Pond and the Stilling Pond. The plot shows that TSS decreased in the Stilling Pond as the polymer feed rates increased and, conversely, that TSS increased as the polymer feed rates decreased.

pH Management

Management of pH was begun in 2009 in response to algae-induced high pH and as a possible control measure if lime treatment were to affect the pond pH. During warm weather in late March and early April 2009, pH in the Ash Pond and Stilling Pond was found to be peaking above 9.0 during daily diurnal variation. Because environmental sampling had identified a possible correlation between arsenic concentrations and sustained pH above 9.0 in the ponds, a pH of 9.0 was targeted as a surrogate parameter to avoid potential release of arsenic in the Stilling Pond effluent. In response, TVA conducted a series of tests to examine the feasibility of applying acetic acid to control pH in the ponds. Between April 7 and 18, 2009, varying lengths and rates of acetic acid were applied at the weirs where the Ash Pond discharges to the Stilling Pond. Instrumentation and facilities were put in place to safely control, adjust rates and monitor the test process. The data indicated that 24-hour sustained application of acetic acid at 500 to 600 mL/min. (approximately 4 to 5 mg/L in the discharge water) resulted in a reduction of the daily peak pH in the Stilling Pond outfall from 9.0-9.4 down to 8.4-8.6. Adjustment of pH was conducted in accordance with best management practices described in the draft *Kingston Fossil Plant Interim TSS Management Plan* (Ref. 10.1.24). An acid application station was installed on the divider dike between the Ash Pond and Stilling Pond and began operation immediately after results from the study were reviewed by Site management. The station was equipped with a programmable peristaltic pump allowing hours of operation and application rate to be controlled.

The pH data collected from three fixed station Hydrolabs were used to track the daily variations in pH in the Ash Pond and Stilling Pond effluent. The rate of acid addition was adjusted to limit the daily maximum pH to less than 8.6. The pH data showed markedly seasonal and diurnal variations in response to algae growth during the summer months. Acid addition was therefore performed intermittently in response to pH measurements. The rate of acid addition was reduced in May 2010 when plant operations resumed and river dredging rates declined.

The daily acid addition rates at each station are provided in Appendix E. The average rate of acid addition from March 2009 to July 2010 was 500 mL/min at the Ash Pond to Stilling Pond dosing station. Figure F-1 contains a plot (March 2009 through November 2010) of pH data versus rate of acid addition at the dosing station between the Ash Pond and the Stilling Pond. The plots show that acid was added when pH approached the target of 9.0.

Filter Press Operation

Filter presses were installed in accordance with EPA OSC approved work plan, *Mechanical Dewatering for Treatment of Ash Pond Fines* (Ref. 10.1.13). The purpose of the filter presses was to improve solids settlement in the Rim Ditch by diverting the solids loading from the Ash Pond dredge discharge away from the Rim Ditch. Consequently, for a period of time from January 11 to April 15, 2010, the discharge from the Ash Pond dredge was sent to 12 recessed chamber filter presses located in the Ball Field area. At the time, high flows were occurring from the river dredge discharges (over 15,000 gpm) and from plant operation (over 22,000 gpm); the combined additional flow from the Ash Pond dredge discharge (over 5,000 gpm) exceeded the solids settling capacity of the Rim Ditch and Sluice Trench, so that the finer materials removed from the Ash Pond were not settling in the ditches. The Ash Pond was filling up faster than it could be dredged, and was losing capacity (free water volume) at a fast rate. The filter press operation was designed to process between approximately 2,000 and 4,000 cy/day, depending on the solids content of the Ash Pond dredge discharge.

Sevenson installed a total of 12 recessed chamber filter presses in the southern end of the Ball Field on an asphalt pad. The presses were Siemens J-Press filter presses, side bar type, compression set, 100 plate, 1m x 1m recessed plate, 8.1 cy per drop, skid mounted. The Ash Pond dredge discharge was pumped directly to the influent tanks on the filter presses. The filter presses were operated in sequence, which allowed some presses to operate while others were being cleaned. The filter presses were operated 24 hours a day and produced a filter cake with a solids content averaging between 70 and 72%. The filter cake was typically offloaded into stockpiles in the Ball Field that were subsequently windrowed to ready the ash for loading. Wash water and effluent from the presses were directed back to the Rim Ditch for further settling. Filter press operation produced 52,464 cy of dry ash cake (average 830 cy/day), which was less than the estimated production rate as designed. The filter press operation was discontinued in April 2010, once the Ash Pond had sufficient storage capacity to accept a faster rate of filling for the remainder of dredging. Demobilization of the filter presses was performed in accordance with the EPA OSC approved *Filter Press Demobilization Work Plan* (Ref. 16.3).

The filter press operation was designed to process between 1,000 and 1,500 cy/day; in reality, only 830 cy/day of dry ash cake were produced, resulting in a much slower process than expected. The filter press operation was designed to produce a filter cake of 75% or greater solids content, so as to be ready to load into railcars. In reality, the initial press runs produced a much wetter filter cake, and even after about a month of process adjustments the filter presses were able to achieve only 70-72% solids content, resulting in a wetter product than expected and requiring the filter cake to be windrowed for additional drying. Installation of the presses took a month longer than expected; originally planned to be operational in mid-December, in reality they were not operational until mid-January. They were subject to frequent mechanical breakdowns which resulted in reduced production rates. The mechanical operation was also a greater risk to worker safety; one of the more serious worker accidents occurred during operation of the filter presses. The actual cost of dry material produced ($175/cy) was several times the estimated cost ($30/cy) because payment was made on a daily rate and daily production was slower than expected. Therefore, the filter press operation resulted in slower production rates, wetter product, longer start-up time, greater mechanical breakdown, and higher cost than expected. As a result, the equipment was demobilized early in favor or other processing options.

A Genesis system (Section 1.3.2.2) was initially planned in addition to the filter presses in the EPA OSC approved work plan (Ref. 10.1.13), but was never installed once the filter presses were procured. While promising as a dewatering technology, the Genesis system had no established commercial application; as an experimental system, there was insufficient time for development of the system to make it commercially viable within the critical period of production occurring in December 2009. In addition, the Genesis vendor did not have sufficient management availability to oversee the mobilization (e.g., onsite water and power supply), operation, and system development. Mobilization and experimental development would therefore have taken too long to justify the use of the Genesis system.

<u>Lateral Expansion Operation</u>

The Lateral Expansion area was reconfigured as an ash processing area in accordance with EPA OSC approved work plans, *Construction of Lateral Expansion Facilities - Phase 1* (Ref. 10.1.10) and its addendum (Ref. 10.1.11). A ditch, acting as a rim ditch, was constructed for settling of ash from the Ash Pond dredge. Similar to the filter presses, the purpose of the ditch was to improve solids settlement operations in the Rim Ditch by diverting the solids loading from the Ash Pond dredge discharge away from the Rim Ditch. To improve ash removal from the ditch, a 150-ft by 250-ft platform was constructed to provide a location from which excavation equipment could operate in accordance with EPA OSC approved work plan, *Construction/Operation of Excavation/Working Platform/Extended Platform on Lateral Expansion* (Ref. 10.1.19 and Ref. 10.1.21). The platform also served as a processing area for excess ash placed in the Lateral Expansion area from mechanical dredging activities. The platform was field designed based on how the underlying ash responded to the loading. A geogrid was placed on the existing ash surface. Dozers then pushed riprap and other stone across the geogrid. After the base rock was placed, No. 57 stone and crusher run was placed. The surface was sloped to enhance drainage and ash dewatering. Excavation adjacent to the platform was not deeper than 10 ft.

From December 2009 through June 2010, the discharge from the Ash Pond dredge was sent to the Lateral Expansion area. The over flow from the Lateral Expansion area originally discharged into a shallow channel along the base of Dike D and flowed southwestward back into the Ash Pond. To improve solids settlement, the discharge of the Lateral Expansion area was relocated away from Dike D and restructured into a broad-crested weir to create a low flow rate and act as a skimmer.. This improvement was implemented in accordance with the EPA OSC approved work plan, *Work Plan, Addendum to Construction of Lateral Expansion Facilities - Phase 1* (Ref. 10.1.11). The weir was constructed on the ash berm separating the Lateral Expansion from the Ash Pond, and capped with stone underlain with a geotextile. The weir was approximately 20-ft long with a crest elevation of 763.4 ft msl. Operation of the Lateral Expansion area for settling of ash from the Ash Pond dredge continued into non-time-critical activities. As of July 2010, over 150,000 cy of ash had accumulated in the Lateral Expansion area. The use of this additional area for ash management expedited the removal of ash from the Emory River.

2.1.1.3 Excavation East of Dike 2

Ash removal east of Dike 2 was initiated in accordance with EPA OSC approved work plan *Ash Movement East of Dike 2* (Ref. 12.1.1). Approximately 700,000 cy of released ash was located at the mouth of Swan Pond Embayment and extended above river level. Because this ash was accessible by land-based equipment, it was possible to mechanically excavate, rather than dredge, the ash. Figure 17 illustrates the area excavated with land-based equipment. To expedite removal of ash as required by the EPA Order, land-based excavation was conducted simultaneously with river dredging, increasing the total volume removed (combined dredging and mechanical excavation) by approximately 20%.

EPA's histogram of the mechanical excavation production rates is presented in Figures 6, 7, and 8. As shown on the histogram, production rates as high as 7,500 cy/day were achieved, which contributed significantly to achieving a total ash removal of 15,000 cy/day (combined dredging and excavation) during the times when mechanical excavation was being performed. Mechanical excavation east of Dike 2 contributed more than 30% to the total volume of ash removed from the Emory River during portions of each dredge phase. During the Phase 1 pilot program when the risk of ash migration was greatest, mechanical excavation contributed 33% of the total volume removed (between June 13 and July 18, 2009). During the Phase 1 production dredging, mechanical excavation contributed 32% of the total volume removed (between August 17 and November 3, 2009). During the Phase 2 dredging, mechanical excavation contributed 39% of the total volume removed (between March 4 and April 18).

TVA's Civil Projects began the land-based excavation east of Dike 2 on June 13, 2009. The ash was moved and shaped using bulldozers, backhoes, and amphibious equipment and then loaded onto articulating trucks by front end loaders and backhoes. In general, land-based equipment reached as far into the surrounding water as possible to pull ash into piles. Those piles were allowed to drain by gravity and then the dried ash was loaded into trucks for transport either to temporary storage areas west of Dike 2 or directly to the Ball Field Ash Processing Area.

Appendix B presents daily statistics on the number of truckloads of ash removed, the trucked volume (calculated assuming a truck volume of 20 to 25 cy/truck), and the in-place volume (calculated assuming a 5% swell factor). Trucked volumes were calculated assuming a 18 to 20 cy/truck capacity after March 1, 2010, to account for the wetter ash being excavated. A total of 737,000 cy were excavated by land-based mechanical excavation from the area east of Dike 2 from June 2009 through May 2010. Productivity rates were highly variable, depending on equipment, weather, and conditions encountered. Daily production rates ranged from as low as 76 cy/day to a maximum of 8,930 cy/day, and averaged nearly 4,000 cy/day.

Different approaches to ash excavation were taken in two subareas east of Dike 2; referred to as the East Embayment, and the area between Dike 2 and the Emory River (Figure 17).

East Embayment

Ash removal from the East Embayment was performed in accordance with the EPA OSC approved work plan *Time-Critical Ash Removal from East Embayment Work Plan* (Ref. 12.1.4). The East Embayment is located north of the haul road referred to as Bob Summers Road, between Lakeshore Drive and Swan Pond Circle Road. On June 30, 2009, before beginning the ash removal activities, 1,273 fish were shocked and relocated from open water areas of the East Embayment to the Emory River. A significant number of fish and some turtles were believed to inhabit the embayment, prompting cause for relocation. A temporary haul road of geotextile and rock was constructed along the length of the East Embayment. The road was removed once the work was completed.

To improve surface water runoff quality, a clean water ditch bypass was constructed in the East Embayment in accordance with EPA OSC approved work plan, *Clean Water Ditch in the East Embayment Work Plan* (Ref. 17.5). A temporary ash berm was built around the major portion of the ash, which allowed cleaner water to bypass most of the ash. A porta-dam material was used on the berm to make it less permeable and the water level inside the berm was lowered with pumps that discharged to the settling basins. The bypass water was sampled routinely at its point of discharge to the Clean Water Ditch, as described in Section 3.

Amphibious trackhoes were used extensively in the East Embayment, because the conditions were wetter in this area. Initially (during September and October 2009), the area inside the berm was excavated, with most of the recovered ash trucked to the Wet Ash Storage areas onsite (Figure 19). Then, months later (during March and April 2010), the area outside the berm was dewatered, with upstream water bypassed through a series of pipes and pumps to the river. The ash outside the berm was then excavated and placed inside the berm for initial dewatering.

To improve moisture content in the excavated ash, lime treatment was conducted in the East Embayment in accordance with the EPA OSC approved work plan *Lime Application Work Plan* (Ref. 10.1.16). Because the recovered ash retained a high moisture content even following this initial dewatering, lime kiln dust was used to treat the ash inside the berm to dry it sufficiently for loading the trains. While there was stored ash inside the berm in the East Embayment, other wet ash such as from the settling basins was brought to this area for storage and eventual lime treatment. By that time, no wet ash storage was allowed in the Dredge Cell area or west of Dike 2.

To determine the best use of lime as a drying agent for the wet ash generated during excavation, a test was conducted in accordance with the EPA OSC approved work plan *Lime Test Work Plan* (Ref. 10.1.9). The lime test was conducted using road stabilization equipment to add lime to wet ash from the Sluice Trench and from areas east of Dike 2. Tests run both by Mt. Carmel and Sevenson using different application and mixing techniques showed that lime application (either using road stabilization equipment or excavator mixing) could reduce the moisture content of the ash and improve its handling characteristics. During the tests, application of lime varied from 3 to 9% of ash weight, with the higher application rates resulting in lower moisture content. In cases where 6 to 9% of lime, by weight, was added, the resultant ash was dry enough for loading the trains.

A request was made of the disposal facility to accept lime in the disposed ash and ADEM approval was received for landfill disposal of lime-treated ash containing up to 6% lime by weight. A vendor was selected to dry the ash with lime kiln dust. The actual quantities added varied with the moisture content and condition of the ash. Lime used onsite was tracked by weight and compared against the tonnage of material sent off by train to calculate a percent of lime in the train. The treated material was taken to Dry Ash Storage areas (Figure 18) or directly to the trains.

The estimated in-place quantity of ash removed from the East Embayment was approximately 245,000 cy. Confirmation samples were taken on a grid throughout the area and examined under a microscope for evidence of ash. For qualitative purposes, vibracore samples used PLM testing to describe the proportion of sediment versus ash within a sample; if the proportion of ash was 50% or greater within the sample, additional excavation was performed. The results were documented in concurrence forms (Appendix C).

<u>Area Between Dike 2 and the Emory River</u>

Ash removal east of Dike 2 was conducted in accordance with EPA OSC approved work plan, *Time Critical Land-Based Ash Removal East of Dike 2 Work Plan* (Ref. 12.1.2 and Ref. 12.1.3). Ash material located between Dike 2 and the Emory River was removed with earthmoving equipment, such as trackhoes and dozers. The material was loaded into articulating dump trucks and taken to either the Ball Field Ash Processing Area, the West Storage Area west of Dike 2, or to the Dredge Cell where it was either used to construct the ash Test Embankment in the Dredge Cell or placed in Wet Ash Storage areas.

To protect this area from high river flow during excavation and to allow the area to be dewatered, an ash berm was built between the north point at Lakeshore Drive (to the north) and the rookery island (to the south). The ash berm separated the excavation from the river to allow dewatering of the excavation. Later, an intermediate berm was built between this berm and Dike 2 to further subdivide the area and facilitate dewatering.

The excavation was dewatered using small portable pumps. The water was pumped to the dirty water system, which in turn discharged to the settling basins where ash was allowed to settle out. The effluent water from the settling basins was sampled routinely to assess the effectiveness of the storm water management system, as described in Section 3.

Small trees and underlying vegetation in the area adjacent to Dike C were removed, while taking care to minimize the number of trees removed on the rookery island. While the heron rookery located on the island was disturbed by the presence of heavy equipment and the associated noise, the impact was minimized by conducting the work when nesting season was over.

The ash situated directly on Dike C was pulled off the land areas by amphibious equipment and other land-based equipment. The ash was removed in narrow strips, exposing the underlying Dike C earth materials for less than 24 hours before placing sand, gravel, and riprap for constructing the Dike C buttress.

Once the material that could be removed with land-based equipment had been excavated, hydraulic dredging equipment was used to remove the ash berm and residual ash present in deeper sections of the embayment east of Dike 2.

The estimated in-place quantity of ash removed from the area between Dike 2 and the Emory River was approximately 492,000 cy. Visual inspection of the exposed sediment was predominantly used as the criterion for completion of ash removal. In areas where dredging was used for final ash removal, confirmatory samples were collected for evidence of ash as the criterion for completion, similar to the East Embayment. The results were documented in concurrence forms (Appendix C).

2.1.1.4 Temporary Ash Storage

Temporary ash storage was necessary during dredging and mechanical excavation, because ash production (10,000 to 20,000 cy/day) was greater than disposal production (8,000 to 10,000 cy/day). Three temporary storage areas were used for storing dry ash. The first was the Ball Field ash storage area next to the processing and loading areas. The second was the West Storage Area, located west of Dike 2 immediately adjacent to the settling basins. The third dry ash storage area was the Test Embankment located in the Dredge Cell, where a stability test was conducted. A fourth dry ash storage area was constructed in the peninsula area, but was never used for storage.

In addition, temporary storage areas for wet ash were located in the Dredge Cell and Lateral Expansion area. Figures 18 and 19 illustrate the locations of the dry ash and wet ash storage areas, respectively. Movement of ash throughout the available temporary storage areas can be tracked via EPA POLREPs, available at www.epakingstontva.com.

Ball Field Ash Storage

In response to the TDEC Commissioner's Order, in February 2009, TVA proposed to utilize a portion of the Kingston plant (namely, the Ball Field area) for the temporary storage of dewatered fly ash (Ref. 10.2.2). After dredging began in early March, the dredged ash was processed, stored, and staged for disposal in the Ball Field Ash Processing Area (see Figure 18). The processing included removing wet ash from the Rim Ditch and Sluice Trench and moving it to windrows to allow drying. To compensate for the differences in daily production between dredging and disposal, temporary storage capacity was provided within the Ball Field. Appendix A provides several photographs showing the Ball Field in differing conditions during the time-critical removal action.

The initial Ball Field storage area design allowed the ash to be stacked up to eight feet in height, as measured from the top of the limestone demarcation layer, without having to conduct further stability studies and with minimal improvements to the ground surface. To improve the volume available for storage, the EPA OSC approved raising the average ash height to 15 ft in June 2009, in accordance with the EPA OSC approved work plan, *Ash Stacking Height in Processing Area Work Plan* (Ref. 10.1.3). Raising of the ash height was based on additional geotechnical analysis conducted by Geosyntec. To further improve the volume available for storage, the EPA OSC once again approved raising the average ash height from 15 ft to 30 ft in January 2010, in accordance with the EPA OSC approved work plan, *Addendum to Ash Stacking Height in Processing Area Work Plan* (Ref. 10.1.15). Raising of the ash height to 30 ft was based on further geotechnical analysis by Geosyntec. Other restrictions to ash storage in the Ball Field included maintaining a minimum 4 horizontal to 1 vertical (4:1) slope at the working edge of any storage slope; maintaining an instrumentation program (settlement plates and piezometers); and incorporating ash elevation data into the instrumentation program. The Ball Field had a storage capacity of nearly 775,000 cy at maximum 30 ft height; however, less than half that volume was ever placed in the Ball Field due to practical constraints of equipment operations and material handling in the Ball Field. The most ash stored in the Ball Field at one time was approximately 480,000 cy.

Improvements to the Ball Field storage were made in accordance with the EPA OSC approved work plan, *Ball Field Reconfiguration Work Plan* (Ref. 10.1.18). During late January and February 2010, high dredging rates increased the volumes of ash to be stored, and wet weather slowed offsite rail transport and disposal. As a result, the Ball Field area was filled to capacity, which impacted operations; although more ash could have been stored, there would have been no room to move equipment around. Therefore, a week-long slow down in dredging was implemented from February 5-11, 2010, to allow the transport and disposal operations to remove some of the stored material and to alternate onsite storage locations to create more capacity in the Ball Field. During these wet months, quick lime was added to the wet ash in the Ball Field, on the filter presses, and at the Sluice Trench, which allowed more dry ash to be stockpiled or loaded onto trains.

West Storage Area

Temporary ash storage in the West Storage Area was performed in accordance with the EPA OSC approved work plan, *Time Critical Land-Based Ash Removal East of Dike 2 Work Plan* (Ref. 12.1.2). Approximately 11 acres of an area west of Dike 2 near the settling basins was developed for dry ash storage. The area was located within the Swan Pond Embayment, on top of 4 to 30 ft of released ash. The area was prepared by grading (contouring) the area to control runoff. Runoff was routed through a series of drains and ditches to the settling basins. The West Storage Area had a storage capacity of over 200,000 cy.

The temporary ash storage was constructed by controlled placement (stacking) of ash in vertical lifts. Adequate surface drainage was maintained on the top of the ash stack surface while maintaining control of erosion on the stack side slopes. The height of the stack increased with the incremental placement of ash. The considerations for providing stack stability were as follows:

- The ash was of a consistency suitable for transporting and stacking.
- The ash was spread with bulldozers in 1- to 2-ft lifts.

- The ash was compacted with equipment (i.e., rubber-tired equipment, track hoe, dozers, etc.).
- The ash was graded to a 3% minimum slope to provide drainage and limit infiltration.
- The ash stack was built to a maximum height of 30 ft; a 12- to 15-ft wide bench was built at a height of 15 ft for erosion control and surface water drainage.
- The ash stack was built with 3:1 side-slopes.

Ash Storage in the Test Embankment

Ash was also stored in the Dredge Cell as part of the Test Embankment Program, which was approved by TDEC in consultation with EPA. The Test Embankment was built to demonstrate the stability of dry ash stacking and was structured to provide key design parameters for conceptual design of Dredge Cell closure in support of the non-time-critical removal action decision process. The construction of the Test Embankment aligned well with additional temporary ash storage needs under the time-critical removal action. The Test Embankment is described further in Section 2.1.1.13. The Test Embankment (Areas A and B) had a combined storage capacity of nearly 500,000 cy. Because only Area A of the Test Embankment was constructed, the estimated volume of ash ultimately stored there was approximately 250,000 cy (Ref. 18.5).

In order to perform ash storage and potential dewatering of ash in the Test Embankment and adjacent relic area of the Dredge Cell, piezometers were installed in accordance with the EPA OSC approved. *Dredge Cell Relic Area Piezometer Installation Work Plan* (Ref. 10.1.12). Multi-level vibrating wire piezometers were installed at six locations in the relic area to monitor the probability of changing water levels. Stantec monitored the piezometric levels as part of the Test Embankment and overall Dredge Cell water level monitoring throughout the time-critical action.

Peninsula Borrow Area Ash Storage

A temporary ash storage area was constructed in the Peninsula Borrow Area in accordance with the EPA OSC approved work plan, *Temporary Ash Stockpile in the Peninsula Borrow Area Work Plan* (Ref. 10.1.6), but was never used for ash storage. The borrow area would have provided approximately 150,000 cy of ash storage area at a height of 30 feet. The area had been used as a source of clay materials in the construction of the Kingston plant's Gypsum Pond on the other side of the peninsula. To convert the borrow area to a temporary ash storage area, TVA constructed a collection pond for storm water runoff, placed a geocomposite clay liner over the planned ash storage area and collection pond, placed 12 inches of earth as a sacrificial layer, and constructed roads and ditches as needed to access the area. However, because the Peninsula Borrow Area was located outside of the exclusion zone, hauling distances would have been much greater for ash handling, and use of that area would not have been cost-effective. Consequently, the planned area was never used; storage areas within the Site were sufficient for storing ash.

Wet Ash Storage

Wet ash storage was conducted in accordance with the EPA OSC approved work plan, *Wet Ash Storage to Support Time Critical Land-Based Ash Removal East of Dike 2 Work Plan* (Ref. 10.1.8). Wet ash was placed in several areas in the Dredge Cell and in the Lateral Expansion area to maximize dredging and excavation production. The wet ash storage was required because the ash was not dry enough for stockpiling in the Ball Field, West Storage Area, or the Test Embankment, or for loading into railcars for offsite disposal. Wet ash storage allowed wet ash to be stored without damaging (adding excess water to) the ash in the dry stockpiles.

Four areas in the failed Dredge Cell were used as wet storage areas (see Figure 19). Originally, the work plan (Ref. 10.1.8) had identified two areas, but four areas were used. Most of the wet ash came from the Sluice Trench operations and ash excavation in the area east of Dike 2. The Main Storage Area (wet ash storage Area 1 on Figure 19) was located north of the Dredge Cell East-West haul road and had roughly 5 to 6 usable acres; approximately 82,000 cy of ash was stored in this area. The Central Storage Area (wet ash storage Areas 2 and 3 on Figure 19) was located south of the haul road, with a 100-ft offset from the Test Embankment. A significant drainage feature divided the Central Storage Area into two areas. Area 2 stored roughly 67,000 cy of wet ash while Area 3 stored roughly 43,000 cy of wet ash. The Valley Storage Area was located along Dike D in an area previously identified for construction of Test Embankment Area B (which was never built) . Roughly 73,000 cy of wet ash was stored in this area. In addition to wet ash, the Valley Storage Area was also partially filled with relic material from the former Dredge Cell high wall and had been operated as a processing area where stockpiles were allowed to dry before moving the ash to the trains.

Greater moisture content control was required in the Valley Storage Area than in the other wet ash storage areas. After initially filling the wet ash storage areas with saturated ash, elevated pore pressure readings were measured in piezometers associated with the Test Embankment, which raised potential engineering concerns about stability of the ash underlying the wet storage areas. While rising groundwater levels due to the extended wet weather could have caused the elevated pore pressure readings, water from the wet ash could have contributed to the rising piezometric levels. To address these concerns, saturated ash placement ceased on top of failed ash in the Dredge Cell and new processes were implemented using unsaturated ash and flatter slopes. Ash storage in the Valley Storage Area resumed in March 2010 in accordance with the EPA OSC approved work plan, *Valley Area #2 Temporary Storage Work Plan, Revision 1* (Ref. 10.1.20). In general, only unsaturated ash (less than 35% moisture content) was allowed to be stockpiled in the Valley Storage Area. In the final use of this area, wet ash was placed in lifts to a maximum height of 10 ft, with 6:1 side slopes.

Controlling ash migration was a key construction element of early wet ash storage. Runoff was directed to the existing dirty water ditches and ultimately to the settling basins. However, ash migrating to the settling basins was decreased through contouring (construction of berms, check dams, and widened areas in the drainage channels). Sock drains were placed in deeper erosion channels prior to ash placement to increase subsurface drainage. The areas were monitored for erosion and ash migration as part of the Storm Water Pollution Prevention Plan inspections, as described in Section 2.1.1.10.

The Lateral Expansion area was also used for wet ash storage in accordance with the EPA OSC approved work plan, *Construction/Operation of Excavation/Working Platform/Extended Platform on Lateral Expansion* (Ref. 10.1.19 and Ref. 10.1.21). Ash that had been mechanically removed from the river was offloaded from barges onto articulating trucks at the north point or south dock. Trucks then transported the wet ash to the Lateral Expansion area northern berm. The ash was dumped from the trucks into the Lateral Expansion area starting at the western edge of the berm. Using dozers and trackhoes (or amphibious trackhoes), the ash was pushed into the Lateral Expansion area. The total height did not exceed 5 ft above grade (maximum elevation of 768.0 ft msl) and slopes were at 6:1 or flatter. No ash was stored on the berm. Lime treatment of wetter ash was approved as a contingent action in accordance with the EPA OSC approved *Lateral Expansion Platform Lime Treatment Work Plan* (Ref. 10.1.23). Wet ash was added and removed from this area from the middle of March 2010 through the end of June 2010. A net gain of approximately 23,000 cy of mechanically dredged wet ash occurred during that time; an additional net gain of approximately 63,000 cy of dredged ash from the Ash Pond and Stilling Pond was also deposited in the Lateral Expansion area, for a total remaining volume of 86,000 cy of ash material.

2.1.1.5 Loading

Railcar loading operations were conducted in accordance with the EPA OSC approved work plan, *Loading Work Plan* (Ref. 8.1.7). Dry ash either from the Ball Field or from other dry ash storage areas onsite was stockpiled along the rail tracks for loading. Windrows of ash were sampled on approximately 100 ft intervals during processing to determine moisture content. The moisture contents were measured using rapid turnaround analysis in an onsite lab. The ash was dried to 20 to 30% moisture content to meet the requirements of the landfill and also to minimize the chance for release of water from the railcars. Moisture content tests were run on every train shipped in an onsite testing laboratory to verify appropriate moisture content. Paint filter tests and TCLP tests were also run to meet acceptance criteria at the landfill, as discussed in Section 3.

Railcars were loaded from three rail spurs. Tracks 1 and 2 were originally built in June of 2009 in accordance with the EPA OSC approved *Rail Spur Construction Work Plan* (Ref. 8.1.6). These tracks served as the main loading areas until February 2010. They were located on the western and northern boundaries of the Ball Field, respectively. Improvements to the rail tracks were implemented in accordance with the EPA OSC approved work plan, *Rail Modification Work Plan* (Ref. 8.1.8 and Ref. 8.1.9). After community concerns were expressed regarding traffic congestion on Swan Pond Road, a third rail spur (Track 3) was built in the middle of the Ball Field and connections onto Tracks 1 and 3 from the plant rail yard were constructed. Tracks 1 and 3 then became the primary loading tracks, allowing the railcars to be transferred out of the loading area without crossing Swan Pond Road, which avoided inconvenience to the public or putting them in danger from a train derailment.

In May, 2009, four contractors participated in tests of the railcar loading process, as described in the *Ash Loading Test Evaluation* (Ref. 8.2.3). As a result of the loading test, procedures for full scale application were recommended, including railcar liner and cover, railcar condition and capacity, and railcar cleaning.

MACTEC was the contractor procured to perform the railcar loading. Prior to loading ash, rail spurs were locked out ("blue flagged") in accordance with established procedures and railcars were inspected for integrity. The inspection of railcars included, at a minimum, the following:

- Checking the railcar physical integrity, that there were no burrs, rips, tears, or holes in the railcar that may damage lining systems.
- Verifying that railcar ID markings were readily readable and that railcar tare and load weight markings were readable.
- Verifying that the railcar was useable, the railcar placards were placed, placards were adhesively mounted on sides and ends of each car.
- Verifying that there was no soil, material, or debris within the railcar.
- Prior to lining, checking that any water had been removed from the car, and that any drain holes were properly plugged with approved expansion foam (later changed to tape).

Following inspection, each railcar was lined. Liners consisting of "burrito" style bags of varying thicknesses were used to contain the ash in the railcars. Liner dimensions were 32 ft. wide by 160 ft. long including side and end flaps. The liners were self-contained systems that did not require a tarp; once the lined railcars were filled, the flaps or sides of the liners were folded back over the top of the ash filling, and secured using bungee cords. Lining was initially performed on the same tracks used for loading; ,and then moved to dedicated lining tracks in February 2010. An extendable forklift was used to place a liner in each car. Personnel accessed the railcar through the use of approved man-lifts. These personnel rolled out or unfolded the liner, depending upon the type and manufacturer of liner used. The flaps (or in the case of the fitted liners, the sides) were extended over the ends and sides of the railcar. When necessary, based on weather conditions (i.e., wind), the flaps or sides of the liner were secured to the railcar with tape, straps, cords, or other means to prevent them from falling back into the railcar during loading.

After the liner was in place, and personnel were safely out of the railcar, loading was started. Stockpiled ash was loaded into the lined railcar using excavators. Excavators were equipped with bucket scales (LOADRITE™) for weighing material during loading. These bucket scales were calibrated by the vendor (FTS Innovations) at the start of loading operations and after a year of operation. Routine calibrations were performed on a frequent basis following the vendor's protocol using a 2.57 ton weight. Railcar shipment loads were further verified using the certified railcar scale at the Kingston plant and the certified scales at the Arrowhead Landfill. Generally between 88 and 126 railcars were loaded a day. Initially, the landfill's permit (issued July 6, 2009) restricted the amount of waste accepted to 10,000 tons per day. This restricted disposal operations to limit the number of railcars per train to 80 railcars (approximately 8,000 tons per train). ADEM revised this permit at the request of the landfill to increase the amount of waste accepted to 15,000 tons per day effective on July 20, 2009. This allowed disposal operations to ship 100 railcars per train (approximately 10,000 tons per train).

Each railcar was a steel gondola with approximately 3,000 cubic foot capacity. The weight limit of the gondola-type railcars was 110 tons. Prior to removing railcars from the loading spurs, the exterior of the railcars (safety appliances, railcar connections, etc.) were cleaned, as necessary, using mechanical means such as brooms or by water sprays. The ash material loaded into the railcars was classified as Reportable Quantity, Environmental Hazardous Substances, Solid, N.O.S., 9, UN3077, PG III (contains arsenic compounds). Appropriate placards were placed on each railcar.

In October, 2009, due to changing material types and an increase in wet weather, several railcars en route to Uniontown were found to contain excess water on top of the ash, which could potentially leak from the railcars. To improve railcar loading procedures, polymer was spread on the surface of the ash within railcars to absorb the excess water. With the help of Profile Products, a polymer was modified for use in assuring adequate containment and mitigation of any potential leaks. The modified polymer, BioCover LS, is composed of high water-absorbent polymer granules attached to cellulose fiber matrix. It is a proprietary (patent pending), single material system with four properties to promote containment: absorption, flocculation, filtration, and solidification. The addition of water absorbing polymer began on October 20, 2009. Over time, management of the polymer usage was optimized, using a combination of field ash processing to dewater the ash, moisture content testing, and polymer placement methods. As a result, polymer usage dropped from an initial 240 pounds per car to 100 pounds per car.

Improvements at that time also included evaluations of moisture content and material composition to develop correlations with excess water. Target moisture contents were established for specific material types. The lowest target, for high sand content material, was 15% or less prior to loading. The target for excavated ash was 25% (without polymer) and 28% (with polymer). The target for dredged ash (which often had some river sand content) was 17% (without polymer) and up to 28% (with high polymer usage). The following polymer usage rates were used as guidance for various moisture contents: for 26.0% moisture content use 200 lbs polymer per car; for 27.0% moisture content use 250 lbs polymer per car; and for 28.0% moisture content use 300 lbs per car.

The initial loading production rate for the first 161 trains was approximately two trains every three days, with an average size of 90 railcars per train. Loading operations were originally planned for loading 88 cars per 8 hour shift. Higher moisture content in the ash at the time of loading was identified as a changed condition. In late September, 2009, additional workers were added and work hours were extended to 12-14 hour shifts, which allowed time for the moisture sampling and moisture control measurements. Contractual modifications to reflect the change in conditions, effective on February 22, 2010, provided an incentive for improving productivity. From February 22, 2010 to completion, one train was shipped on average every day with an average of 97 cars per train. Overall, loading, transport and disposal operations productivity was improved by 75% and was a significant factor in allowing the project to keep pace with the increased removal rate from east of Dike 2.

MACTEC modified the loading procedures to improve productivity over time. The liner placement crew was separated from the ash loading and liner closing crews, which improved production. The liner placement crew either started work earlier or worked longer (depending on availability of empty railcars) to provide lined railcars ready for loading by the ash loading crew. The movement of railcars was coordinated daily with Norfolk Southern so that overnight empty railcars were moved to tracks dedicated to liner placement outside the exclusion zone and lined railcars were moved to tracks dedicated to loading inside the exclusion zone. For the last 6 months of the operation, the limiting factor for railcar loading was the availability of empty railcars. When sufficient empty railcars were available, MACTEC was able to load seven trains in six days.

Loading operations were completed in December 1, 2010. Demobilization was conducted in accordance with the EPA OSC approved *MACTEC Demobilization Plan* (Ref. 8.1.3).

2.1.1.6 Transportation

Norfolk Southern was the procured railroad operator. Norfolk Southern managed a fleet of six trains and 680 railcars dedicated to the Site. Trains varied from 80 to 100 railcars each, with an average of 100 tons of ash per railcar. Trains were loaded in cuts of 20 to 22 railcars on two of the three rail tracks. An empty train returned from the landfill each day to replenish the empty railcars for loading; in addition, Norfolk Southern maintained a minimum of one set of empty railcars at the plant's rail yard. This allowed for three trains to be in transit at any given time, one to be loaded, and one to be unloaded. Extra cars were available when others were removed for maintenance.

The route used to transport the trains for most of the time-critical action was owned predominantly by Norfolk Southern, with a short section between Boligee and Uniontown, Alabama owned by CSX (Figure 23). For a short time near the completion of shipment, a section of track owned by Norfolk Southern near Uniontown, Alabama, was used as an alternate route. Trains departed Harriman, Tennessee bound for Uniontown, Alabama, with stops in Emory Gap and Chattanooga, Tennessee, and Birmingham and Selma, Alabama. The travel time was estimated at 18 hours for a distance of 349 miles. The cycle time was estimated at three days, assuming one day for loading and one day for unloading.

Table 2-4 shows the quantities transported from the Site by rail during the time-critical removal action. More detail can be found in Appendix F.

Table 2-4. Ash Shipped Quantities

Month	Railcars Shipped	Tons Shipped	Average Tons/Railcar
July 2009	1,668	170,751	102.4
August 2009	2,361	252,085	106.8
September 2009	1,826	192,188	105.3
October 2009	1,315	134,526	102.3
November 2009	2,190	222,064	101.4
December 2009	2,208	231,655	104.9
January 2010	1,696	175,557	103.5
February 2010	1,755	179,445	102.2
March 2010	2,291	233,472	101.9
April 2010	2,594	263,900	101.7
May 2010	2,925	296,415	101.3
June 2010	2,993	301,270	100.7
July 2010	2,839	283,714	99.9
August 2010	3,159	313,311	99.2
September 2010	2,750	268,965	97.8
October 2010	2,726	262,945	96.5
November 2010	2,310	228,989	99.1
December 2010	106	10,685	100.8
January 2011[a]	-	3,133	-
Total	**39,712**	**4,025,068**	**101.3**

Note: [a] Final rail yard cleanup quantity

Productivity rates for rail shipments varied. The following describes primary improvements made to rail transportation productivity.

- Initially, between July 2 and September 15, 2009, an average of 87 railcars per train were shipped, operating on average 6 days per week. Between September 16 and November 12, 2009, wet and cooler weather impacted ash processing and loading since the wet ash could not be dried sufficiently for shipment. Shipments dropped to 84 railcars per train and trains operated on average only 4 days per week. In October, the EPA OSC approved addition of polymer on the surface of the ash within railcars to absorb excess water when the moisture content in the ash material itself could not be reduced sufficiently.

- In November 2009, the EPA OSC required larger trains be used to improve productivity rates. Improvements were made to the Ball Field in accordance with the EPA OSC approved *Work Plan, Ball Field Modifications - Roads & Drainage* (Ref. 14.2). Polymer addition to the railcars was standardized at 240 pounds per railcar. These improvements resulted in rail shipments increasing to an average of 103 railcars per train, operating 5 days per week for the remainder of the year.

- In January, 2010, wet and cold weather again impacted productivity, as shipments dropped to an average of 85 days per train and 4 to 5 days of operation per week. There were delays in returning empty railcars from Uniontown to the Site, which reduced productivity. Improvements were made to the Ball Field in accordance with the EPA OSC approved *Ball Field Reconfiguration Work Plan* (Ref. 10.1.18), including drainage and addition of lime to improve wet conditions. In mid-March, 2010, additional rail spurs were constructed in the Ball Field (track 3) and railyard (tracks 16 and 17), which further improved productivity by allowing loading from both sides of a railcar within the exclusion zone, separate from the lining of railcars outside of the exclusion zone. These improvements resulted in rail shipments increasing to an average of 95 railcars per train operating 6 days per week between February 12 and April 15, 2010.

- Between April 16 and October 26, 2010, productivity remained relatively high as a result of the relatively dry and warm weather. Use of dry material from the relic area of the Dredge Cell allowed direct loading of trains without having to dewater stockpiles of wetter material in the Ball Field. Polymer addition was reduced to 160 pounds per car and, by August, use of polymer had been eliminated. As a result, productivity averaged 101 railcars per train. Operations were conducted seven days per week to improve total quantities shipped.

- Between October 27 and December 1, 2010, productivity dropped to an average 92 railcars per train and operations slowed to 6 days per week. Norfolk Southern restricted train size for a period of time due to restrictions on the CSX track at Boligee, Alabama and weight restrictions on the alternate Norfolk Southern track. Return of wet and cold weather slowed productivity as ash transportation drew to completion.

Three train derailments occurred during the time-critical removal action. In response to each incident, A ICS command organization was instituted by TVA personnel. The derailment was documented and root cause was analyzed, while actions were taken to secure the Site and protect safety and health of workers and the public. Action items were prepared for follow-up to the incident, including appropriate repairs, inspections, rail yard modifications, or operational procedure changes. The following summarize the three derailments; ICS incident packages are contained in Ref 30.1, Ref. 30.2, Ref 30.3:

- On July 18, 2009, at 1630 hours, a train was moving railcars from the loop track to the ash track on the Site when four cars filled with ash derailed and damaged 200 to 300 ft of track. Three of the railcars' wheels were inside the tracks while the fourth railcar's wheels were on the outside of the tracks. Norfolk Southern derailment responders lifted the railcars back on the tracks and proceeded to repair the damaged tracks. The root cause was attributed to several factors, primarily vertical movement of the track at the switch point. Corrective actions included tamping of ballast and test loading of the track at switch points and increase in inspections.

- On August 12, 2009, at 1920 hours, a train was moving empty railcars in the railyard, pushing them back on the main line across Swan Pond Road. The ash spur switch was activated as the locomotive approached the Swan Pond Road intersection. The lead locomotive veered down the ash track while the rest of the train remained on the main track, derailing two railcars. The main electrical box powering the train crossing signals was knocked off its foundation and vehicles were stopped at the rail crossing at Swan Pond Road. The root cause was attributed to human performance of the train crew, who had failed to restore the ash lead switch to normal prior to leaving the Site after their shift. Swan Pond Road was closed through the night while the line was replaced. Corrective actions included providing instructions and training to crews to restore all switches to normal, implementing pre-shift job briefings, and reviewing SOPs for hand-operated switches and derails. Additionally, crossing set backs were established on Swan Pond Road (using TVA Police blockades) and at the Site entrance to keep vehicles out of the path of potential derailments.

- On March 22, 2010, at 2040 hours, two locomotives at the south end of the plant railyard derailed while in the process of spotting empty cars on tracks 16 and 17 for lining. As the locomotives approached a ballast rock crossing, the rails moved outward, causing the locomotives to set down their wheels inside the tracks. The root cause was attributed to rotted rail ties at a ballast rock crossing. Corrective actions included repair of the crossing to replace the rail ties, and inspections of timber/rock crossings in the railyard.

Other rail transportation incidents were encountered that did not result in derailments. On October 30, 2009, Norfolk Southern personnel in Gadsden, Alabama, observed railcar liners flapping open in 6 railcars transporting ash material from Harriman to Uniontown; as a result, improvements to the railcar lining system were implemented, including improved tie-downs by eliminating short bungee cords and light-gauge hooks, reconfiguring the way hooks connected to the grommets, and revised training and inspection forms. On January 30, 2010, an unrelated Norfolk Southern train derailed near Chattanooga, Tennessee, during a winter storm event, which delayed shipments of trains into or out of the Site. On April 24, 2010, an outbound train at the plant's railyard ran through the track 7 lead switch, but there was no derailment.

Other rail incidents occurred at the Arrowhead Landfill and involved the wheels of railcars leaving the railroad track. On September 9, 2009 several loaded railcars came off the lead track, yet remained upright, requiring a specialty rail company to lift the railcars back on the rail. The root cause was attributed to ineffective pre-task planning and improper execution of railcar movement on the lead track, lack of effective communication between supervisor and railcar tug operator, decision by the tug operator not to wait for a larger tug to move the loaded railcars, failure to account for the change in grade (which added force to the tug), and improper connection of air lines to the railcars, which could have improved stopping. Corrective actions included (1) improved communication protocols for pre-task (non-routine) planning involving new railcar moves, moves of loaded cars on the lead track, or re-orchestrating of tug movements; (2) evaluation of communications among tug movers, supervisors, grounds personnel, and switch operators; (3) revised procedures for operations on the lead tracks, which included using only the large tug for moving loaded rail cars, setting a maximum number of loaded cars to be moved a one time, checking that air lines are connected and adequate pressure has built up prior to operation of the tug, checking that sand is in the tank, and keeping the switch operator in place; (3) retraining of tug operators on procedures, machine operation processes, and emergency processes; (4) review of safe work plans, and JSAs to check that corrective actions and process changes are incorporated into the plans; and (5) discussion with Norfolk Southern regarding best practices and lessons learned related to this incident.

Other lesser incidents occurred in the unloading area when the front wheels of the railcar were pulled off the rail, requiring them to be placed back on. These incidents occurred on the landfill property on the rail siding. The rail cars remained upright, no coal ash spillage occurred, and locomotives were not in use. The root cause was attributed to build up of ash around railroad tracks or spreading of railroad track gage. Corrective actions included implementing daily cleaning of ash build-up around rail tracks and deploying an enhanced railroad maintenance program.

During the transportation phase, delays were encountered for a variety of reasons, such as: stalled trains, derailments, crew availability, and rail schedule conflicts. These delays were promptly dealt with and resulted either in missing a single train shipment or shipping a train with fewer cars than scheduled. On-time placement was tracked by Norfolk Southern; placement at Kingston was 96% on time versus an 80% target and placement at Uniontown was 71% on time.

Norfolk Southern performed fleet maintenance primarily in Birmingham, Alabama. Returning empty cars were inspected at Birmingham for serviceability during the refueling and service of the locomotive units. In addition, the U.S. Department of Transportation Federal Rail Administration (FRA) inspectors performed spot inspections during the transportation phase. The FRA inspections were performed randomly both along the transportation route and at Uniontown. Summary reports for FRA inspections are available at www.fra.dot.gov. Railcars that failed either FRA or Norfolk Southern inspection were immediately removed from service and repaired. There were two occasions when such inspections and repairs caused delay in delivery of loaded cars to Uniontown.

2.1.1.7 Disposal

Offsite disposal of ash was implemented in accordance with the EPA OSC approved work plan, *Offsite Ash Disposal Options Analysis* (Ref. 8.1.2). The EPA Order (Section XVII, Paragraphs 42, 43, and 44) required that TVA provide written notification of any shipment of waste material to the appropriate state environmental official in the receiving facility's state and to the EPA OSC. The EPA OSC, through the Region 4 RCRA Division, received a Notice of Acceptability from ADEM, which allowed disposal at the Arrowhead Landfill in Perry, County, Alabama, for the ash removed during time-critical removal activities.

The EPA Order further required that the disposal facility be operating in compliance with RCRA Subtitle D permitting requirements for operation and disposal of industrial wastes, which as a minimum shall include the use of a synthetic liner, leachate collection system, groundwater monitoring, financial assurance, and closure and post-closure care. The Arrowhead Landfill is a permitted Class I, Subtitle D, facility (Permit No. 53-03) owned by Perry Uniontown Ventures, LLC and operated by Phill-Con Services, an affiliate of Phillips and Jordan, Inc. The landfill is permitted for 24/7 operation with daily volumes up to 15,000 tons per day of municipal solid waste, construction and demolition debris, sludge, fly ash, industrial slag, and low level contaminated soils. The primary containment feature of the landfill is a composite liner system consisting of 2 ft of 1 x 10-7 centimeter per second (cm/sec) compacted clay, a 60-mil high density polyethylene geomembrane liner, and a 2-ft thick drainage layer with a leachate collection system and protective cover. The secondary containment feature consists of the Selma Group chalk formation, which ranges from 200 to 570-ft thick beneath the landfill property, with a permeability less than 1 x 10-8 cm/sec. The uppermost groundwater aquifer is located beneath this layer. The Arrowhead Landfill therefore met the requirements of the EPA Order.

Arrowhead Landfill is located 4 to 5 miles from Uniontown, Alabama, which is the nearest population center. The landfill is in an isolated area, surrounded by large tracts of property, farms, and ranches. The landfill has a 100-ft buffer that surrounds the property. The nearest residence is approximately 250 to 300 ft away from the site. Air quality monitoring stations are installed at the property lines near the landfill cells and the rail yard. Multiple groundwater wells are installed around the landfill cells, with samples taken and analyzed bi-annually.

Norfolk Southern provides service to the landfill's railyard. Following the receipt of trains, ash was unloaded from the railcars into off-road trucks for transport to the landfill via an on-site haul road. The rail yard was approximately 1.5 miles north of the landfill cells. Railcar interiors and exteriors were thoroughly cleaned by pressure washing and inspected prior to transport back to the Site. Runoff and residue from railcar cleaning operations was collected in in-ground tanks.

Railcar unloading was accomplished in accordance with the EPA OSC approved *Railcar Unloading Operation Work Plan* (Ref. 8.1.5). Each truck transporting ash to the landfill was weighed at the rail unloading area. Tare weights of the trucks were measured regularly and scale calibration was checked on a daily basis for accuracy. The haul road was regularly maintained and watered as needed for dust control. Ash was placed inside the active landfill cells and spread by dozers. Material placed in the active landfill cells was spread in lifts, graded to drain, and compacted by off-road trucks and dozers. Water trucks were utilized for cell dust control as needed. Landfill exterior slopes were covered and vegetated in accordance with permit requirements as final grade was reached. Landfill leachate was collected in an above-ground storage tank and hauled by truck to state-approved facilities for treatment.

The process of unloading and cleaning of the railcars was dynamic and changed continually. Typically, crews were able to bulk unload 10 to 15 railcars per hour and clean 15 to 18 railcars per hour. More than 107,000 truckloads of material were transported from the railcars to the landfill.

Oversight of Arrowhead Landfill operations, including multiple site inspections, was provided by EPA Region 4 RCRA Division, ADEM, the Alabama Department of Health, and the Alabama Department of Transportation.

Table 2-5 shows the quantities of ash disposed in Alabama. More detail on the disposed tonnage can be found in Appendix G.

Table 2-5. TVA Monthly Railcar Unloading Summary

Month	Railcars Unloaded	Tons Unloaded	Truck Loads to Landfill
July 2009	1,583	161,596	4,040
August 2009	2,276	242,730	5,628
September 2009	1,842	195,546	4,484
October 2009	1,363	139,141	3,542
November 2009	2,296	232,602	6,044
December 2009	2,000	210,485	4,943
January 2010	1,730	178,780	4,585
February 2010	1,718	176,040	4,283
March 2010	2,293	233,667	5,368
April 2010	2,595	263,953	6,268
May 2010	2,921	295,431	7,728
June 2010	3,013	304,119	7,488
July 2010	2,821	281,795	7,714
August 2010	3,159	313,566	10,333
September 2010	2,644	259,675	8,533
October 2010	2,778	266,992	8,415
November 2010	2,315	227,641	7,078
December 2010	365	38,179	1,091
January 2011[a]	-	3,133	107
Total	**39,712**	**4,025,068**	**107,672**

Note: [a] Final rail yard cleanup quantity

2.1.1.8 Cenosphere Removal

Cenosphere removal was initiated under the NIMS Unified Command during the emergency response, prior to the EPA Order, as discussed in Section 1.1.5.3. As a result of the ash release, large quantities of cenospheres migrated down river, impacting hundreds of miles of shoreline. Changes in water flows and levels have continued to move cenospheres into the main channels and coves. The initial response effort was to contain the cenospheres and prevent them from migrating down river through use of booms and to remove pockets of cenospheres collecting in coves along the Watts Bar Reservoir. An Outreach Center was established to allow residents to report cenospheres in their areas and a database was developed to track these incoming calls.

EPA, through its START contractor, Tetra Tech, provided field reconnaissance and monitoring of cenosphere recovery actions. During the time critical removal action, Tetra Tech conducted cenosphere reconnaissance activities along the shorelines, coves, and inlets of the Emory, Clinch, and Tennessee Rivers. The objective of the cenosphere reconnaissance was to document the locations and concentrations of cenospheres in support of TVA's efforts to prioritize cenosphere removal operations and minimize impacts on the local community. In addition, Tetra Tech provided support to EPA and TDEC by responding to reports from the local community through the TVA Outreach Center.

From June 10, 2009 through April 15, 2010, Tetra Tech performed cenosphere reconnaissance activities with assistance from the USCG GST and TVA Shoreline Cleanup Assessment Team personnel. Reconnaissance activities were performed from Emory River Mile (ERM) 0 to ERM 6, Clinch River Mile (CRM) 0 to CRM 7, and Tennessee River Mile (TRM) 530 to TRM 573. Tetra Tech provided written and photographic documentation of cenosphere locations. Coordinates for each of the censosphere locations as well as collection booms were recorded with a Trimble GeoXT unit. Tetra Tech submitted daily work order reports summarizing the cenosphere and collection boom locations and concentrations to the EPA OSC, and periodically provided TVA personnel with updated figures depicting those locations and concentrations. Trip reports describing the Tetra Tech reconnaissance and monitoring activities are included in Ref. 29.18.

By March 2009, Southern Waste Systems (SWS), working with TVA personnel and equipment, began removing cenospheres and debris. SWS provided up to 70 people, 6 large boats, 3 vacuum trucks, 3 barge-mounted vacuum units, and associated equipment. TVA provided up to 16 people, barge mounted excavator, barges, tug boat vacuum truck, long reach excavator, and associated support equipment.

The heavy rains on May 4, 2009 created extremely high flows in the Emory River that moved both cenospheres from the released ash and natural debris from the river system. The high waters spread cenospheres and debris (primarily wood) to new areas along the shorelines of Watts Bar Reservoir. In addition, the large amount of debris commingled with the cenospheres, required that the debris be removed with the cenospheres.

Onsite processing of the cenospheres evolved during the time-critical removal action. Originally cenospheres were stored in five collection areas along the south side of the Ash Pond. In June 2009, TVA proposed to consolidate the cenosphere collection areas into one area at the south end of the Sluice Trench to allow the area to be more easily maintained as part of the ash removal from the Sluice Trench, as defined in the EPA OSC approved work plan, *Cenosphere Collection Area Consolidation Work Plan* (Ref. 17.4). However, that area was never constructed because future dragline activity would utilize the area. In October, 2009, the five cenosphere collection areas were consolidated into two areas within the Ash Pond: one at the intersection of Dike C and the divider dike, and the other located near the mid-point of the divider dike, where an earlier Geotube dewatering pilot test had been done. Cenosphere processing was then implemented in accordance with the EPA OSC approved work plan, *Revised Cenosphere Collection Area Consolidation Work Plan* (Ref. 17.7).

As of June 30, 2010, TVA had responded to 335 recorded outreach calls for cenospheres and/or debris removal, at locations stretching from ERM 4 to TRM 541 (a distance of 35 miles). TVA responded to another 200 locations that were observed by TVA crews. Removal operations for these responses ranged from several hours to several weeks depending on the amount of cenospheres and debris. Land-based and barge-mounted vacuum units collected approximately 14.4 million gallons of cenosphere slurry from both offsite and onsite locations. This equates to approximately 800 tons of cenospheres. About two thirds of these cenospheres were combined with the ash for offsite disposal. The remaining third was stored onsite awaiting disposal. Approximately 5,900 tons of debris was removed from the river. The quantity was estimated by multiplying the number of bags collected by 30 pounds per bag plus a visual estimation of the quantity of debris removed by excavator and barge. Approximately 4,000 tons were chipped and used as mulch on the Kingston plant; the remaining 1,900 tons were bagged by field crews using biodegradable bags and disposed of by Waste Management at Chestnut Ridge Landfill in Heiskell, Tennessee.

Demobilization of the cenosphere removal equipment was performed in accordance with the EPA OSC approved *Cenosphere Recovery Demobilization Work Plan* (Ref. 16.8).

In addition to removing the cenospheres, 16 residential docks that were damaged by the surge of water during the original release were removed from the Emory River. The dock debris was disposed of by Waste Management at the Chestnut Ridge Landfill in Heiskell, Tennessee.

2.1.1.9 Skimmer Wall Debris Removal

The skimmer wall debris removal was conducted in accordance with the EPA OSC approved work plan, *Skimmer Wall Debris Removal Work Plan* (Ref. 11.2.12 and Ref. 11.2.15). In preparation for the construction of the new skimmer wall, the debris from the failed sections of the old skimmer wall that resulted from the ash release was removed from the plant's intake channel. The debris included concrete beams and caissons, structural rebar, and debris that washed downriver and got caught in the rubble.

Initially, the location of the skimmer wall debris was unknown and it was assumed that the debris removal would need to extend to 100 ft from the wall center line on both sides. As work has progressed, it was determined that the assumed 100-ft work area on both sides of the skimmer wall center line could be reduced to an area equivalent to a 25-ft offset on both sides of the skimmer wall center line. Originally the plan for the removal of the submerged skimmer wall debris was to be accomplished in two phases.

Aquarius mobilized to the Site and began operations April 6, 2010. The first phase was to include mobilizing a work barge equipped with a mechanical dredge to expose the skimmer wall debris by removing ash that settled and covered the debris. The second phase was to consist of the removal of the skimmer wall beams. As the first phase of the operation began, it was determined that the caissons would need to be removed before the ash covering the wall debris could be removed. Because the caissons were preventing the removal of the ash, the two phases of the operation were combined. As ash was mechanically dredged around the three caissons to allow divers to attach the rigging, the debris and ash was placed into barges and taken to an appropriate processing/ location within the Exclusion Zone. This included unloading the barge and loading haul trucks at the skimmer wall dock landing and hauling the material to the Lateral Expansion area. Caissons were removed using a crane barge and hoisted out of the water where they were decontaminated and washed before being placed in a barge. During dredging operations, a turbidity curtain was installed around the work area to minimize migration of ash outside the work area. Debris was decontaminated and washed within the confinement of a turbidity curtain.

2.1.1.10 Surface Water Management

Storm Water Management

Storm water was managed in accordance with the EPA OSC approved *Storm Water Management Plan* (SWMP) (Ref. 17.6). A series of clean water ditches were installed in the Swan Pond Embayment during the time-critical removal action to bypass upgradient surface water around the ash. This work began under the TDEC Commissioner's Order and was reviewed and expanded under the EPA Order. Nearly 5,900 linear feet of ditches, 4-ft deep and 16 to 20 ft across were constructed through the North and Middle Embayments. The clean water ditches diverted the storm water around the ash to discharge directly to the Emory River, thereby minimizing the load that was placed on the settling basins. Once diverted, the volume and velocity of the water flowing through the ash during high flow events was greatly reduced; thus, the transport of ash was minimized. The clean water ditch bypass was completed ahead of schedule, by June 30, 2009.

Two settling basins were also installed during the time-critical removal action that serve as a treatment system for storm water runoff from ash. These settling basins collected water that flows thru the ash areas, allowed the ash to settle out, and discharged the water via a surface skimmer to the clean water ditch and out the Emory River. Check dams were used in this system to allow ash to settle out of the water as it moved from the basin area to the river. The basins covered roughly 5 acres, with 20-ft wide shot rock tops, 2:1 side slopes, and 10-ft depth. To improve the functionality of the settling basins and eliminate discharge through the ash east of Dike 2, the skimmers were relocated in June 2009 from Settling Area 1A to Settling Area 2A, in accordance with the EPA OSC approved *Settling Area Outlet Work Plan* (Ref. 17.3). Routine maintenance and cleanout of the settling basins was performed in accordance with the EPA OSC approved *Settling Basins Maintenance and Clean Out Plan* (Ref. 17.8).

Storm water in contact with ash within the embayments drained to a series of "dirty water" ditches that discharged to the settling basins. All storm water runoff from the former Dredge Cell drained to the north through swales in the bottom of the cell. Two 48-inch-diameter culvert pipes were installed in January 2010 to convey storm water beneath the East-West Haul Road before discharging to the "dirty water" ditches in the embayment. Runoff from the relatively flat Ball Field Ash Processing Area primarily drained vertically through a series of wick drains, which were tied to a shot rock demarcation layer, which in turn drained to a perimeter ditch (filled with shot rock). The perimeter ditch diverted water around the processing area to the Rim Ditch. The office/support areas were located next to the processing area and drained to existing site ditches and pipes that discharged to the plant's intake channel.

A *Storm Water Pollution Prevention Plan* (SWPPP) was prepared as Appendix D of the EPA OSC approved SWMP (Ref. 17.6). The SWPPP provided a general plan for erosion and sediment control to protect the adjacent surface water bodies. The SWPPP addressed sediment and ash migration as well as spills from construction activities. In accordance with the SWPPP, twice-weekly inspections were performed of slopes, drainages, and settling basins. The need for additional best management practices for maintaining ash west of Dike 2 was evaluated during these SWPPP inspections. Such additional best management practices for erosion and sediment control that were considered included the following:

- Diversion berms / diversion ditches
- Downslope pipe flumes to carry diverted water to the bottom of the slopes
- Gravel berms or check dams
- Gravel and riprap ditch lining
- Sand bag barriers
- Dugout ditch barriers
- Straw bale barriers or silt fences
- Biodegradable filtration logs
- Grading and compacting the ash surfaces using dozers tracking upslope
- Erosion and dust control products such as Flexterra® or vegetation by hydromulching
- Repair and replacement of erosion gullies or washouts
- Large sediment traps in ditches
- Energy dissipaters in areas of surface runoff to capture sediment and ash

For a short three-week period in November, 2009, wet sediment removed from cleaning of the dirty water ditches and settling basins was stored inside the berm in the East Embayment area to promote drainage. This work was accomplished in accordance with the EPA OSC approved *Storm Water Pollution Prevention Addendum* (Ref. 17.9).

To facilitate settling basin cleanout, the rock and jute baffles were removed in January 2010 in accordance with the EPA OSC approved *Settling Areas 1A & 2A Maintenance and Clean Out Work Plan* (Ref. 17.10). Removal of the baffles allowed access for a dredge to be used for sediment basin cleanout, and created one large settling basin instead of two smaller ones. Booms were installed instead of the baffles. The plan also specified the frequency of inspection and maintenance, and cleanout procedures for the settling basins.

Surface Water Monitoring

Surface water quality was monitored in accordance with the approved EPA OSC approved SWMP (TVA 2009u). The primary objectives of surface water monitoring were to: 1) detect changes in water quality that might indicate immediate public health and/or environmental threats from the ash release; 2) detect changes in water quality created by dredging or associated ash processing activities that might impact public health and/or the environment; and 3) monitor events, such as heavy rainfall in the immediate vicinity, higher than normal flow of the Emory River, or any other unusual condition that had the potential to impact the transport of ash and its constituents in the river system.

Surface water quality onsite was measured at the settling basin discharge into the clean water ditch, and in the clean water ditch east of Dike 2. Operational surface water monitoring was conducted in the Rim Ditch, Sluice Trench, Ash Pond, and Stilling Pond for managing the ash processing water treatment system. Samples were collected at the NPDES outfall at the Stilling Pond five times per week for TSS and three times per week for ash-related metal constituents. Stilling Pond effluent samples were collected initially once per week for acute toxicity testing (Ceriodaphnia and Fathead Minnows). Additional sampling occurred at the settling basin, clean water ditch, and stilling pond when a 0.5 inch rainfall or greater was accumulated.

Surface water monitoring within the river system included sampling 10 fixed locations on the Emory, Clinch, and Tennessee Rivers two days per week, with additional sampling at the same 10 locations triggered by either a 24-hour rainfall greater than one inch measured by the Kingston plant's meteorological station or predicted Emory River flow of more than 5,000 cfs. Samples were collected daily from within the dredge plumes and analyzed for turbidity, TSS, and ash-related metal constituents. Continuous readings of turbidity, temperature, pH, and flow rate were taken using fixed Hydrolab® stations at ERM 4.0, ERM 0.5, the plant intake channel, the plant effluent channel, and the Stilling Pond.

Results of the surface water monitoring are presented in Section 3. EPA also collected and analyzed numerous split samples during the surface water monitoring as part of their oversight role, as discussed in Section 3.3. These results are best presented as Comparative Analysis Reports available at http://www.epakingstontva.com and in Ref. 6.6. TDEC also collected and analyzed surface water samples twice weekly during dredging in the river, as presented on their website at http://tennessee.gov/environment/kingston/index.shtml.

2.1.1.11 Dust Management

Dust management was performed throughout the time-critical removal action in accordance with the EPA OSC approved *Site Dust Control and Air Monitoring Plan* (AMP) (Ref. 6.2.1). Dust management was also performed to reduce worker exposure under HAZWOPER in accordance with the EPA OSC approved *Site Wide Safety and Health Plan* (SWSHP) (Ref. 20.1.2, Ref. 20.1.3, Ref. 20.1.7, Ref. 20.1.8).

Dust Suppression and Control

All personnel were responsible for controlling their operations to minimize dust generation. Dust suppression and control activities in the active construction areas were task- and weather-specific.

This included engineered measures that protected equipment operators working in the ash area; management measures such as industrial hygiene personnel monitoring and training procedures that limited worker exposure, and operational procedures during heavy dusting conditions (such as warm, dry weather or windy conditions).

The equipment operating in the ash areas (excavators, dump trucks, dozers, etc.) had enclosed cabs that were air conditioned, heated, and filtered. Site controls were in place to inspect door gaskets, air conditioning units, filters, and other devices that seal the cabs, and to check that they are properly maintained including keeping the inside cab area clean.

Management and training procedures were established to protect other personnel that work in the area (those that are not in equipment cabs). Workers were required to stop operations if dust was sighted and to call for a water truck to control the dust. Industrial hygiene personal monitoring was conducted in accordance with the SSHP as described in Section 5.

Application of a proprietary dust suppression agent (Flexterra®) was the primary method of dust suppression on the ash deposits, either with or without grass seed mixture. Several trial plots of various seed mixes and fertilizer combinations were planted and the most effective mixture was selected for application. The grass seed and fertilizer were mixed with the Flexterra® solution and applied with hydroseeding equipment. The Flexterra® matrix held the seed in place while it germinated and developed a root structure. Vegetation grew in the ash and stabilized the surface.

Water trucks were used to wet down travel areas as well as open ash piles when conditions dictated. The normal travel areas around the Site (public roads, paved in-plant roads) were routinely sprayed by water trucks and cleaned by sweeper vacuum trucks, as conditions warranted. The unpaved gravel haul roads were sprayed with water trucks. These dust suppression methods worked well except during extreme cold weather. To control fugitive dusting on unpaved haul roads, a calcium chloride solution was sprayed on the gravel roads. Calcium chloride attracts moisture, which helped to keep the road surface slightly damp, reducing dusting.

To improve fugitive dust suppression and minimize tracking of ash onto adjacent roadways, a vehicle wash station was installed in accordance with the EPA OSC approved *Work Plan for Vehicle Wheel Wash and Decontamination at Main Entrance-Exit* (Ref. 20.1.5). Vehicle traffic out of the exclusion zones underwent a cleaning procedure at the vehicle wash station, which reduced ash transfer, and reduced fugitive dust on roads throughout the facility.

To control dust during the lime treatment operations, water trucks, and eventually misters, were used to control dust that was generated and prevent it from traveling to workers.

As construction activities were completed in a given area, the remaining ash deposits were contoured to reduce the slopes. Lowering the exposed ash stockpile face accessible to the wind and slicking off the surface was used to controlled dust.

Air Monitoring

Airborne dust monitoring was initiated under the NIMS Unified Command during the emergency response, prior to the EPA Order, as discussed in Section 1.1.5.3. Air monitoring continued during time-critical removal actions as detailed in the AMP. The results of this ambient air monitoring are presented in Section 3. The results of industrial hygiene personal monitoring are presented in Section 4. Data collected to date, both for ambient air and personnel monitoring, consistently show that ambient air standards have not been exceeded and personnel exposure to trace elements in the ash has been below action levels.

Ambient air monitoring at the Site consisted of the following:

- Continuous monitoring was performed at fixed locations at the perimeter of the Site and at selected locations in the community.
- Continuous meteorological data was collected to assist in interpreting air sample results.
- Continuous real-time hand held particulate monitoring was performed at the perimeter of the Site and in the local community. This allowed the flexibility to respond to abnormal or unanticipated events.

Personal monitoring was performed as described in the EPA OSC approved SWSHP (Ref. 20.1.2, Ref. 20.1.3, Ref. 20.1.7, Ref. 20.1.8). Selected personnel were periodically monitored for potential metals and silica exposure. Personnel were selected to represent a variety of job responsibilities (e.g., equipment operators, laborers, and drivers). Results of the industrial hygiene personal monitoring are presented in Section 4.

2.1.1.12 Structural Integrity of Dikes

As required by the EPA Order, TVA evaluated the structural integrity of the existing dikes and berms and developed recommendations for dike improvement, maintenance, and inspection. Inspections were conducted in response to NIMS ICS Unified Command. The EPA OSC relied heavily on consultation with the BOR on reviewing the dike structural integrity evaluations. Four separate dikes were evaluated:

1. Dike D, which separates the failed Dredge Cell from the Ash Pond and Lateral Expansion area

2. Dike C, which surrounds the Ash Pond and Stilling Pond adjacent to the river

3. East Dike, which separates the Sluice Trench from the plant intake channel

4. Dike 2, which divides the Swan Pond Embayment from the Emory River to prevent further migration of ash into the river from the Site.

Dike D Evaluation

Immediately following the release, engineering teams observed indications of strain along Dike D in the form of tension or compression cracks in both the longitudinal and transverse directions as well as a steep scarp line formed on the western side of Dike D. In response, a clay soil cap was constructed over the area to reduce infiltration, slope inclinometers and piezometers were installed to monitor dike stability, a buttress consisting of a zoned embankment was constructed along the Dike D scarp line, and the operational Ash Pond pool was lowered roughly 2 ft to reduce hydraulic loads on the dike. The Dike D evaluation was presented in the *Dike D and Dike 2 Evaluation Report, Kingston Fly Ash Recovery Project* (Ref. 13.1.2), which was reviewed by the EPA OSC and the BOR.

In May 2010, EPA decided to delay implementing further work pertaining to Dike D stability under time-critical removal action; that decision was documented in an EPA OSC memorandum, *Decision process for EPA delaying the work plan pertaining to Dike D stability* (Ref. 13.2.5). The Non-Time Critical Removal Action Embayment/ Dredge Cell Action Memorandum proposed construction of a perimeter containment system encompassing the failed Dredge Cell, Lateral Expansion area, and Ash Pond, which would surround Dike D. As a result, Dike D stability would be more appropriately addressed under the non-time-critical removal action as it pertains to the long-term stability and closure of the disposal area. A *Dike D Interim Stability and Maintenance Plan* (Ref. 13.1.2) was prepared by Stantec that confirmed that the emergency buttress system and grading relating to Dike D have met the objectives of short-term stabilization of the structure, and that an adequate Factors of Safety (FS) were provided for slope stability and steady state seepage under static loading conditions. The EPA OSC concurred with those findings, as documented in the decision memorandum.

Dike inspections were completed daily throughout the time-critical removal action to monitor Dike D conditions (e.g., signs of seepage, cracks, vegetation stress, erosion, etc.). Dike inspection reports were prepared to document those inspections. The inspection reports can be found in Ref. 29.6. Repairs, predominantly filling of erosion rills, were undertaken promptly in response to any inspection findings.

On January 27, 2010, a two-ft diameter hole caused by internal soil erosion (soil piping) was discovered on the southeast side of the road on Dike D, about 200 ft southwest of the intersection of Dike C (Ref. 12.2.4). The hole was at the same location as a stress crack in Dike D that had occurred during the ash release. The EPA OSC, in technical consultation with the BOR, requested an evaluation of the stability of the dike and an evaluation of actions taken. Transport of the fine-grained ash particles by seepage flow over the course of time was identified as the likely mechanism responsible for forming the erosion hole. The erosion hole was sealed by placement of grout to fill the voids. Stantec monitored a limited excavation of the area in an attempt to assess the extent of the soil piping near the surface, and monitored grouting of the hole with lean cement grout, in particular to confirm that there was no visible release or connectivity off the grout flow to the ground surface. TVA grouted the hole using 21 sacks of cement on January 28, 2010, with no pressure buildup observed. After reducing the water content in the grout mix, another 20 sacks of cement were placed on January 29, 2010, and the grout level rose to the top of the hole, After the grout had set, gravel was placed on the surface to complete the repair. No further erosion holes have been encountered in Dike D since the void was filled with grout.

Dike C Reinforcement

Following the failure of Dike C during the release, TVA contracted with Stantec to perform a stability analysis of the remaining dikes at the Site (Ref. 13.2.3). This analysis was reviewed by the EPA OSC with technical consult provided by the UBOR. Stantec advanced 57 borings and installed instrumentation to monitor conditions potentially affecting the FS of Dike C (see Figure 20). Stantec analyzed five representative cross sections through Dike C.

Results of the seepage analysis (Table 2-6) indicated that upward vertical gradients at the dike toe created the potential for soil piping, as seepage water could erode materials from the interior of the dike. Based on USACE design criteria for dams, a target FS against piping of three was used. The computed FS against piping ranged from 1.3 to 2.7. Therefore, Dike C did not meet acceptable criteria for soil piping due to seepage (Stantec 2009b).

Table 2-6. Summary of Computed Exit Gradients and Factors of Safety Against Piping

Cross Section Location	Material	Critical Exit Point	Vertical Gradient (i_v) at Critical Exit Point	Critical Gradient (i_{crit})	Factor of Safety Against Piping (FS_{piping})
108+93	Silty Sand to Sandy Silt	Toe	0.15-0.38	1.03	2.7
119+69	Lean Clay	Toe	0.70-0.74	1.05	1.4
132+37	Clay Starter Dike	Toe	0.73-0.84	1.05	1.3
138+27	Constructed Ash	Toe	0.30-0.42	0.71	1.7
149+14	Silty Sand to Sandy Silt	Toe	0.45-0.50	1.03	2.1

Slope stability analysis evaluated four types of conditions: a deep-seated failure, a shallow failure in the lower "starter" dike, a shallow failure in the upper "raised" dike, and a shallow failure on the upstream (interior pond-side) slope. Based on USACE design criteria for dams, a target FS against slope failure of 1.5 for static, long-term, steady state seepage conditions was used. Results of the analysis (Table 2-7) indicated that although Dike C met acceptable criteria for a deep seated failure, it did not meet criteria for shallow failures. The computed FS against shallow slope failure ranged from 1.13 to 1.42 on the downstream face of Dike C (Ref. 13.2.3).

Table 2-7. Summary of Computed Factors of Safety for Slope Stability

Cross Section Location	Deep Seated Slide	Shallow Slide in Starter Dike	Shallow Slide in Raised Dike	Shallow Slide in Upstream Dike
108+93	1.66	1.42	1.39	N/A
119+69	1.48	1.25	1.39	1.738
132+37	1.47	1.24	1.22	1.33
138+27	1.52	1.13	1.38	N/A
149+14	1.49	1.15	1.35	N/A

In accordance with the EPA Order, the EPA OSC directed TVA to reinforce Dike C so as to meet the minimum required FS against slope failure of 1.5. Stantec recommended the construction of a rock buttress on Dike C to achieve an acceptable FS against both soil piping and shallow failures. The Dike C Buttress design was begun in August 2009. The length to be buttressed was approximately 5,700 ft. To facilitate design, Dike C was broken into two phases: Phase 1 focused on the starter dike and Phase 2 focused on the raised dike. The Phase 1 work was broken into four segments (A through D). Segment A is from the southern Red Water Pond Area to the bridge over the plant intake channel; Segment B is from the bridge to the skimmer wall; Segment C is from the skimmer wall to the divider dike; and Segment D is from the divider dike to the intersection of Dike D. Each segment had its own design and constructability concerns. Figure 21 is a cross section of the buttress.

Dike C also suffered from poor maintenance practices which allowed the establishment of mature trees and other vegetation on the embankment slopes. The tree roots penetrated the dike material and the retained ash, which are fine-grained soils that can be eroded by seepage. The tree root penetration could shorten the seepage pathways and a seepage-related internal erosion failure could occur. Scouring of the Emory River bank along Dike C was also identified as a concern for the stability of the dike. To mitigate this concern, in May, 2009, the existing riprap was removed, trees and associated rootballs were removed, and the resulting divot hole was backfilled with clay and compacted. Removal of an initial section of trees was approved by the OSC consultation with the BOR provided that as a safety precaution, road base material (a mixture of gravel, sand, and silt) be stockpiled at the dike for use in seepage control. The initial tree removal resulted in several of the rootball excavations showing the initiation of seepage flow. The road base was immediately placed into the rootball excavations. This action, along with daily visual monitoring provided temporary control of the seepage. A layer of gravel was placed as bedding material, and riprap was placed as a temporary measure until the Dike C buttress could be constructed. An engineered sand filter was incorporated into the design of the Dike C buttress to provide additional protection against the possibility of a seepage-related failure. It was decided that further tree removal would be delayed until shortly before buttress construction in a given location. Excavation and filling of the rootball was subsequently performed just prior to installation of the buttress with filter sand being used to fill the rootball excavation.

Construction started on Phase 1, Segment D in December 2009, which allowed a portion of the buttress to be constructed above the water line, but also required the removal of approximately 6,000 tons of ash, as described in Section 2.1.1.3. Reinforcement of Dike C was implemented in accordance with the EPA OSC approved *Dike C Risk Mitigation Work Plan* (Ref. 13.1.3) and the *Dike C Buttress Work Plan - Section C* (Ref. 13.1.4) and the *Dike C Buttress Work Plan - Segment A* (Ref. 13.1.7). Construction advanced southward from the Dike D intersection toward the Emory River. Approximately 2,280 ft of Phase 1 buttress was completed by June 2010 when the decision was made to suspend construction until November 2010. That decision was documented in an EPA OSC memorandum, *Request for Temporary Suspension of Dike C Buttress Construction Activity* (Ref. 13.2.6). The decision was made to allow the water level in the river to return to winter pool. Conducting the work during summer pool potentially inhibits compaction, results in a significant loss of materials, and impedes the judgment of the Quality Control Manager. Constructing the buttress during winter pool would improve construction because more of the buttress would be constructed above water.

As of June 2010, a total of 5,911 loads (103,042 tons) of sand and rock material from a local quarry had been delivered to the Dike C construction. The breakdown of materials is as follows: 66,352 tons of riprap, 24,574 tons of No. 57 stone, 21,670 tons of No. 2 stone, and 17,446 tons of filter sand.

Similar to Dike D, dike inspections were completed daily throughout the time-critical removal action to monitor Dike C conditions (e.g., signs of seepage, cracks, vegetation stress, erosion, etc.). Dike inspection reports were prepared to document those inspections and can be found in Ref. 29.6. Repairs, predominantly filling of erosion rills, were undertaken promptly in response to any inspection findings.

<u>East Dike Study</u>

In March 2010, the EPA OSC approved a *Work Plan for Construction Support Geotechnical Investigation of East Dike* (Ref. 13.1.5), which specified the drilling of six borings to aid in the stability analysis of the East Dike. Results of slope stability calculations conducted by Geosyntec indicated the FS against slope failure was greater than the target value of 1.5 for long-term loading conditions. The calculated FS for the raised dike without construction traffic were greater than 1.5 and under construction traffic were greater than 1.3, which were considered appropriate for both long-term and short-term conditions at the Site. However, under conditions in which the pore pressures of the lower dike fill layer of the East Dike increase, the FS could drop to 1.2. To improve the local stability in the event of elevated water pressures, control surface erosion, and reduce the potential loss of fines from the East Dike foundation, Geosyntec initially recommended a rock blanket be placed along the outboard slope of the East Dike (Ref. 13.2.7).

Four additional borings were installed in July 2010, with samples analyzed for soil characterization, permeability and strength parameters. Geosyntec performed additional slope stability analyses, which were presented in a seepage and stability study report (Ref. 13.2.10). Those analyses concluded that the calculated factors of safety were adequate for the slopes of the north end of the East Dike, both for the seepage gradient and for slope stability considering a deep-seated failure mechanism under long term conditions. The seismic stability analysis indicated that deformations that could develop during the design earthquake would be less than the maximum allowable deformation, and were thus acceptable. Therefore, no further stabilization of the East Dike was recommended. That report was reviewed by the EPA OSC and BOR, with the following two significant comments: (1) the report says there are no seismic concerns with the foundation, which is in contrast to large seismic concerns with Dike C, so a specific discussion of how the geology (presence of loose sands) changes across the site should be added; and (2) the report mentions a low FS of 1.96 for heave or "blowout" conditions, but recommendations include only monitoring; given the history of the site, recommendations should include improvement to a minimum FS of 4.0. Resolution of these comments is ongoing.

Dike 2 Study

The Dike 2 evaluation was presented in the *Dike D and Dike 2 Evaluation Report, Kingston Fly Ash Recovery Project* (Ref. 13.1.2), which was reviewed by the EPA OSC and BOR. The stability of Dike 2 was initially evaluated in July 2009 (Ref. 13.2.2). Geosyntec calculated the FS against slope failure at two cross-section locations, and for both the end of construction condition and for the long term condition. Based on USACE design criteria, a target FS against slope failure of 1.3 was used for the end of construction and 1.5 for the long term. For a circular slip failure mode, the computed FS against slope failure ranged from 1.9 to 3.4 for the end of construction condition and from 1.5 to 1.7 for long-term condition. Therefore, Dike 2 was found to meet acceptable criteria for slope stability.

Similar to Dike D, dike inspections were completed daily throughout the time-critical removal action to monitor Dike 2 conditions (e.g., signs of seepage, cracks, vegetation stress, erosion, etc.). Dike inspection reports were prepared to document those inspections and can be found in Ref. 29.6. Repairs, predominantly filling of erosion rills, were undertaken promptly in response to inspection findings.

In July 2010, Geosyntec completed a second evaluation of Dike 2 under extreme rainfall events (Ref. 13.2.8). This evaluation was performed because of the planned continued use of Dike 2 under the non-time critical removal action. The results of that structural integrity analysis of Dike 2 indicated that static and seismic conditions are acceptable for water elevations exceeding the 1,000-year design storm event. The calculated minimum FS value for static slope stability was 1.6 for the four water elevation scenarios, which is greater than the target FS of 1.5. For the seismic slope stability analyses, the calculated permanent seismic deformation was 1.6 inches, which does not exceed the 6 to 12 inches of maximum allowable deformation. That evaluation also concluded that under a 1,000-year storm event, flow can be expected in the emergency spillway, and it is likely that localized erosion may occur in the downward face of the dike, and that minor repairs may be required after the storm event.

In response, the EPA OSC concluded that further evaluation of Dike 2 should be referred to the non-time-critical removal action, but directed that the outboard slope be armored to prevent erosion. The armoring was implemented in accordance with the EPA OSC approved *Dike 2 Remediation Work Plan* in August 2010 (Ref. 13.1.6).

2.1.1.13 Test Embankment

A *Test Embankment Program* (Ref. 18.1) was approved by TDEC in consultation with EPA. The Test Embankment program was implemented within the central portion of the former Dredge Cell to verify both geotechnical design parameters and construction methodology for dry ash stacking above hydraulically placed Ash Pond deposits and material displaced during the December 22, 2008 release.

Results of the Test Embankment program were considered during the non-time-critical removal action decision-making process under CERCLA. To evaluate a range of final alternatives for closing the Dredge Cell, including use of the failed Dredge Cell as a future disposal facility, additional geotechnical engineering data about ash stability was collected.

The scale of the test was large because ash stability cannot be assessed on a small scale; sufficient area and height was needed to gather reliable information. Originally, two areas (Area A and Area B) were intended for the Test Embankment program (Ref. 18.1); however, only Area A was built, since results at Area A met the test objectives. Approximately 270,000 cy of compacted ash, both recovered ash from the time-critical removal action and ash from the relic area (Cell 1) were placed in the Test Embankment between July 2009 and March 2010. This equates to approximately 350,000 cy of loose ash transported to the test via pans or trucks. A portion of the ash in the Test Embankment was later removed for loading into railcars.

Prior to construction of the Test Embankment, the subgrade across portions of the footprint were graded to provide a relatively level surface. A working platform was then constructed to provide a stable base to support subsequent embankment construction as well as to provide a pathway for water draining from the underlying ash as the test was loaded. Geogrid reinforcing mat was placed over the subgrade followed by 12 to18 inches of crushed aggregate (maximum 1.5-inch size particles) and approximately 3 to 6 inches of coarse sand. In some locations, a second layer of geogrid and additional aggregate was placed to improve bearing conditions. The platform was then proof rolled to confirm subgrade stability.

The construction of the Test Embankment used heavy equipment to transport, place, and compact the ash. Ash materials typically ranged from near optimum moisture content (22 to 25%) to more than 5% above optimum moisture content. Mechanical processes such as disc harrowing and windrowing were employed when wetter conditions were encountered. Materials were compacted to a minimum of 90% of standard proctor maximum dry density.

Targeted geotechnical design parameters included settlement in response to loading, horizontal displacement parameters, short- and long-term strength projections, pore pressure dissipation characteristics, and subsurface drainage methods. Geotechnical instrumentation consisting of piezometers, slope inclinometers, and settlement plates were installed prior to and during embankment construction. The monitoring plan considered both pore pressure and displacement ratios. The following threshold limits were used for monitoring the Test Embankment:

- Pore pressure ratio. The pore pressure ratio was defined as the change in pore water pressure, measured by the piezometers, divided by the change in fill pressure, estimated from surveyed cross sections routinely scheduled during the embankment filling activities. When the pore pressure ratio was 10% or below, embankment filling could continue with regular monitoring. When the pore pressure ratio was 10 to 15%, embankment filling could continue, but with an increase in monitoring. When the pore pressure ratio was greater than 15%, embankment loading was to be stopped until pressures dissipated or additional stability analyses demonstrated that the Test Embankment was stable.

- Displacement ratio. The displacement ratio was defined as the maximum horizontal displacement, measured by the slope inclinometers, divided by the vertical displacement, measured by the settlement plates. When the displacement ratio was 20% or below, embankment filling could continue with regular monitoring. When the pore pressure ratio was 20 to 30%, embankment filling could continue, but with an increase in monitoring. When the pore pressure ratio was greater than 30%, embankment loading was to be stopped until pressures dissipated or additional stability analyses showed that the Test Embankment was stable.

In response to this monitoring, embankment filling activities were suspended once in fall 2009 and once in winter 2010. On October 30, 2009, measured pore pressure ratios were calculated above the threshold limit. Stantec analyzed the stability of the embankment (Ref. 18.2), which indicated that adequate factors of safety existed for slope stability. The high porewater pressures measured at that time appeared to have been driven by high rainfall and drainage from adjacent areas of the Site. Filling activities resumed on November 3, 2009.

On February 2, 2010, factors of safety for undrained slope stability were calculated to be less than 1.3, attributed to the displacements of the foundation ash layers (Ref. 18.3). Reinforcement of the embankment was implemented in accordance with the EPA OSC approved *Test Embankment Buttress Work Plan* (Ref. 18.4). A berm about 5-ft thick and 50-ft wide was constructed around the western half of the Test Embankment. The berm construction was completed on March 18, 2010. Filling activities in the western half of the Test Embankment resumed on March 19, 2010.

The Test Embankment verified the methodologies of constructing an embankment over challenging foundation conditions located in the failed Dredge Cell. It also demonstrated the importance of using geotechnical instrumentation and monitoring to avoid potential slope failures. The results of the test and more information on how the test was conducted can be found in the *Report of Test Embankment Program* (Ref. 18.5).

2.1.1.14 Transition Activities

In order to facilitate the transition from time-critical to non-time-critical activities as defined by the EPA Order and to meet the expectation expressed by TDEC that ash removal from the North Embayment and Middle Embayment and restoration of the waters of the State continue without interruption, a list of transition activities was compiled. The transition activities were performed simultaneously with time-critical removal actions in furtherance of the mid-term strategic objectives for the Site as defined in the EPA Order, and before the Action Memorandum for non-time-critical activities had been approved. These activities would have been needed for whichever alternative was chosen as the remedy for the non-time-critical removal action, and their completion did not bias that remedy selection. The following three work plans were approved by EPA for implementing transition activities.

- Central area recontouring was implemented in accordance with the EPA OSC approved *Central Area Re-Contouring Work Plan* (Ref. 19.3). The central area of the failed Dredge Cell was recontoured to build a subgrade in anticipation of subsequent dry stacking under non-time-critical actions, to improve drainage, and to stabilize the Dredge Cell against erosion. This work plan was later revised in July 2010 and the subsequent recontouring was conducted as part of the non-time-critical removal action.

- North Embayment ash consolidation was implemented in accordance with the EPA OSC approved *North Embayment Ash Consolidation Work Plan* (Ref. 19.1). Ash from two outlying areas in the North Embayment were consolidated to a more centralized area where it could be graded to dry. Approximately 125,000 cy, covering approximately 16.7 ac, were consolidated. The two areas consolidated were:

  (1) An area along the edge of Swan Pond Road and Swan Pond Circle Road. Ash material from the original release was located outside the dirty water ditch along these roads. Removal of this material allowed fresh water springs that flow into the roadside ditches to be isolated; once isolated, the water was diverted from the ash to the clean water ditch system.

(2) An area in the far northern reaches of the embayment. This area was relatively shallow and was located under high voltage lines. Removal of this material allowed the material to be stockpiled for drying prior to final disposition under the non-time-critical actions. This ash consolidation also aided in diverting spring water.

The removed ash was stockpiled in the center of the North Embayment to aid in drying of the material. Material was placed in 2-ft lifts and compacted by tracked equipment. After the ash was removed, the areas were protected from runoff from the ash stockpiles to prevent recontamination. The ash consolidation effort began on April 19, 2010 and continued under the non-time-critical removal action.

A new continuous air monitoring station (PS13) was erected in the North Embayment, north of newly established work areas, and air monitoring station PS06 was decommissioned. The Air Monitoring Plan was revised accordingly. Sampling of the cleaned areas will be conducted under the non-time-critical removal action to verify the areas are clear of ash.

- The North Embayment underpass was constructed in accordance with the EPA OSC approved *North Embayment Underpass Work Plan* (Ref. 19.2). A bridge was constructed on Swan Pond Circle Road and a haul road through the underpass beneath it to allow subsequent ash hauling during the non-time-critical removal action from the North Embayment to disposal areas onsite without crossing a public road. A temporary bypass (drive around road) was constructed to allow Swan Pond Circle to remain open to the public during bridge construction. Bridge construction began on June 23, 2010 and continued under the time-critical removal action. Components of this work included:

(1) A series of geotechnical borings were drilled and sampled to provide data for the bridge and haul road design.

(2) A two lane road was constructed north of Swan Pond Circle Road to allow traffic to drive around the construction with minimal interruption. The drive around road was constructed on ash material in the North Embayment and consisted of two feet of shot rock, six inches of crusher run and two inches of asphaltic pavement. The road was lined with concrete jersey barriers.

(3) The underpass area was excavated to an elevation of 735 ft msl, and a reinforced earth wall was constructed to form the foundation for the bridge abutments. The reinforced earth wall consisted of geogrid materials faced with concrete panels, steel tie down bands and aggregate materials.

(4) Pre-stressed box girders, designed for a HS25 loading, were used to form the bridge structure. The bridge was completed using concrete abutments and bridge slab, asphaltic pavement, and guard rails. The roadway was designed and constructed to Roane County requirements; the completed bridge and roadway was transferred to the county on November 10, 2010.

2.1.2 Listing of Quantities and Types of Materials Addressed

2.1.2.1 <u>Ash Removal Volumes</u>

The short-term strategic objectives as specified in the EPA Order were to expeditiously and efficiently remove ash from the river and from the embayment area east of Dike 2 so as to restore flow and minimize further downriver migration. Volumes removed were key to effective implementation of the actions.

This section summarizes the volume of ash and other materials addressed by the removal action. Table 2-8 lists the estimated quantities of materials removed.

During the pilot dredging program, the volume of material hydraulically dredged by Trans-Ash was estimated by multiplying the dredge production time (in hours) by an assumed 113 cy/hour production rate for the 10-inch dredges. The volume is highly sensitive to the assumed production rate; therefore there is high uncertainty in the estimated volume.

The volume of material hydraulically dredged by TVA during the pilot dredging program was estimated by multiplying the daily travel distance of the dredge, by the average vertical cut observed on the boom, and by the cut width (90-ft swing of the boom). There was no direct measure of the volume removed, which results in relative uncertainty in the estimated volume. However, because the volume is smaller compared to other removal activities, the error is not considered as significant.

Table 2-8. Listing of the Quantities of Materials Removed

Removal Activity	Material	Ash Removed (cy)
River Hydraulic Dredging		
Pilot dredging by Trans-Ash	Ash, sediment	350,000
Pilot dredging by TVA	Ash, sediment	118,000
Phase 1 hydraulic dredging by Sevenson	Ash, sediment	1,492,000
Phase 2 hydraulic dredging by Sevenson	Ash, sediment	750,000
River Mechanical Dredging		
Pilot dredging by Southern Shores	Ash, sediment	19,000
Phase 2 mechanical dredging by Sevenson	Ash, sediment	28,000
Phase 2 mechanical dredging by Aquarius	Ash, sediment	15,000
Ash Excavation East of Dike 2 by TVA	Ash, sediment	737,000
	Total Ash and Sediment	**3,511,000**
Cenosphere Removal by SWS and TVA	Cenospheres	750
Cenosphere Removal by SWS and TVA	River debris	7,000
Skimmer Wall Debris Removal by Aquarius	Other debris	500
	Total Other Materials	**8,250**

During both Phase 1 and Phase 2 hydraulic dredging by Sevenson, volumes of ash and associated sediment removed were calculated by Sevenson and checked by Jacobs. Sevenson calculated draft daily volumes using dredge length of advance, width of swing, and average depth of cut. These draft daily numbers were later replaced by volumes calculated from bathymetric survey information (Section 2.1.1.1). Bathymetric surveys were performed when the dredge and pipeline were out of the way and the weather allowed. Survey quality control included observing that the end of survey bar checks matched the calibration check and that the survey path covered the area indicated. Both Sevenson and Jacobs performed separate independent calculations of volumes from the same bathymetric data. Discrepancies were resolved and the calculated removed volume was considered final. Care needs to be taken when reviewing volume removed numbers. Draft volumes presented in Sevenson daily reports are based on the area and depth covered, while the final volumes used in this report are based on the checked bathymetric survey information. The volumes based on bathymetric survey results are considered to be within acceptable survey tolerances, so that there is less uncertainty than other volume estimating methods.

The volume of material removed by mechanical dredging and excavation east of Dike 2 was estimated by counting the number of barge or truck loads and assumed volume per truckload. Each of the trucks was assumed to carry an average of 22 cy and a compaction factor of 95% was applied to reflect the difference between ash volume in a pile versus in a truck. When wet material was moved, a lower volume per truck was assumed (18 to 20 cy for larger trucks). These volumes, especially those estimated by counting barge or truckloads, are highly uncertain.

The EPA OSC reported the volumes of ash removed by combined hydraulic and mechanical dredging throughout the time-critical removal action in the POLREPs (Ref. 27.1, Ref. 27.2, Ref. 27.3). The dredge volumes reported in the POLREPs were estimated based on Sevenson daily reports. Bathymetric survey information was not available at the time due to the position of the dredges within the areas to be surveyed. Validated volumes were updated typically within three to five work days. The quantities listed in Table 2-8 are the validated numbers following receipt of the bathymetric survey data.

Due to the uncertainties in estimating ash removal volumes, the reader is cautioned against comparing the quantity generated to the quantity disposed and quantity stored, as discussed in Section 2.1.2.2.

The volume of cenospheres removed from the river is estimated at less than 1,000 cy. The volume was calculated by counting the number of vacuum trucks hauling cenospheres to the storage cells; a total of 4,801 truckloads were hauled between January 2009 and July 2010. Only about 10% of the vacuum truck loads (approximately 480 truckloads) came from the collection of cenospheres from the river system; the remainder came from onsite ponds (e.g., Ash Pond or Stilling Pond). Cenosphere loads from river collection had a higher density than those collected from onsite ponds, because loads were transferred from barge-mounted vacuum units where excess water could be drained. It is estimated that there was 2,500 pounds of cenospheres per truckload from the river, yielding 600 tons of cenospheres. Assuming an average unit weight of 0.8 tons/cy, this equates to 750 cy of cenospheres.

The volume of natural river debris removed from the river is estimated at less than 7,000 cy. The volume was calculated by multiplying the number of bags collected by 30 pounds per bag plus a visual estimation of the quantity of debris removed by excavator and barge, then converting to volume assuming an average unit weight of 0.8 tons/cy. Although these estimates are based on broad assumptions and result in high uncertainty, the volumes are small and the error is considered insignificant.

Skimmer wall debris consisted of 15 concrete beams, each 2-ft square by about 50-ft long, and three concrete caissons, each about 45-ft long. The cylindrical caisson diameter varied; the top 30 ft was approximately 8-ft diameter and the bottom 15 ft was 11-ft diameter. Total volume of the debris, prior to size reduction, was therefore less than 500 cy.

2.1.2.2 **Listing of Ultimate Destinations of Materials Disposed**

The short-term strategic objectives as specified in the EPA Order were also to ensure that coal ash material removed during the response actions is properly managed (stored) and properly disposed. Therefore, the ultimate destinations of materials disposed were key to effective implementation of the actions. This section summarizes the disposal locations for the ash and other materials addressed by the removal action. Table 2-9 lists the estimated quantities and disposal locations of materials removed.

Table 2-9. Listing of the Quantities and Ultimate Destinations of Materials Disposed

Disposal Facility	Material	Quantity Disposed (tons)
Arrowhead Landfill, Uniontown, Alabama	Ash, sediment	4,025,100
Arrowhead Landfill, Uniontown, Alabama	Cenospheres	400[a]
Chestnut Ridge Landfill, Heiskell, Tennessee	River debris	1,900
Aquarius Marine, Taylorsport, Kentucky	Other debris	1,000
	Total Quantity Disposed	**4,028,400**

Note: [a] Included in the quantity disposed with ash and sediment.

Ash that was removed during the time-critical removal action was disposed at the Arrowhead Landfill in Uniontown, Alabama. A total of 4,025,100 tons of ash and entrained sediment were disposed in the landfill. The weight loaded, transported, and disposed is fairly accurate as that weight is measured by scales on the loading excavator bucket and confirmed by scales at the landfill in Uniontown, Alabama. There is therefore low uncertainty as to the quantity of material disposed offsite.

Approximately 600 tons of cenospheres were collected with approximately two thirds of that (400 tons) transported offsite to the Arrowhead Landfill for disposal; this small quantity is therefore included in the ash and sediment quantity stated above. Nearly 1,900 tons of non-ash-contaminated natural river debris was transported to the Chestnut Ridge Landfill in Heiskell, Tennessee, by Waste Management.

Both the Arrowhead and Chestnut Ridge Landfills are permitted Class I, Subtitle D, disposal facilities with liner and leachate collection systems for proper disposal of the materials from the time-critical removal action. The landfills are therefore effective disposal locations.

Concrete debris from the skimmer wall was salvaged by Aquarius. The concrete beams and caissons were decontaminated and shipped to their salvage yard along the Ohio River in Taylorsport, Kentucky, where the material was salvaged and recycled.

Temporary ash storage areas are discussed in Section 2.1.1.4. The quantities of materials remaining in the temporary storage areas as of June 25, 2010, are listed in Table 2-10. These volumes, reported in POLREP 170 (Ref. 27.2), are based on truck haul volumes. As a result, these estimates have a degree of uncertainty similar to ash removal estimates. Between June 25, 2010, and end of offsite shipment of the ash on December 2, 2010, materials were hauled from these storage areas to the Ball Field for loading trains. Ash from the relic area of the Dredge Cell and plant-generated ash was also used for loading trains in lieu of ash in storage. As of December 2010, approximately 415,000 cy of time-critical ash and sediment were in storage. Of the 3,511,000 cy removed from the river, approximately 415,000 cy remain in storage and 3,096,000 cy were shipped offsite for disposal.

Table 2-10. Listing of the Quantities and Ultimate Destinations of Materials Stored

Temporary Storage Area	Material	Quantity Stored (cy) as of June 2010	Quantity Hauled to Trains (cy) June to December 2010	Quantity Stored (cy) as of December 2010
West Storage Area	Ash, sediment	199,000	190,000	9,000
Test Embankment	Ash, sediment	171,000[a]	132,000	39,000
Wet Ash Storage (Main)	Ash, sediment	1,000	0	1,000
Wet Ash Storage (Valley)	Ash, sediment	187,000	72,000	115,000
Wet Ash Storage (Central)	Ash, sediment	115,000	1,000	114,000
Lateral Expansion	Ash	153,000	103,000	50,000
Ash and Settling Ponds	Ash	516,000	94,000	422,000
Ball Field	Ash, sediment	246,000	78,000	168,000
Relic area Dredge Cell	Ash	0	390,000	(-390,000)[b]
Plant-generated ash	Ash	0	113,000	(-113,000)[b]
			Total Ash and Sediment Stored	**415,000**

Notes:

[a] Test Embankment also contained ash from the relic area of the Dredge Cell; this quantity is only the time-critical ash removed from east of Dike 2 that was stored in the Test Embankment.

[b] Ash from the relic area of the Dredge Cell and plant-generated ash was used to fill trains in lieu of time-critical ash in storage; these quantities must therefore be subtracted from ash in storage.

As discussed in Section 2.1.1.8, nearly 750 cy of cenospheres were removed from the river, one third of which (estimated at 250 cy) remains onsite. Cenospheres are being stored in a collection pit in the south corner of the Stilling Pond. Another 4,000 tons (5,000 cy) of natural river debris consisting of wood and trees were chipped and used as mulch on TVA property.

2.1.2.3 Estimate of Ash Remaining

Although the project's short-term strategic objectives were to remove ash from the river and from the embayment area east of Dike 2 so as to restore flow and minimize further downriver migration, the EPA OSC Dredge Determination Memo documents that all parties recognized that some ash would remain in the Emory River east of Dike 2. The non-time-critical removal action for the river system will address this remaining ash, as well as ash in the embayment west of Dike 2, so as to achieve the mid-term strategic objectives as stated in the EPA Order. Estimated volumes of ash remaining in the river at the end of the time-critical action are listed in Table 2-11. These estimates are based on interpretations of data from multiple sources, including post-dredging bathymetric data, pre-spill river bathymetric data, dredging logs, visual surveys, and vibracore data; the estimates therefore have inherent uncertainty and will be revised based on additional data being gathered as part of the non-time-critical removal action. Figures 12 through 14 depict the locations where this ash is likely present, based on interpretations of bathymetric survey information and results of vibracore sampling.

Table 2-11. Estimated Quantities of Materials Remaining in the River System

Dredging Plan River Segment	Emory River Mile (ERM)	Quantity Remaining (cy)
Below 4 (B4)	ERM 0.0 – 1.2 (no removal due to presence of cesium)	120,000
W of B4	Shallows west of Below Segment 4	112,000
4b	ERM 1.2 – 1.5 (no removal due to presence of cesium)	72,000
4a	ERM 1.5 – 1.8	14,000
W of 4	Intake channel west of Segment 4	77,000
2 & 3	ERM 1.8 – 2.1	11,000
1	ERM 2.1 – 2.6	17,000
E of 1	Shallows east of Segment 1 (ERM 2.0 – 3.0)	33,000
Embayment	Swan Pond Embayment west of Segment 1	5,000
5	ERM 2.6 – 3.2	21,000
Above 5 (A5)	ERM 3.2 – 3.9 (channel upriver of Segment 5)	11,000
N of 5	Shallows north of Segment 5	15,000
Above A5 (AA5)	ERM 3.9 – 6.0	24,000
	Total Ash Remaining	**532,000**

2.2 ACTIONS TAKEN BY STATE AND LOCAL FORCES

The TDEC has been actively engaged in the actions associated with remedying the release since it occurred. On January 12, 2009, TDEC issued a Commissioner's Order which remains in effect, although TDEC has agreed that work performed under the EPA Order, in consultation with TDEC, would satisfy portions of the TDEC Order. As part of the ICS Unified Command, which included EPA and TVA, TDEC personnel have been onsite as part of a coordinated effort to contain the immediate threat to human health and the environment. Their efforts included sampling and analysis for public drinking water systems to assess whether the raw water entering and the finished water produced by the Kingston Water Treatment Plant meets public health standards. Work also included ongoing water quality monitoring and assessment within the major waterways impacted by the ash release including the Emory, Clinch, and Tennessee Rivers. TDEC and the Tennessee Department of Health provided public health guidance and recommended precautions for citizens that came in contact with the ash; they had major involvement in completing a public health assessment, available at http://health.state.tn.us/Environmental/list.htm and included in Ref. 2.1.

TDEC provides resources to review all regulatory documents produced by TVA. EPA consulted with TDEC prior to EPA approving any work. On June 14, 2010, the TDEC Commissioner Jim Fyke and the Deputy Commissioner Paul Sloan announced the issuance of a Commissioner's Order against TVA assessing $11.5 million in penalties in response to the release. The penalties address violations of the *Tennessee Water Quality Control Act* and the *Tennessee Solid Waste Disposal Act*.

Actions taken by TDEC during the time-critical removal action are presented in detail on their website, available at http://tennessee.gov/environment/kingston/index.shtml.

The ADEM has participated in the disposal of recovered ash material at the Arrowhead Landfill in Perry County, Alabama. The EPA OSC, through EPA Region 4 Program Representatives, coordinated with the

ADEM regulatory programs, in particular the RCRA program for landfill regulations and the Alabama Department of Public Health for RESRAD evaluations of TENORM regulations. ADEM provided a Notice of Acceptability to EPA, which allowed disposal at the Arrowhead Landfill, and approval for disposal of the TVA waste at the Perry County Associates (Arrowhead) Landfill (Ref. 8.2.2).

2.3 ACTIONS TAKEN BY OTHER AGENCIES AND SPECIAL TEAMS

The following groups supported EPA time-critical response actions: EPA START contractors (Tetra Tech and OTIE); EPA Region 4 Air, Pesticides and Toxics Division; EPA Region 4 OExA; EPA Region 4 TSS of the Superfund Division; EPA Region 4 Science and Ecosystems Support Division SESD, EPA Region 4 RCRA, EPA Region 4 OEA, EPA Region 4 Water Protection Division, EPA Region 4 Office of Congressional and Intergovernmental Affairs, EPA Region 4 Federal Facilities Branch, EPA ERT, EPA SAB, USCG GST, BOR, ATSDR, and USACE.

- EPA START contractors Tetra Tech and OTIE provided on-site and offsite support to the OSC and Community Involvement Coordinator (CIC) of OExA. Tetra Tech conducted surface water monitoring and sampling, supported cenosphere reconnaissance, provided community involvement support to the CIC, and supported database and mapping activities. OTIE provided data management and mapping support to the OSC including initiating a dedicated website for the Site.

- EPA Region 4 programs supported the EPA OSC throughout the time-critical removal action. The CIC from the EPA Region 4 OExA coordinated and help plan public outreach activities with TVA and TDEC. OExA has also provided assistance in creating and distributing press releases for the Site. The EPA Region 4 TSS of the Superfund Division assisted the OSC in determining risk assessment concerning the Emory River recreational advisory. The EPA Region 4 SESD conducted drinking water well sampling during the initial emergency response and conducted quarterly audits on TVA's air monitoring network. In addition, SESD reviewed the Site data management plans and quality assurance plans for compliance with Region 4 sampling protocols. The EPA Region 4 RCRA division has provided technical expertise for landfill operations and closure. The EPA Region 4 OEA has provided the OSC with legal expertise.

- Other EPA organizations also provided support to the EPA OSC. The EPA ERT located in Edison, New Jersey, in coordination with USCG GST, conducted quarterly Site safety and health audits in addition to reviewing the SWSHP. The EPA SAB provided a Science Panel Review Paper *Review of Potential Selenium Issues Following a Coal Ash Spill* (Ref. 11.3.4), to inform Senate Environment and Public Works Committee staff of data available regarding selenium levels related to the coal ash release and conditions at the site. The EPA Air, Pesticides and Toxics Management Division (APTMD) analyzed air data for compliance with standards. The EPA Water Protection Division was involved with pre-Order activities. The EPA Region 4 Office of Congressional and Intergovernmental Affairs coordinated congressional testimonies. The EPA Region 4 Federal Facilities Branch assisted with sediment studies in association with ORNL.

- The USCG GST assisted the EPA in river management, safety and health management, and monitoring time-critical removal actions. The GST had up to four personnel and a response boat on-scene to ensure the safety of the public and responders, assist with water sampling and monitoring, and assist with ICS Unified Command management. The GST provided onsite Safety and Health oversight, including designating exclusion zones and monitoring and control to ensure safety on the river as large dredges operated in the area. Members of the Gulf Strike Team and Pacific Strike Team have been instrumental in ensuring safety at the Site.

- ATSDR, an agency of the U.S. Department of Health and Human Services, assisted the EPA in public health actions. The ATSDR reviewed data collected at the Site and assisted the Tennessee Department of Health in completing a public health assessment, which is available at http://health.state.tn.us/Environmental/list.htm (Ref. 2.1). ATSDR, in coordination with the Tennessee Department of Health, held a public meeting to discuss potential health effects from exposure to ash. The ATSDR also supported EPA on river advisories and public outreach, and provided health information on public concerns related to exposures to toxic substances. ATSDR created a video featuring the OSC explaining the activities during the time-critical removal actions.

- BOR assisted the EPA in providing engineering consultation and review. Engineering technical assistance was provided for a variety of issues, including stability of temporary storage areas, dike evaluations and maintenance, reinforcement of Dike C buttress, and evaluation of dredge productivity rates. The Bureau of Reclamation provided onsite engineering oversight and review of construction activities. In addition, BOR provided technical support to the OSC for work plan reviews.

- USACE provided river modeling and consultation to the OSC for dredging operations. The U.S. Army Corps of Engineers assisted the EPA in providing engineering consultation on dredging productivity rates and fate and transport migration, including speciation testing and leaching testing. The Corps of Engineers' ERDCWES modeled fate and transport of sediment and ash to estimate the volume of ash material potentially transported downriver during major peak flow flood events.

2.4 ACTIONS TAKEN BY CONTRACTORS, PRIVATE GROUPS, AND VOLUNTEERS (NON-GOVERNMENT ORGANIZATIONS)

Third-party environmental investigations conducted at the Site fall into five categories:

1. Investigations funded by organizations with no formal association with TVA and conducted by independent third-party investigators;

2. Investigations funded by and in support of plaintiffs in lawsuits against TVA;

3. Investigations commissioned by state or federal regulators and performed by independent third-party investigators, but ultimately funded by TVA;

4. Investigations by third-party investigators from whom TVA solicited proposals and with whom TVA may cooperate in designing and conducting the investigations; and

5. Investigations funded by TVA, but for which the request for proposals, screening of initial proposals, and administration of grants is through the ORAU.

The Unified Command emphasized open communication with other organizations and provided access to the Site. In some cases, TVA contractors would also collect samples of ash and ship them to the interested party. The investigations completed or ongoing in these five categories are summarized in Section 3.

3 MONITORING AND ANALYTICAL RESULTS

3.1 DATA MANAGEMENT PROGRAM

Quality assurance of data collected at the Site was implemented in accordance with the EPA OSC approved site-wide *Quality Assurance Program Plan, TVA Kingston Fossil Plant Ash Recovery Project*, *TVA-KIF-QAPP* (QAPP) (Ref. 5.1). Samples of multiple media have been collected in association with the Site and have been subjected to a variety of chemical, radiological, and toxicological analyses to support TVA's objectives of characterizing the extent of the fly ash deposition, monitoring ash containment and remediation operations, and assessing the potential short- and long-term health hazards and ecological impact.

Field investigations and sampling procedures were conducted such that samples were representative of the media sampled and the resultant data could be compared to other data sets. Work plans and/or sampling and analysis plans (SAPs) described the rationale for the collection of environmental samples, the sampling design to provide a statistically meaningful number of field sampling points, and the laboratory analyses required to meet Data Quality Objectives (DQOs). The work plans, SAPs, and associated Site standard operating procedures (SOPs) that were employed to implement the field investigation specified the sampling methods, including equipment requirements and decontamination procedures, required to meet the objectives of the Site. A listing of the SOPs is provided in Section 9.0. The SOPs are included in Ref. 6.4.

To ensure that Site objectives were met, a comprehensive environmental Quality Assurance (QA) Program was developed. QA for analytical data associated with the Site is described in the Site-wide QAPP (Ref. 5.1). The QAPP provides an overall framework for QA and data management activities associated with the Site. Project-specific QAPPs have been developed for specific sampling and monitoring activities when QA requirements more stringent than those presented in the QAPP were required to support the DQOs for the sampling and monitoring tasks.

An extensive data management program was required to support the objectives of the Site. The primary goals of the data management program were to generate high quality, reliable, defensible analytical data.

3.1.1 Quality Assurance Activities

Quality Assurance surveillances were performed during representative sample collection activities to check that the collection of samples met Site objectives and adhered to Site planning documents. Table 3-1 lists the QA surveillances performed by TVA's QA contractor, ESI. Summaries were prepared for each QA surveillance, documenting the observations, recommendations and corrective actions, as appropriate. The frequency and types of QA surveillances were dependent on the phase of the removal and the prevalent sampling activity. Between February 13, 2009 and August 25, 2010, the QA team performed 205 surveillances of sampling activities.

Laboratory surveillances were conducted of each of the contracted analytical laboratories to assess compliance with the contractual technical requirements, the QAPP, and referenced analytical methods (Table 3-2). Laboratory surveillances included review of personnel qualifications, equipment, documentation, sampling techniques, analytical methods, and adherence to QA procedures. Surveillances of laboratories conducting chemical and radiological analyses of samples were performed by the TVA Technical Liaison/QA Officer and the ESI QA Manager. Surveillances of laboratories performing toxicological testing were conducted by the TVA senior toxicologist, the TVA Technical Liaison/QA Officer, and the ESI QA Manager in accordance with TVA's toxicological monitoring program. Reports were prepared for each of the laboratory surveillances, including observations, recommendations and corrective actions, as appropriate.

Table 3-1. Quality Assurance Surveillances by TVA During the Time-Critical Removal Action

Type of Sampling Activity	Number of Oversights
Routine surface water and storm induced surface water sampling	30
Plume monitoring	13
Swan Pond Embayment Sampling	17
Stilling Pond (including low-level mercury sampling)	13
Ambient air monitoring	21
Sediment and submerged ash sampling	21
Groundwater sampling	10
Soil boring and well installation	6
Hydrolab change-outs and calibrations	12
Biota (amphibians, avian eggs, turtles, fish, raccoons, vegetation)	15
Third-party researchers (Duke University, Old Dominion University, Appalachian State, Tennessee Aquarium, North Carolina State, University of Georgia, Middle Tennessee State University	29
Plaintiff sampling events	2
Miscellaneous (waste management, special studies)	16
Total Number of TVA Oversights	**205**

Table 3-2. Laboratory Surveillances Conducted by TVA During the Time-Critical Removal Action

Laboratory	Facility Location	Audit Date	Matrices/Analyses
Bureau Veritas	Novi, MI	July 2009	Ambient air (particulate matter, metals)
Bureau Veritas	Kennesaw, GA	March 2010	Ash (PLM)
Environmental Enterprises USA	Slidell, LA	April 2010	Toxicological analyses
Frontier Geosciences, Inc.	Seattle, WA	July 2010	Metals speciation
Galson	Syracuse, NY	March 2009	Ambient air (silica)
Hydrosphere Research	Gainesville, FL	May 2009	Toxicological analyses
Inter-Mountain Laboratories	Sheridan, WY	June 2009	Ambient air (particulate matter, metals)
Pace Analytical Services, Inc.	Green Bay, WI	June 2009	Biota
Pace Analytical Services, Inc.	Minneapolis, MN	August 2010	Biota
PMET	New Brighton, PA	July 2010	Geophysical parameters
RJ Lee Group, Inc.	Monroeville, PA	March 2010	Ash (PLM), industrial hygiene (silica)
RJ Lee Group, Inc.	Monroeville, PA	July 2010	Ash (PLM), industrial hygiene (silica)
TestAmerica	Nashville, TN	January 2009	Surface water, groundwater, ash, sediment, residential soil, and wipes

EPA performed five quarterly audits of the ambient air monitoring network during time-critical activities. These quarterly audits consisted of a review of sampling activities; sampling equipment; laboratory results; and data management. In addition, EPA conducted a quality audit in January 2010; this audit focused on field sampling and data management for surface water and solid matrices. EPA also conducted three laboratory audits. Table 3-3 lists the EPA environmental audits conducted during the time-critical removal action. EPA audit reports and TVA responses are included in Ref. 7.4.

Table 3-3. Audits Conducted by EPA During the Time-Critical Removal Action

Site Field Operations Audits	Facility Location	Audit Date	Field Operations
Air audit, data management	Kingston, TN	June 2009	Air sampling, data management
Air audit	Kingston, TN	November 2009	Air sampling
Multimedia audit	Kingston, TN	January 2010	Multimedia sampling (sediment, surface water, air, biota)
Air audit	Kingston, TN	March 2010	Air sampling
Air audit	Kingston, TN	June 2010	Air sampling
Air audit	Kingston, TN	October 2010	Air sampling
Laboratory Audits:		**Audit Date**	**Matrices/Analyses**
TestAmerica	Nashville, TN	April 2010	Surface water, groundwater, ash, sediment, residential soil, and wipes
Inter-Mountain Laboratories	Sheridan, WY	March 2010	Ambient air (particulate matter)
Inter-Mountain Laboratories	Sheridan, WY	August 2010	Ambient air (metals)

3.1.2 Verification/Validation Process

The analytical data generated from the sampling activities were compared with the defined QA objectives and criteria for precision, accuracy, representativeness, completeness, and comparability and sensitivity. The primary goal of these procedures was to check that the data reported are representative of conditions at the Site.

TVA's contracted laboratories performing chemical analyses were required to submit three types of deliverables: a limited (Level 1) data package containing sample results and batch quality control (QC) sample results; a fully-documented (Level 4) data package including raw data for all analyses; and electronic data deliverables (EDDs) for loading to the EQuIS database. Data generated from toxicological testing was submitted, reviewed, and stored in accordance with TVA's toxicological monitoring program.

EDDs were subjected to completeness and correctness testing during loading to EarthSoft's EQuIS® database. After being loaded to the EQuIS database, the data were subjected to verification. As defined in the QAPP, data verification involved comparison of the data loaded in the EQuIS database to the results reported in the Level 1 data package. In addition, data verification included review of the batch quality control summary forms for compliance with the applicable methods and for data usability with respect to the Site data quality objectives and the QAPP. Data that have undergone verification are generally considered acceptable for use by Site personnel.

Following receipt of the Level 4 data package, data were subjected to validation. As defined in the QAPP, data validation included review of raw data and associated QC summary forms for compliance with the applicable methods and for data usability with respect to the appropriate guidance documents.

This full data validation expanded upon the completeness, correctness, and usability assessment performed during verification to include evaluation of instrumental QC analyses, review of sample preparation information, and recalculation of reported results from raw data.

Initially, 100% of the chemical analysis data were subjected to data validation. The frequency of full validation was reduced for some data streams as they matured. All laboratory reported data used for Site decision-making or risk assessment have undergone data verification, at a minimum. Analytical data were reported to the regulatory agencies after verification. Data were reported to the public following data validation where data validation was requested; if data validation was not requested, data were available for public consumption following verification.

3.1.3 Database Management

Database management was performed in accordance with the EPA OSC approved *Data Management Plan for the TVA KIF Ash Recovery Project, KIF-DMP-001* (DMP) (Ref. 4.2). A comprehensive data management plan was developed for the Site to ensure that all sample data associated with the Site are appropriately maintained and accessible to data end users. The Data Management Plan outlined data management activities from pre-planning of sampling events to reporting and analysis, emphasizing completeness, data usability, and defensibility of the data.

Data were collected from several data streams and consolidated in a single Site EQuIS database. QA procedures have been implemented at each step in the data transfer process to ensure that a complete, correct data set is maintained. In addition, sample planning and tracking processes were developed to control the flow of historical data, fixed-base laboratory data, field data, and continuous monitoring data into the Site database.

Data were reported from the Site EQuIS database to the EPA's SCRIBE database. SCRIBE is used for emergency response and time-critical removal actions by EPA. Initially, EPA's START contractor OTIE used EPA's database SCRIBE to store a copy of TVA's data. However, the following issues were encountered while using SCRIBE:

- Publishing to Scribe.net sessions time out before a full upload is completed.
- Multiple SCRIBE databases have the potential to overwrite previously published data.
- SCRIBE does not provide sufficient flexibility as a photo database. A different database is needed to house photos of the Site.
- Hydrolab® and meteorological station data fields currently don't match in SCRIBE.
- Real-time air data are the largest subset of data collected on this Site and will continue to be collected at this pace for the duration of the project.

Large amounts of data limit the usefulness of a single database. As the amount of analytical results continued to grow, OTIE recognized the need to transition the database to EPA's EQuIS database. EPA uses EQuIS for long term non-time-critical removal actions and remedial actions requiring large quantities of analytical data to be produced. The database contains validated analytical data, field quality measurements, and real-time data collected by TVA and some third-party researchers. EPA and TDEC data are also stored in EPA's database. OTIE began maintaining a copy of TVA's EQuIS database for EPA during the non-time-critical removal action.

In addition, a subset of ambient air monitoring data was reported to the EPA Air Quality System (AQS) database.

Monitoring and sampling activities associated with the Site included ash characterization, surface water monitoring and sample, rainfall event monitoring and sampling, effluent discharge sampling, air monitoring and sampling, sediment sampling, groundwater sampling, and biota sampling. Results of the monitoring and sampling are summarized in Appendix H and discussed in the following sections.

3.2 ASH CHARACTERIZATION

During the emergency response phase (December 2008 and January 2009), TVA, TDEC, and EPA performed soil and ash sampling in the former Dredge Cell, in the embayment, and at several private residences. The objectives of the soil and ash sampling were to characterize the chemical nature of the ash, determine if the released ash resulted in residual impacts to native soil, and evaluate the potential threat of the released ash to human health and the environment. Later, characterization of recovered ash was performed to assess disposal options and to guide potential removal activities. Locations of ash characterization samples are shown on Figure 24.

The following constituents of fly ash are hazardous substances as defined by CERCLA: arsenic, barium, beryllium, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, and isotopes of potassium, radium, uranium and thorium.

3.2.1 Tennessee Valley Authority Sampling

During the emergency response, TVA collected eight ash samples from private residential properties adjacent to the Site on December 27, 28, and 29, 2008 and January 2, 2009. These samples (locations PR-1 through PR-4 and PR-7 through PR-10) were analyzed for total metals and TCLP metals. On December 31, 2008, TVA collected five surface ash samples from ash remaining in the former Dredge Cell and 23 subsurface ash samples from one Geoprobe® vertical profile within the Dredge Cell. These ash samples (locations S-1 through S-5 and the Geoprobe® location) were analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX) using EPA SW-846 Method 8260; total metals using EPA SW-846 Method 6010B; mercury using EPA SW-846 Method 7471; and TCLP metals using EPA SW-846 Methods 1311 and 6010B/7470A. A total of 19 five-point composite ash samples were collected on January 6 and 12, 2009, from the released ash in Swan Pond Embayment. These samples (locations AFA-1 through AFA-19) were analyzed for total metals using EPA SW-846 Method 6010B/7470A.

The locations of the December 2008 and January 2009 ash samples are depicted on Figure 24. Data from the initial analytical laboratory for ash samples collected in December and January were rejected because of method compliance and reporting issues identified during the rigorous data validation process. Retained samples were returned to TVA and sent to multiple contract laboratories for reanalysis of metals. Samples were not reanalyzed for mercury because sample holding time had been exceeded. Three of the ash samples (PR-9, AFA-16, and AFA-18) were not returned for re-analysis; therefore, data are unavailable for these samples.

Additional sampling was conducted in September 2009 in accordance with the *Supplemental Ash Sampling and Analysis Plan* (Ref. 10.1.7). Eleven supplemental ash samples (EECA-1 through EECA-11) were collected from the Dredge Cell and embayment area and analyzed for polynuclear aromatic hydrocarbons (PAHs), mercury, and radioisotopes. The locations of the September 2009 ash samples are also depicted on Figure 24. PAHs are not anticipated to be present in the ash due to the conditions under which the coal is combusted (e.g., high temperature, oxygen rich environment). PAHs were not detected, except for 2-methylnaphthalene in a single ash sample. That sample was collected from an area of the ash that has had substantial regrading and movement of ash by heavy equipment. Therefore, the presence of 2-methylnaphthalene is likely attributable to deposition from equipment exhaust. The 2-methylnaphthalene detection was slightly greater than the reporting limit; re-extraction/reanalysis did not confirm the presence of 2-methylnaphthalene above the reporting limit.

Ash is known to contain naturally-occurring radionuclides, specifically isotopes of uranium, thorium, and potassium-40, and their short-lived daughter products. Initial analysis of the ash included only gamma spectroscopy which identified potassium-40, radium-226, and several of the gamma-emitting short-lived daughter products of uranium and thorium. This is consistent with results from analysis conducted by TDEC. In order to accurately characterize the activity of the uranium, thorium, and radium isotopes, which cannot be directly characterized using gamma spectroscopy; the additional ash samples collected by TVA were analyzed by both alpha spectroscopy and gamma spectroscopy. Levels of radioactivity in the ash are similar to those of typical regional soils. An exception is that levels of radium-226 generally exceed the range typical of regional soils; levels of radium-226 in regional soils are typically in the range of 0.5 to 2 picocuries per gram (pCi/g), whereas those in ash range between 4.5 and 9 pCi/g.

Table H-1 in Appendix H presents the range of concentrations of metals and radioisotopes found in TVA ash sampling. The following analytes are considered constituents of interest related to fly ash: arsenic, chromium, copper, lead, mercury, nickel, selenium, thallium, vanadium, zinc, and the naturally-occurring radionuclides, specifically isotopes of uranium and thorium, their short-lived daughter products, and potassium-40.

Arsenic is one of the naturally-occurring trace elements concentrated in ash through the coal combustion process. Arsenic is a known human carcinogen routinely detected in ash samples at concentrations that may be a concern for human exposures. Arsenic concentrations in ash samples collected by TVA ranged from 2.78 to 166 milligrams per kilogram (mg/kg) (at a sampling interval from 44 to 46 ft below ground surface), with an average of 65 mg/kg. Concentrations of arsenic exceed EPA's residential Regional Screening Level of 0.39 mg/kg. However, arsenic is widely distributed in the natural environment. Arsenic levels for soils typical of the Roane County region range from 6.4 to 655 mg/kg (Table H-2 in Appendix H). Arsenic concentrations reported in TVA ash samples are within the range of concentrations reported for soil. It should be noted that ash is not natural soil, and therefore direct comparisons to "background" concentrations cannot be made. These comparisons are only meant to provide a framework for recognizing differences or similarities between the ash constituents and those found in typical regional soils.

The EPA OSC presented concentrations of inorganic elements found in coal ash and typical soil to the Tennessee Legislature in February 2010 (Ref. 3.5.2). Table 3-3 compares inorganic concentrations in coal ash to those in typical soil, as presented by the EPA OSC to the Tennessee Legislature. Average concentrations of copper, arsenic, and selenium in coal ash are two to six times higher than average concentrations of those elements in typical soil.

Table 3-3. Examples of Inorganic Concentrations in Coal Ash and Typical Soil

	Coal Ash		Typical Soil	
Inorganic Element	**Average Concentration (mg/kg)**	**Estimated Mass (pounds)[a]**	**Average Concentration (mg/kg)**	**Estimated Mass (pounds)[a]**
Aluminum	22,700	177,000,000	18,905	147,000,000
Iron	17,961	140,000,000	27,304	213,000,000
Copper	59	462,000	16	129,000
Arsenic	66	515,000	24	183,000
Selenium	6	51,000	1	8,600

<u>Note</u>: [a] Based on an equivalent 3,000,000 cy volume.

Results for other naturally-occurring trace elements in ash also indicate concentrations greater than would be expected in typical regional soils. Barium, beryllium, boron, selenium, thallium and vanadium were detected in more than 80% of the ash samples and at maximum concentrations that are greater than maximum levels for soils typical of the Roane County region. Maximum concentrations of these metals measured in ash were up to five times greater than maximum values reported for typical regional soils (Table H-2 in Appendix H). Similarly, essential dietary nutrients such as potassium and sodium were also detected at maximum concentrations greater than those for typical regional soils.

Ash samples collected from residential properties had results similar to those from the released ash in the embayment, and the ash remaining in the former Dredge Cell. The ash is a relatively well-mixed, homogenous material with no discernable difference in its constituent concentrations across the Site.

3.2.2 Tennessee Department of Environment and Conservation Sampling

During the emergency response, TDEC collected 12 ash samples on January 6 and 7, 2009. Two of the ash samples were collected from the Dredge Cell and the remaining samples were collected from surrounding residential properties. The samples were analyzed for total metals, TCLP metals, BTEX, radionuclides (gross alpha and gross beta), and PAHs. TDEC has reviewed the data and has posted relevant information on their website available at www.state.tn.us/environment/kingston. As reported on their website, the ash does contain metals and radioactive materials. Table H-1 in Appendix H presents the range of concentrations of metals detected in ash samples collected by TDEC. After review of the metal analyses, the only metal identified by TDEC at concentrations that may present a potential health hazard is arsenic (TDEC website). The TDEC ash samples contained arsenic ranging from 26 to 100 mg/kg (with an average of 73 mg/kg), similar to the range found in TVA sampling. TDEC did not detect any volatile organic compounds (which include BTEX) or PAHs in the ash samples.

3.2.3 U.S. Environmental Protection Agency Sampling

During the emergency response, EPA's START contractor collected samples during December 2008 and January 2009. Sampling results with detailed explanation can be found in the *Final Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Emergency Response Report, Kingston Fossil Plant Fly Ash Response* (Ref. 24.1). EPA collected two 10-point composite samples from the ash pile onsite and three grab samples of ash that had been deposited along the roadway. Samples were analyzed for target analyte list metals, BTEX, silica, and TCLP metals. Table H-1 in Appendix H presents the range of concentrations of metals detected in ash samples collected by EPA. Similar to TVA and TDEC sampling results, EPA testing showed arsenic to be present in the ash at levels ranging from 44.8 to 81.3 mg/kg (with an average of 61.1 mg/kg). EPA testing of the ash found no gasoline products (BTEX) and showed that the ash would not qualify as hazardous waste based on TCLP analysis.

3.2.4 Ash and Sediment Sampling

Ash and sediment samples were collected from the river system in accordance with the EPA OSC approved *Kingston Fossil Plant, Fly Ash Recovery Project, Sampling Plan for Phase I Dredging Operations* (Ref. 11.2.2). Samples of released ash and sediment in the river system were collected at multiple times throughout the time-critical removal action. Specifically, to comply with the TDEC Commissioner's Order, samples were collected to assess soil and determine the impact of ash on these soils. To comply with the EPA Order, samples were collected to identify all waters of the United States impacted by the release. Two nature and extent investigations documented compliance with the EPA Order, as described in the *Time-Critical Removal Action Completion Report for River System Phase II Nature and Extent of Ash Investigation* (Ref. 7.3.4). In addition to requirements of the orders, sampling was also used to guide dredging efforts, evaluate risks to human health or the environment, and characterize the ash and mixtures of ash with sediment material.

Samples were also taken between November 2009 and March 2010 to evaluate the distribution and thickness of released ash in accordance with the *Emory River Mile 0.0 to 1.0 Sediment Sampling Plan* (Ref. 6.3.5). The majority of the samples were taken from the lower reaches of the Emory River to characterize impacts due to legacy contamination from historical releases by DOE in the Clinch River. Samples were analyzed for metals, radiological constituents, pesticides, and polychlorinated biphenyls (PCBs). Results are shown in Table H-3 in Appendix H.

Concentrations of metals in released ash and sediment samples taken from the river system were slightly less than the concentrations in ash samples taken from the Dredge Cell and embayment. The lower concentrations are due to several factors, including mixing of ash and sediment in the river, and dilution of metal constituents into surface water, except mercury. Average concentrations of mercury were three times higher in river samples than in samples from the Dredge Cell and embayment. Mercury is a legacy constituent from historical releases in the Clinch River, and therefore its presence in river sediment is to be expected, especially in the lower reaches of the Emory River.

Levels of radiological constituents in river ash and sediment were slightly higher than those in ash taken from the Dredge Cell and embayment. Levels of cesium-137 were much higher (maximum 17.57 pCi/g) in the river ash and sediment; cesium-137 was detected in more than half of the river sediment samples, but was not detected in samples from the Dredge Cell and embayment. Cesium-137 is a legacy constituent from historical releases from DOE in the Clinch River, and therefore its presence in river sediment is to be expected, especially in the lower reaches of the Emory River.

Pesticides were not detected in the nine samples analyzed for pesticides. Only one PCB isomer was detected in a single sample, out of a total of 59 samples analyzed for PCBs, and at a concentration of only 65.6 µg/kg. Therefore, pesticides and PCBs are not of concern in ash and sediment from the river system.

3.2.5 Ash Waste Characterization

In accordance with Perry County Associates Landfill Permit (issued April 27, 2009), under ADEM landfill regulations, waste characterization samples were regularly collected. Ash samples were initially collected for waste characterization purposes in April 2009 as part of a test loading activitiy under the TDEC Commissioner's Order in accordance with the *Final Ash Disposal Sampling Plan, TVA Kingston Plant, Kingston, Tennessee* (Ref. 8.1.4).

During the time-critical removal action, ash waste characterization was conducted to satisfy requirements of the EPA Order and to meet waste acceptance criteria described in the landfill's permit. Prior to the first shipment of ash in June 2009, ash waste characterization samples were analyzed for radionuclides in accordance with the *Sampling Plan for Characterization of Radium-228 and Radium-226 In Recovered Fly Ash At the Tennessee Valley Authority Kingston Fossil Plant Kingston, Tennessee* (Ref. 11.2.6), as shown on Table H-4. The purpose of this sampling was to determine whether the average radioactivity of the material exceeded the state of Alabama threshold of 5 pCi/g for combined radium-226/228, which is the suggested limit for permitted disposal of Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) established by the Conference of Radiation Control Program Directors (CRCPD). The Alabama Department of Public Health, Office of Radiation Control has adopted CRCPD recommendations as a guidance document in its TENORM policy. If this threshold is exceeded, ADPH requires that the landfill obtain a radioactive material license. Results of this radium-226/228 sampling, shown on Table H-4 in Appendix H, indicated an average combined level of approximately 7 pCi/g and a maximum combined level of approximately 10 pCi/g, exceeding the suggested limit for TENORM. The

Arrowhead Landfill submitted a residual radioactivity (RESRAD) evaluation, *Assessment of the Radiological Dose Consequences of Disposing of Ash Waste Containing TENORM in a Municipal Solid Waste Landfill* (Ref. 8.2.4). The evaluation that showed worker exposure to ash (unloading trains/placing in cells, etc.) was safe to a level of approximately 44 pCi/g. ADPH therefore granted the Arrowhead Landfill an exemption from licensing requirements of Alabama Radiation Protection Rule 420-3-26.01(3)(a) and revised the allowable threshold for the Arrowhead Landfill to 10 pCi/g for combined radium-226/228 (Ref. 8.2.6). No ash sample exceeded this threshold.

Beginning June 19, 2009, routine waste characterization was performed in accordance with the *Sampling and Analysis Plan, Offsite Shipments of Ash for Remediation of the Tennessee Valley Authority Kingston Fossil Plant Ash Spill* (Ref. 8.1.1). On a biweekly basis, a representative composite sample was collected from ash staged for offsite disposal and analyzed for TCLP metals, total metals, and radiological constituents. In August, 2009, this plan was modified through discussions with the landfill to reduce the sampling frequency to once per month (Ref. 8.2.9).

As ash was loaded, TVA performed onsite paint filter tests to assess the absence of free liquids. Results of paint filter tests are reported as either “pass” or “fail”. All but one paint filter test result as measured at the Site passed the test (indicated free liquid was absent). The single failed test (free liquids present) was retested at the Arrowhead Landfill located in Uniontown, Alabama upon arrival and was found to have passed this retesting (no free liquids present).

Ash samples were collected for TCLP waste characterization from the Ball Field beginning on April 27, 2009 and continued through the completion of ash shipments to the disposal facility. EPA defines a material as a hazardous waste if it exhibits one of four characteristics: ignitability, corrosivity, reactivity, and toxicity (U.S. Code of Federal Regulations [CFR], Title 40, Part 261, Subpart C). Toxicity is determined by EPA through the TCLP laboratory procedure, which simulates the leaching of contaminated liquids from the waste. The TCLP helps identify wastes likely to leach concentrations of contaminants that may be harmful to human health or the environment. A total of 109 samples were tested for TCLP metals by TVA of the ash for waste characterization purposes as shown in Table H-4 in Appendix H.

Six of the eight RCRA metals analyzed for TCLP were detected. In each case, the maximum detected concentration in the TCLP leachate was less than its corresponding TCLP limit. Therefore, the concentrations of the TCLP metals, including arsenic, found in samples from the Site have been consistently below the threshold values that would categorize the ash as hazardous waste material under 40 CFR Part 261. Two waste characterization samples were analyzed for total metals, as shown on Table H-4. Results are comparable to those for ash samples from the Dredge Cell and embayment.

Ash waste characterization samples were also analyzed for radionuclides to determine whether man-made radionuclides from DOE legacy contamination, in particular cesium-137, were present in materials dredged from the river prior to disposal. Results, summarized in Table H-4, indicate that cesium-137 was not detected in the materials dredged.

3.3 SURFACE WATER MONITORING

In response to the release, TVA, TDEC and EPA Region 4 have collected surface water samples from the Emory, Clinch, and Tennessee Rivers since December 2008. EPA surface water monitoring was performed on split samples as a quality assurance procedure for comparison to TVA reported data. EPA’s Data Comparison Results for October 2009 through December 2010 are on the EPA website.

TVA has collected more than 2,500 surface water samples since the release, with TDEC independently collecting several hundred more. TVA conducted routine surface water monitoring at five locations on the Emory River (ERM 0.1, 1.75, 2.1, 4.0, and 12.2), four locations on the Clinch River (Clinch River Mile [CRM] 0.0, 2.0, 4.0, and 5.5), and two locations on the Tennessee River (TRM 563.5 and 568.5) (Figure 25). Location TRM 563.5 was only sampled if turbidity at CRM 0.0 was above 20 NTUs. These locations were selected to assess possible impacts of the ash release on water quality and to monitor ash movement associated with high river flows. Sampling locations encompassed approximately 14 miles of the river system, both upriver and downriver of the Site.

Immediately following the release, TVA performed sampling at these locations three days per week (Monday, Wednesday, and Friday). At the start of pilot dredging in March 2009, TVA continued sampling three days per week in accordance with the TDEC approved *Kingston Fossil Plant, Fly Ash Recovery Project, Sampling Plan for Phase I Dredging Operations*.(Ref. 11.2.2). Following the start of the time-critical removal action under the EPA Order, TVA reduced the frequency of sampling in August 2009 to two days per week (Monday and Friday) in accordance with the EPA OSC approved *Kingston Fossil Plant, Fly Ash Recovery Project, Sampling Plan for Phase I Dredging Operations* (Ref. 11.2.2).

TDEC has performed independent surface water sampling at these and other locations every Tuesday and Thursday since January 2009. In addition, both TVA and TDEC performed sampling in response to local rainfall (greater than 1.0 inch in 24 hours; currently >1.0 inch) or elevated flows (greater than 5,000 cfs) on the Emory River as measured at the USGS gauging station in Oakdale, Tennessee, in accordance with the EPA OSC approved SWMP (Ref. 17.6). Results of TDEC's surface water sampling are on the TDEC website.

TVA's samples have been analyzed for TSS and for total and dissolved forms of 24 different metals and metalloids. Field parameters (temperature, dissolved oxygen, pH, conductivity, and turbidity) have been measured at each location using a multi-analyte programmable data logger (Hydrolab®) or equivalent instrument. Figure 25 shows the locations of TVA's routine surface water sampling locations from December 2008 through May 2010.

The objective of the surface water monitoring was to determine whether there was any down-river migration of ash-related constituents that posed an imminent public health or environmental threat. The intakes for two municipal public drinking water treatment systems (Kingston and Rockwood) are downriver from the release area and were sampled by TVA daily between December 26, 2008 and January 6, 2009. TVA continued to reimburse the City of Kingston for daily sampling and analysis of raw and finished water throughout the time-critical removal action. TDEC performed weekly sampling and analysis of the raw and finished water at the Kingston and Rockwood water treatment plants between December 23, 2008 and December 14, 2009. In addition, TVA has sampled the water discharged from the Stilling Pond since the beginning of dredging (March 19, 2009), and has sampled the water flowing from the Swan Pond Embayment into the Emory River. Dredging operations in the Emory River and associated ash processing have been monitored multiple times per week to detect changes in surface water quality that might impact public health or the environment. During this period TVA installed and operated floating stations at strategic river locations with equipment to provide real-time information on water quality (Hydrolab®). One floating station was reconstructed with an automated sampler that can be remotely activated to collect rainfall event samples during periods of heavy rainfall and high Emory River flows. This automated sampler was modified at the request of the CAG to monitor and water quality during rainfall events and high water flows, and began operation in December 2009.

Sampling was performed during routine operation (non-rainfall events), following rainfall events, directly downriver of dredge plumes, in the Stilling Pond outfall, and in Swan Pond Embayment. These sampling activities are described in the following subsections. Trends in arsenic and selenium concentrations during the time-critical removal action are shown on Figures 26 and 27, respectively.

Surface water monitoring was conducted in accordance with the EPA OSC approved SWMP (TVA 2009u). This section is a summary evaluation of surface water monitoring data collected from September 11, 2009 through August 27, 2010 for the Emory, Clinch, and Tennessee Rivers fixed locations, Dredge Plume, and Swan Pond Embayment monitoring locations. This period was selected because it coincides with the beginning of method detection limit (MDL) reporting for analytical results and the completion of the dredging under the time-critical response action. The MDL as defined by 40 CFR Part 136, Appendix B does not take into account instrument blank or background effects and may be lower than is achievable. In addition, laboratories only determine the MDL on an annual basis and instrument maintenance issues may change the achievable MDL mid-year. Consequently, at the start of the time-critical removal action, TVA preferred the reporting limit (RL) as a more defensible number for reporting. In comparing data sets from different regulatory agencies (EPA and TDEC), it was found that other laboratories utilized the MDL as the limit on data reports. Consequently, to provide better data comparability TVA requested an achievable “project MDL” from its providing laboratories and moved away from RL reporting. TVA also obtained a dataset from TDEC’s independent surface water monitoring program and compared the results to the TVA dataset as a way to perform a general qualitative reliability evaluation of the TVA data. Overall, the results generally are consistent.

3.3.1 Routine (Non-Rainfall Event) Monitoring at Fixed Locations

Tables H-5 and H-6 in Appendix H summarize analytical results for Emory River surface water samples under routine sampling (non-rainfall events). Table H-5 summarizes those results at the Emory River reference background location (ERM 12.2); Table H-6 summarizes those results at downriver locations consisting of one location at the upper reach of the ash deposition (ERM 4.0), two locations in the immediate vicinity of the ash release (ERM 2.1 and 1.75), and one location at the mouth of the Emory River as it enters the Clinch River (ERM 0.1). Data summaries are included for the emergency response phase (December 22, 2008 to April 30, 2009) for reference. Data for the time critical removal action (May 1, 2009 to August 27, 2010) are also included in Tables H-5 and H-6 and are discussed in the following paragraphs.

During the time-critical removal action, dissolved arsenic in one downriver surface water sample (0.2% of the total samples) and total arsenic in four downriver surface water samples (0.8% of the total) exceeded the Tennessee Domestic Water Supply Standard (TDWS) and Tennessee Water Quality Criterion (TWQC) of 0.01 mg/L. These exceedances were in the vicinity of the ash release at ERM 2.1 and ERM 1.75. Dissolved copper exceeded the fish and aquatic life criterion in one sample (0.2% of the total) at ERM 1.75. Total lead exceeded its TDWS in two Emory River samples (0.4% of the total) at ERM 1.75. Thallium was detected in 51 samples (11% of the total), all of which exceeded its TWQC, which is lower than the laboratory detection limit.

Comparing downriver surface water concentrations (Table H-6) with reference background in the Emory River (Table H-5), indicates that maximum detected concentrations for some analytes are within the area of the release (ERM 2.1 or 1.75), suggesting that dredging operations or residual ash may have contributed to elevated concentrations of some metals in the river system. For example, the average arsenic concentration in downriver samples was nearly seven times higher than reference background. Similarly, total aluminum, copper, molybdenum, and vanadium concentrations were more than two times higher in downriver samples; there are no water quality criteria for these analytes for comparison.

Tables H-7 and H-8 in Appendix H summarize analytical results for Clinch River surface water samples under routine sampling (non-rainfall events). Table H-7 summarizes those results at the Clinch River reference background location (CRM 5.5); Table H-8 summarizes those results at downriver locations. During the time-critical removal action, there were no exceedances of the TWQC for arsenic in downriver samples collected in the Clinch River. Total lead exceeded the TDWS in one sample (0.3% of the total) at CRM 4.0. Dissolved mercury exceeded the TWQC in two downriver samples (0.5% of the total) at CRM 0.0, and total mercury in one downriver sample (0.3% of the total) at CRM 0.0. Thallium was detected in 17 samples from the Clinch River (5% of the total), all of which exceed the TWQC, which is lower than the laboratory detection limit.

Comparing downriver surface water concentrations (Table H-8) with reference background in the Clinch River (Table H-7), indicates little difference in concentrations. One notable exception is that the average arsenic concentration in downriver samples was twice the reference background. Similarly, the average concentration for total antimony was higher in downriver samples, although there is no water quality criterion for this analyte for comparison.

Table H-9 in Appendix H summarizes analytical results for Tennessee River surface water samples under routine sampling (non-rainfall events). In the Tennessee River, dissolved and total mercury exceeded the TWQC in one sample collected during the time-critical removal action (0.8% of the total number of samples) at TRM 568.5. Average concentrations in the Tennessee River were similar to upriver reference background concentrations in the Emory and Clinch River, suggesting that dredging operations or residual ash did not affect surface water quality in the Tennessee River.

Comparing downriver surface water concentrations (Tables H-6, H-8, and H-9) with reference background concentrations (Tables H-5 and H-7) for some analytes indicates potential impact in the area of the release, with declining concentrations downriver. For example, average arsenic concentrations downriver rise to nearly seven times background in the Emory River, but decline to near background concentrations in the Tennessee River. Similar trends can be seen for aluminum, copper, molybdenum, vanadium, and TSS. Other analytes do not show a significant trend.

3.3.2 Rainfall Event Monitoring at Fixed Locations

Rainfall event sampling was conducted in the Emory, Clinch, and Tennessee Rivers to monitor the potential migration of ash further downriver. Rainfall event sampling in the river system was triggered when cumulative rainfall exceeded 1.0 inch at the Kingston plant or if flow in the river exceeded 5,000 cfs as measured at the Oakdale, Tennessee, gauging station (about 20 miles upriver of the Site on the Emory River). The objective was to conduct sampling of the storm flow in the river within 24 hours of the rainfall event being triggered.

Manual monitoring of surface water quality following a rainfall event was performed at 10 fixed locations. In December 2009, TVA placed an automated Isco sampling platform at ERM 0.5 to monitor surface water quality during peak flow without endangering sampling personnel in accordance with the EPA OSC approved *Technical Memorandum KIF Rainfall Sampling Events* (Ref. 6.3.9). In a subsequent memorandum to TVA regarding *Clarification for KIF Rainfall Sampling Events* (Ref. 6.3.11), the EPA OSC clarified that this single Isco sampling platform was not meant to replace rainfall event sampling at other locations as detailed in the EPA OSC approved SWMP. Automated sampling at ERM 0.5 was put in place at the request of the CAG to maximize the opportunity to capture peak flow. Although routine river sampling coincided with 10 out of 13 rainfall events from November 2009 through April 2010, sampling during three rainfall events was not executed by TVA in accordance with the approved plans. The EPA OSC concluded that a significant loss of data did not occur that would have impaired decision making ability. Manual sampling of rainfall events resumed at the 10 fixed locations in June, following receipt of the EPA OSC memorandum.

Tables H-10 through H-14 in Appendix H summarizes analytical results for surface water samples collected during rainfall event monitoring. Results are generally similar to routine (non-rainfall event) sampling. No more than two exceedances of water quality criteria (less than 2% of the total number of samples) were recorded for arsenic, lead, and mercury in the various stretches of river, including reference background locations. All detections of thallium exceed the TWQC, which is lower than the detection limit.

In general, average metal concentrations in rainfall event samples were less than two times greater than non-rainfall event samples ; upriver concentrations increased during rainfall events as much as downriver samples. These results suggest that dredging operations and residual ash had minimal impact on water quality during rainfall events.

3.3.3 Hydrolab® Monitoring at Fixed Locations

Water quality parameters were measured at up to four locations in the Emory River (ERM 0.5, 2.0, 3.0, and 4.0), and at the Stilling Pond discharge, plant intake channel, and plant effluent channel using multi-analyte programmable data loggers (Hydrolab®). The water quality parameters measured included temperature, dissolved oxygen, saturated oxygen, pH, conductivity, and turbidity, with turbidity being the primary measurement of interest. The dissolved oxygen, saturated oxygen, pH, and conductivity measurements remained stable with only minor fluctuations since dredging began in March 2009. The water temperature gradually increased with the warmer weather in May through September 2009.

The difference in turbidity between points located upriver and downriver of dredging operations was targeted at less than 200 NTU for a rolling 24-hour period during dredging operations. This 200 NTU target was used by the EPA OSC as a performance criterion for evaluating dredging operations. Between March 20, 2009 and August 19, 2010 there were 214,903 turbidity data points recorded by remote instrumentation. Data were recorded at 15 minute intervals with an average of 415 data points per day collected. Over 4,000 (approximately 98%) of the data points were less than 200 NTU. The only values for individual readings that exceeded 200 NTU were due to high flow events (when no dredging was taking place) or they were due to maintenance issues with the instruments (see lessons learned in Section 8). The 200 NTU target was not exceeded during dredging activities.

3.3.4 Emory River Dredge Plume Monitoring

To monitor the effectiveness of best management practices (e.g., turbidity curtains) to reduce ash migration during dredging and to evaluate potential toxicity of re-suspended ash, TVA performed daily monitoring of dredge plumes in the Emory River. Field turbidity measurements were used to identify the more concentrated portions of dredge plumes for sample collection. These samples were obtained by first identifying the more turbid part of a visual dredge plume using hand-held Hydrolab® instruments, then collecting the samples from that location within the plume. Samples were analyzed for total and dissolved metals and TSS. The TSS average for all samples collected from dredge plumes was 99.26 mg/L; maximum measured TSS was 1840 mg/L.

Table H-15 in Appendix H summarizes analytical results for Emory River dredge plume sampling. Dredge plume samples collected during the dredging operations had one or more concentrations of antimony, arsenic, beryllium, copper, lead, mercury, nickel, selenium, or thallium that exceeded water quality criteria. Most notable of those are arsenic, lead, and thallium.

During the time-critical removal action, there were 147 exceedances (42% of the total number of samples) of the TDWS and TWQC for arsenic in samples collected from the dredge plumes. Antimony exceeded the TDWS in a single sample (0.3% of the total) and the TWQC in two samples (0.6% of the total).

Beryllium exceeded the TDWS in 14 samples (4% of the total); dissolved copper exceeded the Fish and Aquatic Life (F&AL) criteria in a single sample (0.3% of the total). Lead exceeded the TDWS in 115 samples (35% of the total). Dissolved mercury exceeded the TWQC in three samples (0.9% of the total); nickel exceeded the TDWS in a single sample (0.3% of the total); and selenium exceeded the F&AL in two samples (0.6% of the total). Thallium exceeded the TDWS in seven samples (2% of the total) and the TWQC in 109 samples (31% of the total).

Comparison of the maximum and average concentrations in surface water for dredge plume samples (Table H-15) and other Emory River samples (Tables H-4 and H-5) indicates distinct impacts of dredging operations. Average concentrations of several analytes (aluminum, arsenic, copper, and vanadium) were more than ten times higher in the dredge plume than in reference background, and more than five times higher than in other downriver (non-plume) Emory River samples. However, the results demonstrate that during dredging activities, ash-related constituents rapidly settled out of the water column or were rapidly diluted. Concentrations declined from the higher values in the dredge plume to locations downriver in the Emory, Clinch, and Tennessee Rivers, and were near reference background values in the Tennessee River.

Periodically (weekly, then biweekly), dredge plume samples were also collected for acute toxicity tests. Test results showed no difference in effect between the controls and the dredge plume samples. These results are discussed further in Section 3.6.2.3.

3.3.5 Stilling Pond Monitoring

Concurrent with the beginning of the pilot phase of dredging, on March 19, 2009, TVA began sampling the NPDES permitted outfall at the Stilling Pond discharge, KIF 001, daily to track effects of dredging to maiantain compliance with NPDES permit limits and apply appropriate controls when results approached permit limits. The Stilling Pond is the final solids settling location. KIF 001 is the final point of discharge for water from plant operations and dredging operations. Figure 16 shows the overall ash settling system and Figure 25 shows the location of the outfall 001 sample (AP_IMP001).

Table H-16 in Appendix H summarizes analytical results for the Stilling Pond sampling. During the time-critical removal action, there were 228 exceedances of the TDWS and TWQC for arsenic in samples collected from the Stilling Pond (86% of the total number of samples). Antimony exceeded the TDWS and the TWQC in three samples (60% of the total, since only five samples were analyzed for antimony). Total and dissolved mercury exceeded the TWQC in one (0.3%) and three (1% of the total) samples, respectively. Selenium exceeded the F&AL in 109 samples (41% of the total). Total and dissolved thallium were detected in 90 (34%) and 102 (38% of the total) samples, respectively, all detected concentrations exceed the TWQC, which is lower than the laboratory detection limit.

Average concentrations of antimony, arsenic, boron, molybdenum, selenium, and vanadium were 10 to 60 times higher than concentrations in Emory River reference background. These results indicate that the ash settling system, comprised of water treatment by gravity settling, discharges greater concentrations of these constituents in the permitted outfall than those measured in the river system.

3.3.6 Swan Pond Embayment Monitoring

Surface water sampling was conducted in the Swan Pond Embayment in accordance with the EPA OSC approved *Swan Pond Embayment Sampling Plan* (Ref. 6.3.4) to evaluate the quality and flow of the water entering the Emory River from the Swan Pond Embayment following the release. Samples are taken routinely from two stations: the discharge from the settling basins (and the clean water ditch just downstream of the settling basin discharge (Figure 25). Sampling of surface water in the clean water ditch and settling basin began on July 7, 2009. After two weeks of daily sample collection, sampling was reduced to two times a week and after a rainfall event of more than 0.5 inch rainfall in 24 hours.

Table H-17 in Appendix H summarizes analytical results for surface water samples collected from the Swan Pond Embayment clean water ditch and settling basins during routine sampling (non-rainfall events). During the time-critical removal action, there were 93 exceedances (73%) of the TDWS and TWQC for dissolved arsenic and 105 exceedances (82%) for total arsenic in samples collected from the clean water ditch and settling basin. Antimony exceeded the TDWS in 5 samples (4%) and the TWQC in 6 samples (5% of the total). Lead exceeded the TDWS in 14 samples (11% of the total). Selenium exceeded the F&AL in 39 samples (30% of the total). Total and dissolved thallium were detected in 51 (39%) and 30 (23%of the total) samples, respectively; all detected thallium concentrations exceed the TWQC. The maximum concentrations of most constituents were reported for samples from the settling basin discharge, prior to mixing with the clean water ditch.

Table H-18 in Appendix H summarizes analytical results for surface water samples collected from the Swan Pond Embayment clean water ditch and settling basins during rainfall event sampling. Results are similar to non-rainfall event sampling. During the time-critical removal action, there were 110 exceedances (79%) of the TDWS and TWQC for dissolved arsenic and 119 exceedances (86%) for total arsenic. Antimony exceeded the TDWS in 17 samples (12%) and TWQC in 20 samples (14% of the total), respectively. Total lead exceeded the TDWS in 24 samples (17% of the total). Selenium exceeded the F&AL in 95 samples (68% of the total) and the TDWS in one sample (0.7% of the total). Total and dissolved thallium were detected in 55 (40%) and 76 (55% of the total) samples, respectively, all detected thallium concentrations exceed the TWQC (55% of the total). The maximum concentrations of most constituents were reported for samples from the settling basin discharge, prior to mixing with the clean water ditch.

Comparison of rainfall event to routine (non-rainfall event) sampling data indicates that average metal concentrations in rainfall event samples were less than three time greater than non-rainfall event samples. Similar to the river sampling, these results suggest that water quality in the Swan Pond Embayment was impacted as much during rainfall events as during non-rainfall events.

Comparison of samples from the embayment to Emory River reference background indicate average concentrations of several analytes (aluminum, arsenic, boron, copper, molybdenum, and vanadium) were more than ten times as high in the embayment as in reference background. Of these, aluminum, arsenic, copper, and vanadium are also higher than reference background in Emory River dredge plume samples. Boron and molybdenum are also higher than reference background in the Stilling Pond samples (where the water is in direct contact with ash). These results indicate impacts of runoff from the ash in the embayment.

3.3.7 East Embayment (Swan Pond Slough) Monitoring

Surface water sampling was conducted in the East Embayment (Swan Pond Slough) to evaluate the quality and flow of the water entering the Emory River from the East Embayment following the release. Sampling of surface water in the East Embayment began on June 11, 2009 and continued until July 1, 2009 while the clean water ditch for the East Embayment was constructed. Samples collected from this location in June 2009 were analyzed for metals and TSS. Sampling of the East Embayment clean water ditch was conducted between July 23, 2009 and November 24, 2009. Samples collected from this location between July and November 2009 were analyzed for metals, total dissolved solids, TSS, alkalinity, hardness, and pH. Sampling occurred weekly and after rainfall events (greater than 0.5 inches of rain) until the ash was removed from the embayment.

Table H-19 summarizes analytical results for surface water samples collected from the East Embayment. During the time-critical removal action, there were 12 exceedances (50% of the total number of samples) of the TDWS and TWQC for dissolved arsenic and 18 exceedances (75% of the total) for total arsenic. Total selenium exceeded the F&AL in six samples (25% of the total). Total and dissolved thallium were detected in four samples (17% of the total); the detected thallium concentrations exceed the TWQC.

Comparison of samples from the East Embayment to Emory River reference background indicate average concentrations of several analytes were more than ten times as high in the East Embayment as in reference background. Similar to results for the Swan Pond Embayment, higher concentrations of arsenic, boron, molybdenum, selenium, and vanadium indicate impacts of runoff from the ash in the embayment.

3.3.8 EPA Surface Water Monitoring

During the time-critical removal action, EPA's START contractor Tetra Tech conducted water quality monitoring on the Emory River (Ref. 6.5). The objective of the water quality monitoring was to monitor the effectiveness of the turbidity curtains in preventing the migration of ash during dredging operations conducted by TVA in the Emory River. In addition, Tetra Tech collected coordinates for the water quality monitoring locations as well as the locations of the turbidity curtains and collection booms on the Emory River to document the placement of the booms in reference to dredging operations.

Water quality measurements focused primarily on turbidity, but also included temperature, specific conductivity, dissolved oxygen, pH, and oxidation reduction potential (ORP). A Site-specific screening level of 200 NTU was used to identify potentially elevated turbidity readings; this level was obtained from the *Revised Emory River Dredging Plan* (Ref. 11.2.7). Water quality measurements at each location were obtained using the YSI 6920 Sonde and 650 Handheld Display System, and were collected from the surface of the water and from depth intervals of five feet until the river bed was reached. If the river bed was contacted at an interval of less than five feet, no reading was collected from the bottom due to the potential of sediment disturbance that could cause a falsely elevated reading.

From September 2009 through August 2010, Tetra Tech performed water quality monitoring with assistance from the USCG GST and TVA personnel. Water quality monitoring was performed at seven locations on the Emory River ranging from ERM 0 to ERM 4.2 outside of the turbidity curtains and dredging operations; dredge plume monitoring inside the turbidity curtains was performed by TVA personnel. From April 16, 2010 to June 2, 2010, an additional water quality monitoring location was established at ERM 6 to monitor dredging operations that had expanded upriver to ERM 5.75.

Tetra Tech submitted daily work order reports summarizing the water quality monitoring locations to the EPA OSC, including figures illustrating the monitoring locations. The daily work order reports are available on the EPA website and included in Ref 7.7. During water quality monitoring activities, START Tetra Tech did not identify any turbidity readings above 200 NTU.

During time-critical removal actions, Tetra Tech was tasked by EPA to periodically collect split surface water samples with TVA during sampling events to provide a comparison for TVA's laboratory analytical results. Tetra Tech and TVA performed river and embayment surface water split sampling from October 2009 to August 2010 for the following events:

- Routine split sampling on the Emory, Clinch, and Tennessee Rivers;
- Routine split sampling in the Swan Pond Embayment;
- Rain event split sampling on the Emory, Clinch, and Tennessee Rivers; and
- Rain event split sampling in the Swan Pond Embayment.

Split surface water samples were collected by TVA, with Tetra Tech present, using a RolaTec peristaltic pump. Routine and rain event split surface water samples were collected at the same locations and at the same time as TVA samples. Sampling locations were recorded in the field logbook and coordinates for each location were obtained using a Trimble GeoXT unit. During sampling activities, water quality monitoring was also conducted at each river sampling location by Tetra Tech and TVA. Monitoring focused primarily on turbidity, but also included temperature, specific conductivity, dissolved oxygen, pH, and ORP.

Split surface water samples obtained by Tetra Tech were submitted to Analytical Environmental Services (AES), Inc. (Atlanta, Georgia) for the following analyses:

- River samples were analyzed for TSS, TDS, pH, alkalinity, hardness, dissolved metals (including mercury and strontium), and total metals (including mercury and strontium).
- Embayment samples were analyzed for TSS, dissolved metals (including mercury and strontium), and total metals (including mercury and strontium).

Validated analytical results were compared to the TWQC as outlined in the Rules of Tennessee Department of Environment and Conservation, Tennessee Water Quality Control Board, Division of Water Pollution Control, Chapter 1200-4-3, General Water Quality Criteria (June 2008). Daily work order reports were prepared to summarize sampling activities and analytical results, and were submitted to the EPA OSC. In addition, monthly Data Comparison Reports were prepared to evaluate the comparability of the results obtained by Tetra Tech to those obtained by TVA for arsenic and selenium (Ref. 6.6). The criteria used for the data comparisons are discussed in the EPA *Contract Laboratory Program (CLP) National Functional Guidelines (NFG) for Inorganic Data Review* (October 2004). However, these criteria apply to duplicate/replicate values from a single laboratory. Because the values compared in the data comparison reports came from two different laboratories, the guidance used is considered a conservative approach, and slightly relaxed criteria may be more appropriate. A brief overview of the findings of the data comparison reports for October 2009 through August 2010, which were submitted to OSC Francendese under separate cover, is provided below:

- A total of 348 split surface water samples were collected.
- A total of 1,392 data comparisons were made and 1,377, or 98.9 percent of the total, resulted in the same conclusion when compared to the TWQC.
- A total of 71 split surface water samples, or 20.4 percent of the total, indicated concentrations of arsenic and/or selenium that exceeded the TWQC. Of the total of 71 split surface water samples that exceeded the TWQC, 60 samples were collected from the embayment locations and 11 samples were collected from the river locations, including the plant effluent and the dredge plume.

3.4 AIR MONITORING

Ambient air monitoring was conducted in accordance with the EPA OSC approved *Site Dust Control and Ambient Air Monitoring Plan* (AAMP) (Ref. 6.2.1). This section is a summary evaluation of ambient air monitoring data collected from May 1, 2009, through July 31, 2010, for the time-critical removal action. The purpose of the ambient air monitoring was to assess impact to local air quality at and near the Site during implementation of the removal action. The resuspension of inhalable and respirable fly ash particles by strong winds was of greatest concern. EPA has established National Ambient Air Quality Standards (NAAQS) that define levels of air quality that EPA deems protective of public health. The NAAQS were used as performance criteria for evaluation of air quality at the Site, although they are not relevant for other regulatory purposes (e.g., to determine attainment status).

Air quality in the vicinity of the Site was monitored in real time using fixed air monitoring stations and mobile air monitoring instruments. Locations of fixed air monitoring stations are shown on Figure 28. Air sampling data were compared to the relevant NAAQS for particulate matter using data for PM2.5 and PM10 on a time-weighted, 24-hour average basis. Airborne releases onsite or offsite were identified so that onsite activities or dust suppression measures could be modified to prevent recurrence.

In addition to particulate air concentrations (PM2.5 and PM10), air samples collected from the fixed-station monitoring locations were analyzed for metals and crystalline silica by laboratory analyses of the sample filters. High volume samplers were appropriate for lowering the laboratory detection limit to measure other metal constituents in airborne dust and were used at one location (PS07) for this purpose. When sample filters accumulated sufficient quantities of dust such that other metal constituents may have been detectable, they were analyzed for these other metal constituents as well. Action levels (Table 3-4) were determined using existing standards where possible, or were calculated from risk-based screening levels or other appropriate guidelines, as described in the AAMP.

Data were made available to regulatory agencies and the public as they became available and underwent quality assurance review. Trends of PM2.5, PM10, and arsenic were routinely posted on the TVA website. Trends for PM2.4 and PM10 at station PS07 are shown on Figures 29 and 30.

Table 3-4. Action Levels

Analyte	Offsite-Specific Action Level	Source
Airborne Dust	Visible Dust	TDEC Chapter 1200-3-8
Particulate PM2.5 (24-hour average)	26 μg/m^3	75% of NAAQS
Particulate PM10 (24-hour average)	112 μg/m^3	75% of NAAQS
Arsenic (24-hour average)	20 ng/m^3	ATSDR, 2007
Crystalline Silica (24-hour average)	10 μg/m^3	ACGIH TLV Divided by 420

Note: For definitions, see the List of Acronyms.

3.4.1 Fixed-Station Filter-Based Monitoring

PM2.5 was monitored at five fixed monitoring locations at the perimeter of the Site using filter-based sampling systems. PM10 was monitored at two fixed monitoring stations. The monitors in the prevailing wind direction (PS6, PS07, and PS08) were sampled every third day; the remaining monitors were sampled every sixth day. Samples were analyzed for particulate matter; samples from one of the five stations (PS07) were also analyzed for metals, and silica for comparison with the action levels. Prior to the ash release, TDEC had established a monitoring station approximately 2.5 miles northwest of the Kingston plant at Harriman High School. TVA augmented the equipment at that location. Data from the Harriman High School monitoring station were used as an indicator of background levels. Fixed station PM2.5 and PM10 monitoring was transitioned to continuous real-time monitoring at the end of the time-critical removal action.

Table H-20 in Appendix H summarizes analytical results for air samples collected from the five fixed-station monitoring sites using filter-based monitors. Samples were analyzed using a Federal Reference Method (FRM), a filter-based determination where a sample is collected over a 24-hour period and the filter weighed at an offsite lab. No NAAQS or risk-based limits were exceeded during this portion of the time-critical removal action. Regional air quality conditions triggered Site-specific action levels for PM2.5 to be exceeded on five occasions. Monitoring showed that the Site did not contribute to local airborne PM2.5 for those exceedances, because regional air quality levels of particulates were also high during those times.

3.4.2 Fixed-Station Real-Time Monitoring

TVA obtained real-time data from fixed station instrumentation that provided an immediate indication of the presence of airborne particulates at the perimeter of the Site at a location in the direction of the prevailing winds from the Site. TDEC operated a continuous real-time PM10 monitoring instrument at fixed station PS07 during the time-critical removal action. TVA added one continuous real-time PM2.5 monitoring instrument at PS07 in mid-August 2009. TVA added a second real-time PM2.5 monitoring instrument at PS13 after April 26, 2010 to monitor ash consolidation conducted as part of transition activities in the North Embayment (Berkshire Slough). This station was authorized on April 8, 2010 by the EPA OSC approval of a *Technical Memorandum, Change in Location of Air Monitoring Stations* (Ref. 6.2.3). The change was further documented in the EPA OSC approved *North Embayment Ash Consolidation Work Plan* (Ref. 19.1) and later in an approved revision to the AMP for the non-time-critical removal action.

During the time-critical removal action, fixed station real-time monitoring was performed using a tapered element oscillating microbalance (TEOM) instrument manufactured by Thermo Scientific. During the transition to the non-time-critical removal action, The TEOM instrument at PS07 was replaced with a beta attenuation monitor (BAM) manufactured by Met One Instruments,

Table H-20 summarizes results for PM2.5 from the fixed-stations using a continuous particulate monitor. Real-time measurements were made every hour, reported at the end of the hour. Samples were analyzed using a Federal Equivalent Method (FEM), a filter-based method where sampling is continuous and the filter is evaluated within the machine hourly and reported by telemetry on an hourly basis. Although hourly measurements are not valid for comparison to NAAQS or project action levels, they were most useful in providing real-time information to dust control crews. No NAAQS or risk-based limits were exceeded nor were Site-specific action levels triggered during this portion of the time-critical removal action for fixed station real-time monitoring.

3.4.3 Mobile Real-Time Monitoring

TVA implemented real-time mobile monitoring for PM10 at the Site perimeter and in the community 24 hours/day, 7 days per week using portable instruments. Measurements were instantaneous and significantly influenced by immediate short term localized conditions associated with routine community activities. Mobile monitoring was discontinued as fixed station particulate monitoring was transitioned to continuous real-time monitoring at the end of the time-critical removal action. The mobile instruments were also used as an investigative tool if visible dust was identified at the Exclusion Zone boundary that exceeded TDEC fugitive emission limits, or if the average of the real-time PM2.5 or PM10 values in the previous 24 hours exceeded 75% of the NAAQS.

Table H-20 summarizes results for PM10 monitoring using mobile real-time monitors. Mobile measurements were instantaneous (less than one minute in duration) approximations of PM10 by an unqualified method, and are considered “worst case” indicators of localized conditions that are not representative of air quality at the Site. Mobile measurements were made every day (24 hours/day) except during rainfall events. A total of more than 150,000 measurements were recorded. Although instantaneous measurements as high as 1,430 $\mu g/m^3$ were recorded, no 24-hour average concentration was found to exceed Site-specific action levels. Hourly measurements are not valid for comparison to NAAQS or Site-specific action levels, but they were useful in providing real-time information to dust control crews.

In addition, industrial hygiene monitoring was conducted for the Site to determine whether specific work activities would result in airborne concentrations exceeding applicable exposure limits. Results of the industrial hygiene monitoring are discussed in Section 4.3.

3.4.4 EPA Air Audits

The EPA Region 4 SESD performed six audits of the Site air monitoring program during the time-critical removal action (through December 2010). The EPA audit reports and TVA responses are included in Ref. 6.4. These audits and key findings and recommendations included the following:

- June 2009 air audit: EPA recommended installation of a continuous PM2.5 monitoring location at PS07, and recommended an expanded metal analyte list to match TDEC's list.
- November 2009 air audit: EPA recommended submittal of air data to the EPA AQS database.
- January 2010 multimedia audit: EPA identified significant issues for PM 2.5 and PM 10 filter-based monitoring data, and recommended corrective action, as described below. No significant issues were identified for surface water, sediment, ash, or biota tissue.
- March 2010 air audit: EPA agreed that air sampling location PS06 be moved to the northern part of the North Embayment to better monitor planned ash removal there. EPA recommended that TVA transition to continuous PM2.5 monitors and investigate use of other laboratories for metal analysis.
- June 2010 air audit: EPA recommended that TVA improve the upload of data to AQS.
- October 2010 air audit: EPA agreed that TVA report air data as "not blank corrected" (per EPA policy), but provide a statement explaining blank correction on the TVA website. EPA also recommended that TVA update its QAPP to adequately document the laboratory MDLs for metals analysis of high volume filters.

Problems with the air monitoring data were identified as a result of the January 2010 air audit by EPA Region 4 SESD. Between September and December 2009, the PM2.5 air monitoring data generated by TVA's contracted laboratory was deemed unusable because both the incorrect analytical method was used and the method that was used by the contract laboratory had inadequate controls. TVA self-discovered this error and reported it to the EPA OSC; the incorrect method was not discovered sooner due to the backlog in validation packages. TVA's policy of 100% validation of data is likely to have contributed to this delay. The laboratory facility performing the analyses was unable to control relative humidity within the tight limits required in the EPA reference methods, as described in the *Quality Assurance Handbook for Air Pollution Measurements* (Ref. 6.1.3). In January 2010, the laboratory testing was transferred to a new contracted laboratory, Inter-Mountain Laboratories, which serves as the referee lab for the EPA particulate methods. Validation procedures were also changed to prevent extensive backlog in air data processing.

The EPA OSC presented a *Time Critical Removal Action Update* at a public meeting in Kingston, Tennessee, on January 26, 2010 (Ref. 3.5.1). The EPA OSC presented the weight of evidence supporting the EPA's conclusion that the public was not put at risk during this period. The redundant nature of the air monitoring system coupled with prevailing environmental conditions supported EPA's confidence. This weight of evidence included the following:

- The continuous air monitoring station at PS07 captured the worst case air monitoring conditions. Concentrations at PS07 were far below the NAAQS. Months of good quality data at PS07 demonstrated that the continuous air monitoring results are excellent predictors of air quality surrounding the Site.

- Thousands of mobile PM10 readings had been taken during this time frame that supported this conclusion.

- Industrial hygiene samples had been taken during this time frame within the exclusion zone that also supported this conclusion,

- During this time period it rained 40% of the time, which would limit particulates in the air.

The redundant nature of the air monitoring system provided other sources of data, including stationary continuous particulate monitors, mobile hand-held measurements, and locations throughout the local community, were used to demonstrate that there was no potential health risk to the public during this time frame. The rejected air data are maintained in the project archives with appropriate qualifiers.

Corrective actions were ordered by the EPA OSC in a memorandum to TVA *Evaluation of the Perimeter Air Monitoring Strategy and Identification of Corrective Actions at the TVA Kingston Fly Ash Release Time-Critical Removal Action* (Ref. 6.2.2). These corrective actions included the following:

- The EPA OSC required TVA to prepare an investigative report of the laboratory analytical problem

- EPA audit staff participated in TVA’s weekly QA conference calls with its analytical laboratories.

- EPA audit staff conducted audits of TVA contract laboratories on a periodic basis.

- EPA continued to conduct periodic independent sampling and performance audits of TVA’s air monitoring network.

- The EPA OSC required TVA to submit a *Corrective Action Plan* and schedule for accelerating the validation of raw data in order that it can be released for review on a more timely basis.

- The EPA OSC required TVA to submit a *Corrective Action Plan* for upgrading its perimeter stations to include additional continuous monitors.

- The EPA OSC noted that TVA had already replaced the laboratory conducting filter-based particulate monitoring.

Corrective actions were subsequently implemented in accordance with the EPA OSC approved *Corrective Action Plan for January 2010 Air Audit* (Ref. 6.2.4). A root cause analysis was conducted in January 2010 and included as Attachment 1 to the *Corrective Action Plan*. Failure of the laboratory analytical process increased scrutiny of the monitoring program with respect to its scope and objectives. As a result, in July 2010, the monitoring strategy was transitioned to one based on the use of continuous FEM analyzers. These instruments provide real-time results relevant to the Site dust control program, while removing several sources of potential difficulties in meeting quality control requirements in the reference methods (in particular the humidity control requirement). Implementing the network of FEM analyzers during the non-time-critical removal action will improve the reliability of the monitoring, maintain high levels of accuracy, and reduce monitoring costs.

3.5 GROUNDWATER MONITORING

Compliance monitoring of the Dredge Cell and Ash Pond area is being conducted in accordance with its operating permit No. IDL 73-0094, issued by TDEC on September 12, 2006. and the TDEC approved work plan *Ash Processing Area Construction and Operation Plan*. (Ref. 10.1.1). As a permitted industrial waste landfill, the Dredge Cell is subject to TDEC Rule 1200-01-07 for Solid Waste Processing and Disposal. The sampling and analysis methods, suite of analysis, and frequencies of groundwater sampling were determined by TDEC and EPA groundwater sampling protocol. Groundwater monitoring reports were submitted to TDEC and EPA quarterly..

Locations of groundwater monitoring wells are shown on Figure 31. Historically, unfiltered groundwater samples have been collected semiannually from at least four monitoring wells associated with the Dredge Cell, and analyzed for the 17 inorganic constituents listed in Appendix I of the TDEC Rule 1200-1-7-.04. Well KIF-22 has historically been sampled only for general water chemistry (e.g., field parameters, nitrogen compounds, and organic carbon) and water levels. Groundwater samples were not analyzed for radionuclides. Two of these monitoring wells (4B and 16A) were destroyed in the ash release. In addition, a new well (6AR) was installed to replace well 6A, which was damaged by equipment. The three remaining wells (6-AR, 13B, and 22) were sampled quarterly (Table 3-5). Three new wells (AD-1, AD-2, and AD-3) were also installed in the Ball Field area from March through May 2009, as documented in the *Ash Processing Area Construction and Operation Plan* (Ref. 10.1.1). To provide the non-time critical removal action with a more robust database for decision making, in August, 2009, The EPA OSC directed that the sampling frequency of wells AD-1, AD-2, AD-3 and 13B be increased to once monthly and that sampling adhere to EPA guidance on groundwater sampling using low-flow sampling techniques. Consequently these wells were sampled monthly from September 2009 to August 2010. As a result, groundwater monitoring of the Dredge Cell and the Ball Field area was accomplished through a network of six wells (Figure 31). Wells 6-AR, 22, AD-1, AD-2, and AD-3 are shallow groundwater wells. Well 13B was the only bedrock well present during the time-critical removal action; Well 13B was destroyed by construction equipment in January 2010 and has been abandoned.

Table 3-5. Groundwater Sampling Events

Sampling Event	Monitoring Well Identification					
	13B	22	6A, 6AR	AD1	AD2	AD3
01/02/2009[a]	X	X				
06/10/2009 - 06/11/2009	X	X	X	X	X	X
07/23/2009					X	
09/14/2009 - 09/15/2009	X	X	X	X	X	X
10/13/2009 -10/19/2009	X			X	X	X
11/16/2009 - 11/17/2009	X			X	X	X
12/14/2009 - 12/17/2009	X	X	X	X	X	X
01/11/2010 - 01/13/2010				X	X	X
02/16/2010 - 02/17/2010				X	X	X
03/08/2010 - 03/11/2010		X	X	X	X	X
04/12/2010 - 4/19/2010		X	X	X	X	X
05/10/2010 - 05/11/2010				X	X	X
06/14/2010 - 06/16/2010		X	X	X	X	X
07/12/2010 - 07/13/2010				X	X	X

Notes:
X indicates well sampled during this event
[a] Sampling in January 2009 was prior to the time-critical removal action.

Groundwater data are summarized in Table H-21 in Appendix H. Concentrations of each metal analyte are compared to its corresponding MCL for those analytes where MCLs are available, per TDEC Water Quality Criteria for Domestic Water Supplies, Rule 1200-4-3.03(1)(j). Results for the single bedrock monitoring well 13B show that no analyte exceeded its MCL. Results for shallow groundwater monitoring wells show that only arsenic exceeded its MCL. Arsenic exceedances of the MCL are restricted to three results (6% of the total 51 samples) and for just one well, AD2, which is downgradient of the Ball Field. No other metal was detected above its MCL in any well. Concentrations of aluminum, iron, and manganese in both bedrock and shallow groundwater samples have exceeded the secondary MCLs for these constituents. Concentrations of sulfate and TDS exceeded the secondary MCLs for these constituents in shallow groundwater samples only. Secondary MCLs are not health based but rather are based on aesthetics (e.g., taste, color, and odor).

3.6 BIOTA MONITORING

3.6.1 Fish Sampling

For decades, TVA and other federal and state agencies have cooperated in studies to assess the health of fish and the accumulation of metals, pesticides, and PCBs in fish tissue. Earlier studies of fish from the Clinch River and the Watts Bar Reservoir focused on mercury from the DOE's Oak Ridge Reservation resulting from Manhattan Project activities.

Following the release, these cooperative studies continued with additional emphasis on the presence of ash-related metals including arsenic, selenium, and mercury. Limited arsenic and selenium data are available from earlier studies. Between January and April 2009, TVA and the federal and state agencies collaborated to collect data to serve as a baseline for comparison with future results in order to detect and evaluate potential trends, long-term bioaccumulation, and impacts on the fish population. The results from these initial studies are considered to represent pre-existing and current conditions.

This section summarizes the fish collection and analysis activities conducted in response to the release. Figure 32 depicts fish sampling locations including routine sampling and sampling conducted in response to the release. Fish samples were sent to one of several laboratories for analysis, including TVA's contract laboratory (Pace Analytical Laboratory), TVA's Central Laboratory, ORNL contract laboratory (ALS), or the Tennessee State Laboratory. Most fish data were reported on a wet weight basis, consistent with fish data reported in most literature studies and data reported by EPA and state agencies. However, because selenium seasonal monitoring levels for the protection of fish as recommended in the *Draft Aquatic Life Water Quality Criteria for Selenium* (Ref. 6.3.1) are based on dry weight concentrations in whole fish, the Pace fish data were reported on a dry weight basis.

3.6.1.1 Summary of Results of 2009 Fish Sampling

The following fish sampling events were conducted in the spring of 2009.

- Baseline post-spill sampling of fish from locations on the Emory and Clinch Rivers was carried out in January and February 2009 and supplemented by sampling at ERM 8.0 in April 2009 to document concentrations of metals in fish tissue and fish health. The data were used to evaluate baseline bioaccumulation levels and potential human health impacts due to fish consumption immediately after the release, when little bioaccumulation would have occurred. TVA, TDEC, TWRA, and ORNL collaborated in the collection of 53 largemouth bass, channel catfish, blue catfish, and spotted bass for metals analysis of muscle (filet) tissue. The 53 fish were individually processed and homogenized at TDEC.

- Four redear sunfish and four largemouth bass were collected in March 2009 in response to TDEC and U.S. Congressional subcommittee inquiries. These samples were used to provide a quick assessment of metals bioaccumulation in local fish species. The individual fish were combined and homogenized as whole fish composite samples by species. These two composite samples were analyzed by TDEC and Pace.

- Additional largemouth bass, bluegill, and white crappie were collected during April and May 2009 to assess the effects of exposure to ash on fish health and reproduction. The fish were examined for several indicators of reproductive health, including condition of reproductive organs, clutch size and quality of eggs, and hormone levels. As part of this effort, 20 black crappie were analyzed for total metals. Five whole fish from each of four locations on the Clinch and Emory Rivers (including locations immediately adjacent to and downriver from the release) were homogenized at the Tennessee State Laboratory and split among TVA, TDEC, TWRA, and ORNL for separate analyses.

- Several species of fish samples were collected from the Stilling Pond in April 2009, at the request of EPA, TDEC, USFWS, and TWRA. The Stilling Pond, which is a part of the ash processing system for the Kingston plant, is not a natural habitat and is not conducive to sustaining fish and aquatic life due to exposure to metals and lack of food. EPA, TDEC, USFWS, and TWRA acknowledge that these fish are not representative of fish from the Emory River, but represent an extreme scenario for exposure of fish to contaminants in coal ash.

A preliminary evaluation of fish populations in the Stilling Pond was performed on April 7, 2009 followed by collection of carp, bluegill, and green sunfish on April 9, 2009. The fish collected were visually evaluated for abnormalities and overall condition. A few fish were sent to the University of Tennessee Veterinary School for computerized tomography scans to examine skeletal deformities. Samples of blood were drawn from some fish and analyzed for enzyme levels, which may be expected to increase when fish are exposed to metals. Other fish were dissected to remove internal organs, weighed, and examined. Samples of organs were sent to laboratories for metals analysis; the remaining portions of organs were prepared for microscopic examination for abnormalities. Five bluegill and five carp were fileted to analyze muscle tissue for metals, while four bluegill and four carp were analyzed as whole fish. Thirty small bluegills were divided into three sets of ten fish each that were analyzed as composite whole fish samples.

- Fish from the Swan Pond East Embayment were captured for relocation to the Emory River in June 2009. The capture and transfer was conducted to prevent a die-off of fish in the embayment due to reduced oxygen levels and increasing water temperature in the stagnant water body. Ninety-six fish were collected. Largemouth bass, bluegill, gizzard shad, and redear sunfish were retained for sampling and analysis for total metals to assess the uptake of heavy metals in whole body fish. Five individual largemouth bass samples were analyzed. The remaining fish were analyzed as composite whole fish samples, including six bluegill composite samples, two gizzard shad composite samples and two redear sunfish composite samples.

- TVA, TDEC, TWRA and ORNL collaborated in the collection of fish for bioaccumulation and health study in the autumn of 2009. During the collection, each fish was visually inspected for general health, including inspecting for deformities, sores or abrasions; the condition of internal organs; and whether the fish appear emaciated. A variety of different measurements were used to assess the health of these fish. These include biochemical indicators (e.g., blood chemistry), physical condition, along with analyzing tissues and organs for metals content. Fish sampled include largemouth bass, channel catfish, blue catfish, redear sunfish, crappie, and bluegill.

Analytical results for 2009 fish fillet samples are included in Tables H-22 and H-23 in Appendix H, with results reported in four categories: bass, bluegill/sunfish, catfish, and crappie. Fish fillet data are reported here because of their relevance to human health impacts due to fish consumption. Data for whole body fish and fish organs are archived in the Site EQuIS database, and will be used in evaluating ecological impacts during the non-time-critical removal action as part of the ecological risk assessment for the river system. Data on fish population surveys, fish health, and reproduction are also archived in Site records and will be evaluated during the non-time-critical removal action.

Analytical results were compared to human health screening values derived following EPA *Risk Assessment Guidance for Superfund, Volume (Part B)*, (Ref. 20.2.1), and obtained from the Oak Ridge National Laboratory Risk Assessment Information System (http://rais.ornl.gov). For some analytes, notably arsenic, the screening value may be lower than the laboratory detection limit. In the Emory River, a total of 90 fish samples were analyzed. Arsenic exceeded its screening value in 55 bass, bluegill/sunfish, and crappie samples. According to EPA and the ATSDR, arsenic in fish is mostly in an organic form which is considered to be relatively nontoxic and not a threat to human health. Inorganic arsenic is known to cause cancer in humans, but represents only a small percentage of the total arsenic in fish. TVA will be conducting additional analytical testing during the non-time-critical removal action for the river system to evaluate speciation of arsenic in fish tissues to aid in determining the potential for toxic effects in humans who may consume fish.

In the Emory River (Table H-22), concentrations of antimony exceeded its screening value in 8 samples of bass and catfish (9% of the total 90 fish samples). Cadmium exceeded its screening value in only 2 bass samples (2% of the total). Mercury exceeded its screening value in 70 samples (78% of the total) and in all fish categories. Selenium exceeded its screening value in 19 bass and bluegill/sunfish samples

(21% of the total). Thallium exceeded its screening value in five bluegill/sunfish and crappie samples (6% of the total).

In the Clinch River (Table H-23), a total of 88 fish samples were analyzed. Concentrations of metals in fish in the Clinch River were similar to those in the Emory River. Antimony exceeded its screening value in 10 samples of bass and catfish (11% of the total). Arsenic exceeded its screening value in 22 samples (25% of the total) and in all fish categories. Cadmium exceeded its screening value in only one bass sample (1% of the total). Mercury exceeded its screening value in 62 samples (70% of the total) and in all fish categories. Selenium exceeded its screening value in 14 bass and bluegill/sunfish samples (16% of the total). Thallium exceeded its screening value in 6 bass and crappie samples (7% of the total).

3.6.1.2 <u>Summary of Results of 2010 Fish Sampling</u>

During the time-critical removal action, one fish sampling event was conducted. TVA, TDEC, TWRA and ORNL collaborated in the collection of fish for bioaccumulation, health, and reproduction studies in the spring of 2010. During the collection, each fish was visually inspected for general health, including inspecting for deformities, sores or abrasions; the condition of internal organs; and whether the fish appear emaciated. The fish were analyzed for several indicators of reproductive health, including condition of reproductive organs, clutch size and quality of eggs, and hormone levels. A variety of different measurements were used to assess the health of these fish. These include biochemical indicators (e.g., blood chemistry), physical condition, and reproductive health, along with analyzing tissues and organs for metals content. Fish sampled include largemouth bass, channel catfish, blue catfish, redear sunfish, bluegill, and crappie.

Analytical results for 2010 fish fillet samples are included in Tables H-24 and H-25 in Appendix H. In the Emory River (Table H-24), a total of 100 fish samples were analyzed. Arsenic exceeded its screening value in 76 samples (76% of the total) and in all fish categories, but as discussed above is present in its relatively nontoxic organic form. Copper exceeded its screening value in two bass and catfish samples (2% of the total). Mercury exceeded its screening value in 85 samples (85% of the total) and in all fish categories. Selenium exceeded its screening value in 26 bass, bluegill/sunfish and crappie samples (26% of the total). Thallium exceeded its screening value in 22 bass, bluegill/sunfish, and crappie samples (22% of the total).

In the Clinch River (Table H-25), a total of 96 fish samples were analyzed. As with the 2009 data, concentrations of metals in fish in the Clinch River were similar to those in the Emory River. Arsenic exceeded its screening value in 87 samples (91% of the total) and in all fish categories. Copper exceeded its screening value in one catfish sample (1% of the total). Mercury exceeded its screening value in 80 samples 94% of the total) and in all fish categories. Selenium exceeded its screening value in 26 bass and bluegill/sunfish samples (27% of the total). Thallium exceeded its screening value in 19 bluegill/sunfish, catfish, and crappie samples (20% of the total).

Results of the 2010 fish bioaccumulation study were similar to those found for 2009 fish bioaccumulation. Concentrations in each species are similar for both years and do not indicate a trend.

3.6.2 Toxicity Testing

This section summarizes the results of aquatic toxicity testing conducted during the time-critical removal action. The objective of that testing was to determine whether constituents associated with fly ash found in sediment and surface water are harmful to or bioaccumulate in benthic invertebrates. Those studies included a 1) whole sediment toxicity evaluation; 2) elutriate toxicity evaluation; 3) dredge plume toxicity evaluation; and 4) Stilling Pond discharge toxicity evaluation. The methods used in these evaluations are described in the *Sampling Plan for Phase I Dredging Operations* (Ref. 11.2.2).

Further studies aimed at addressing potential toxicity from dredging activities and dewatering of dredged ash onsite continue to date. This monitoring effort is described in the EPA OSC approved *Surface Water Monitoring Plan for the Emory, Clinch, and Tennessee Rivers* (Ref. 6.3.3).

3.6.2.1 Whole Sediment Toxicity Evaluation

"Whole sediment" refers to the combined solids and interstitial water (or porewater) of sediment samples collected from a water body. Tests performed using 100% fly ash were described as "whole ash" instead of "whole sediment" exposures.

TVA conducted laboratory sediment and surface water toxicity studies in the spring and summer of 2009 in accordance with the EPA OSC approved *Kingston Fossil Plant, Fly Ash Recovery Project, Sampling Plan for Phase I Dredging Operations* (Ref. 11.2.2). Multiple 3.1-m vibracore samples were collected immediately upriver (VB.1) and downriver (VB.2) of the main portion of Emory River ash on March 17, 2009, composited into two discrete samples, individually homogenized, placed in 19-L plastic buckets and kept in cold storage (4º Celsius) until use. On June 11 and 12, 2009 two additional vibracore samples (VB.3 and VB.4) were collected and processed in the same manner from approximately the same locations as the March 17, 2009 samples (Figure 33). Laboratory control sediment was collected from CRM 189.0.

Various toxicity test protocols were used in the whole ash studies, including:

- *Corbicula fluminea* bioaccumulation for sediments
- Freshwater Juvenile Mussel (*Lampsilis siliquoidea* – VB.1 & VB.2; *Lampsilis cardium* VB.3 and VB.4) 5-d survival for sediments
- Freshwater Juvenile Mussel (*Lampsilis siliquoidea* – VB.1 and VB.2; *Lampsilis cardium* VB.3 and VB.4) 10-d survival for sediments
- *Hyalella azteca* 10-d survival and growth for sediments
- *Lumbriculus variegatus* 4-d toxicity test (pre-bioaccumulation) for sediments

All laboratory test exposures with whole ash were conducted at TVA's contract toxicity laboratory, Hydrosphere Research, in Alachua, Florida.

Bioaccumulation Test Results

Results from the *C. fluminea* bioaccumulation study indicated no appreciable bioaccumulation of metals in 28-d exposures to whole ash (Table H-26 in Appendix H). All weights have been converted to a dry weight basis. The highest bioaccumulation factors (BAFs) (excluding calcium and sodium) were for zinc, with VB.1 sample BAFs ranging from 0.426 to 0.721 kilogram (kg) body weight/kg sediment, and VB.2 through VB.4 sample BAFs for zinc ranging from 0.154 to 0.294 kg body weight/kg sediment.

Results for aluminum indicated a relatively wide variation in BAFs between test samples, ranging from 0.0001 kg body weight/kg sediment for VB.3 to 0.031 kg body weight/kg sediment for VB.1. Results for barium also indicated a relatively wide variation in BAFs, ranging from 0.001 body weight/kg sediment for VB.4 to 0.021 body weight/kg sediment for VB.1. The BAFs for other metals compared more closely between tests.

Toxicity Test Results

Table 3-4 includes results of the whole ash toxicity tests. Whole ash test exposures were compared to laboratory control sediment samples taken from the Emory River. No effects on survival were noted for *L. siliquoidea* (5-d) exposures to VB.1 and VB.2 samples. However, 10-d exposures to one of the whole ash samples (VB.1) did result in effects on survival (48%) relative to laboratory control sediment (92%). *H. azteca* exposures (10-d) to both whole ash samples indicated adverse effects on survival, growth, and biomass. Survival was 11 and 25% (VB.1 and VB.2, respectively) as compared to the laboratory control sediment (89%). No unusual behavioral effects (such as avoidance of ash) were noted by the laboratory.

Table 3-4. Summary Results of Whole Ash Toxicity Tests

Species	Duration (days)	Test Endpoint	LCS[a]	VB.1	VB.2	LCS[b]	VB.3	VB.4
Lampsilis siliquoidea	5	% Survival	100	100	100	-	-	-
	10	% Survival	92	48[c]	96	-	-	-
Lampsilis cardium	5	% Survival	-	-	-	96	90	32[c]
	10	% Survival	-	-	-	82	76	6[c]
Hyalella azteca	10	% Survival	89	11[c]	25[c]	98	48[c]	55[c]
		Growth[d]	0.1272	0.0827[c]	0.0669[c]	0.1366	0.0681[c]	0.0715[c]
		Biomass[e]	0.1124	0.0101[c]	0.0161[c]	0.1338	0.0321[c]	0.0406[c]
Lumbriculus variegatus	4	% Survival	100	98	100	100	98	100
		% Burrowing	100	0[c]	60[c]	100	3[c]	3[c]

Notes:

[a] LCS = Lab Control Sediment (collected at Clinch River Mile 189.0) used in tests with VB.1 and VB.2
[b] LCS = Lab Control Sediment (collected at Clinch River Mile 189.0) used in tests with VB.3 and VB.4
[c] Hypothesis testing (1-tail, 0.05) indicates significant difference from LCS
[d] Mean dry weight (mg) calculated by dividing total dry weight of treatment by number of survivors
[e] Mean dry weight (mg) calculated by dividing total dry weight of treatment by number of animals used to initiate tests

The *L. variegatus* toxicity test for VB.1 and VB.2 was performed as a preliminary qualifying test for a 28-day bioaccumulation study. The criteria that must be met before a particular test species can be used in the bioaccumulation test are 1) the test organism must be able to survive an exposure to the test medium, and 2) the test organism must be able to burrow. *L. variegatus* exposures (4-d) to whole ash resulted in no effects on survival. However, the number of worms that managed to burrow into either ash sample was significantly less than the number burrowing into the lab control sediment. Therefore, the 28-day bioaccumulation test was not performed for this species.

Table 3-4 also includes results of the whole ash toxicity tests for VB.3 and VB.4; whole ash test exposures were compared to laboratory control sediment samples taken from the Emory River. No significant decrease in survival was observed in 5- and 10-d *L. cardium* exposures to VB.3. Adverse effects on survival were noted in the VB.4 whole ash sample for *L. cardium* exposures (5- and 10-d), with survival in the 10-d exposure at 6%.

Similar to tests with VB.1 and VB.2 samples, *H. azteca* exposures (10-d) to VB.3 and VB.4 whole ash samples resulted in significant decreases in survival, growth, and biomass. These effects were not as pronounced as with the earlier ash samples. *L. variegatus* exposures (4-d) to VB.3 and VB.4 whole ash resulted in no effects on survival, but similar to the exposures to VB.1 and VB.2 samples, worms did not burrow, so bioaccumulation was not assessed.

3.6.2.2 Elutriate Toxicity Evaluation

Elutriate toxicity tests were performed to evaluate the potential acute toxicity resulting from exposures to chemical contaminants potentially released to the water column through dredging activities.

Vibracore samples VB.1, VB.2, VB.3, and VB.4 were each combined with Emory River water at a volumetric ratio of 1:4, stirred vigorously for 30 minutes, and allowed to settle for one hour. The supernatant was decanted and split into two aliquots. One aliquot was serially diluted and used in one set of test exposures, while the other was centrifuged prior to exposures without dilution. Toxicity tests included 96-h exposures with *Ceriodaphnia dubia* and *Pimephales promelas*, and 10-d exposures with the freshwater juvenile mussels *L. siliquoidea* and *L. cardium*. A total of 24 test exposures were performed. In *C. dubia* tests, only one test exposure (centrifuged VB.4) resulted in significant mortality (Table 3-5). In the *P. promelas* tests, mortality was only observed in the VB.4 elutriates. *L. siliquoidea* tests did not result in adverse effects when exposed to VB.1 and VB.2 elutriates, while *L. cardium* exhibited significant mortality in exposures to VB.3 and VB.4. It is not clear why *L. cardium* tests ended with significant effects, although the laboratory did note problems with biological contamination and interference throughout that test series.

Table 3-5. No Observed Effect Concentrations (Percent) in Elutriate Toxicity Test Exposures

	C. dubia		***P. promelas***		***L. siliquoidea, L. cardium***	
Elutriate	**Uncentrifuged**	**Centrifuged**	**Uncentrifuged**	**Centrifuged**	**Uncentrifuged**	**Centrifuged**
VB.1	100	100	100	100	100	100
VB.2	100	100	100	100	100	100
VB.3	100	100	100	100	12.5[a]	<100[a]
VB.4	100	<100[a]	25[a]	<100[a]	6.25[a]	<100[a]

Note: [a] Statistically significant difference relative to Emory River water control

3.6.2.3 Dredge Plume Toxicity Evaluation

Dredge plumes were visually located by sampling personnel deployed in boats. Visual observations and turbidity measurements via manual monitoring equipment and Hydrolabs® were used to identify the horizontal and vertical boundaries of the plume. After locating the most turbid part of the plume (depth and horizontal location), a water sample was collected using a peristaltic pump.

Aliquots from the plume samples were used in toxicity tests within 36 hours of sample collection. Samples collected in April, May, and June 2009 were used in laboratory exposures including a 3-brood *C. dubia* Survival and Reproduction Test and a 7-d *P. promelas* Larval Survival and Growth Test. Samples collected beginning in August 2009 through May 2010 were used in 96-h modified static renewal acute tests with *C. dubia* and *P. promelas*. Samples were collected weekly from August through October 2009, and monthly thereafter.

During the time-critical removal action, 26 plume samples were collected and used in tests on two species, for a total of 52 individual toxicity tests. No toxicity to *C. dubia* or *P. promelas* was observed in any dredge plume sample.

3.6.2.4 Stilling Pond Discharge Toxicity Evaluation

Sampling of the stilling pond discharge through Outfall 001 were conducted to evaluate the potential effects to aquatic biota from exposures to residual contaminants (metals or polymers) that may be present from dredged ash dewatering processes.

Twenty-four hour (24-h) composite samples were collected from the stilling pond discharge at Outfall 001. Samples collected in April, May, and June 2009 were used in laboratory exposures including a 3-brood *C. dubia* Survival and Reproduction Test and a 7-d *P. promelas* Larval Survival and Growth Test. Samples collected beginning in August 2009 through June 2010 were used in 96-h modified static renewal acute tests with *C. dubia* and *P. promelas*. Samples were collected weekly from August through October 2009, and approximately twice per month thereafter.

During the time-critical removal action, 27 stilling pond discharge samples were collected and used in tests on two species, for a total of 54 individual toxicity tests. No toxicity to *C. dubia* or *P. promelas* was observed in 53 of those tests. One sample (October 27, 2009) resulted in statistically significant effects on *C. dubia* only. After a thorough evaluation of related metals data and operational records, it was concluded that residual polymers in the outfall may have resulted in the toxicity measured in that one test.

3.7 SPECIAL STUDIES

During the course of the time-critical removal action, TVA initiated numerous special studies. Table H-27 summarizes the purpose of these studies which range from evaluating the effects of additives on the leaching characteristics of metals in ash to evaluating sediment samples for the presence of ash. Since many of these events consisted of a single sample or a limited number of samples, no attempt has been made here to summarize or interpret the results. The raw data associated with these events are archived in the Site EQuIS database.

Third-party environmental investigations conducted at the Site fall into five categories:

1. Investigations funded by organizations with no formal association with TVA and conducted by independent third-party investigators;

2. Investigations funded by and in support of plaintiffs in lawsuits against TVA;

3. Investigations commissioned by state or federal regulators and performed by independent third-party investigators, but ultimately funded by TVA;

4. Investigations by third-party investigators from whom TVA solicited proposals and with whom TVA may cooperate in designing and conducting the investigations; and

5. Investigations funded by TVA, but for which the request for proposals, screening of initial proposals, and administration of grants is through the ORAU.

The following sections summarize the investigations in these five categories. TVA emphasized open communication with other organizations and provided access to the Site. In some cases, TVA contractors would also collect requested samples of ash and ship them to the interested party.

3.7.1 Independent Investigations Funded by Organizations with No Formal Association with TVA

Representatives of Appalachian Voices, the Tennessee Aquarium, and the Appalachian State University Department of Biology began collecting samples of fish, water, and sediments from the Emory, Clinch, and Tennessee Rivers in less than a week following the release. Those collections have continued at about three-month intervals since the initial sampling in December 2008 and January 2009. Initially, results were reported through press releases and follow-up interviews with reporters. A May 18, 2009 telephone press conference and online report were used to present results obtained through that time (www.appvoices.org/index.php?/site/av_news/tva_ash_spill_results/). These investigators also presented their results in a special poster session at the annual meeting of the Society for Environmental Toxicology and Chemistry (SETAC) in New Orleans in November 2009 (Ref. 26.1), and at a special Kingston Fly Ash Release Environmental Research Symposium (the Kingston symposium) organized by TVA in March 2010. The March 2010 abstracts and poster presentations are provided in Ref. 26.2.

USFWS and TWRA collected sediments from the ash release area in early January 2009 that they submitted to the USACE ERDCWES and to the U.S. Geological Survey for standard sediment elutriate toxicity testing. They also submitted a sample to Tennessee Technological University for chemical analysis and for extraction using a pH 4.0 acetate solution. Preliminary results of those investigations were provided to TVA by email (Steve Alexander to Peggy Shute, John Baxter, and Hill Henry, Subject: Fly Ash Data, 9:55 am March 3, 2009). At TVA's invitation, preliminary results were presented at the SETAC 2009 meeting in New Orleans and at the March 2010 Kingston symposium.

Dr. Avner Vengosh and his graduate students at Duke University conducted a brief investigation of water and sediments in early 2009 that was funded by a private donation. The results of that study led to his group's receiving a National Science Foundation Rapid Response grant to continue the investigation, and subsequently to a grant from TVA through ORAU (category 5). Results of the initial study were published online (http://pubs.acs.org/doi/full/10.1021/es900714p) in Environmental Science and Technology in May 2009 and in the hard-copy of that journal in August 2009. At TVA's invitation, the Duke University team also presented their findings at the SETAC 2009 meeting in New Orleans and at the March 2010 Kingston symposium.

Dr. Roy Sidle and his associates at the Appalachian State University Department of Geology also received a National Science Foundation Rapid Response grant in spring 2009 to investigate geochemistry of ash deposits in the Emory and Clinch Rivers, and to evaluate use of a Sub-Bottom Profiler to characterize the depth and extent of ash deposition. TVA subsequently supplemented that grant with a contract to assist TVA in the same type of investigation. That investigation will be submitted for publication in a peer-reviewed journal. Preliminary results were presented at the SETAC 2009 meeting in New Orleans and at the March 2010 Kingston symposium.

3.7.2 Investigations Funded by and in Support of Plaintiffs in Lawsuits Against TVA

TVA is aware that multiple plaintiffs or the firms representing them have collected samples of air, water, ash, and/or sediments for chemical analysis in support of their positions in legal proceedings against TVA. The few instances in which the privately held results of these studies were made available publicly were as press releases, Internet blog postings, or in response to discovery motions.

3.7.3 Investigations Commissioned by Regulatory Agencies and Performed by Independent Third-Party Investigators, but Ultimately Funded by TVA

At the request of TDEC, upon TVA's beginning of ash dredging from the Emory River in March 2009, staff from the USACE ERDCWES collected ash samples from the river, the Dredge Cell relic, and the ash that had been dredged from the river for an extreme, 10-day elutriate test under both aerobic and anaerobic conditions. Results were presented at SETAC 2009 and at the Kingston symposium. Results also were presented in a USACE ERDCWES technical report and two scientific papers have been submitted to Geochimica et Cosmochimica Acta for publication.

TWRA has commissioned a researcher at Middle Tennessee State University, Dr. Ryan Otter, to assist TWRA in studies of the potential effects of ash on river mussels. Preliminary results were presented at the March 2010 Kingston symposium (Ref. 26.2).

EPA commissioned a researcher at the USACE ERDCWES, Dr. Steve Scott, to perform numerical modeling of suspended sediments transport and deposition in the Emory, Clinch, and Tennessee Rivers. Dr. Scott issued an interim report to EPA in April 2010, and is currently making additional refinements to ensure the model provides the most accurate predictions possible.

3.7.4 Investigations by Third-Party Investigators from whom TVA Solicited Proposals

Prior to EPA's commissioning Dr. Scott at USACE ERDCWES to perform suspended sediments transport modeling, TVA contracted with Dr. Rollin Hotchkiss at Brigham Young University to develop a similar, but less sophisticated numerical model. Dr. Hotchkiss completed the model development and verification, and delivered both the model and training in its use to TVA. Dr. Hotchkiss also cooperated in providing data files he had accumulated for initial model set-up to Dr. Scott.

TVA has subsequently contracted with Dr. Hotchkiss to perform flood risk modeling for post-dredging bathymetry to ensure that at the completion of dredging in the Emory River the flood risk for properties adjacent to the rivers is no greater than prior to the ash release. That work will be completed by March 2011.

TVA contracted with ORNL immediately following the release to collect fish samples during January through April 2009, to establish baseline information on bioaccumulation, fish health, and reproductive competence. That contract was extended to include fish and benthic invertebrates (mayflies and snails) collections in fall 2009, and spring and fall 2010. Summary results of the winter/spring 2009 sampling were presented at the SETAC 2009 meeting in New Orleans and at the Kingston symposium. ORNL staff plan to prepare scientific papers on these investigations for submission to peer-reviewed journals.

TVA contracted with ORNL in spring 2010 to conduct laboratory mesocosm investigations of possible effects of ash on larval fish and fish reproduction. Those studies were initiated in the summer of 2010.

TVA is co-funding, along with the University of Tennessee, an investigation of potential bioaccumulation of contaminants from ash in raccoons and muskrats being conducted by Dr. Marcy Souza of the University of Tennessee Veterinary School. That investigation is currently underway. Results will be presented at national scientific conferences and in peer-reviewed journals.

TVA has contracted with the Virginia Polytechnic Institute and State University for a cooperative investigation directed by Dr. William Hopkins of possible bioaccumulation and effects of ash on tree swallows, turtles, and other wildlife. This investigation is an expansion of initial studies implemented by

TVA in 2009. The contract for that work has just recently been executed. Results will be presented at national scientific conferences and in peer-reviewed journals.

Prior to the EPA Order, TDEC, EPA, and TVA desired greater Site-specific information concerning metals speciation. TVA contracted with the USACE ERDCWES to perform geochemical investigations of arsenic and selenium contaminants in the ash left in the Emory, Clinch, and Tennessee Rivers after time-critical dredging. These investigations are examining dissolution and oxidation rates, chemical speciation, and effects of photo-oxidation and naturally-occurring organic materials on arsenic and selenium geochemistry. This work began in spring 2010, and will continue for at least another year, possibly more. Results will be presented at national scientific conferences and in peer-reviewed journals.

3.7.5 Investigations Funded by TVA through Oak Ridge Associated Universities

TVA contracted with ORAU to solicit pre-proposals on investigations of the environmental fate and effects of fly ash, obtain independent reviews of pre-proposals and select a subset for submission of full proposals, obtain reviews of the full proposals, and provide a prioritized list of recommended studies to TVA. As a result of that process, TVA has funded the environmental investigations described below. Funding and contract administration is being handled by ORAU. Each of these investigations is just beginning; results will be published in peer-reviewed journals.

- Geochemical and Isotope Characterization of TVA Coal Combustion Products: Identification of contaminants and modeling their fate in the environment. (A. Vengosh, H. Hsu-Kim, Duke University, J. Hower, University of Kentucky, and T. Johnson, University of Illinois-Urbana) – These researchers are developing geochemical and isotopic tracers for TVA fly ashes to evaluate long-term environmental impacts, model fates of metals and metalloids in leachates, and establish diagnostic tools for delineating the sources of environmental contaminants. Focus is on boron, strontium, and mercury isotope ratios, effects of various environmental factors (e.g., calcium content, pH, redox, humic matter, sulfate-reducing bacteria) on chemical transformations, methylation potential of ash-related mercury, and chemical equilibrium modeling of dissolution processes.

- The Effect of Dissolved Organic Matter and Mixing Energy on the Release of Trace Elements from Coal Ash in Natural Surface Waters. **(**J. Ryan, University of Colorado and G. Aiken, U.S. Geological Survey, Boulder) – These researchers plan to characterize ash and leachate water using several recently developed analytical techniques (inductively-coupled plasma - atomic emission spectroscopy [ICP-AES], inductively-coupled plasma - mass spectrometry [ICP-MS], X-ray fluorescence, powder X-ray diffraction, and X-ray absorption near edge structure spectroscopy [XANES]). They plan to examine effects of mixing energies characteristic of rivers and other environmental factors on dissolution of ash constituents.

- *A New Approach to Quantifying the Release of Bioactive Trace Elements from Coal Combustion Products to Natural Waters*. (P. Sedwick and G. Cutter, Old Dominion University) – These researchers will examine use of a flow-through leaching procedure at a very low ash/leachate ratio, as opposed to batch-type leaching, that is more characteristic of the environmental conditions for ash that has been released to rivers. They plan to adapt methods used to investigate dissolution of trace metals from mineral aerosols in ocean waters for this study.

- *Predicting Mobilization and Bioaccumulation of Trace Elements from Coal Fly Ash Using Speciation Analysis*. **(**D. Hesterberg, D. Buchwalter, and O. Duckworth, NC State University) – These researchers plan to characterize the mineralogy and trace element speciation of fly ash using recently developed analytical techniques (K-edge, Lm-edge, and M-edge XANES, X-ray diffraction, and extended X-ray absorption fine structure), then will conduct batch leaching tests and bioaccumulation to investigate effects of various environmental factors on dissolution of metals/metalloids from ash. Leachates from these studies will be used to investigate bioaccumulation of arsenic, chromium, selenium, copper, zinc, uranium, and strontium by natural periphyton films and pure algae cultures, followed by full life cycle tests with mayflies fed these periphyton to evaluate potential toxicity.

- *Selenium Biogeochemistry in Rivers Receiving Direct Coal Ash Inputs*. (G. Cutter, Old Dominion University) – Dr. Cutter will investigate speciation of dissolved and particulate selenium, differences in the biogeochemical cycle of selenium in lotic and lentic systems, and the rates of various processes in selenium's biogeochemical cycle (e.g., regeneration of particulate organic selenide to dissolved organic selenide). This proposed work will build on Cutter's earlier (1980s) Se investigations in lentic systems and on more recent investigations in the San Francisco Bay estuary.

3.7.6 Medical Screening

TVA contracted with Oak Ridge Associated Universities (ORAU), a consortium of over 100 universities, to independently address health concerns of Roane County residents. Individual confidential health assessments were conducted by physicians from Vanderbilt University Medical Center. TVA also contracted with Ridgeview Resources for Living in Harriman, Tennessee, to provide mental health services to residents.

Results of the health assessments were reported in the *Kingston Project Surveillance Program, Baseline Medical Screening Results* (Ref. 24.15). A total of 214 individuals (representing 112 households) volunteered to participate in the screening evaluation between September 2009 and April 2010. Approximately half of the participants lived within two miles of the spill. The most common symptoms reported by participants were those related to upper airway irritation, including runny nose, cough, and congestion. The physical examination for most participants was normal, with abnormalities or variations due to preexisting medical conditions. There were no findings that indicated local or systemic toxicity related to constituents identified in the ash. The following summarizes results of specific tests.

- Blood tests found elevated blood values for selenium in 27% of those tested. After the individuals reduced their selenium intake in their dietary and supplement sources, repeat measurements found selenium within the normal range. ORAU recommended repeat evaluations of this group of individuals be performed periodically over several years to assess whether there have been changes in health that may be related to the fly ash spill. A few individuals demonstrated slightly elevated blood values for copper, aluminum, and chromium, but none approaching a toxic range. Blood tests for arsenic, cobalt, and nickel found blood values within the normal range.

- Pulmonary (lung) function tests for participants older than six years of age indicated individuals had normal lung function tests. The majority of individuals with abnormal tests were smokers. Among non-smokers, there was no difference between individuals living within two miles of the spill compared to those living greater than two miles away.

- Chest x-rays did not reveal conditions expected to be caused by exposure to fly ash. Two individuals were found to have a mass in their lungs that needed further follow-up with their primary care doctor.

- Urine tests for beryllium, thallium, arsenic, and vanadium did not reveal elevations.

4 SAFETY AND HEALTH

4.1 SAFETY AND HEALTH PROGRAM

The EPA Order, Article XIII, paragraph 35, required TVA to submit for EPA review and approval a plan to ensure the protection of the public health and safety during performance of on-Site work, in accordance with EPA's *Standard Operating Safety Guide* and consistent with Occupational Safety and Health Administration (OSHA) provisions for response action worker safety and health found in 29 CFR Part 1910.

The EPA Order, Article XX, paragraph 50, defined the authority of the EPA OSC, which included the authority to halt any work or to conduct or direct other response action at the Site in an emergency or under circumstances that may present an immediate threat to public health, welfare or the environment. The EPA OSC executed this role using the EPA Region 4 ERT to review the SWSHP and conduct audits. In addition the USCG Strike Teams (Gulf, Atlantic, and Pacific) were used to provide direct onsite feedback and action. The USCG acted as the EPA OSC representative onsite concerning safety and health. Daily Reports can be found on the EPA website and in Ref. 20.5.

4.1.1 Site Wide Safety and Health Plan

A comprehensive SWSHP (Jacobs 2009a, 2010a, 2010b) was developed for the Site, which governed the overall health and safety program. The SWSHP was written to comply with the EPA Order, Article XIII, paragraph 35. The SWSHP was approved by the EPA OSC in consultation with TDEC, and is available on the EPA and TVA websites. The SWSHP has been revised five times since originally published in March 2009; the versions of the SWSHP are included in Ref. 20.1.

The SWSHP was written to apply to all Site general construction safety as well as CERCLA remediation activities in accordance with EPA's *Standard Operating Safety Guide* (Ref. 20.2.2). The plan addresses both Site safety hazards and worker health hazards and compliance with TVA and OSHA standards as found in 29 CFR Part 1910. The plan describes the potential hazards at the Site, the health hazard monitoring, and personal protective equipment required for the protection of workers. In addition, the SWSHP addresses work zones, site control, personal hygiene, medical surveillance, training, hazard communication, and emergency response. The SWSHP provides the safety and health framework for Site-specific plans and health and safety procedures, including job-specific hazard analysis, meetings, logs, reports, and recordkeeping. The SWSHP was prepared and distributed by the TVA and Jacobs Safety and Health Managers.

During the emergency response phase, workers were provided access to the health and safety plan by posting it on the TVA website, and a hard copy was stored at the TVA onsite trailers. To comply with the EPA Order under CERCLA, access was improved by issuing hard copies of each SWSHP to Site contractors for access by their workers. Each worker attended a Site-specific orientation, which summarized the SWSHP and contained a question and answer session to ensure workers understood the site requirements as they applied to them, and signed their attendance at the orientation training. The EPA Region 4 ERT in recurring audits recommended improvements to worker access to the SWSHP. In response, improvements included issuing electronic copies on compact disk to Site contractors, issuing controlled copies of SWSHP revisions, and covering revisions to the SWSHP in the annual 8 hr refresher course required by all workers. In addition to the orientation and as an improvement to safety communications, each worker was issued a Site Wide Safety and Health Plan booklet in April 2010, a concise summary of site hazards and the controls used to protect workers. The most recent version of the SWSHP continues to be maintained on both the EPA and TVA websites.

4.1.2 Safety and Health Program Management

Management of the safety and health program under the time-critical removal action was via the ICS under a Unified Command, as shown on the EPA website and Ref. 1.3. As per the EPA Order, the EPA OSC was responsible for overall safety and health at the Site. EPA oversight of removal activities on the Site was provided through the U.S Coast Guard Strike Teams (Gulf, Atlantic, and Pacific). This oversight responsibility was designated by the EPA OSC in a memorandum regarding *Letter of Federal Designation Concerning Health and Safety On-Site* (Ref. 20.2.4. The EPA OSC delegated to the USCG GST onsite authority to stop work due to health and safety concerns and to respond in case of an emergency. Further, the EPA OSC delegated to the USCG GST authority to conduct actions as the OSC Representative in the event the EPA OSC was not on Site, with timely notification to the EPA OSC. EPA review and audits of the safety and health program were provided through the EPA Region 4 ERT.

TVA was responsible for executing work in accordance with the approved SWSHP, under the direction of TVA's Site Safety Official. Jacobs was responsible for managing the Safety and Health Program for the Site as agent for TVA. The Jacobs Lead Assistant Safety Official reported directly to the TVA Site Safety Official and managed the Safety and Health Program. Each contractor was responsible for implementing the Safety and Health Program and complying with their corporate requirements. Each contractor's Assistant Safety Official reported to the Lead Assistant Safety Official and directed the implementation of the Safety and Health Program within their company. Jacobs Safety personnel and reported to the Jacobs Assistant Safety Official and supported the development and implementation of task plans and challenged work methods that did not meet Site requirements and provided suggestions for improvement. They had the authority to request Site activities be conducted in a different manner to improve safety.

Confusion over Jacobs' role by Site contractors on the Site was noted by ERT in its safety audit in March 2010. The ERT found that while TVA contracts with Jacobs to manage the safety program and provide safety oversight of Site contractors, Jacobs was also being directed by TVA to follow the TVA Corporate safety program model, which was creating confusion and did not allow for a smooth implementation of safety functions. The ERT found that there was a conflict within the current ICS Unified Command structure and the superimposed TVA corporate safety structure. The ERT recommended that the structure identify TVA site safety staff as the Site Safety Officers, and identify the portions of the safety and health program that are to contracted to Site personnel while retaining for TVA a visible portion of the program implementation. In March, 2010, TVA assigned Chuck Proffitt and Tom Heffernan as the Site Safety Officers to assist with integration of the project with TVA corporate safety structure. These two assignments improved the integration of the safety culture across Site contractors. In delegation of safety oversight, the ERT recommended that TVA make Jacobs' responsibility visibly evident to all Site personnel by providing a formal delegation of safety oversight responsibility to Jacobs. The roles and responsibilities of the TVA health and safety program personnel in overseeing the work processes, equipment, and personnel of the multiple Site contractors were clarified June 2010 in SOP-HSE-001, *Jacobs Safety Management Authority* (Ref. 20.7).

Every individual onsite had the right and obligation to stop work activities or address conditions on the spot that were safety hazards, with no fear of reprisal. Every individual onsite was required to have continuous safety awareness, vigilance of job site conditions, and questioning attitude toward safety.

Onsite workers were required to complete two types of Site-specific training: site orientation and ammonia training. In addition, all field workers with access to the Exclusion Zones and Contamination Reduction Zones were required to complete 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training. In addition, craft workers were required to complete OSHA 10-hour construction safety training. Specialized tasks, such as elevated work, cranes, heavy equipment, water operations, or railroad work, required to have additional training. .

4.1.3 Safety and Health Program Audits

On June 1-2, 2009, EPA Region 4 ERT conducted an initial review of the SWSHP and the Site's Safety Program. EPA subsequently conducted a safety audit on October 26-27, 2010, of the Site Safety and Health Program, and conducted follow-up audits on March 22-24, May 10-14, and July 13-15, 2010. Audit findings were tracked and corrective actions put in place to close the surveillances and/or audits. ERT's safety and health audits can be found on EPA's website and are included in Ref. 20.4.

The following discusses three recurring observations of the ERT audits and their resolution.

- *Site workers are not routinely required to read and sign off on the Health and Safety Plan.* From the start of the time-critical removal action, Site workers were required to attend Site-specific orientation. This orientation covered key elements of the SWSHP and allowed for a question and answer session to ensure workers understood Site requirements as they applied to them. During this orientation, workers would sign a Certificate of Worker Acknowledgement that documented the worker had been briefed on and understood the SWSHP. During its March 2010 audit, the ERT noted that the coverage of the information from the SWSHP within the orientation was a viable method for documenting worker signature. The SWSHP was issued by controlled hard copy to each Site contractor for access by their workers. A Site Wide Safety and Health Plan booklet, which provided a concise summary of site hazards and the controls used to protect the worker, was also issued to Site workers.

- *While there are several informal means of communication between the site safety staff, there is no formal daily meeting between Jacobs, USCG GST, and contractor safety staff.* From the start of the project, the site held a weekly safety meeting with all Jacobs, USCG GST, and contractor safety personnel. Daily interface between members of the safety staff was done informally through pre-job briefing meetings, planning meetings, and other informal means of communication. Starting in March of 2011, the Site has incorporated a daily meeting of the Site safety staff.

- *A schedule should be developed to provide continual follow-up on all inspection findings, deficiencies, and recommended corrective actions to ensure timely implementation.* In March, 2010, the USCG GST implemented a corrective actions tracking report that was reviewed daily to ensure consistent follow-up to closure of observations from the field. This tracker tool was integrated into the Site safety process when the GST demobilized from the Site. The tracker has evolved several times since the original tracker database was formed. The current tracker generates a daily printout of SORs from the previous day as well as any currently open items from the SOR database. Field observations and informal Site inspections were performed several times per day by safety personnel and construction managers. Findings of those Site inspections were identified in weekly reports that were sent to the TVA Site Safety Officer. Any action items were tracked until closed. Items were either closed on the spot by the observer through intervention or coaching in the field or communicated to the appropriate individual responsible for the closure of the observation. In both cases, the observation would be logged into the weekly tracker and SOR database for tracking, closure, and trending of the observations. Weekly audits of specific work areas and activities were performed by a team of management and craft workers from various organizations.

Program audits were also conducted by both TVA and EPA. Jacobs, as agent for TVA, contracted with Mr. William Sturm of Industrial Safety and Health to conduct a surveillance of dredging activities in September 2009; a Safety and Health Site Assessment was prepared following that surveillance. Jacobs conducted a surveillance of Site activities during the time-critical removal action in November 2009 and prepared a corresponding Safety Evaluation Report. These audit reports can be found in Ref. 20.3.

4.1.4 Safety and Health Management Tools

Several standardized tools were used to help achieve a safe workplace. These tools included pre-task planning documents, including Activity Hazard Analysis (AHA) and Job Safety Analysis (JSA), Safety Observation Reports (SORs), and program audits.

The AHA was a systematic way of identifying the potential health and safety hazards associated with major phases of work at the Site and the methods to avoid, control, and mitigate those hazards. The AHAs were used to train work crews in identifying and controlling hazards prior to beginning a task. The Site Safety and Health Officer, in consultation with the construction manager and field engineer, developed task-specific AHAs for the planned work or obtained them from contractors, and reviewed them for accuracy. Based on the scope of work, AHAs were developed for each individual removal component expected to be performed onsite during the time-critical removal action. Appendix E of the SWSHP contained AHAs for typical work elements.

The JSA was a task-specific planning tool and was completed prior to task execution and reviewed by the craft lead and worker crew on the actual day of activity. The superintendent or foreman as well as the work crew participated in developing the JSA as a collective effort. The JSA breaks down a task, listing the steps and the hazards involved in each step. A JSA was required for each work task on a daily basis and was developed by considering hazards and controls, weather, nearby activities, changing conditions and any relevant items that may have impacted the work task.

The hazards associated with each removal activity were captured within the SWSHP as well as in greater specificity within the work plans and AHAs or JSAs associated with them. Level D PPE was used throughout the Site, as required by the SWSHP, Section 6.2.1. The requirement to use coveralls instead of other work clothing was determined at the task level, based on conditions of the ash as well as expected contact with the material. Additional PPE, such as hearing protection, personal flotation devices, face shields, or fall protection, were selected and used to mitigate hazards at the task level. Hazards were monitored by assessing Site conditions prior to initiating each task and throughout the day, as conditions changed.

Improvements to Site Safety and Health program were implemented continuously throughout the time-critical removal action. Examples of these improvements include the following:

- Site access restrictions: In accordance with the EPA Order, the Site became subject to HAZWOPER requirements in July of 2009. Access restrictions to the exclusion zone were implemented at that time as part of the time-critical removal action. This control of pedestrian and vehicle entry and exit from the Site significantly reduced the likelihood of uncontrolled ash migration from the site into the surrounding community. Exclusion zone boundaries were established based on presence of ash from the release and operational requirements. The Ball Field, Ash Pond, and Stilling Pond areas were included within the exclusion zone boundaries to facilitate the removal, processing, and loading of the ash onto trains for disposal. Personnel and equipment entry/exit points were selected and installed to control the flow of personnel and equipment from the exclusion zone to the support zone. Each entry/exit point within the contamination reduction zone was equipped with ash decontamination resources designed to limit the tracking of ash outside the exclusion zone. The exclusion zone boundaries for the time-critical removal action are shown on Figure 34.

- Decontamination facilities: Pedestrian decontamination shacks were installed at main entry/exit points of the Site that provided resources for pedestrians to remove ash from boots with boot washes and removal of ash from exposed body parts with wipes. A vehicle wash facility was installed at a primary vehicle entry/exit point that provided resources for vehicles and equipment to remove ash from the undercarriage and body of the vehicle prior to exiting the exclusion zone and ultimately entering the surrounding community, in accordance with the EPA OSC approved *Work Plan for Vehicle Wheel Wash and Decontamination at Main Entrance-Exit*. (Ref. 20.1.5). Improvements to the vehicle wash facility included adding two truck washes, power washers, interior vehicle decontamination, paved surfaces within the decontamination area that were sloped to shed the runoff to the Sluice Trench, and a rigid roof shelter to protect the decontamination area from weather, including freezing temperatures and intense sun during summer.

  In October, 2010, a centralized heavy equipment decontamination area was established to accommodate large pieces of equipment and vehicles being permanently removed from the Site. Each contractor was required to consult a competent person for specific decontamination requirements and procedures and to verify equipment temporarily or permanently leaving the Site was properly cleaned. These guidelines were that (1) vehicles and equipment be free of ash, dirt and/or residue both inside and outside of the vehicles and equipment; (2) vehicles and equipment be sprayed using power washers or water truck hoses; (3) a supervisor or foreman determine when decontamination may be discontinued; (4) moving parts be actuated for complete cleaning; (5) rags or pads be used to clean areas containing grease or oil; and (6) the supervisor, foreman, and workers take time to ensure complete coverage of vehicles and equipment. This equipment decontamination procedure was authorized as part of the EPA approved Revision 5 of the SWSHP, Section 8.3, *Equipment Decontamination*.

- Construction entrance: In June 2009, the main construction entrance off Swan Pond Road was relocated several hundred feet north in accordance with the EPA OSC approved *Swan Pond Road Construction Entrance Work Plan* (Ref. 14.1). Improvements that this relocation accomplished included: (1) separating construction traffic from office support traffic, (2) eliminating congestion at the rail spur, (3) providing room for wheel washes and vehicle decontamination as needed at the exclusion zone boundary, and (4) providing entry to the site for large vehicles carrying heavy equipment. The new location became a central material access point, where materials and supplies could be transferred from incoming trucks to onsite trucks without crossing the exclusion zone boundary, thereby minimizing decontamination operations. As noted in the EPA Region 4 ERT October 2009 audit, this central inspection and material access control point was established at the entrance to the Site as a follow-up action to the fatality incident (described below), where deliveries could be inspected for proper loading and delivery procedures prior to being allowed on Site.

- Construction site security was conducted in accordance with the EPA OSC approved *Construction Site Security Plan* (Ref. 20.1.4). The goals of the improved construction site security were to protect the public from inadvertently or purposefully entering the Site and being injured; to ensure timely response of emergency responders in the event of an emergency call; to secure onsite materials and equipment; to support safe and efficient transportation of materials, equipment, and personnel on and off the Site; to control site access and limit vehicular traffic so as to limit dust generation or ash migration offsite; and to control unauthorized access to the Site. The plan established controlled physical boundaries (e.g., jersey barriers, gates, and posts); security gates and posts at six locations; access badging and training requirements; and policies and procedures for visitors, equipment and supply deliveries, vendors, water-based operations, secure storage facilities, and emergency response.

- A Pre-Job Briefing or "Start of the Day Evaluation" was conducted before the start of any shift to check that the Site environment was safe for planned activities. The superintendent and Jacobs Safety professional responsible for the area conducted a walk-down of the area. Notes were taken of hazards, changed conditions, tools out of place, trip hazards, equipment paths, flagging locations, and housekeeping issues (trash, items out of place). Issues identified were brought to the crew's attention in the Plan of the Day, and appropriate changes were made to the JSAs to correct or work around the issue. Similarly, the JSAs were reviewed and modified if there were changes to the work scope during the work shift.

- A work package review process was implemented in March 2010 for all contractor work. The review process included appropriate sign-offs by the construction manager, project manager, technical contract manager, and TVA safety and health professionals before any work could begin. Prior to March, 2010, Site contractors were allowed to utilize their individual work package formats and internal review process. The issuance of SOP-PM-004 brought Site contractors under the same requirements and Site review process to improve control of work processes. TVA Civil Projects, through the time-critical removal action, implemented TVA procedure TVA-SPP-18.005, *Plan Jobs Safely,* which applies to TVA employees and augmented staff employees. This procedure, similar to SOP-PM-004, describes the systematic method for work planning, work package review, and required level of sign off based on the hazard level of the work.

- A "Two-Minute Rule" was implemented to raise worker awareness of jobsite safety. The rules ask that workers take two minutes to think about the work to be done when they arrive at a work location, are about to work with risky equipment, encounter a potential safety hazard, or see any other change in work layout sequence, activity, tools, etc.

- The SOR process was implemented for identifying potential workplace hazards and unsafe actions of workers, and conversely, for identifying and documenting safe acts and safe workplace conditions. The process was designed to minimize workplace injuries and illnesses, and damage to the environment in both the field and the office. In accordance with the SOR process, observations were made by any individual of the work in progress; the observations were recorded on a form, and analyzed to identify causes of safe/unsafe acts or conditions, to develop safety trends, and to provide feedback to the workforce. Safety call-in hotlines were also established for workers to report safety observations. Observations of unsafe conditions or acts were documented and tracked through the corrective action phase using an SOR tracking database. Good work practices were also documented in this process.

  The USCG also maintained a Corrective Actions Tracking Report as a system for tracking observations and corrective actions. That report was a critical management tool to check that observations in the field were followed through and corrective actions taken. The report displayed color codes for identifying status of corrective actions not yet completed. Beginning in March 2011, the report was integrated with the SOR tracking database and incorporated into Site safety and health management.

- Safety and Health Standard Operating Procedures (SOPs) were developed to outline specific program requirements. A total of 35 SOPs were developed, covering program processes and tools, high-hazard work activity requirements, and weather-related work safety requirements. These SOPs can be found in Ref. 20.7.

- In March, 2010, a fatigue management policy was implemented to control worker safety under long work hours and work weeks. TVA issued a memorandum on March 3, 2010, to Site

Contractors that was captured in SOP-HSE-016, *Safe Work Hours Management Policy* (Ref. 20.4). The EPA Region 4 ERT in its March 2010 safety audit found that the Safe Work Hours (Fatigue) Management Program was an excellent tool to analyze and address worker fatigue, included a limitation of work hours to a maximum, and provided responsible control of work allowances through documentation by Site management.

- An automated external defibrillator (AED) program was implemented in April 2010 after a Site worker sustained a heart attack within close proximity to the medic trailer. Five more AED's were purchased and strategically placed around the site to provide coverage if a similar emergency were to take place onsite.

- Recovery boards were distributed across the site. These boards consisted of plywood pads between 2 and 4 ft in dimension that were used to assist individuals who had gotten a boot stuck in the ash. The boards offered a stable platform to distribute weight evenly over a larger area. The boards provided the stuck individual a safe place to step as well as a place for anyone assisting that individual from getting stuck as well. The boards were placed initially in 6 key locations across the Site to provide quick access.

- Protective tents and rest stations were erected to protect flaggers from inclement weather (rain, wind, cold, or intense sun). During summer, a relief van would drive around the Site to provide shade, air conditioning, and cold water to workers.

Safety awareness became heightened in March 2010 following two serious incidents, as discussed below. This heightened safety awareness, combined with the improvements to the safety and health planning tools listed above, was a big factor in improving the Site safety record. After March 2010, the project performed approximately 775,000 hours with zero recordables attributed to work-related tasks.

4.1.5 Emergency Response

The Emergency Response and Contingency Plan implemented during the initial time-critical removal action was included as Appendix F of the SWSHP, addressing required actions in response to accidents, injuries requiring medical care, fires, explosions, spills, or extreme weather event. The Emergency Response Plan for the Site was separate from that for the Kingston plant. In December, 2009, the two plans were integrated into a single plan, Revision 31of the *Kingston Fossil Plant Emergency Response Plan* (Ref. 20.1.6), which addressed emergencies in a coordinated response regardless of organizational entities that may be performing work within the TVA Kingston plant site. The plant's Emergency Response Plan was modified by updating notification lists and interfaces with the CERCLA removal action personnel, clarifying ICS references and nomenclature, identifying sectors of the Site to aid emergency response efforts, adding water extraction points, adding changes in responses to upstream dam failure or flood conditions, and addressing the inspection, maintenance and response for the dikes surrounding the Ash Pond and Stilling Pond.

Early in the time-critical removal action, emergencies such as severe weather alerts were communicated by word of mouth or personal cell phones. Site radios were purchased in August 2009 and issued to the Site contractors for distribution to their Assistant Safety Officers, foremen, and workers, as appropriate, to communicate emergency messages in a timely manner throughout the Site.

Emergency response drills were conducted, as recommended by the EPA Region 4 ERT in audit reports. Chemical release drills were conducted on June 10 and September 9, 2009. Man overboard drills were conducted on October 15, 2009 and July 26, 2010. An Emergency Management System railcar rescue drill was conducted on April 19, 2010 together with first responders. Fire drills were conducted for the office trailer complex on June 8, 2010 and September 28, 2010. An ammonia release tabletop exercise was conducted on March 30, 2010. In addition, tornado evacuations were ordered on June 10, 2009, October 9, 2009, and April 24, 2010, after which lessons learned and improved emergency response procedures for severe weather were communicated to Site workers.

During the emergency response, TVA hired Advatech to use onsite medical facilities available at the south end of the rail yard. In early spring of 2009, the Site established a onsite medical facility, located in the main trailer complex, dedicated to the removal action. Advatech continues to provide certified paramedics that are present on the Site during operational hours to provide first aid and emergency response.

4.2 SAFETY AND HEALTH INCIDENTS

Safety and health incidents were reported to TVA and Jacobs through each of the contractor's onsite safety and health management organizations. All incidents, regardless of the severity, were reported to management, and investigations were completed of each incident. Incidents were reported to the EPA OSC in a timely manner through meetings, telephone, email, or other personal communication. Incidents of a serious nature were reviewed by a management team for corrective actions to be developed. Through the end of the time-critical removal action, 130 incidents were reported and reviewed, including recordable injuries, first aid incidents, and near-misses.

The Site safety and health statistics are summarized in Table 4-1. Additional information on the types of incidents, type of injury, body area, description, and actions is summarized in Tables I-1 and I-2 in Appendix I. Accident reports for the recordable injuries are included in Ref. 20.6.

The Total Recordable Incident Rate (TRIR) for the Site is used to assess the performance of the safety program and identify areas where operational improvements may be made. The TRIR was calculated based on the combined recordable injuries and manhours reported by all Site contractors. Site contractors per are responsible for their OSHA Form 300 log and all OSHA reporting, including investigations.

Table 4-1. Summary of Safety and Health Incidents

Incident Type	FY 2009	FY 2010[a]	Project Totals[a]
Number of Recordable Injuries	7	18	25
Number of Worker-Hours	1,000,000	1,400,000	2,400,000
Total Recordable Incident Rate (TRIR)[b]	1.4	2.6	2.1
Number of First Aid Incidents	23	48	71
Number of Near Misses	6	28	34
Type of Injury (Includes both recordable and first aid incidents):			
Sprains/ strains	10	30	40
Lacerations/ punctures	9	13	22
Contusions/bruises	8	5	13
Insect bites	1	7	8
Exposure	2	5	7
Fractures	0	4	4
Foreign body	0	2	2
Type of Activity (Includes both recordable and first aid incidents):			
Dredging operations	1	11	12
Ash processing	2	16	18
Earthwork, ash hauling, Dike C	9	15	24
Railcar loading and railyard operations	10	9	19
River operations, debris removal	8	5	13
Facilities and trailer maintenance	0	7	7
Sampling and office work	0	3	3

Notes:

[a] Through July 2010
[b] The Environmental Remediation NAICS (56291) industry average TRIR varied between 3.1 and 4.8 for years 2003 through 2009.

Five serious incidents occurred during the time-critical removal action, resulting in a fatality and four lost-time injuries:

- In July 2009, a fatality occurred to a vendor's truck driver while unloading of dredge pipe as part of the mobilization. A Site-wide safety stand-down was enacted on the day of the incident and the following day to reinforce the importance of developing a safe work culture. Corrective measures included development of policies for deliveries and material inspections.

- In December 2009, a worker suffered amputation of four fingers after getting his hand caught in a pulley while securing a dredge barge. Corrective measures included installing protective guarding on barge equipment to mitigate the crushing or amputation hazard.

- In February 2010, a tug boat captain opened a hatch to the engine room, then slipped going down the ladder, falling six feet and resulting in a broken arm. Engineered controls were implemented, which involved installing structures for workers to grab onto for descending the ladder, retrofitting the area around the vault hatch, attaching non-slip tape to the ladder steps, and covering exposed metal spots.

- In March 2010, worker fell from an elevated platform on the filter press equipment, resulting in a fractured hip and injured liver. The filter press area was shut down, and crews were briefed on the incident. A walk-through was conducted of the filter press area to verify that all railings and catwalks were adequate and that hazard markings were in place. A Site-wide safety stand-down was enacted following this incident to reinforce the importance of developing a safe work culture.

- In March 2010, a crane operator experienced lacerations and fractures to his head and face from uncontrolled crane rigging striking the crane cab. This was the result of an unstable crane and load. A safety stand-down was implemented on the day of and after this incident. Work practices and controls were reviewed by contractors and additional pre-job task planning was implemented. In addition, clamshell/dragline operators were required to follow the same TVA safety procedures as crane operators.

4.3 INDUSTRIAL HYGIENE

TVA contracted with EnSafe, Inc. (EnSafe) to conduct industrial hygiene monitoring for the Site between January 1, 2009 and May 19, 2010. Results of this monitoring were reported in the *Industrial Hygiene Sampling Report* (Ref. 20.2.6). Personal air sampling was performed to determine whether specific work activities would result in airborne concentrations of a variety of constituents exceeding applicable exposure limits. Measured concentrations were compared to four types of exposure limits, as required by the EPA OSC approved SWSHP:

- OSHA Permissible Exposure Limit Time-Weighted Average (PEL-TWA)
- Tennessee OSHA PEL-TWA
- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV).
- National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL).

Personal air sampling was conducted under the supervision of a certified industrial hygienist. Personal air samples were collected from workers' breathing zones to determine personal exposures while performing tasks associated with the time-critical ash removal. Workers were sampled while performing a variety of tasks including but not limited to operating heavy equipment, providing security, maintenance, lining and closing railcars, dredging, and flagging. During the sampling, none of the workers were observed wearing respiratory protection. Throughout this period, workers worked 10- to 12-hour shifts. These employees were monitored for durations of 8 to 11 hours during normal operations.

Personal air sampling was conducted using personal air sampling pumps which underwent a pre- and post-sampling calibration check for flow. Pump calibration was performed annually by the equipment manufacturer or vendor. Metal and total dust samples were collected on matched weight mixed cellulose ester filter media. Respirable dust and silica samples were collected on preweighed polyvinyl chloride filters using a 10-millimeter nylon cyclone. Radium, thorium, and uranium samples were collected on matched weight mixed cellulose ester filter media. Carbon monoxide sampling was conducted using field measurement equipment.

Samples were analyzed for metals, radionuclides, carbon monoxide, respirable dust, total dust, and four separate forms of silica. Personal air sampling results indicated that there were only two analytes for which there was at least one reported exceedance of an exposure limit: beryllium and silica quartz. Table 4-2 summarizes the sampling results for these two analytes. There were no exceedances for other analytes.

Table 4-2. Summary of Industrial Hygiene Sampling Results

Sample Parameter	No. of Samples Collected	Results > OSHA PEL	Results > Tennessee OSHA PEL	Results > ACGIH TLV	Results > NIOSH REL
Beryllium	134	0	0	134[1]	0
Silica Quartz	279	0	2	9	2

Notes:

If no applicable exposure limit exists for a given analyte, a zero is shown.
[1] Beryllium results were below the laboratory reporting limit.

Beryllium results were below the laboratory's reported detection limit (approximately 0.0001 mg/m^3), which was higher than the ACGIH TLV of 0.00005 mg/m^3. Of the 134 samples collected for beryllium analysis, all 134 sample results fell below the laboratory's detection limit, and were therefore not detected. Limitations of sample collection (sample duration based on shift lengths and sample pump battery life) and limitations of the laboratory's equipment capabilities resulted in detection limits lower than the ACGIH TLV for beryllium were unachievable. Therefore nondetected sample results reflect a potential exceedance, not an actual measured exceedance of that exposure limit.

Silica quartz results were compared to the Tennessee OSHA PEL standard of 0.05 mg/m^3. For non-detected results, values were taken as one-half the detection limit for purposes of comparison. Two samples exceeded the Tennessee OSHA PEL of 0.05 mg/m^3 (which is the same as the NIOSH REL of 0.05 mg/m^3). These two samples were within two weeks of each other, and both involved activities related to river operations (debris collection and debris downsizing with a chainsaw). To improve operations for protection of workers, corrective actions were taken in the field to use wetting methods when performing downsizing operations. Subsequent personal air sampling did not detect silica quartz exceeding the standard, which confirmed that the corrective actions mitigated the exposure.

There were seven additional silica quartz results that exceeded the ACGIH TLV of 0.025 mg/m^3, but did not exceed the Tennessee OSHA PEL of 0.05 mg/m^3. The ACGIH TLV was used as an action level for the Site, but is not a regulatory standard. When these action levels were exceeded, the specific work activities connected to the sample results were reviewed and work methods were modified to reduce the generation of dust during the performance of those work activities. EnSafe recommended continuation of particulate control measures to reduce the risk of worker exposures. These include dust suppression methods; worker training on reducing disturbance of ash by blowing, sweeping, or other activity; and sanitary facility for washing hands and boots before entering break areas or exiting the exclusion zone.

4.4 ENVIRONMENTAL EVENTS

TVA requires a corrective action for events resulting from human activities or Acts of Nature that has the potential to negatively impact human health or the environment and/or environmental compliance. Environmental incidents are emergencies that require external reporting to comply with environmental regulations and are tracked and reported using TVA's Environmental Incident Information System. Response and reporting of environmental events has been conducted in accordance with TVA's Environmental Management Procedure 18, *Environmental Incident Response Notification Procedure*.

Reportable environmental events include:

- Spills or releases of hazardous chemicals and products or oil;

- Accidental releases of pollutants to air, land, or water (does not include permitted releases or non-emergency permit exceedances);
- Fish and other wildlife kills;
- Discovery of hazardous or potentially hazardous containers (i.e., tanks, drums, etc.) or materials in public waters or dumped on TVA property;
- Fires; and
- Other incidents that require external reporting to comply with regulations or have potential to negatively impact human health or the environment.

Minor events that were under direct control of Site personnel and did not require immediate external reporting and did not threaten human health or the environment, were tracked as non-reportable environmental events.

The environmental events are summarized in Table 4-3. Additional information on the type of incident, location, description, and actions taken is summarized in Tables I-3 and I-4 in Appendix I.

Table 4-3. Summary of Environmental Events

Incident Type	FY 2009	FY 2010	Totals[a]
Number of Reportable Environmental Events	11	11	22
Number of Non-Reportable Environmental Events	11	3	14
Type of Event (includes both reportable and non-reportable):			
Hydraulic fluid release	14	12	26
Fuel release	4	1	5
Coolant release	2	0	2
NPDES exceedance	1	0	1
Tank repair	1	0	1
Water sheen	0	1	1

[a] Through July 2010

During the time-critical removal action, there were no serious environmental events that resulted in any negative impact to human health or the environment. Most incidents involved release of small quantities of hydraulic fluid from dredges, excavators, or other heavy equipment involved in the time-critical removal activities. All such small quantity releases were immediately reported and cleaned up to eliminate the spilled substance. Waste generated during cleanup of spills was collected, sampled and disposed of as solid waste in permitted facilities. Waste management procedures were clarified in December 2009 in SOP-OPS-007, *Waste Management* (Ref. 31).

5 PUBLIC INFORMATION AND COMMUNITY RELATIONS ACTIVITIES

EPA, TVA and TDEC functioned under a Unified Command as part of the NIMS ICS structure during the time critical removal action. During this period, community relations activities were performed to promote open communication among citizens, TVA, EPA, TDEC, and other agencies, and provide opportunities to the community for meaningful and active involvement in the cleanup process. While the EPA OSC did not have approval authority over TVA public information releases, the members of the Unified Command endeavored to promote accurate, fact-based public information while maintaining separate information outlets such as independent fact sheets, websites and press releases. In addition, the Unified Command communicated to the public together and in separate venues.

5.1 U.S. ENVIRONMENTAL PROTECTION AGENCY'S COMMUNITY RELATIONS ACTIVITIES

5.1.1 EPA Mobilization

EPA mobilized to the Site in May 2009 to conduct onsite community involvement activities, assisted by EPA's START contractor Tetra Tech. EPA was onsite or stationed at the TVA Community Outreach Center to address questions from the public throughout the time-critical removal action. EPA provided CERCLA presentations to various community groups in June 2009, including the Long Term Recovery Committee (LTRC) and the Emory River Community Action Commission. The community involvement team personnel were onsite to support EPA and provide guidance to TVA through May 2010, and have been involved either onsite or via teleconference since then.

5.1.2 Congressional Testimonies and Presentation to the Tennessee Legislature

EPA provided testimony on three occasions before the Committee on Transportation and Infrastructure, Subcommittee on Water Resources and the Environment, U.S. House of Representatives. The first testimony, provided on March 31, 2009, by Stan Meiburg, Acting Regional Administrator, EPA Region 4, described the EPA response to the Kingston coal ash release, and key cleanup activities (Ref. 23.2). The second testimony, provided on July 28, 2009, by Mathy Stanislaus, Assistant Administrator, EPA Office Of Solid Waste And Emergency Response, described the coal ash release and response actions, environmental monitoring and sampling, EPA and TDEC oversight of cleanup activities, the time-critical removal action, non-time-critical removal activities, and impoundment structural integrity assessments (Ref. 23.4). The third testimony, provided on December 9, 2009, by Stan Meiburg, Acting Regional Administrator, EPA Region 4, provided an update of these activities, describing the coal ash release and response actions, environmental monitoring and sampling, oversight of cleanup activities, the time-critical removal action, non-time-critical removal activities, and community involvement activities at the Site (Ref. 23.6).

EPA also presented a release site removal update to the Tennessee Legislature on February 16, 2010 (Ref. 3.5.2). The presentation included nature and extent of ash deposition and migration during rainfall events, river closure and advisory, potential threat to water and air quality, and status of source removal and disposal activities.

5.1.3 CAG Development and Implementation

EPA began discussion with interested community members to educate them on the merits of organizing a Community Advisory Group (CAG) in June 2009. EPA met with interested community members on June 25, 2009 to discuss the criteria for developing a CAG. On July 23, 2009 EPA presented information on CAGs to a group of interested community members, after which they organized and began to develop a CAG. On August 6, 2009, the newly formed CAG elected their board members and developed a meeting schedule. EPA assisted the CAG with developing a meeting schedule and facilitated the development of a mission statement, bylaws, and a website.

EPA has provided guidance and updates on various Site activities on a monthly basis since the inception of the CAG. EPA participated in over 16 CAG meetings in 2009 and 2010. EPA continues to assist the CAG by tracking action items and preparing meeting summaries.

EPA prepared a fact sheet for the CAG and issued it to a mailing list of over 600 recipients to announce their development and to invite the public to become involved in their meetings on September 30, 2009. EPA assisted the CAG with public meeting announcements and support for three public meetings on December 14, 2009, March 15, 2010 and June 10, 2010.

EPA provided the CAG information on applying for Technical Assistance Plan Program (TAPP) grants to assist the community in hiring a Technical Advisor (TA). EPA notified the CAG on August 24, 2009, that they were selected to receive a TAPP grant, provided by TVA. EPA aided the CAG in selecting an interim TA, through the Technical Services for Communities (TASC) program to begin assisting them with reviewing upcoming technical documents. The interim TA began assisting the CAG in November 2009.

5.1.4 Community Mailing List Development

EPA developed a community mailing list by combining TVA real estate contact information, CAG members, and those who signed up to be on the mailing list at public meetings, and visiting the TVA Community Outreach Center. EPA updates the community mailing list with new information from public meeting sign in sheets and returned mail.

5.1.5 Fact Sheet Preparation

During the time-critical removal action, EPA developed quarterly fact sheets and issued them to a mailing list of approximately 600 residents and interested community members. These include the following:

- Quarterly Fact Sheet #1 (September 2009): Work conducted May through August 2009;
- Quarterly Fact Sheet #2 (January 2010): Work conducted September through December 2009;
- Quarterly Fact Sheet #3 (April 2010): Work conducted January through March 2010;
- Quarterly Fact Sheet #4 (July 2010): Work conducted April through June 2010; and
- Fact Sheet #5 (December 2010): Work conducted July through December 2010.

In addition to quarterly fact sheets, EPA prepared the following topic-specific fact sheets:

- Questions and Answers on the Administrative Order and Agreement on Consent for the Tennessee Valley Authority Kingston Fossil Fuel Plant Release; and

- Frequently Asked Questions Regarding the Disposal of Coal Ash at the Perry County, Arrowhead Landfill Uniontown, Alabama.

EPA will continue to prepare fact sheets updating the progress on the Site as needed through the completion of the non-time-critical removal action work. The fact sheets can be found on EPA's website located at: www.epakingstontva.com.

5.1.6 EPA Website

EPA produced and maintains a website that is accessible to the public at www.epakinstontva.com. The website includes up-to-date Site photos, maps, documents out for public comment, and additional information of community interest. The community has noted in blogs, at public meetings, and during Site tours that they frequently visit the website for updated information on the cleanup, and has mentioned on multiple instances the user-friendly nature of EPA's website.

After the EPA Order in May 2009, EPA's START contractor OTIE established a website, easily accessible to the public, centralizing information produced by EPA and Site personnel including documents approved by EPA, released by EPA, and contact information. The website also includes a private log-in area for EPA use in sharing and reviewing information. As the time-critical removal action progressed, additional sections were added to the website for photographs, videos, scientific studies, work plans, and maps.

The website was created using Microsoft Sharepoint®. No additional software design packages were considered for creating this website due to time constraints. Additional server space storage was procured to accommodate the increasing amount of material being posted on the website. In addition, the website is stored on more than one server to accommodate different program specifications. Some of the programs created to enhance the website needed to be run on a separate server that could process the scripting language they were written in.

EPA's START contractor OTIE tracked the usage of the website by running a monthly site usage report that is included in Microsoft Sharepoint®. One "hit" was counted each time a user accessed the home page. The peak monthly usage for the site was approximately 3,300 hits in June 2009. Usage progressively decreased as the removal progressed over time. Website usage met a plateau at approximately 1,000 hits beginning in September 2010 (Ref. 32.1). Periodic maintenance on the server storing the homepage produced inaccurate tracking in February and March 2010.

The website contains various sections specific to each removal operation. Site sections, or site tabs, highlight Disposal, Excavation, Dredging, Productivity, Nature and Extent, River Closure/Advisory, and Health and Safety. For each of these tabs, a slideshow format of photographs display each type of operation. The Nature and Extent tab slideshow displays aerial images of the Site in chronological order. Maps on each tab illustrate the area on Site where the operation occurs. The Productivity tab displayed a graph instead of a map illustrating the amount of ash removed by dredging and excavation over the duration of time-critical removal actions. The River Closure/Advisory tab displayed a map of the latest restricted areas of the Emory River. The Health and Safety tab displayed the current exclusion zone boundary including entry and exit locations. Documents and website links were also included on these tabs for additional information. Two additional tabs included a calendar for scheduling Site tours (Calendar), and local weather conditions (Weather). The public accessed the website to see the Site tour schedule and contact EPA to make an appointment.

In addition to Site Sections, Document Libraries organized Site documents into categories. Below is a description of those libraries:

- Pollution Reports (POLREPs) are reports produced three days a week by OTIE for EPA. The POLREPs were distributed to several divisions of EPA as a semi-daily update of site activities and posted on the website for public viewing. POLREPs continue to be produced weekly during non-time critical removal. Information within the POLREPs included work plan updates, meteorological information, on-site personnel, community involvement activities, and production numbers. Maps and graphs were included in the POLREPs for tracking Site production to augment written information. POLREPs 1 through 182 documented the majority of time-critical removal actions. The completion of offsite disposal was documented in POLREP 195.

- Community Information included documents that were mailed to the public and handed out at public meetings by EPA, including quarterly newsletters, factsheets, press releases, and information about the CAG.
- Incident Command library contained the current Site objectives and Site command structure.
- Time-Critical Documents included work plans and concurrence forms approved by the EPA OSC.
- Two libraries contained environmental monitoring data, Air and Water Data Summaries (located in the Time-Critical Documents library) and EPA Air Audits and Data Comparison Reports. Audit review reports conducted by EPA's SESD for air monitoring and data quality, were also included in the Air Audits library.
- Selenium Reports library contained selenium studies conducted by an EPA SAB and USACE ERDC.
- EPA Order and Administrative Record library posted the EPA Order, together with response to comments.
- USEPA Region 4 Congressional Testimonies library contained copies of testimonies given by EPA.
- TVA Weekly Reports included reports submitted weekly by TVA to EPA as required by the EPA Order.

Revisions to the website, including layout changes and library additions, were often suggestions from Site personnel and the public. Two libraries specifically requested by the public were Documents for Current Public Comment and Recent Additions. These two libraries reduced the amount of time searching the website for recent updates and decision documents needing the public's input. The most noticeable layout change was the addition of site tabs organizing the website by removal operations. The public noted in blogs, at public meetings, and during Site tours that EPA's website was their primary destination for up-to-date information on the removal actions.

Imagery Libraries were created to group the three types of imagery media: aerial images, photographs, and videos. Photographs are organized chronologically. Approximately 5,000 photographs at low resolution are contained in the Photo Gallery. EPA's photo database, maintained by EPA's START contractor OTIE, contains the metadata for these photographs in Microsoft Access®. The Videos library includes videos created by EPA's START contractor Tetra Tech and the ATSDR.

EPA with OTIE coordinated monthly aerial photographs of the Site. A local Tennessee company was subcontracted to fly the aerials and process the images. The camera was geo-referenced with software to accommodate GIS usage (NAD83, Tennessee State Plane). The camera was mounted to the underneath side of the plane through the cargo bay for vertical imagery capture. The images were flown at two altitudes for the needed resolutions in several flight lines north to south: five-ft resolution (low resolution, high altitude) and six-inch resolution (high resolution, low altitude). Post-flight image processing consisted of putting together (as a mosaic) multiple flight lines of sequential images to produce one large image covering the needed extent at each resolution (five-ft and six-in). The images were not pixilated or digitized during post processing. Electronic images were sent to OTIE one week following the flight. Aerials were flown monthly from May 2009 through July 2010. Additional aerial images were flown by TVA. Aerial imagery provided a base map for all maps displayed on the website and in POLREPs. Aerials are also used to keep the website current. Aerial imagery is organized chronologically including a 2007 pre-spill aerial image and a 1941 topographic map.

5.1.7 Site Tours

EPA instituted an open house policy for interested parties to schedule (typically on a Saturday) a Site tour and be briefed on the subject of their choice. Numerous visitors took advantage of this policy ranging from universities to local citizens as well as various media organizations. EPA hosted Site tours for community members and media agencies as requested throughout the time-critical removal action. EPA hosted over 25 individual and group site tours to show the progress of the removal actions. EPA will continue to conduct Site tours as requested through the non-time-critical removal action.

5.1.8 Press Releases and Media

EPA prepared and issued over a dozen press releases regarding information on the time-critical removal action cleanup. EPA's press releases were frequently picked up by the associated press and covered by various media organizations nationwide. Press releases can be found on the EPA Region 4 website http://www.epa.gov/region4/ and EPA's Site website.

EPA conducted various interviews with local, national, and international media outlets that include print, broadcast and internet agencies as requested. EPA conducted in person and teleconference interviews with the media throughout the time-critical removal action. EPA conducted interviews with nationally-recognized media outlets such as CBS 60 Minutes show, which originally aired in October 2009, and can be viewed at: http://www.cbsnews.com/stories/2009/10/01/60minutes/main5356202.shtml.

EPA also provided an interview with The History Channel show *Modern Marvels,* which aired on November 19, 2010. EPA has had significant media exposure in the past year due to the proposed coal ash regulations. EPA will continue to conduct interviews with the media as requested through the non-time-critical removal action.

EPA prepared daily communication briefings to update management and staff on articles regarding the project when information was available (Ref. 27.1, Ref. 27.2, Ref. 27.3).

5.1.9 Community Involvement Plan

EPA provided oversight and reviews on TVA's Community Involvement Plan (CIP). EPA provided TVA guidance on drafting a CIP and assisted with taking comments from the CAG and the public to incorporate into the final document.

5.1.10 Administrative Record and Information Repository Audits

EPA provided oversight to TVA in the establishment and maintenance of the Administrative Record and Information Repositories for all documents related to the removal actions. EPA conducts routine audits of the AR and IR to ensure the proper documentation is available to the public. Documents related to the time-critical removal action can be found throughout EPA's and TVA's website.

5.1.11 Long Term Recovery Committee Meeting

EPA attended over a dozen Long Term Recovery Committee (LTRC) meetings. During several meetings EPA provided updates or presentations as requested by the LTRC. The LTRC was disbanded in March 2010 upon completion of their mission.

5.1.12 Public Meetings/Availability Sessions

EPA assisted with the coordination and attended joint TVA, EPA and TDEC public meetings and availability sessions. Availability sessions were held on months when public meetings were not scheduled. EPA hosted booths at both public meetings and availability sessions to answer questions from the public and to provide information as needed. EPA will continue to participate in public meetings and availability sessions as they are scheduled. EPA has participated in at least 15 public meetings and availability sessions.

5.1.13 General Community Outreach Activities

EPA attended and presented to various community organizations and schools and universities throughout the time-critical removal action. EPA will continue to be available to attend meetings and answer questions regarding the removal actions as requested.

5.2 TVA COMMUNITY INVOLVEMENT PROGRAM

The EPA Order Section XXXVII, paragraph 95, required TVA to prepare a Community Involvement Plan (CIP) that specifically addresses the requirements of CERCLA and the NCP. In October, 2009, TVA developed a draft CIP to facilitate two-way communication between the community surrounding the Site and to encourage community involvement in Site activities. TVA has utilized the community involvement activities outlined in the CIP to ensure that residents are continuously informed and provided opportunities to be involved. The CIP presented TVA's community involvement program and listed resources available to the public. Community involvement was subsequently implemented in accordance with the EPA OSC approved *Draft Community Involvement Plan* (CIP) (Ref. 3.1.1).

Interviews with the community showed that Roane County residents receive their information in a wide variety of ways. No single communication method is guaranteed to reach everyone who is interested in the removal actions, so TVA used a variety of methods – from the Internet to conventional media to face-to-face meetings – to interact with the public. The following communications tools have been used to interact with the community and expand understanding about the Site. Some tools are a required part of the CERCLA information and decision-making process; others were chosen by TVA to improve communications regarding the Site. Table 5-1 summarizes the timing and the use of each of the communications tools.

Table 5-1. Timing and Use of Communications Tools

Communication Tool	Time Frame and Use of Tool
Administrative Record and Information Repository	Completed (updated as new documents are made available)
Website and New Media	Ongoing
TVA Community Outreach and Learning Center	Ongoing
TVA Outreach Team	Ongoing
Roane County CAG Meetings	Ongoing and as requested
Economic Development Foundation	Ongoing funding disbursements
Public Notices	As documents become available and as public comment periods are scheduled
Availability Sessions	Regularly and as needed
Public Meetings	Quarterly or as needed
Public Comment Periods	As needed and required
Responsiveness Summaries	Following public comment periods
Fact Sheets and Newsletters	As needed
Community Handouts for Local Residents	Ongoing and as needed
Road Signs in the Affected Area	Ongoing and as needed
Speaker's Bureau for Community Speaking Engagements	Ongoing and as needed or requested
Media Relations	Ongoing

5.2.1 Administrative Record and Information Repository

The EPA Order, Section XXI, paragraphs 51 and 52, and Section XVII, paragraph 95 required TVA to establish an Administrative Record for the Site. The Administrative Record is defined as a set of documents which form the basis for selection of a response action under Section 113(j) of CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986. TVA has established and maintains an Administrative Record. Hard copies of the Administrative Record are stored at the following Information Repositories: EPA Region 4 Regional Office; TVA Community Outreach and Learning Center; and the Kingston Public Library. The Administrative Record is available on disk at the Harriman Public Library and on TVA's website. The Administrative Record and Information Repository were established in May 2009, and will remain open until the cleanup is completed and the final Decision Documents are signed. TVA will add new documents as they become available.

5.2.2 Website and Electronic Media

TVA's website was established in the emergency response phase and was redesigned to be more user-friendly during the time-critical removal action. The website, which is accessible from TVA's home page, has been updated regularly with sampling results and the latest information pertaining to the removal action. It contains background information, photographs and video presentations, and news about the ash release and cleanup, as well as water, air, solid, and biological testing results. The website provides a way for residents to send their questions and concerns to TVA. Website visitors also can sign up to receive regular email updates. The website will be maintained at least until the removal actions are is completed and the last decision document is signed.

The TVA website includes the following types of information:

- Information for residents, public meeting notices, news releases, fact sheets, reports and other documents prepared throughout the emergency response, time-critical removal action, and non-time-critical removal action;
- Information on water, air, solid, and biological testing results;
- Photographs and videos;
- Administrative Record documents, including general plans and reports; time-critical removal action plans, work plans, and reports; and non-time-critical plans, work plans, and reports;
- Weekly status reports, recent updates, and archives, including root cause analysis; and
- Meteorological information.

5.2.3 TVA Community Outreach and Learning Center

The TVA Community Outreach Center, located at 509 N. Kentucky Street, Kingston, Tennessee, opened January 6, 2009, two weeks after the release. It was a center for information and help for people affected by the release, particularly those negotiating the sale of their property to TVA, making health or property claims, requesting help with cenosphere and debris removal, or wanting to consult the Administrative Record. The TVA Community Outreach Center transitioned to the TVA Outreach and Learning Center, and continued to keep people informed about site progress along with other TVA initiatives. The TVA Outreach and Learning Center provided a location for the Administrative Record and a reading area for those documents; a place to ask questions and relay messages about the site; a place to get general information about TVA and the environment; and a place to display information about the Site and other environmental, energy, and economic development issues. The Outreach and Learning Center was closed on March 15, 2011.

5.2.4 TVA Outreach Team

TVA formed an outreach team comprised of current employees and retirees. This team conveyed information to the public; listened to concerns and worked to provide answers; handled issues dealing with real estate transfers relating to the ash release; and handled other matters, such as debris removal, traffic impacts, other property, and health claims. The team's size has decreased as real estate transfers have been completed and as the time-critical removal action was completed, but the team will continue to assist in communicating with the public.

5.2.5 Community Advisory Group

The EPA Order Section XXXII, paragraph 95, required TVA to provide EPA a Technical Assistance Plan for providing and administering $50,000 of TVA's funds to be used by a qualified community group to hire independent technical advisors during the removal activities. In August 2009, EPA helped the community form the Roane County Community Advisory Group (CAG), which was commissioned to assist community members with information about the Site and participate in the decision-making process. Technical assistance was provided to the CAG in accordance with the EPA OSC approved *Technical Assistance Work Plan Draft Agreement between TVA and the Roane County Community Advisory Group* (Ref. 3.1.2). The CAG was made up of community members and was designed to serve as the focal point for the exchange of information among the local community and TVA, TDEC, EPA, and other pertinent agencies involved in the removal actions. TVA, as requested, provided support to the group as it developed bylaws, invited members, developed meeting schedules, and determined the activities of the group. TVA officials attended monthly CAG meetings to share information about project progress for the purpose of relaying that information to the community. On November 23, 2009, the CAG was awarded $50,000 in funding under the Technical Assistance Plan to hire a technical advisor to help CAG members understand Site cleanup issues and enable the group to share this information to others in the community. . TVA used the CAG as a primary point of notification concerning changing site conditions such as episodic rainfall events and their effect on the Site.

TVA is currently meeting with the CAG bi-monthly, providing weekly emails about Site activities and conducting periodic tours of the Site. EPA and TVA will continue to support the CAG as requested and will make information available to members of the CAG throughout the removal actions.

5.2.6 Congressional Testimonies

TVA provided testimony on three occasions before Congress. On January 8, 2009, Tom Kilgore, TVA President and Chief Executive Officer, testified before the Senate Environment and Public Works Committee, about the release at the Kingston Site, outreach to the public, environmental impacts (including water, soil, and air quality), and the recovery efforts (Ref. 23.1). On March 31, 2009, Mr. Kilgore, testified before the U.S. House Committee on Transportation and Infrastructure, Subcommittee on Water Resources and Environment, describing fly ash storage, history of the release event and emergency response, environmental efforts, and recovery actions (Ref. 23.3). On July 28, 2009, Mr. Kilgore, testified again before the U.S. House Committee on Transportation and Infrastructure, Subcommittee on Water Resources & Environment, describing the results of the Root Cause Analysis; TVA actions and accountability; TVA systems, controls, standards and culture; and progress of the recovery operations, environmental conditions, and community outreach (Ref. 23.5). On December 9, 2009, Mr. Kilgore testified a third time before the U.S. House Committee on Transportation and Infrastructure, Subcommittee on Water Resources & Environment, describing the prior year's recovery progress and plans, commitment to Roane County neighbors, initiatives in Public Health and Safety, environmental monitoring results, improvements to impoundments at TVA's fossil plants, and improvements to TVA management performance (Ref. 23.7).

5.2.7 Briefings of Public Officials

On a periodic basis throughout the time-critical removal action, TVA held update briefings of the work being done as well as site tours for local, state and federal officials. These included U.S. Congressional members and staffers, state senators and representatives, Roane County Executive, Roane County Commission, Roane County Community Advisory members, Roane County Long Term Recovery Committee members, and various others. As of December 2010, TVA had held briefings with 60 public officials; a list of the public officials and description of each briefing are included in Appendix J.

5.2.8 Economic Development Foundation

On September 14, 2009, TVA and the elected leaders of Roane County and its communities announced the establishment of the Roane County Economic Development Foundation. Through the foundation, Roane County and its communities will receive more than $40 million in economic development funds from TVA for locally identified projects as part of TVA's response to the ash release. The foundation's board consists of four TVA representatives and four elected leaders. Projects approved for funding by the board included Roane County Schools, sewer improvements in Kingston, paving of an industrial park road in Rockwood, support for the Princess Foundation for Arts Education and Conference Center in Harriman, and other locally identified projects.

5.2.9 Public Notices

In accordance with the EPA Order, TVA placed more than 150 paid advertisements in the local newspaper (*Roane County News*) and in a weekly advertising paper (*Roane County News-Record*

"Shopper") (not in the classifieds) announcing the availability of work plans, decision documents, other important work documents, and public comment periods. TVA also emailed those who asked to be notified electronically of such announcements. The ads were placed for at least three consecutive days.

5.2.10 Availability Sessions

Beginning November 2009, TVA held monthly availability sessions at the TVA Outreach Center. TVA used visual aids such as maps, posters or charts, examples of Site equipment, handouts, etc. to share information about the Site. TVA placed display advertisements on the website,in the front section of the local newspaper (*Roane County News*), and in a weekly advertising paper (*Roane County news-Record 'Shopper"*) (not in the classifieds). Addition, information was displayed on message boards near the Site to announce upcoming Availability Sessions. TVA continued to host informal sessions until April 2010, when residents no longer attended the sessions.

5.2.11 Public Meetings

In addition to open houses held in January and March 2009, in accordance with the EPA Order, TVA has held quarterly public meetings since June 2009 to brief the public on activities at the Site and allow members of the community to interact with Site management and personnel regarding the ash release. The meetings provided opportunities for the public to address Site personnel involved in the removal action and ask questions, both openly and in one-on-one or small group settings. Meetings held during public comment periods included the opportunity to present formal comments to TVA. TVA placed display advertisements on the website in the front section of the local newspaper (*Roane County News*) and in a weekly advertising paper (*Roane County News-Record "Shopper"*) (not in the classifieds). Information was also displayed on message boards near the Site to announce upcoming public meetings. TVA will continue to host public meetings where TVA, EPA, and TDEC can present progress to date and plans for future work while public interest warrants them.

5.2.12 Public Comment Periods

Announcements of public comment periods appeared in the local newspaper (*Roane County News*) and in a weekly advertising paper (*Roane County News-Record "Shopper"*) (not in the classifieds). Additionally, the announcements were emailed to those who had asked to be notified electronically of such announcements. The announcements included details on duration, how to make comments, where to submit comments, etc. TVA solicited comments on the following draft documents: the CIP, the Action Memorandum for the time-critical removal action, work plans for time-critical removal action, and amendments to the time-critical removal action work plans. Comments continue to be solicited for the non-time critical removal action decision documents and work plans. Comment periods were announced as documents and plans were released. Comment periods lasted a minimum of 30 days.

5.2.13 Responsiveness Summaries

TVA prepared a responsiveness summary for each public comment period, which can be found on EPA and TVA websites. The responsiveness summary included an overview of the document(s) being reviewed and a summary of comments received and TVA's responses. EPA reviewed and approved all responsiveness summaries. For the time-critical removal actions, the responsiveness summary for all public comment periods was made available before the completion of the removal actions.

5.2.14 Community Handouts, Fact Sheets, and Newsletters

In June and December 2009, TVA mailed to 32,700 Roane County residents the *Report to Our Roane County Neighbors*, which provided a comprehensive update on the removal action. Fact sheets or newsletters were hand-delivered and mailed (or emailed when desired) to Roane County residents and other interested parties and made available at the Information Repositories. TVA prepared and distributed newsletters throughout the time-critical removal action. TVA's website contains nearly 50 fact sheets, newsletters, and links to reports or other documents that were prepared during the time-critical removal action. The website also contains the numerous *Area Resident Information* newsletters and links to information about the removal activities, which were prepared every one to two weeks during the time-critical removal action.

5.2.15 Road Signs

TVA used temporary road signs and electronic message boards to tell the public about changes to the Site including traffic impacts, temporary road closings, and train crossings. The electronic message boards also announced events such as public meetings and other relevant information..

5.2.16 Kingston Speakers' Bureau and Public Speaking Engagements

In support of non-time-critical activities, TVA identified opportunities for TVA staff and subject matter experts to speak with area groups in formal and informal settings. Groups included local and county government bodies, schools, and community organizations. Forums for public speaking engagements included, but were not limited to: Rotary Club (Roane and Knox counties), Kiwanis Club (Roane and Knox counties), other civic clubs, garden clubs, Chambers of Commerce (Knox County and City of Oak Ridge), schools, Roane Alliance, Oak Ridge Economic Partnership, and Roane County Environmental Review Board. Speaking opportunities were identified by TVA Communications or Valley Relations staff, personal requests and suggestions from community members. Communications or Valley Relations staff, personal requests and suggestions from community members. TVA also met monthly with the Roane County Long-Term Recovery Committee, established by then County Executive Mike Farmer. TVA updated the committee on the removal actions at the Site and answered questions posed by the committee. The last meeting held was March 2010.

5.2.17 Media Relations

TVA worked actively with local, regional, and national news media to ensure that news outlets had access to accurate information about the Site and the removal actions. In addition to responding to requests for interviews and information, TVA issued news releases, published bi-weekly site update columns in the *Roane County News*, held news conferences, and gave media tours. TVA coordinated more than 50 visits for the media to get a close-up look at the removal activities at the Site.

5.2.18 Medical Screening

TVA contracted with Oak Ridge Associated Universities (ORAU), a consortium of over 100 universities, to independently address health concerns of Roane County residents. Individual confidential health assessments were conducted by physicians from Vanderbilt University Medical Center. TVA also contracted with Ridgeview Resources for Living in Harriman, Tennessee, to provide mental health services to residents. Results of the individual confidential health assessments and medical screening are summarized in Section 3.7.6.

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6 RESOURCES COMMITTED

6.1 TENNESSEE VALLEY AUTHORITY COSTS

Costs incurred since the event through the time-critical removal action totaled $580 million. Actual costs of the work performed have been captured in accordance with the project Work Breakdown Structure (WBS). Table 6-1 lists the WBS elements associated with the time-critical removal action, and the costs incurred.

Table 6-1. TVA Costs Incurred During the Time-Critical Removal Action

Work Breakdown Structure Element	Costs Incurred
WBS 01.01 - Program Management	$28,800,000 [a]
WBS 01.02 - Government Relations, Legal, Health	$29,000,000 [a]
WBS 01.03 - Community Outreach	$42,200,000 [a]
WBS 01.04 - Infrastructure	$108,200,000 [a]
WBS 01.05 - Ash Dredging & Processing	$106,200,000[b]
WBS 01.06 - Cenosphere Removal	$22,000,000 [c]
WBS 01.07 - Skimmer Wall (Debris Removal)	$2,300,000 [c]
WBS 01.08 - Ash Disposition (Long-Term Disposal)	$179,500,000[b]
WBS 01.09 - Peninsula Ash Processing Area	$500,000 [a]
WBS 01.10 - Dike Reinforcement	$7,900,000 [a]
WBS 01.11 - Environmental Management	$26,300,000 [a]
WBS 01.12 - Embayment Restoration	$3,300,000 [a]
WBS 01.13 - Failed Dredge Cell	$8,900,000 [a]
WBS 01.98 - Fuel Related Contract Settlements	$15,300,000 [a]
Project Total	**$580,400,000**

Notes:

[a] Actual Cost of Work Performed through June 30, 2010 completion of the time-critical removal action phase.

[b] Actual Cost of Work Performed through December 31, 2010 completion of offsite disposal.

[C] Actual Cost of Work Performed through September 30, 2010, completion of cenospheres removal and debris removal.

TVA has recorded an estimate in the amount of $1.178 billion for the total cost of cleanup related to the release. The $1.178 billion estimate includes, among other things, a reasonable estimate of costs related to ash dredging and processing, ash disposition, infrastructure repair, dredge cell repair, root cause analysis, certain legal and settlement costs, environmental impact studies and remediation, human health assessments, community outreach and support, regulatory oversight, cenosphere removal, skimmer wall installation, construction of temporary ash storage areas, dike reinforcement, project management, and certain other remediation costs associated with the cleanup.

TVA has not included the following categories of costs in the above estimate since it has determined that these costs are currently either not probable or not reasonably estimable: penalties (other than the penalties set out in the TDEC order), regulatory directives, natural resources damages, outcome of lawsuits, future claims, long-term environmental impact costs, final long-term disposition of ash processing area, costs associated with new laws and regulations, or costs of remediating any discovered mixed waste during ash removal process. There are certain other costs that will be incurred that have not been included in the estimate as they are appropriately accounted for in other areas of the financial statements. Associated capital asset purchases are recorded in property, plant, and equipment. Ash handling and disposition from current plant operations are recorded in operating expenses.

In 2009, TVA originally charged a portion of this amount to expense as follows: $525M, $150M, and $258M during the three months ended December 31, 2008, March 31, 2009, and June 30, 2009, respectively. However, in August 2009 the TVA Board reclassified all amounts previously expensed as a regulatory asset and the amount is being charged to expense as it is collected in rates over 15 years, beginning October 1, 2009. As the estimate changes, additional costs may be deferred and charged to expense prospectively as they are collected in future rates.

TVA received a Commissioner's Order from TDEC on June 14, 2010, that assessed penalties of approximately $12M against TVA in connection with the ash release (Ref. 22.1). The TDEC order stated that the penalties address violations of the Tennessee Water Quality Control Act and the Tennessee Solid Waste Disposal Act. TVA does not plan to appeal the order. During the third quarter of 2010, TVA paid TDEC $3M to reimburse it for oversight costs, and TVA paid TDEC an additional $3M on July 15, 2010.

6.2 U.S. ENVIRONMENTAL PROTECTION AGENCY COSTS

Approximate EPA costs incurred are based on the period from March 2009 through the end of August 2010. These costs are for EPA time-critical removal action costs. EPA non-time critical removal action costs are not included. Total EPA time-critical removal action costs calculated are 0.9% or approximately 1 % of overall total time-critical removal action costs for the Site ($580,000,000). Table 6-2 lists the costs incurred by EPA.

Table 6-2. EPA Costs Incurred During the Time-Critical Removal Action

Organization	Costs Incurred
U.S. Environmental Protection Agency	$2,047,000
Department of Interior – Bureau of Reclamation	$300,000
U.S. Army Corps of Engineers	$107,000
Department of Homeland Security – USCG	$176,000
Superfund Technical Assessment and Response Team	$2,370,000
Project Total	**$5,000,000**

7 DIFFICULTIES ENCOUNTERED, MEASURES TAKEN, AND CONCLUSIONS

This section of the OSC Report records the problems encountered in implementing the time-critical removal action, the measures taken, and conclusions as they relate to compliance with the EPA Order.

7.1 MEANS TO PREVENT A RECURRENCE OF THE DISCHARGE OR RELEASE

Following the ash release, AECOM prepared a Root Cause Analysis of the Dredge Cell failure to determine the most probable cause(s) of failure (Ref. 25.2). AECOM's findings are discussed in Section 1.1.3. The Action Memorandum for the Non-Time-Critical Removal Action for the Embayment/Dredge Cell (Ref. 10.2.3) identified measures for berm configuration and foundation design to effectively address the contributing factors. These measures included the following:

- Fill Geometry. The former failed dike was constructed using small dikes stacked progressively up slope on top of nearly 80 feet of sluiced ash and a sensitive silt ("slimes") layer. Total height of the dikes that surrounded the former Dredge Cell prior to its failure was elevation 820 ft msl. The ash release may have been prevented by constructing the perimeter containment using compacted earthen berms placed on stable foundations. The ash release may also have been prevented by constructing the perimeter dikes to a lower height, below elevation 820 ft msl.

- Fill Rates. The elevation of the ash in the former Dredge Cell prior to failure was increasing at a rate of about 6 ft/year, more rapidly compared to earlier years, which added load to the wet ash beneath the dikes. In particular, filling resulted in loose, wet ash saturated throughout its depth, which led to high porewater pressures at depth and low strength in the sluiced ash materials. The ash release may have been prevented by constructing the ash fill by dry stacking using dewatered ash, compacted in thin lifts. Results of the test embankment have shown that such construction methods would not result in excess porewater pressures in the foundation ash materials under a controlled and monitored rate of filling.

- Foundation Soils. Creep deformations within the submerged loose slimes was occurring under the load of loose wet ash in the former Dredge Cell, which caused a reduction in the strength of the slimes and led to deep-seated failure of the dike. The ash release may have been prevented by reinforcing the perimeter berm foundation so that stability would not rely on the strength of the soft foundation soil layer to support the internal pressures from the landfilled ash.

- Ash Fill. The original sluiced ash was deposited under water, resulting in a high void ratio (very loose ash) that did not consolidate or become denser under the surcharge weight of ash placed above it. As a result, the loose wet ash had a low undrained shear strength with a very sensitive structure. The ash release may have been prevented by constructing the cell fill using dewatered ash, compacted in thin lifts. Results of the test embankment study have shown that the shear strength of the compacted dry ash is much greater than loose wet ash.

TVA OIG prepared an Inspection Report as a review of TVA's ash management practices (Ref. 25.3). The findings of the OIG Inspection Report are discussed in Section 1.1.3. TVA has acted to address ash management weaknesses. TVA management has begun to reassess its management program and has taken several actions, including: organizational changes to address management and accountability issues; development of programmatic documents specifying operational, maintenance, engineering and construction policies and procedures; changes designed to improve the corporate culture which had de-emphasized the importance of ash management; and steps to assess ash storage facilities against dam safety guidelines and take corrective measures.

A TDEC Advisory Board also prepared a report of lessons learned from the Dredge Cell failure. The findings/recommendations of the TDEC Advisory Board are discussed in Section 1.1.3. Proper engineering design should have addressed the material properties (including pore pressure dissipation and consolidation mechanisms) and the methods of placement of the ash (including the raising of the cells, the staged upstream construction, and the dredging activities). Management of the evolutionary process should have included on-going evaluation, documentation, and communication of design. The quality of engineering design, construction, inspection, and maintenance should have incorporated a higher standard of care. TVA has taken steps to address the underlying issues that led to the Dredge Cell failure and recommendations by the TDEC Advisory Board. These steps include organizational and management oversight and governance to emphasize life-cycle design through programmatic application of engineering design principles. Safety monitoring has been improved through instrumentation and Dam Safety oversight, inspections and rigorous maintenance practices have been implemented at all of TVA's coal combustion facilities.

7.2 OPERATIONAL DIFFICULTIES

7.2.1 Expediting the Removal of Ash from East of Dike 2

The EPA Order recognized the importance of expeditiously removing ash from east of Dike 2 as safely as possible in order to reduce the threat of flooding and reduce the threat of migration. The early May high flow event moved over 100,000 cy of ash beyond the Emory River system and demonstrated that the ash remaining in the Emory was subject to significant migration without likelihood of containment. In order to reduce this threat, the EPA OSC, in conjunction with the Unified Command, established a target of 15,000 cy/workday removal rate as the optimum sustained attainment removal rate goal for Phase 1 (August 2009 through January 2010). Early progress and obstacles in attaining this goal described in the EPA OSC memorandum re: *Time Critical Removal Action Status Memo for the TVA Kingston Fly Ash Release* (Ref. 24.9). The project averaged approximately 13,300 cy/workday removal rate from east of Dike 2 during Phase 1 with individual rates of production exceeding 20,000 cy/workday. Phase 2 was geared towards final contouring and a slower rate mostly due to the distance needed to be covered. The removal goal was established at 10,000 cy/workday. The project averaged approximately 8,000 cy/workday removal rate with individual high production rates of 15,000 cys. A timeline history of the removal east of Dike 2 can be seen in the histograms prepared by EPA (Figures 6, 7, and 8).

Measures Taken. The following measures were taken during Phase 1 to expedite ash removal:

- During the pilot dredging program (prior to the EPA Order), the Unified Command tested a higher rate of dredging by adding an additional 14-inch cutterhead dredge to flush out potential operational obstacles. Results of the pilot dredging program led to Rim Ditch stabilization improvements, including sheet piling, and larger dredges and larger Rim Ditch excavators to process ash at the expedited production rate.

- As part of the Unified Command initiative, TVA accelerated its procurement schedule by approximately one month or an 8% improvement in project schedule.

- Early completion of the west of Dike 2 stormwater controls allowed for the rapid commencement of excavation east of Dike 2. The aggressive land-based mechanical excavation of material from increased total removal productivity from east of Dike 2 by 25%.

- Phase 1 dredging productivity was increased by the use of 20-inch and 16-inch cutterheads as opposed to the previously planned 14-inch. This improvement raised expected hydraulic dredging productivity by 95% and overall removal productivity from east of Dike 2 by 32%.

- Use of larger dredges during Phase 1 allowed better cutting angles at greater depth before the ladder angle turns the cutterhead axis to vertical to reach bottom. Dredges having different cutterhead attachment angles were also used to optimize dredging productivity. Dredging optimization is a tradeoff between pushing more material and less water without plugging the lines.

- The Unified Command coordinated with respective agencies to close the Emory River dredging area which allowed for a more controlled and efficient work zone.

- Mechanical debris removal ahead of dredge paths helped increase productivity as approximately 10 acres of tree debris was commingled with the originally released ash in the primary plug. While improvement in productivity is difficult to quantify, debris removal ahead of dredging avoided slowdowns of the hydraulic dredges.

These measures (use of larger cutterheads, schedule acceleration, and concurrent mechanical excavation east of Dike 2) improved Phase 1 removal productivity by 65%. The contribution to efficiency made by both the river closure and debris removal improvements is conservatively estimated to have improved productivity by an additional 10%, for total estimated improvement of 75%.

The following measures were taken during Phase 2 to expedite ash removal:

- Simultaneous land-based mechanical excavation east of Dike 2 accounted for approximately 18% of the material removed during Phase 2.

- The addition of simultaneous mechanical dredging increased the project’s ability to reach upriver ash and more isolated areas resulting in an approximate 4% improvement in productivity.

- Originally proposed, the Phase 2 contour dredging included two 14-inch cutterheads and one 16-inch. In keeping with the Unified Command priority of progressing in an expeditious and efficient fashion, TVA secured additional 14-inch and 16- inch cutterheads, for a total of five dredges. This resulted in a 33% improvement in productivity over the original Phase 2 dredge plan.

- The Unified Command worked to establish a streamlined decision making progress that allowed for the maximum pace to be attained with the maximum efficiency in removing ash while minimizing the dredging of native sediment. Frequent bathymetry as well as vibracore sampling allowed information gathering to keep pace without impeding operational progress. Aerial photography and vibracore sampling were used to more accurately define boundaries of sand bars and the river channel prior to dredging. Defining the interface between ash and native river sediments sooner avoided overdredging and disturbance of native river sediments.

- During Phase 2, the removal action was improved by providing smaller dredges and precision cutting techniques. The hydraulic cutterhead dredges were equipped with GPS and 3-D software capable of controlling the cutterhead position and thereby allow the dredge operators to more accurately excavate to a planned surface. A boundary control protocol was implemented to monitor and control overdredging. The combination of these two actions resulted in significantly less dredging of river sediment in Phase 2 than in Phase 1.

- In addition, the Unified Command continued to manage the river closure to effectively position equipment and improve efficiency.

These measures (additional hydraulic dredges, mechanical dredging, and land-based excavation) improved Phase 2 productivity by 55%. The contribution of the river closure, streamlined approval process for concurrence and the use of aerial photography, extensive vibracores and GPS tracking is conservatively estimated to have improved productivity by an additional 10%, for a total estimated improvement of 65%.

Conclusions. The following conclusions have been identified regarding expediting ash removal from east of Dike 2:

- The total quantity of ash removed from east of Dike 2 was approximately 3,500,000 cy. An estimated 500,000 cy of ash remains in the Emory River system. Approximately 90% of the retrievable ash in the Emory River was removed during the time-critical removal action.

- Faced with the inability to contain the release in the open river environment, the Unified Command met the expeditious demands and efficiencies needed to remove the ash from east of Dike 2. Approximately 90% (3,500,000 cy) of the ash east of Dike 2 was removed within a 14-month period (March 2009 thru June 2010). Approximately 85% of that (3,000,000) was removed in a 10-month period (August 2009 thru June 2010).

- While not sustaining the EPA OSC's stated target removal rate of 15,000 cy/workday for Phase 1 and 10,000 cy/workday for Phase 2, the time-critical removal action did achieve expeditious and efficient removal of the material east of Dike 2 as safely as possible. Potential flooding was minimized and migration was significantly reduced as ash was rapidly removed.

7.2.2 Gravity Settling Capacity of Ash Fines Relative to Dredge Production Rate

Difficulties were experienced in maintaining the target removal rate of 15,000 cy/workday, as described in the EPA OSC memorandum re: *Time Critical Removal Action Status Memo for the TVA Kingston Fly Ash Release* (Ref. 24.9). The EPA OSC identified significant obstacles to dredging production, including ash recovery systems, wet ash materials handling, and loading/transport. Improvements were made to those systems to meet the objectives of the EPA Order to expeditiously remove the ash from the Emory River as safely as possible.

The high dredging production rates combined with prolonged wet weather and major storm events throughout the duration of the time-critical removal action affected the ash processing operations and ash handling and storage operations. These items affecting the response are described further below.

Dredged ash slurry processing was designed to reduce the moisture content of the hydraulically dredged slurry from 85% by weight as pumped to 28% by weight for offsite shipment by train. Gravity settling of solids in the dredged ash slurry was to occur primarily within the Rim Ditch, with minimum carryover of solids to the Sluice Trench. Gravity settling of solids in sluiced ash generated by the plant was to occur primarily within the Sluice Trench, with minimum carryover of solids into the Ash Pond. However, the required river dredging production rates were substantially higher than initially anticipated. The required high production rate exceeded the gravity settling capacity of the combined Rim Ditch and Sluice Trench system. As a result, fine-grained solids accumulated in the Ash Pond at a much higher rate than planned. This accumulation of solids reduced the free water volume in the Ash Pond, which decreased the retention time for gravity settling of solids, and could have affected water quality, as measured by the performance criteria used for TSS measured at the Stilling Pond outfall.

Measures Taken. The following measures were taken to mitigate the difficulties encountered due to accumulation of ash fines in the Ash Pond at high rate:

- The EPA OSC, in an October 2009 memorandum re: OSC Determination Concerning Permit Requirements to Maintain the Free Water Volume of the Settling Pond at the Kingston Fly Ash Release Time Critical Removal Action (Ref. 6.3.7), determined that the response actions had attained the applicable or relevant and appropriate requirements, and noted that loss of production concerning removal of ash from the river is of higher public health and/or environmental consequence than maintaining the free water volume at the plant's NPDES permit level.

- Developing and implementing Best Management Practices for the Rim Ditch and Sluice Trench ash slurry processing system so as to maximize retention time while minimizing turbulence. These practices included such items as keeping accumulated material to less than 25% of the total volume; alternating the excavation of accumulated material in a series of cells within the ditches; keeping the flow channel wider; increasing the frequency of depth soundings and volume surveys; installing or adjusting weirs between cells; and adding polymers to enhance the settling rate.

- Using the Lateral Expansion area for gravity settling and storage of ash fines recovered from the Ash Pond. Initially, ash fines were dredged from the Ash Pond and the dredged slurry was discharged to the Rim Ditch. Diverting this flow to the Lateral Expansion area reduced the solids loading on the Rim Ditch, and reduced the recirculation of fines back to the Ash Pond.

- Installing a mechanical dewatering system (filter presses) to handle a portion of the ash fines recovered from the Ash Pond. However, the filter presses used to dewatering the finer-grained solids removed from the Ash Pond failed to live up to expectations. The filter press operation resulted in slower production rates, wetter product, longer start-up time, greater mechanical breakdown, and higher cost than expected. As a result, the equipment was demobilized early in favor of other mitigations described herein.

Conclusions. In conclusion, the time-critical removal action successfully met the objectives of the EPA Order by safely as possible, efficiently and expeditiously handling the increased fines that resulted from an increase in removal productivity east of Dike 2.

7.2.3 Weather Conditions Effect on Dewatering Operations

The gravity settled ash was excavated out of the Rim Ditch and Sluice Trench and placed on the Ball Field for further dewatering. Dewatering was to occur by windrowing, a process of progressively moving the ash material across the Ball Field in a series of long piles (windrows) until it is dry enough to load on the trains for shipment. This movement enhances evaporation by exposing the surface of the ash to the atmosphere and also enhances drainage by loosening the ash in the pile.

As a result of prolonged wet weather and increased production, difficulties were encountered in dewatering of the ash sufficient for handling and shipping. Conditions in the Ball Field area became wet and sloppy, limiting ash movement and stockpiling. Evaporation and drainage were adversely affected by the wet weather. Higher sand content in some stockpiles required greater degrees of dewatering to achieve lower moisture content for material handling. Dewatering of material removed from of the Sluice Trench was particularly difficult because the material contained a higher percentage of fines. Due to the high rate of solids production, the space available for windrowing was filled by mid-November 2009, resulting in stockpiles of ash having high moisture content.

Measures Taken. The following measures were taken to mitigate the difficulties encountered due to wet ash handling and storage:

- Wet storage areas were established within the former Dredge Cell and Lateral Expansion area for temporary storage of wet ash to relieve conditions in the Ball Field.
- Lime stabilization was used to augment windrow dewatering operations in the Ball Field so as to reduce moisture content sufficiently for shipment and to support construction equipment. Lime treatment was also used in portions of the East Embayment excavation to facilitate material removal to temporary storage areas.
- Polymer was added on the surface of the ash within railcars to absorb excess water when the moisture content in the ash material itself could not be reduced sufficiently.
- Material from the relic area of the Dredge Cell, which was at a moisture content suitable for loading into railcars, was mixed with and/or substituted for dredged ash material that was too wet for loading.

Conclusions. In conclusion, the time critical removal action successfully managed the obstacles presented by inclement weather in an efficient and expeditious fashion as safely as possible. The management of temporarily stored ash supported the increased rates of productivity.

7.2.4 River Flow Impacts on Dredge Operations

Wet weather and frequent rainfall events also led to high flows in the river that affected dredging operations and water sampling in the river. When conditions became critical, dredging and sampling were halted to protect the safety and health of workers. Severe high flow events resulted in downriver migration of some ash, as simulated by the USACE ERDCWES and discussed in Section 1.1.2.

Measures Taken. Measures taken to mitigate river flow impacts included halting dredge operations during severe high flow conditions. Worker health and safety considerations override the objective of maintaining dredge rate productivity.

Conclusions. In conclusion, despite these impacts, and with implementation of these mitigation measures, the time-critical removal action successfully met the removal action objectives within the required time frame.

7.2.5 Difficulties Maintaining Energy System Grid Reliability During Removal Action

Power generation system reliability requirements impacted ash processing facilities, as described in the EPA OSC memorandum re: *TVA Kingston Generation Needs for Reliable System Operations* (Ref. 24.10). NERC is committed to ensuring the reliability of the bulk power system in North America and has been granted legal authority to enforce reliability standards. Consistent with NERC contingency plans, TVA requires N-1 contingency planning for reliable operating systems. These requirements came into play in December 2009, when removal actions were under high productivity rates. Although the Kingston plant was not part of the CERCLA Site, maintenance of a reliable system power grid was a common objective of the Unified Command.

Measures Taken. Measures were taken to maintain the aggressive removal rates and maintain the power system reliability requirements. TVA proposed to determine the feasibility of unit startup on current stacks and TDEC addressed permitting issues on use of the gypsum scrubber system. Step-down of dredge usage was planned according to unit startup. Plans for use of the Lateral Expansion, filter presses, and Genesis system were prepared to alleviate impact on the dredge support system, allowing dredges to remain in operation while power generation units at the Kingston plant were online.

Conclusions. In conclusion, this coordinated effort with the Kingston plant resulted in the maintenance of a reliable power grid without significantly impacting high removal productivity, as evidenced by the manageable amounts of ash accumulating in the pond system during this time period without exceedance of TSS requirements at the Stilling Pond outfall.

7.2.6 Difficulties in Selection of a Disposal Facility

As per the EPA Order, large volumes of ash were to be safely transported and stored in a disposal facility meeting the following requirements, "TVA shall not permanently dispose of any waste material at an offsite facility, or in a new landfill onsite, unless that facility or landfill is operating in compliance with RCRA Subtitle D permitting requirements for operation and disposal of industrial wastes, which at a minimum shall include the use of a synthetic liner, leachate collection system, groundwater monitoring, financial assurance, and closure and post-closure care."

In addition to the above requirements, several other factors were evaluated in the selection of the facility. These factors included evaluating the desired type of transport, capacity of receiving facilities, expedited nature of the option in order to support high dredging productivity rates, and community acceptance.

Measures Taken. The following measures taken in selection of a disposal facility:

- As per the Order, TVA submitted the *Offsite Ash Disposal Options Analysis* (Ref. 8.1.2). EPA retained final approval of the analysis in consultation with TDEC. Following a request for proposals, TVA evaluated over 20 proposals and the Arrowhead Landfill in Perry County, Alabama, was selected.

- The EPA included environmental justice considerations as part of its evaluation of disposal options. These concerns were addressed via EPA Region 4 community involvement with the receiving community. Additionally, TVA was considerably active in follow-ups to both the local community and landfill operations. Significant public attention resulted in the Congressional testimony of a Perry County Commissioner.

- In addition to the above measures, EPA Region 4 RCRA and ADEM's enforcement program provided a significant number of inspections and follow-up to address community concerns.

Conclusions. In conclusion, the requirement of the offsite disposal options analysis as per the EPA Order was an effective tool towards identifying an acceptable receiving facility. The proactive community involvement of both EPA and TVA at the disposal facility was an effective method of addressing environmental justice concerns. The EPA RCRA Region 4 program in coordination with ADEM enforcement officials provided effective landfill oversight.

7.2.7 Difficulties in Sustaining a High Volume Loading, Transport and Disposal

The EPA Order and the EPA OSC's November memorandum *re: Time Critical Removal Action Status Memo for the TVA Kingston Fly Ash Release* (Ref. 24.9) required ash to be removed expeditiously and described the difficulties related to sustaining a sufficient loading, transport, and disposal rate.

Measures Taken. The following measures were taken to maintain a high volume loading, transport, and disposal productivity rate.

- Rail spurs were constructed within the exclusion zone to load ash directly from the Ball Field ash processing area. Additional modifications were made to alleviate traffic concerns. Tracks were modified to allow trains in the Ball Field to utilize the plant railyard for switching instead of across Swan Pond Road.

- Additional rail tracks outside the exclusion zone, in the plant railyard, were used for lining railcars. This allowed empty railcars to be lined while lined railcars were loaded and secured on rail tracks inside the exclusion zone.

- Contractual modifications added personnel and extended work shifts from 8 hours/shift to 12-14 hours/shift to increase the number of railcars loaded per shift from 88 to 97 railcars.

- Adjusting shifts for lining crews and loading crews allowed lined cars to be ready at the start of loading crew shifts. Modifications were also made for Norfolk Southern to stage empty cars for the beginning of lining crew shifts.

- Polymer was added to the top of railcars to absorb excess water when wet conditions prevented ash from meeting the required moisture content. This allowed shipment often 7 days per week.

Conclusions. In conclusion, these measures improved loading, transport, and disposal productivity from loading two trains every three days to loading seven trains every six days, an improvement in the productivity rate of 75%. This improvement together with the efficient management of temporarily stored ash allowed ash management to keep pace with ash removal.

7.2.8 Difficulties in the Management of Dust

From the onset of the release, management of fugitive dust emissions related to the release was an ongoing exercise in evolving best management practices. During the time-critical removal action, the increased removal production rate necessitated numerous additional construction activities. Management of dust became more difficult as these activities accelerated.

Measures Taken. The following measures were taken to control fugitive dust. Best management practices continued to evolve through trial and error throughout the time-critical removal action.

- The EPA OSC approved *Site Dust Control and Air Monitoring Plan* (Ref. 6.2.1) incorporated the previously successful TDEC fugitive dust management Site requirements and identified best management practices.

- Flexterra® was used to cover 30-70% of exposed areas at any one time coupled with a selective vegetative cover based on a pilot study.

- Construction techniques, such as blading ash mounds to create a thin crust, were effective for areas that were more likely to be disturbed due to removal activities.

- Significant resources were dedicated to keeping main roads either wet or swept.

- Rigorous decontamination procedures were instituted as part of HAZWOPER for both workers and equipment.

- A Site-wide culture of minimizing dust during work was embraced by Site workers.

Conclusions. In conclusion, the Unified Command sought iterative improvements to dust management practices. These dust management practices were successful as evidenced by the air quality monitoring system.

7.2.9 Difficulties of Removal Actions in an Open River System

The EPA Order recognized that a significant quantity of ash remained in an open, relatively uncontained river system. These circumstances provided significant threat in terms of potential flooding and downriver migration. Typically, CERCLA action is meant to secure, contain, and remove the release of a hazardous substance. The difficulty presented on this Site was that the removal of the material had to be done in a relatively uncontained environment.

Measures Taken. The following measures were taken to remove ash in an open river system.

- Productivity rates for ash removal east of Dike 2 were accelerated by approximately 75% as discussed in section 7.2.1, to expeditiously and efficiently remove the ash, while maintaining safe best management practices.

- Substantial monitoring and sampling was conducted in the river system (Emory, Clinch, and Tennessee Rivers) in order to alert the Unified Command to public health or environmental threats. In addition, the most at-risk drinking water intake at the Kingston water treatment plant was monitored on a frequent basis by TDEC and TVA.

- Ash migration that resulted from storm events was modeled to estimate quantities moved and likely locations of deposition, followed by the characterization of the nature and extent of ash deposition.

- Cenosphere removal actions managed the migration and removal of floating ash particles.

Conclusions. In conclusion, accelerated expeditious removal of approximately 90% of the retrievable ash in the open river system of the Emory River alleviated flood risks and successfully mitigated downriver migration. Water quality was impacted in the immediate range of dredging activities, but dissipated downriver. Drinking water intake samples indicated no exceedances of drinking water standards. While the Unified Command maintained a closure and recreational restriction in the Emory River, recreational users downriver were not significantly affected.

7.2.10 Difficulties of Dike Stability During Removal Operations

As per the EPA Order, TVA was required to provide a schedule for development of a structural integrity evaluation, recommendations and maintenance plan for existing site dikes or berms beings used to contain spilled ash. During the course of the time-critical removal action, Site dikes were evaluated for stability and potential improvements. Dike C was identified as a dike that required significant improvement for either being below the USACE recommended factor of safety for slope or piping failure.

Measures Taken. Measures taken to maintain dike stability included buttressing of Dike C. Through the Unified Command approval process, TVA submitted a work plan for Dike C buttressing. The OSC relied on BOR expertise in remediating the structure. The estimated date of completion of the buttressing is December 2011.

Conclusions. In conclusion, the simultaneous remediation of Dike C during removal actions east of Dike 2, resulted in a reduction in potential risk due to slope failure of the structure or piping failure due to seepage through the structure.

7.2.11 Difficulties in Implementing Effective Planning

The most effective response management styles emphasize the anticipation of obstacles or challenges and the minimization of having to react to them. While effective in reacting to obstacles and challenges such as identification of limited storage space, treatment of fines in the dewatering process, and health and safety challenges, additional improvement can be made via a separate planning function that is fully participated in by members of the Unified Command. This issue was briefing discussed in the EPA OSC November 2009 memorandum re: *Time Critical Removal Action Status Memo for the TVA Kingston Fly Ash Release* (Ref. 24.9).

Measures Taken. The following measures were taken to improve effective planning.

- Throughout the time-critical removal action, the Unified Command was given access to TVA contractors' 90-day look-ahead schedule.

- The Unified Command established routine meetings to discuss current status and future planning for the removal action. These included daily planning meetings at the end of each work day, weekly work plan status meetings, and weekly integrated agency management planning meetings (TVA, EPA, and TDEC). These planning meetings were established to incorporate EPA and TDEC into TVA planning functions. Senior managers who participated in these meetings were involved in day-to-day operations and were often distracted by short-term obstacles, challenges, and demands.

Conclusions. In conclusion, demands of real-time execution during times of high production operations distracted the participating parties in the Unified Command from focusing solely on future planning and anticipating problems. Future multi-party Unified Command responses should establish a "potential future obstacles planning group" separate from the senior managers involved in day-to-day operations. This group's primary function should be to anticipate potential future obstacles and create a short list of viable and effective ready-to-implement contingent actions.

It should be noted that while this difficulty existed, the project did expeditiously and effectively react to obstacles and challenges that arose during the time critical removal action. The project maintained confidence and resourcefulness in the face of numerous challenges resulting in a significant level of achievement.

7.3 ENVIRONMENTAL DIFFICULTIES

7.3.1 Difficulties of a Multi-User Environmental Database

While required by the Order, SCRIBE was not adequate for supporting a large multi-user environmental database and is not the preferred database for the EPA remedial program.

Measures Taken. The following measures were taken to mitigate limitations of the environmental database.

- Initially, multiple SCRIBE databases were created to spread out the large quantity of data. However, publishing multiple databases to SCRIBE.net became unreliable. SCRIBE.net automatically merges databases with the same project name. While updates of individual databases were needed on a weekly basis, this compromised the merged database containing all project data.

- Assistance was given to TDEC to import their data into SCRIBE.
- As part of the transition to non-time critical and in coordination with the OSC, the RPM amended the requirement of SCRIBE under the Order, replacing SCRIBE with EQuIS.

Conclusions. In conclusion, several attempts were made to reformat SCRIBE to accommodate large quantities of data and function as a multi-user database. After these attempts failed to produce a useable format, SCRIBE was replaced with EQuIS to fulfill the database needs of the project.

7.3.2 Difficulties of Environmental Information Gathering

The tremendous demand for information required the project to collect and analyze a large and varied amount of environmental data. The difficulties encountered ranged from capturing specific conditions to demonstrating proof of the negative (that hazards do not exist).

Measures Taken. The following measures were taken to expeditiously and efficiently collect and analyze samples.

- Air monitoring. The Unified Command accepted the reality of having to continue to demonstrate the proof of the negative, despite thousands of perimeter air monitoring results demonstrating consistent compliance with NAAQS. Additional metals were added to TVA's air quality analysis to match TDEC's metals analysis group. Problems with the air monitoring data were identified as a result of a January 2010 air audit by EPA Region 4 SESD. Between September and December 2009, the PM2.5 air monitoring data generated by TVA's contracted laboratory was deemed unusable because both the incorrect analytical method and the method that was used by the contract laboratory had inadequate controls, as discussed in Section 3.4.4. In January 2010, the laboratory testing was transferred to a new contracted laboratory, Inter-Mountain Laboratories, which serves as the referee lab for the EPA particulate methods. Validation procedures were also changed to prevent extensive backlog in air data processing while maintaining quality assurance.
- Water quality monitoring. In response to CAG concerns that the water quality during peak storm events was not being captured despite a robust water quality monitoring program, TVA constructed and executed the deployment of a real-time sampling system capable of safely collecting samples during peak storm events. The frequency of sampling was reduced as a greater amount of data was validated. The EPA Order incorporated the existing TDEC water quality parameter requirements. In response to concerns, surface water sampling for metals analysis was added at the settling basins discharge in the Swan Pond Embayment.
- Legacy contamination. Difficulties were encountered in implementing dredging operations in the lower Emory River, due to the presence of DOE Oak Ridge Reservation legacy contamination in the river sediment that existed prior to the ash release. During December 2009 and January 2010, the lower Emory River was characterized for the presence of legacy constituents that might have migrated from the Clinch River into the Emory River. These data confirmed the presence of cesium-137 with radioactivities up to 17 pCi/g in the Emory River between ERM 0.0 and ERM 1.8 and along the length of the plant intake channel. The presence of cesium-137 precluded the removal of ash (volume estimated to be approximately 170,000 cy) from this reach of the Emory River, due to difficulties handling radioactively impacted sediments not related to the ash release.

Further evaluation of the cesium-137 impacted sediments in the Emory River is to be performed under the non-time-critical removal action for the river system, in accordance with the *Sampling and Analysis Plan* (Ref. 11.2.16).

- TENORM requirements. The Arrowhead Landfill completed a study in response to Alabama Office of Radiation Control TENORM policy, as discussed in Section 3.2.5. Results of the RESRAD study showed that worker exposure to ash (unloading trains/placing in cells, etc.) was safe to a level of about 44 pCi/g. Upon review of the RESRAD study results, the Director of the Alabama Office of Radiation Control, ADPH, issued to the operators of the Arrowhead Landfill a waiver to the SSRCR suggested limit for radium-226/228.

Conclusions. In conclusion, the Unified Command pursued decision-quality data on an as-needed basis while maintaining a robust overall media sampling strategy. While the project made limited improvements in reducing the amount of non-essential data, the need to demonstrate proof of the negative persisted.

7.4 SAFETY AND HEALTH DIFFICULTIES

7.4.1 Difficulties Incorporating CERCLA Required OSHA HAZWOPER

The TVA corporate safety and health program does not require the use of HAZWOPER at its fossil fuel plants, while CERCLA requires the implementation of OSHA 1910.120 which includes the execution of HAZWOPER.

Measures Taken. The following measures were taken to incorporate CERCLA requirements.

- Within the first two months of the EPA Order signing, TVA provided training for hundreds of Site personnel.
- The Unified Command immediately began to institute exclusion zone conditions as required by HAZWOPER.
- The Unified Command implemented applicable exposure limits for contaminates of concern as monitored for in the industrial hygiene sampling program.
- The EPA OSC used the technical services of the EPA Region 4 ERT and on-site support of the USCG Strike Team to oversee this requirement.

Conclusions. The above measures taken by the Unified Command successfully transitioned the Site to be compliant with HAZWOPER requirements.

7.4.2 Difficulties Integrating Safety and Health Policies and Procedures

As noted in the ERT March 2010 safety audit, it was found that a conflict existed between the current ICS Unified Command structure and the superimposed TVA corporate structure.

Measures Taken. The following measures were taken to integrate Site and TVA corporate Safety and Health programs, policies, and procedures.

- ICS structure was revised to identify TVA safety and health staff as Site Safety Officers and identify the portions of the safety and health program that are to be implemented by Site contractors while simultaneously retaining for TVA a visible portion of the program implementation.

- In the delegation of safety oversight, ERT recommended that TVA make Jacobs' responsibility visible to all personnel by providing a formal delegation of safety oversight responsibility to Jacobs. This was documented in a June 2010 SOP, which clarified that Jacobs is TVA's agent to manage its Health and Safety program for the Site.

- Informal means of communication between the Site safety staff, USCG strike team, and contractor safety staff were formalized into an overall daily meeting of site safety staff in March 2011.

- The USCG existing delegation of EPA OSC authority for safety and health oversight in the field was reinforced. The USCG implemented a corrective actions tracking report that was reviewed daily to ensure consistent followup and closure of observations from the field. The tracker tool was formally integrated into the site safety process.

- Several standardized tools were used to achieve a safe workplace. These tools included the AHAs, JSAs, and SORs.

- Prior to March 2010, Site contractors were allowed to utilize their individual work package formats and internal review process. An SOP was developed in March 2010 that brought site contractors under the same requirements and review process.

- The "Two-Minute Rule" was implemented to raise worker awareness. A fatigue management procedure was also implemented.

Conclusions. The above measures were significant factors in improving the Site safety record. After March 2010, the project performed approximately 775,000 hours with zero recordable incidents.

7.5 COMMUNITY INVOLVEMENT DIFFICULTIES

7.5.1 Difficulties of Effective Transparency

Because of the significant size of the release, the public and affected public agencies insisted on a substantial level of transparency in ongoing Site decisions and execution. The Unified Command was equally tasked with the priorities of moving expeditiously, efficiently, safely, and transparently. The potential existed for the removal action to be impeded based on the larger audience that decisions and actions would be subject to.

Measures Taken. The following measures were taken to improve community involvement.

- The Unified Command encouraged independent organizations including NGOs to have escorted access to the Site for either scientific investigation or an update on operations and conditions.

- Work plans were immediately posted on the websites upon approval signature and subject to 30-day public comment periods.

- Significant resources were used by EPA, TVA, and TDEC to address individual questions or concerns. Onsite staff was available to the public and interested agencies on a near 7-day basis.

Frequent public appearances and presentations were implemented by the respective agencies of the Unified Command.

- The creation and the funding of the CAG allowed for a geographically immediate group to have direct access to the Unified Command for particular questions or concerns.

- EPA, TVA, and TDEC issued their own public releases. While each agency was responsible for their own content, significant efforts were made between the three to use the accurate facts.

Conclusions. Through the above measures, the Unified Command effectively created transparency. Frequent updates and access-on-demand allowed information to be effectively communicated in a timely manner. The use of website e-services and face-to-face communications were an effective component of these actions.

7.5.2 Difficulties of Demonstrating Effective Independent Review

Among the public perception was the impression that TVA reporting was not independent enough to satisfy doubts.

Measures Taken. The following measures were taken to demonstrate effective independent review.

- As per the Order, work conducted on the Site had to be approved by the EPA OSC in consult with TDEC.

- Both EPA and TDEC provided independent sampling and program audits. The EPA OSC coordinated with the following independent agencies: USCG, BOR, USACE. These agencies were under the direction of the EPA OSC.

- As stated above, independent organizations or NGOs, were permitted escorted access to conduct their own investigations. The results of these investigations were included in the environmental database used for decision making when they met the standards of the QAPP.

- While not required by the Order, TVA set up a several million dollar fund for investigations of interested independent parties.

Conclusions. Comparative analysis results conducted by EPA for surface water quality indicate a 98% correlation to TVA data and thus validate the reliability of both their sampling methodology and analytical results. Overall, audits conducted by EPA Region 4 SESD on the perimeter air monitoring system validated TVA derived sampling, analysis, and subsequent data and made corrective actions and improvements where necessary.

Proactive incorporation of NGOs and other agency concerns created a management environment that encouraged legitimate and qualified independent investigations.

7.6 DIFFICULTIES AVOIDED IN TRANSITION

The EPA Order identified activities necessary to achieve short-term strategic Site objectives as non-time-critical removal actions. One such mid-term objective for the Site was to remove any remaining ash from the embayments and tributaries west of Dike 2, to the maximum extent practicable. The Unified Command agreed that the transition from time-critical to non-time-critical removal actions should proceed smoothly to be able to remove the ash from Swan Pond Embayment as quickly as possible.

Measures Taken. The following measures were taken by the Unified Command to expedite a smooth transition from time-critical to non-time-critical removal actions.

- The EE/CA and Action Memorandum for the non-time-critical removal action for the Embayment and Dredge Cell closure were prepared concurrent with implementation of the time-critical activities. The Action Memorandum was issued on May 18, 2010.

- The EPA OSC approved work plans under time-critical authority and consistent with non-time-critical removal objectives (Section 2.1.1.4). These work plans authorized the following operations:

  - The central area of the failed Dredge Cell was recontoured to build a subgrade in anticipation of subsequent dry stacking under non-time-critical actions, to improve drainage, and to stabilize the Dredge Cell against erosion.
  - Ash from two outlying areas in the North Embayment was consolidated to a more centralized area where it could be stockpiled graded to dry sufficiently for subsequent ash stacking.
  - A bridge was constructed on Swan Pond Circle Road and a haul road through the underpass beneath it to allow subsequent ash hauling during the non-time-critical removal action.

Conclusions. The Unified Command exercised appropriate forethought in implementing actions using time-critical authority that provided for smooth and expeditious transition to non-time-critical actions. As a result, non-time-critical removal of ash from Swan Pond Embayment was initiated in August 2010, as the last of the time-critical mechanical dredging was being completed.

7.7 VOLUNTARY ACTIONS BY TVA NOT REQUIRED BY THE EPA ORDER

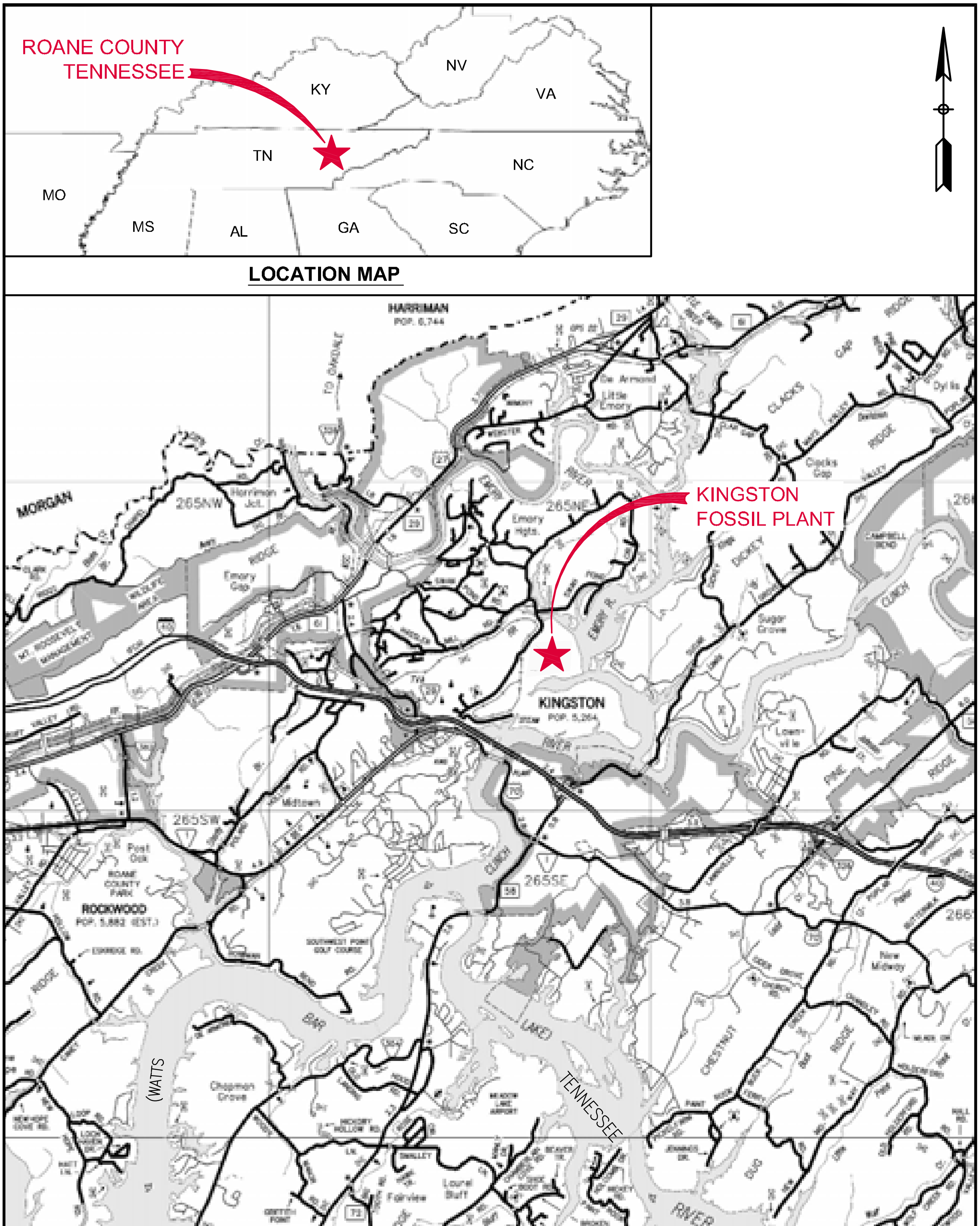
TVA undertook other voluntary initiatives beyond those required by CERCLA under the EPA Order concurrent with time-critical removal actions. These voluntary actions were taken to improve the quality of life of Roane County citizens potentially impacted by the release.

- TVA established and provided $40 million to the Roane County Economic Development Foundation, which was formed to fund locally identified projects that would enhance the economic development of Roane County and the cities within it.

- TVA purchased approximately 185 properties that were either directly impacted by the release or could be affected during the removal action operations. This created a buffer to Site operations to reduce disturbance of residents remaining in the area.

- TVA constructed improvements to utilities serving residents in the area, consisting of water distribution lines. These improvements not only repaired lines damaged during the release, but included enhancements to extend capacity and service offered by the Harriman Utility Board and Lenoir City Utility Board.

- TVA also constructed road improvements, not only to repair the sections of Swan Pond Road and Swan Pond Circle Road damaged during the release, but to pave over 10 miles of roadways beyond the area affected by the release for support to the Roane County Highway Department.



SOURCE:
GENERAL HIGHWAY MAP, ROANE COUNTY, TENNESSEE
TENNESSEE DEPARTMENT OF TRANSPORTATION, 2006

0 1 2 4
SCALE IN MILES

FIGURE 1
LOCATION OF THE
KINGSTON FOSSIL PLANT
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 01 Location of the KIF.dwg Mar 10,2011 -bperatro

DATE OF PHOTOGRAPHY: APRIL 5, 2005

0 750 1500 3000
SCALE IN FEET

FIGURE 2
KINGSTON FOSSIL PLANT
PRE-SPILL CONDITIONS
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 02 KIF Pre-Spill Conditions.dwg Mar 10,2011 -bperatro

DATE OF PHOTOGRAPHY: DECEMBER 28, 2008

FIGURE 3
KINGSTON FOSSIL PLANT
POST ASH SPILL CONDITIONS
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

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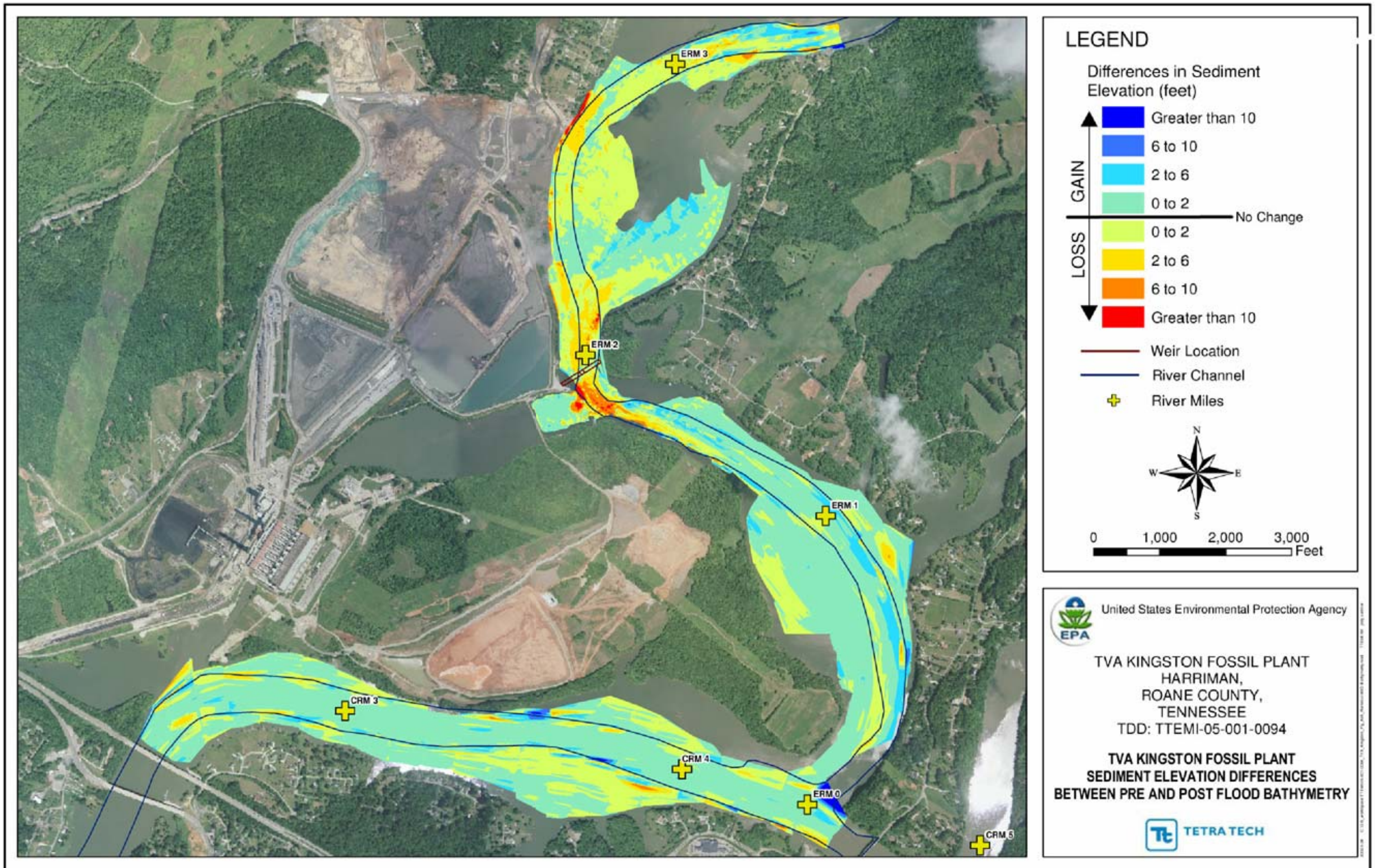


NOTE:
THIS FIGURE BASED ON AN EXISTING EPA-PRODUCED FIGURE AVAILABLE AT www.epakingstontva.com

FIGURE 4
SEDIMENT ELEVATION DIFFERENCES
PRE- AND POST-FLOOD (MAY 2009)

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
22 Mar 2011	OSC Final Report

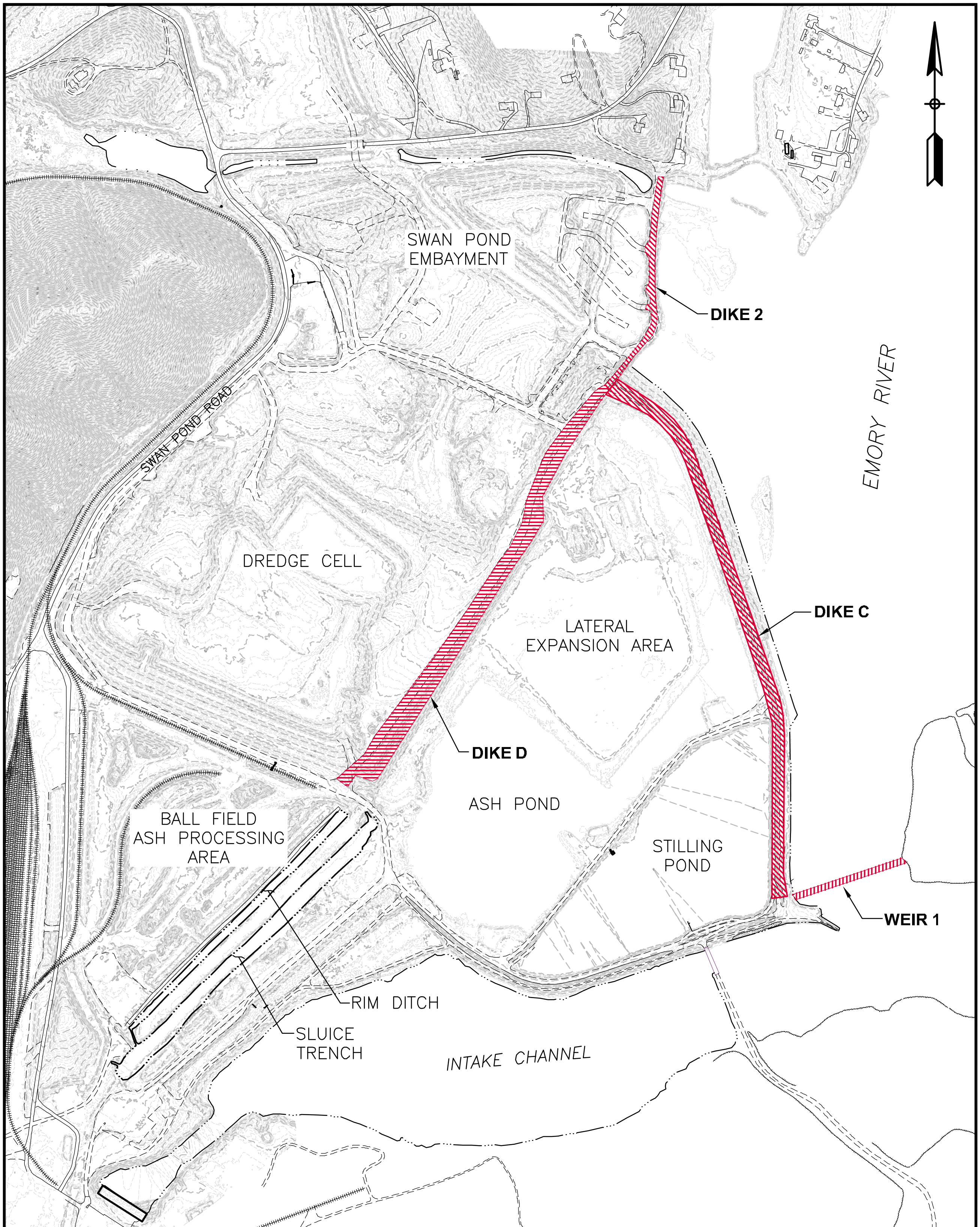
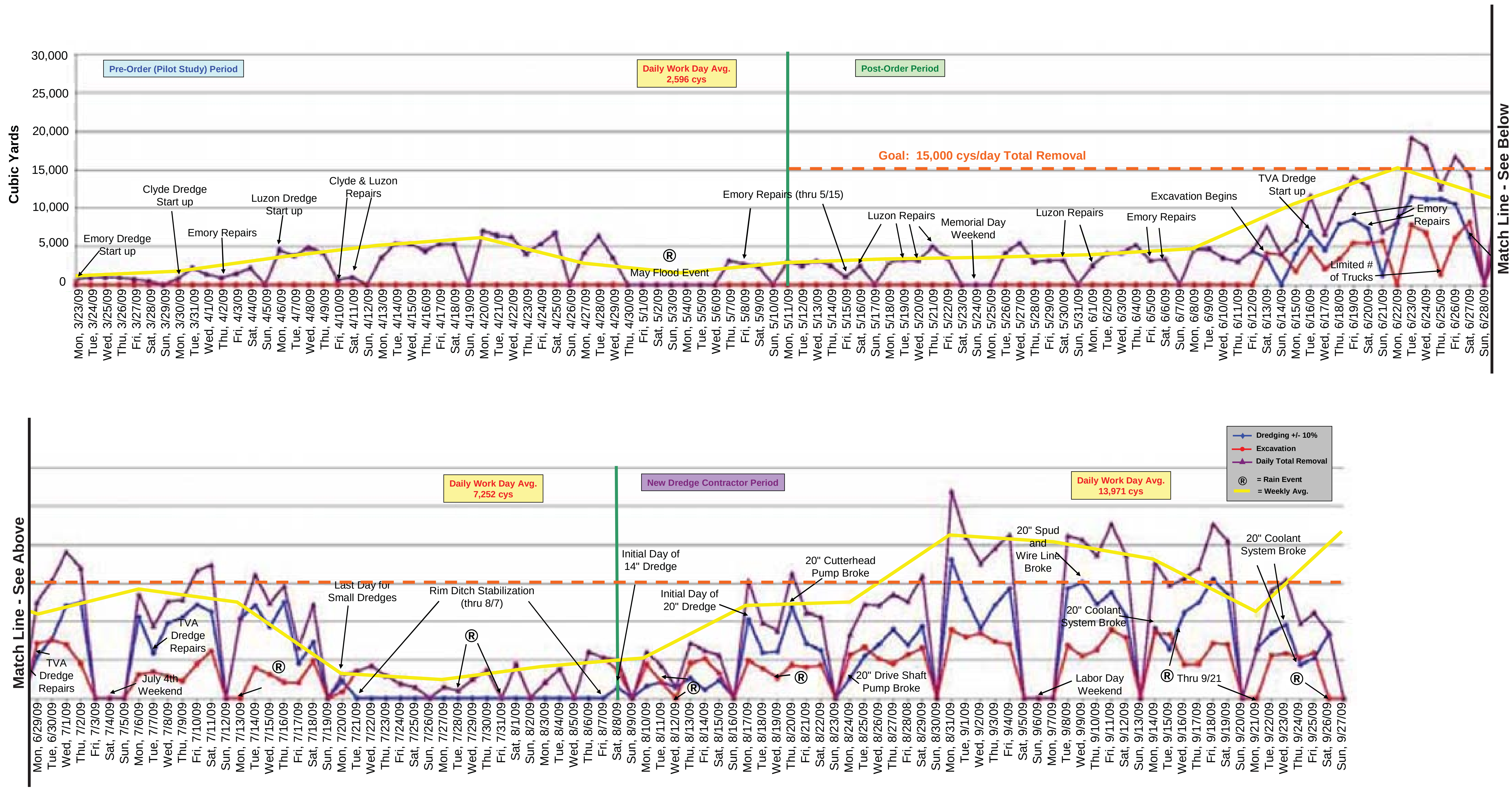


FIGURE 5
LOCATIONS OF WEIRS AND DIKES

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
22 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 05 Weir and Dike Locations.dwg Mar 22,2011 -bperatro



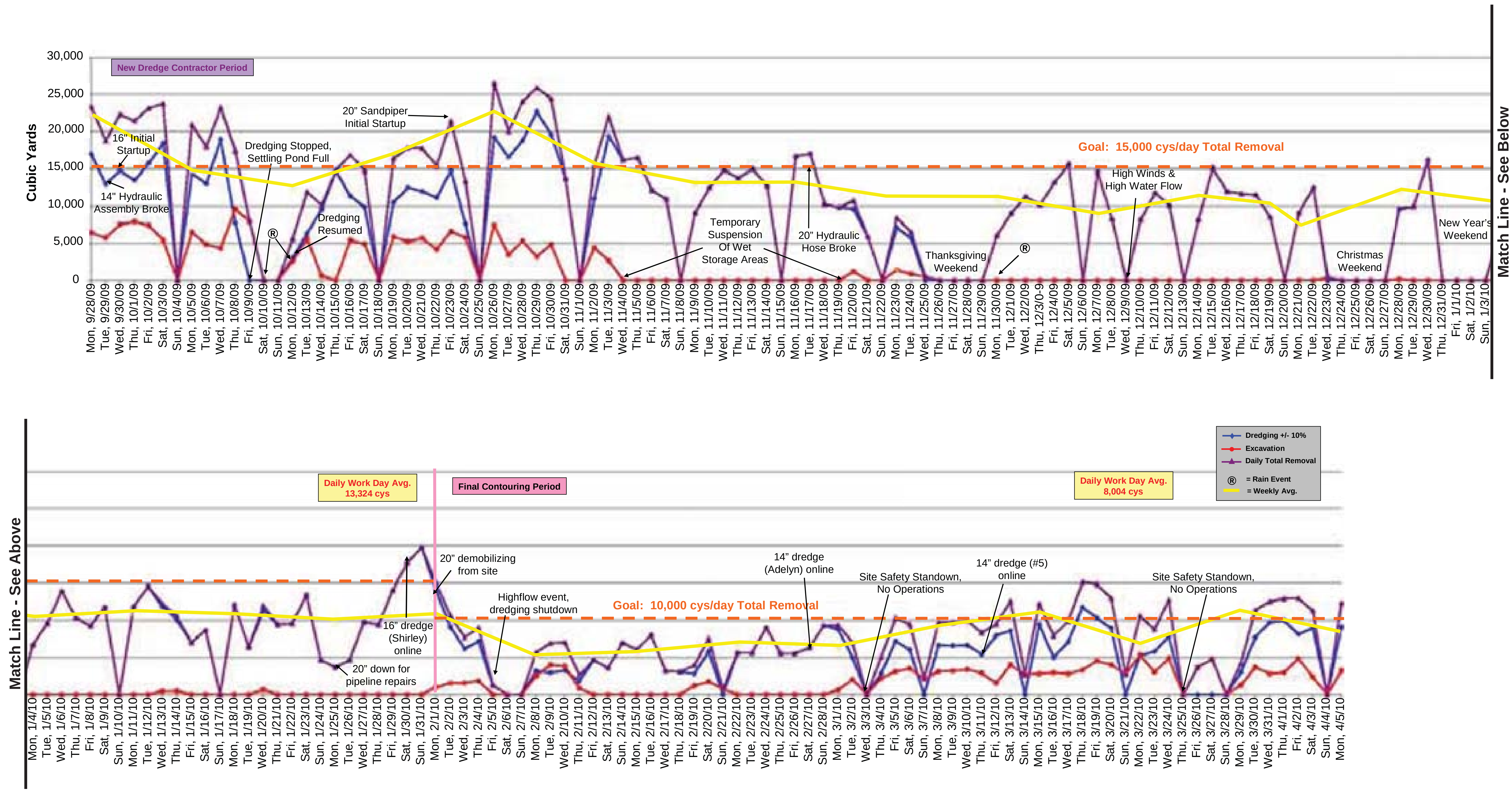
NOTE:

THIS FIGURE BASED ON AN EXISTING
EPA-PRODUCED FIGURE

FIGURE 6
DAILY REMOVAL EAST OF DIKE 2
MARCH - SEPTEMBER 2009

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report



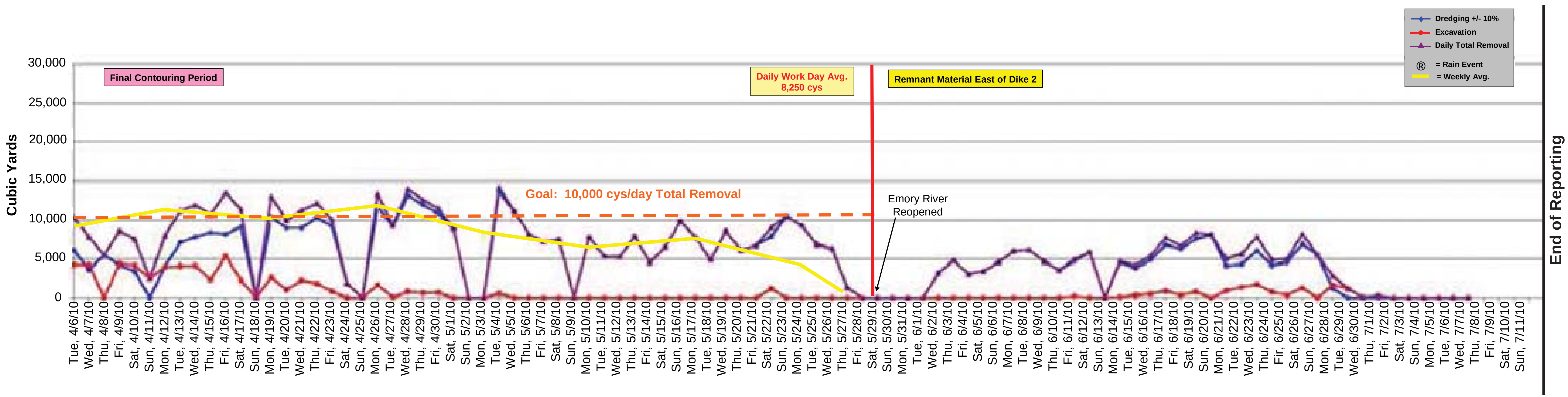
NOTE:

THIS FIGURE BASED ON AN EXISTING EPA-PRODUCED FIGURE

FIGURE 7
DAILY REMOVAL EAST OF DIKE 2
OCTOBER 2009 - MARCH 2010

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report



NOTE:

THIS FIGURE BASED ON AN EXISTING EPA-PRODUCED FIGURE

FIGURE 8
DAILY REMOVAL EAST OF DIKE 2
APRIL - JULY 2010

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

DATE OF PHOTO: DECEMBER 1, 2009

NOTE: SEE FIGURES 9a AND 9b FOR CROSS SECTIONS.

0 1000 2000 4000

SCALE IN FEET

FIGURE 9
EMORY RIVER DREDGING SEGMENTS

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

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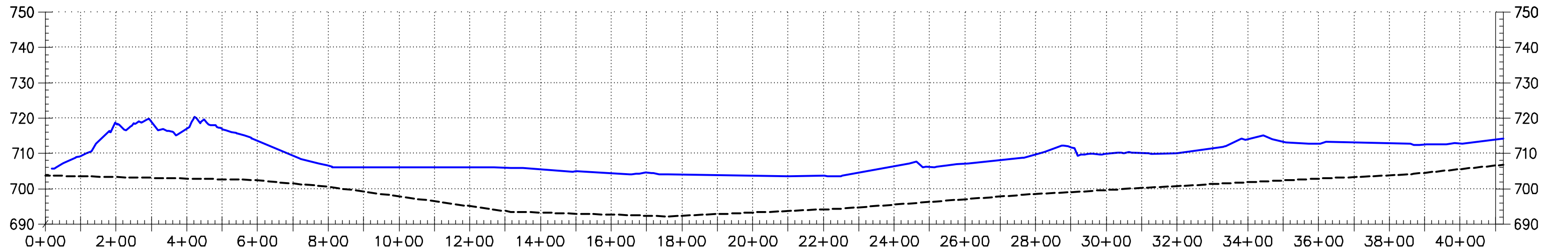
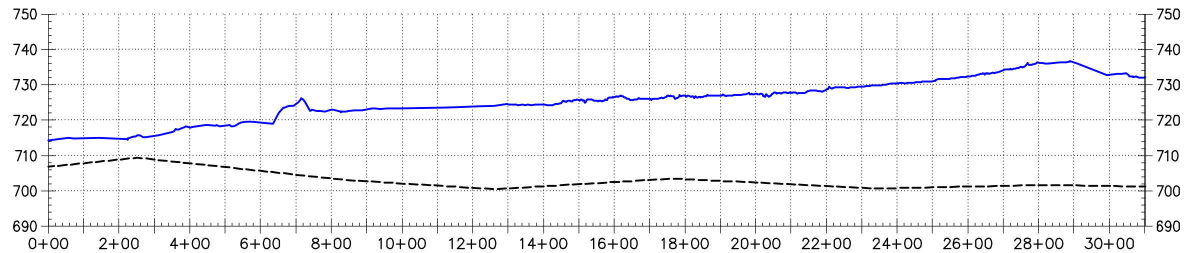
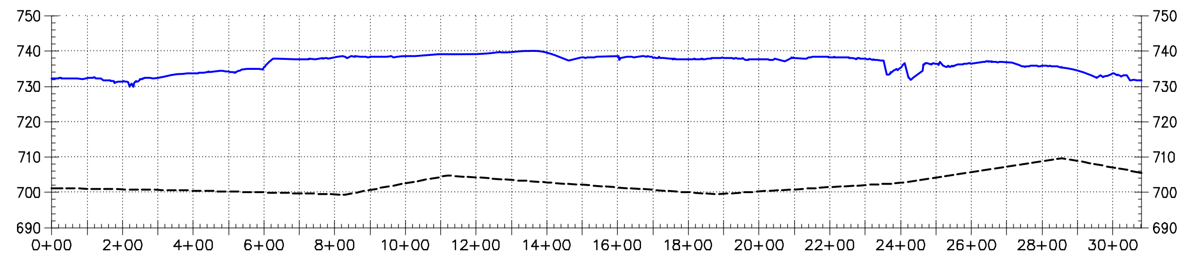


ABOVE SEGMENT 5
206,000 CY



SEGMENT 5
534,000 CY



SEGMENT 1
1,272,000 CY

LEGEND:

——— POST MAY 2009 RAIN EVENT

– – – – PRE-SPILL , EMORY CHANNEL BOTTOM, SEPTEMBER 2007

NOTE:

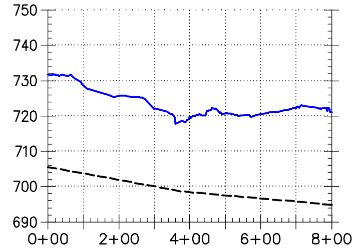
ASH VOLUMES ROUNDED TO NEAREST THOUSANDTH

FIGURE 9a
EMORY RIVER DREDGING PROFILES

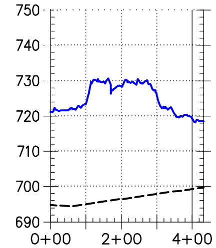
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

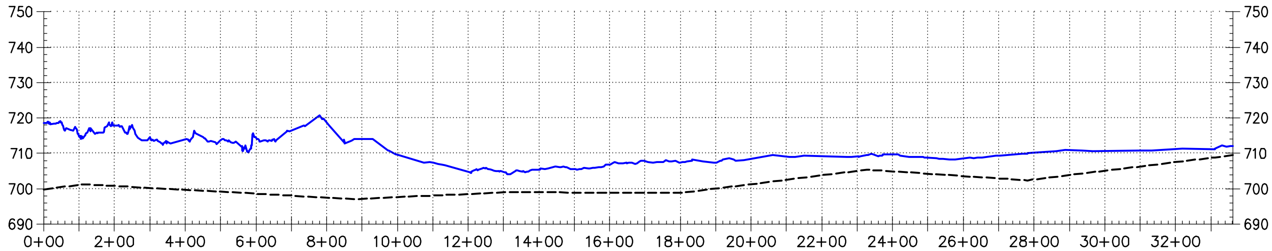
I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 09a-b Cross Sections.dwg Mar 10,2011 -bperatro



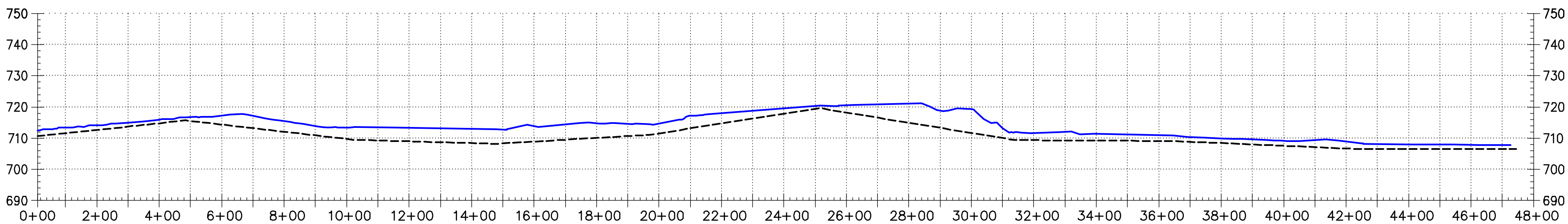
SEGMENT 2
168,000 CY



SEGMENT 3
99,000 CY



SEGMENT 4
191,000 CY



BELOW SEGMENT 4
122,000 CY

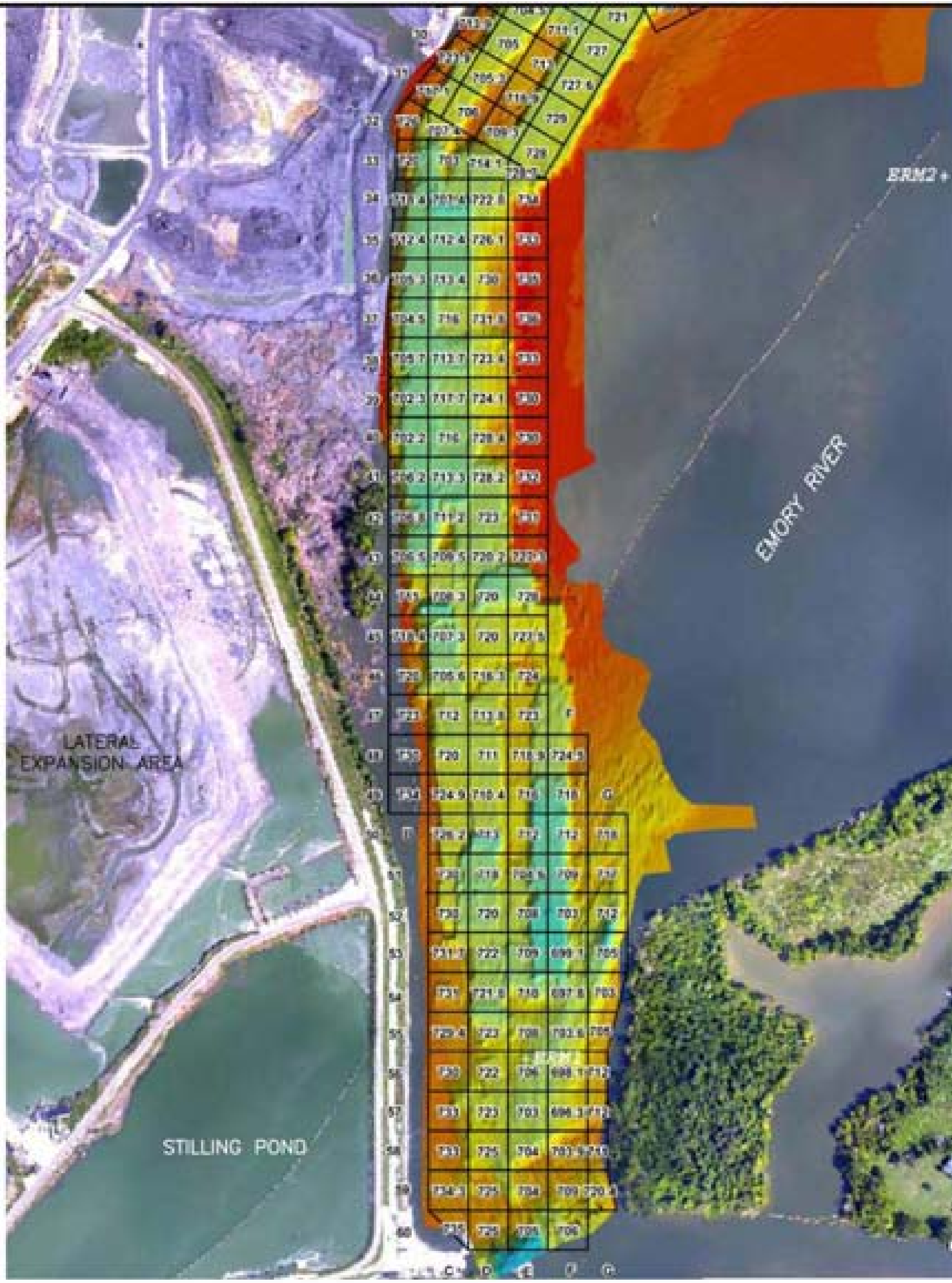
LEGEND:
POST MAY 2009 RAIN EVENT
PRE-SPILL , EMORY CHANNEL BOTTOM, SEPTEMBER 2007

NOTE:
ASH VOLUMES ROUNDED TO NEAREST THOUSANDTH

FIGURE 9b
EMORY RIVER DREDGING PROFILES

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report



LEGEND

EMORY RIVER BATHYMETRY: ELEVATION, FEET

DREDGING ACTIVITIES THROUGH 11/17/03 FOR THE SANDPIPER, 11/18/09 FOR THE MCKENZIE, AND 11/17/09 FOR THE KYLEE

740 - 742	732 - 734	724 - 726	716 - 718	708 - 710
738 - 740	730 - 732	722 - 724	714 - 716	706 - 708
736 - 738	728 - 730	720 - 722	712 - 714	704.88 - 706
734 - 736	726 - 728	718 - 720	710 - 712	

0 250 500 1,000

SCALE IN FEET

719.1 TARGET ELEVATION WITH 10 FT PARAMETER

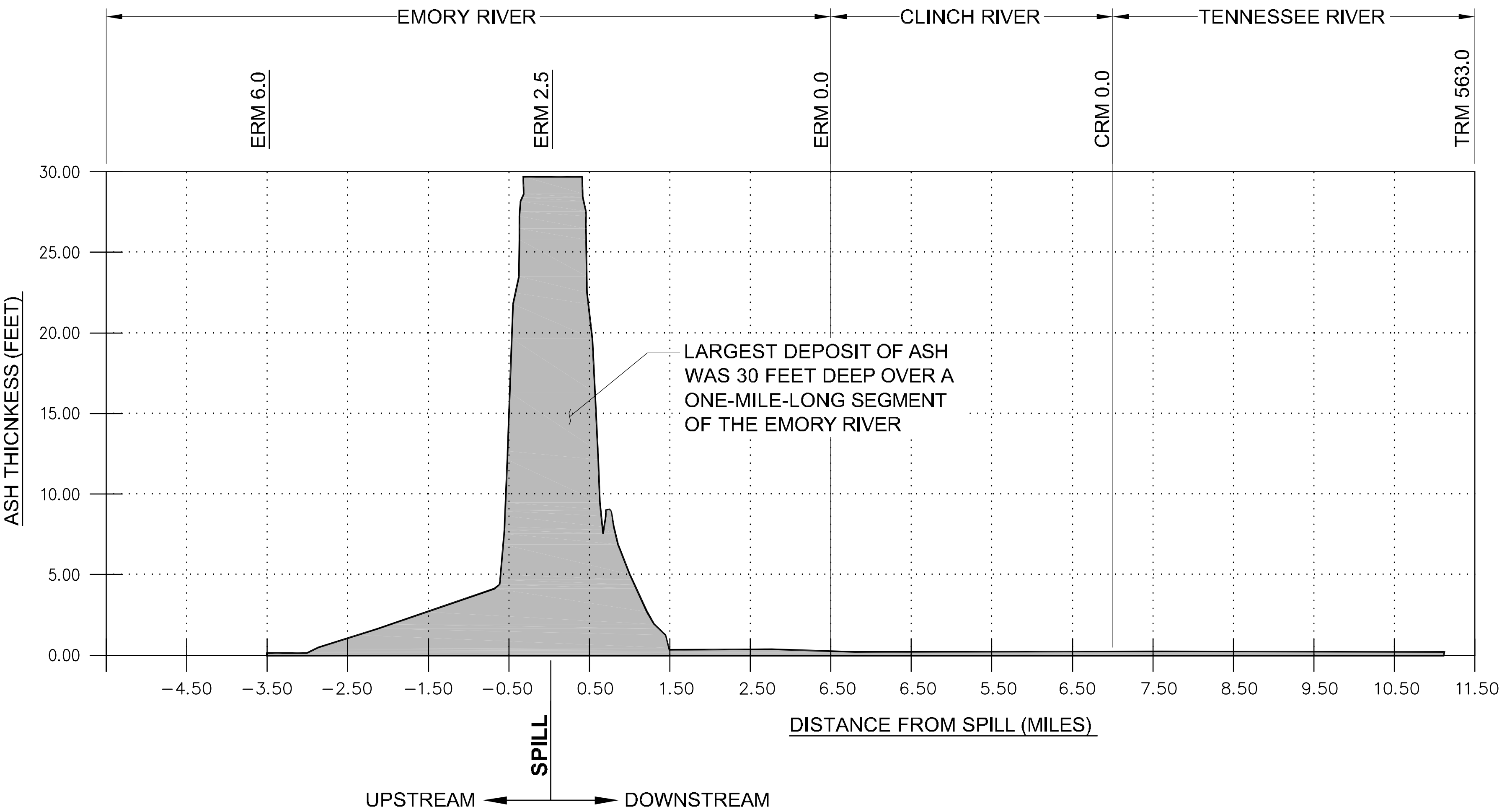
FIGURE 10
EMORY RIVER DREDGING PHASE 1 TARGET ELEVATIONS

KINGSTON ASH RECOVERY PROJECT

DATE: 10 Mar 2011

PHASE: OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 11 Ash Thickness in Rivers.dwg Mar 10,2011 -bperatro

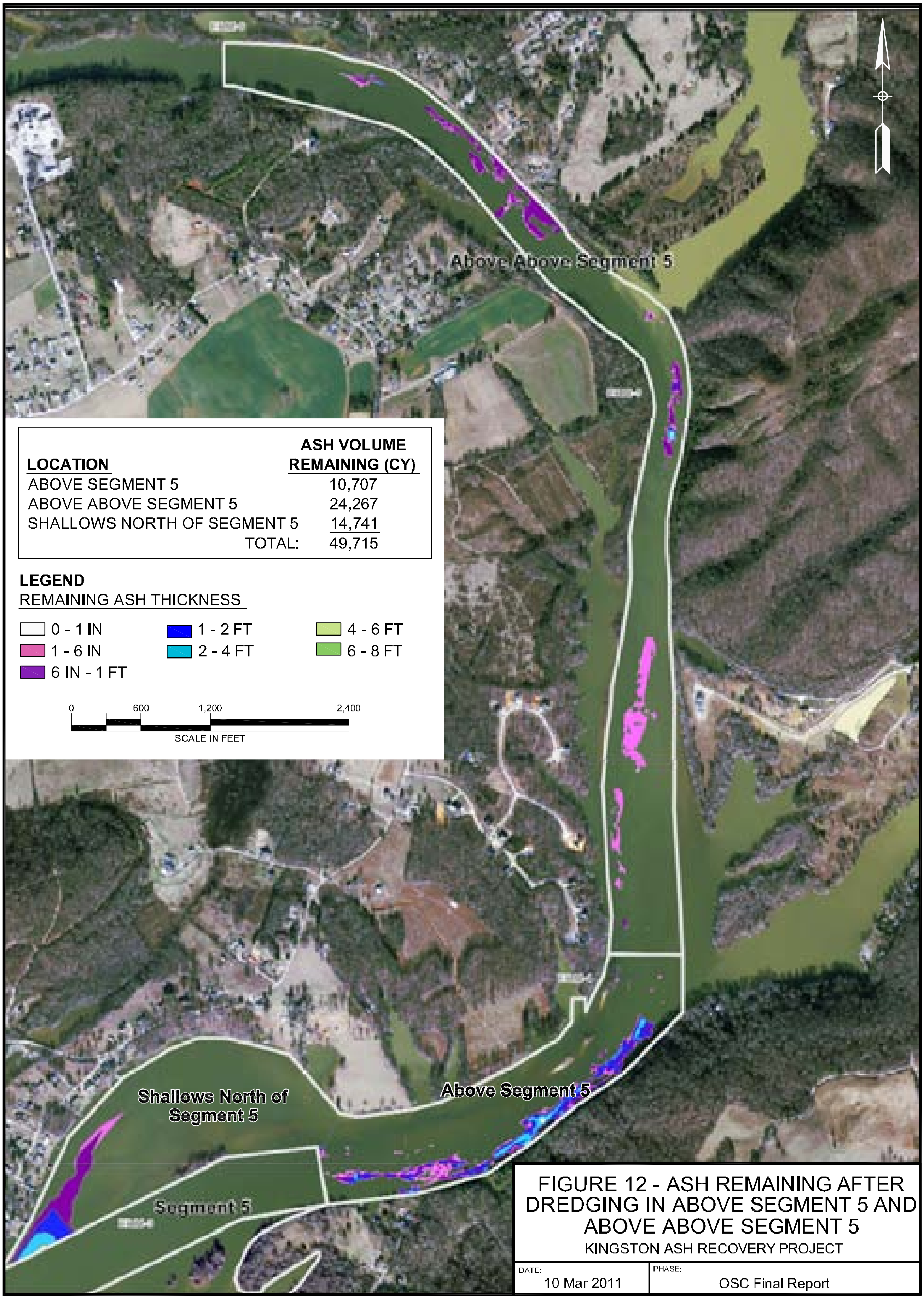


NOTE:
THIS FIGURE BASED ON AN EXISTING EPA-PRODUCED FIGURE

0 100 200 400
SCALE IN MILES

FIGURE 11
ASH THICKNESS IN RIVERS PRIOR TO DREDGING
KINGSTON ASH RECOVERY PROJECT

DATE: 10 Mar 2011
PHASE: OSC Final Report



LOCATION	ASH VOLUME REMAINING (CY)
ABOVE SEGMENT 5	10,707
ABOVE ABOVE SEGMENT 5	24,267
SHALLOWS NORTH OF SEGMENT 5	14,741
TOTAL:	49,715

FIGURE 12 - ASH REMAINING AFTER DREDGING IN ABOVE SEGMENT 5 AND ABOVE ABOVE SEGMENT 5

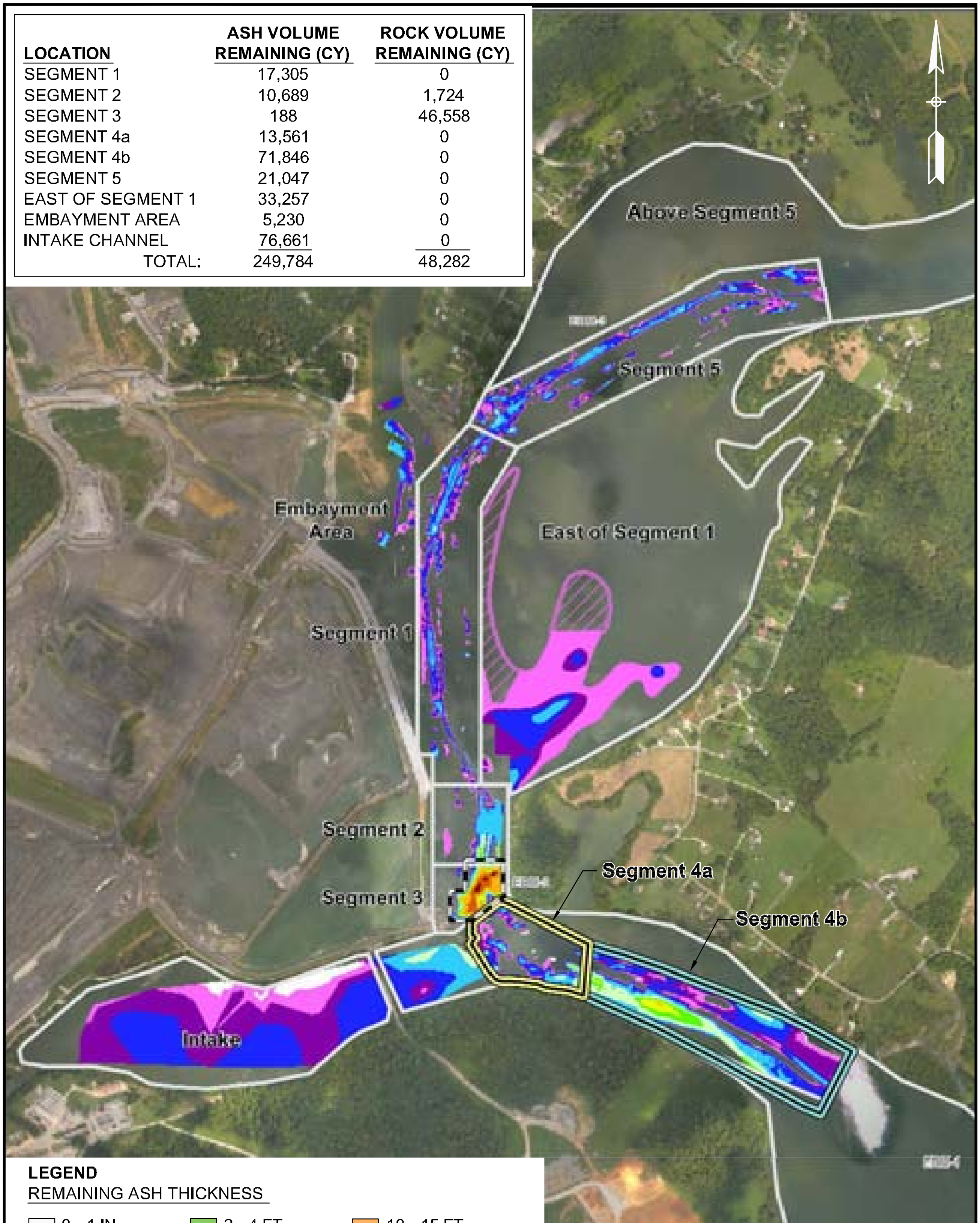
KINGSTON ASH RECOVERY PROJECT

DATE: 10 Mar 2011

PHASE: OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 12 Ash Remaining Above Seg 5.dwg Mar 10,2011 -bperatro

LOCATION	ASH VOLUME REMAINING (CY)	ROCK VOLUME REMAINING (CY)
SEGMENT 1	17,305	0
SEGMENT 2	10,689	1,724
SEGMENT 3	188	46,558
SEGMENT 4a	13,561	0
SEGMENT 4b	71,846	0
SEGMENT 5	21,047	0
EAST OF SEGMENT 1	33,257	0
EMBAYMENT AREA	5,230	0
INTAKE CHANNEL	76,661	0
TOTAL:	249,784	48,282



LEGEND

REMAINING ASH THICKNESS

- 0 - 1 IN
- 1 - 6 IN
- 6 IN - 1 FT
- 1 - 2 FT
- 2 - 4 FT
- 4 - 6 FT
- 6 - 8 FT
- 8 - 10 FT
- 10 - 15 FT
- INTERMIXED
- WEIR 1 AREA

0 600 1,200 2,400

SCALE IN FEET

FIGURE 13
ASH REMAINING AFTER DREDGING IN SEGMENTS 1, 2, 3, 4, AND 5

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 13 Ash Remaining Seg 1,2,3,4,5.dwg Mar 10,2011 -bperatro

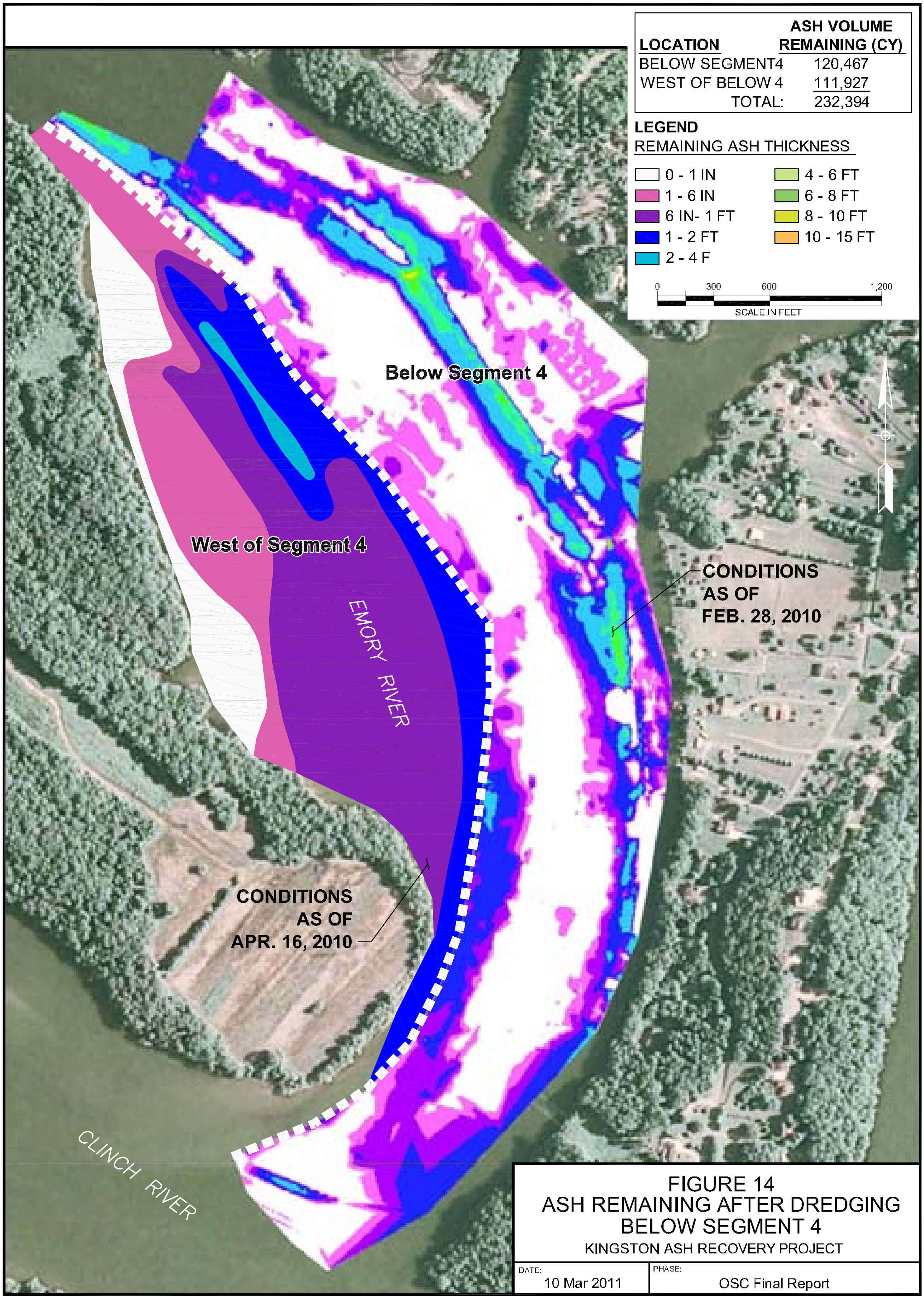


FIGURE 14
ASH REMAINING AFTER DREDGING BELOW SEGMENT 4
KINGSTON ASH RECOVERY PROJECT

DATE: 10 Mar 2011	PHASE: OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 14 Ash Remaining Below Seg 4.dwg Mar 10,2011 -bperatro

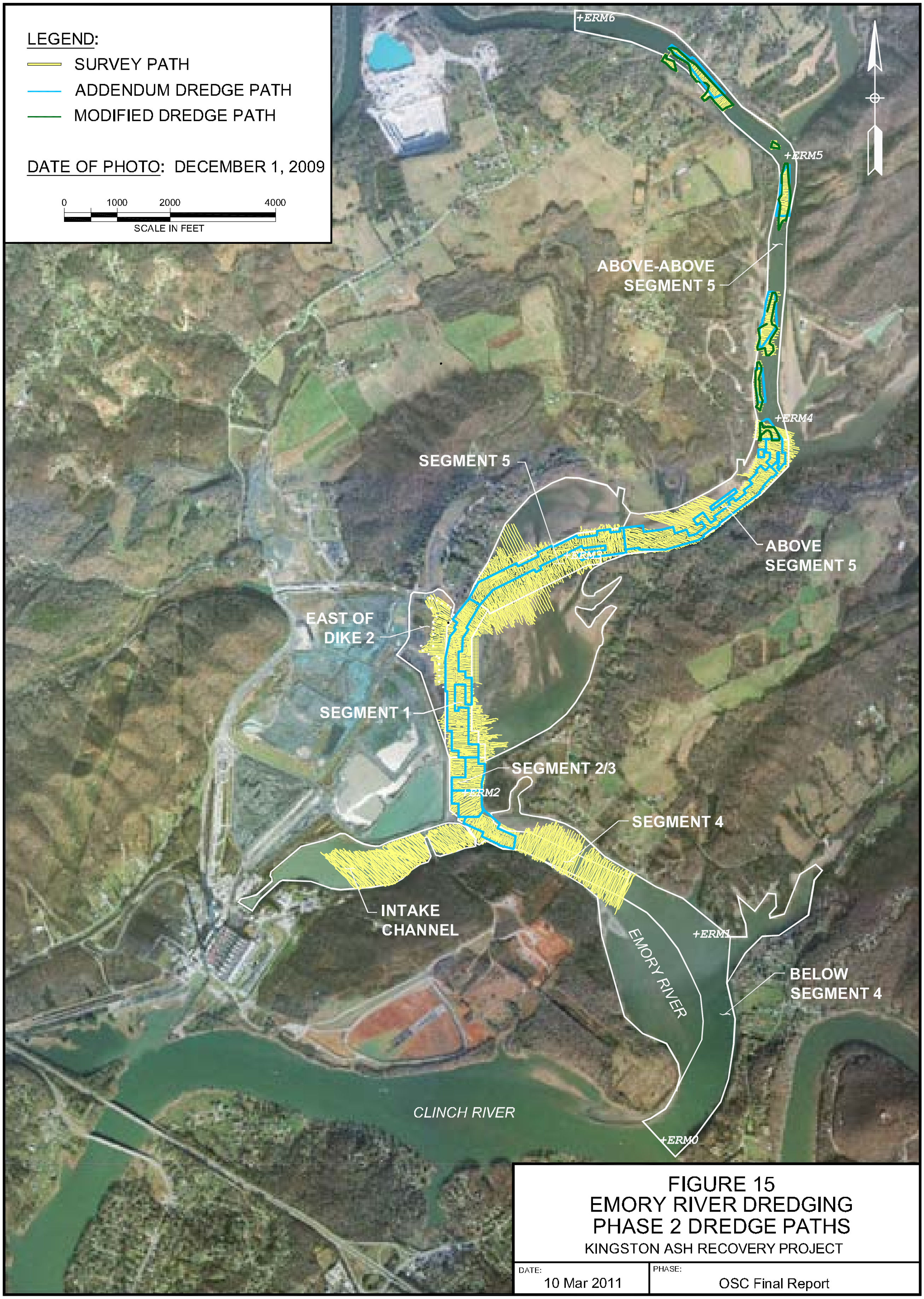
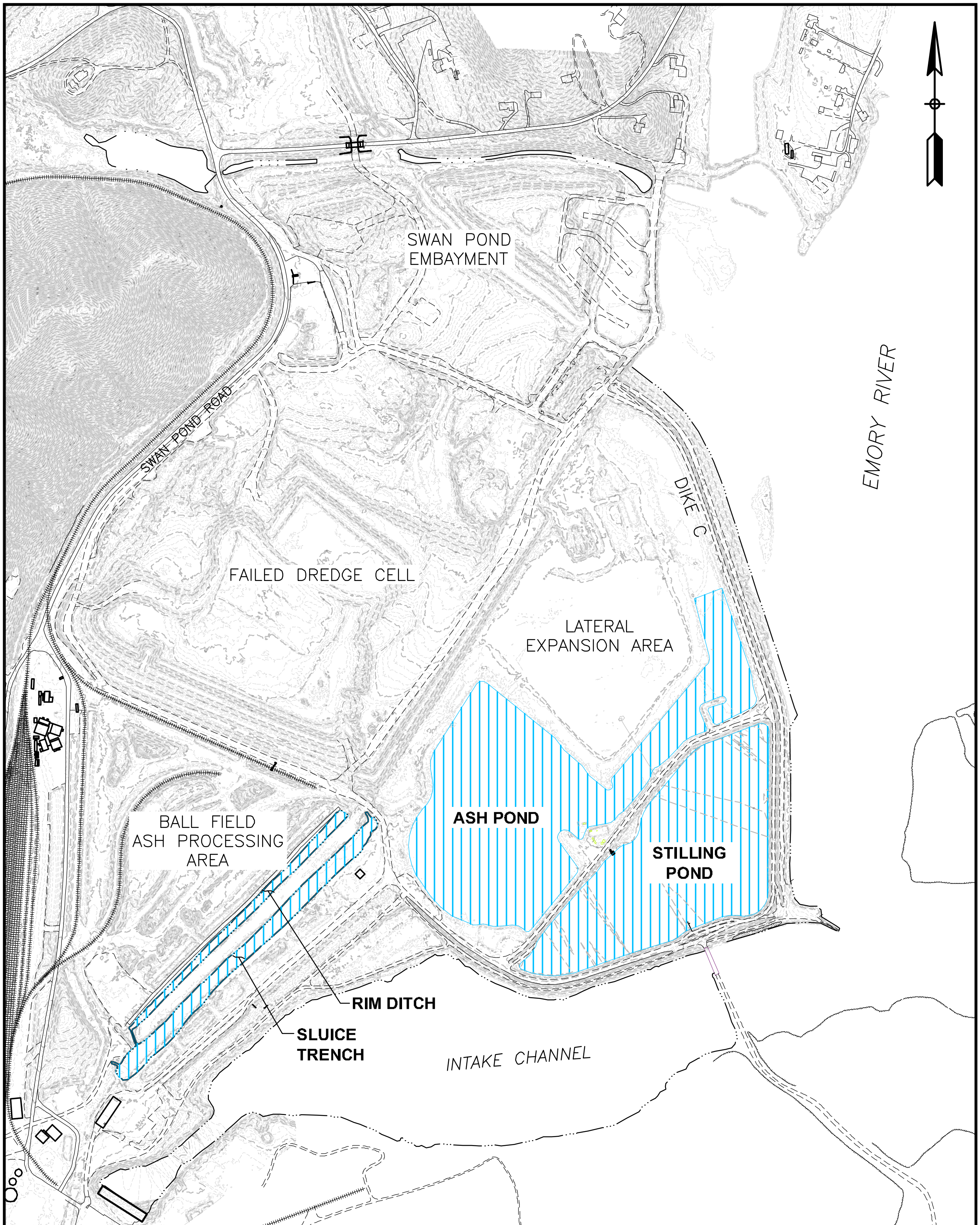


FIGURE 15
EMORY RIVER DREDGING
PHASE 2 DREDGE PATHS
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 15 Ph2 Dredging Paths.dwg Mar 10,2011 -bperatro



NOTE: TOPO INFORMATION FROM TVA'S MAY 19, 2010 SURVEY

0 500 1000 2000
SCALE IN FEET

FIGURE 16
ASH PROCESSING COMPONENTS

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 16 Ash Processing Components.dwg Mar 10,2011 -bperatro

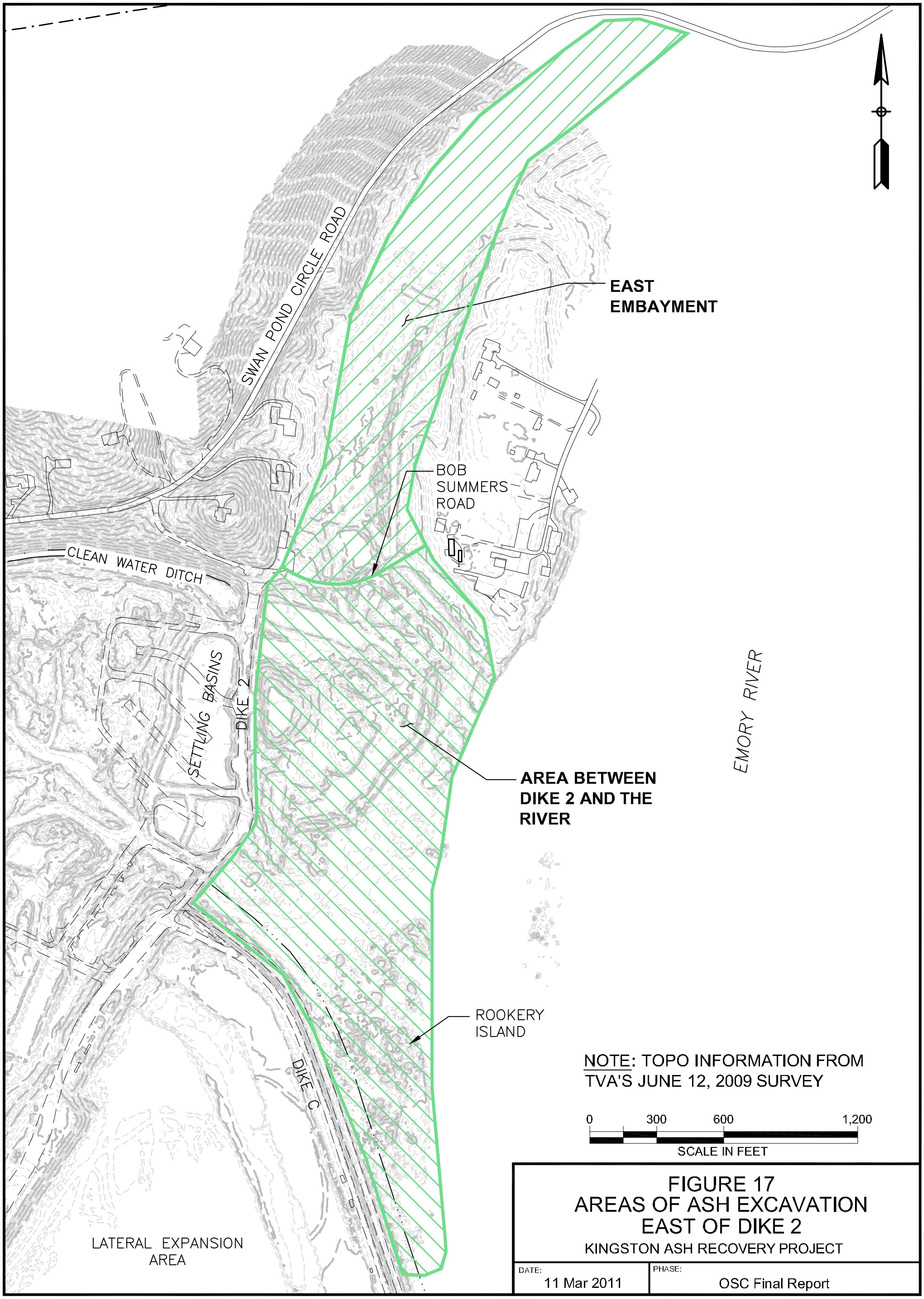


FIGURE 17
AREAS OF ASH EXCAVATION
EAST OF DIKE 2
KINGSTON ASH RECOVERY PROJECT

DATE: 11 Mar 2011 | PHASE: OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 17 Ash East of Dike 2.dwg Mar 10,2011 -bperaro

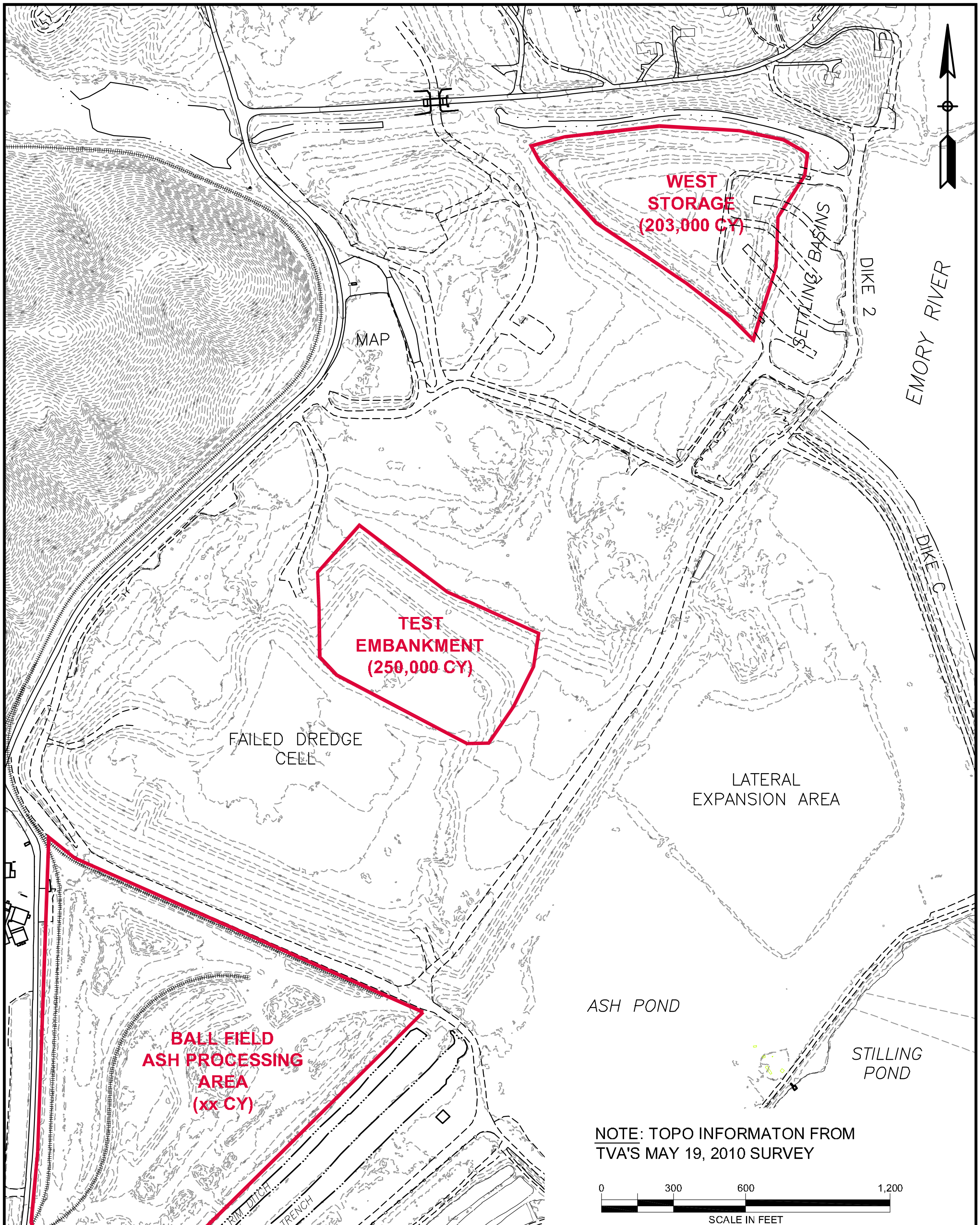


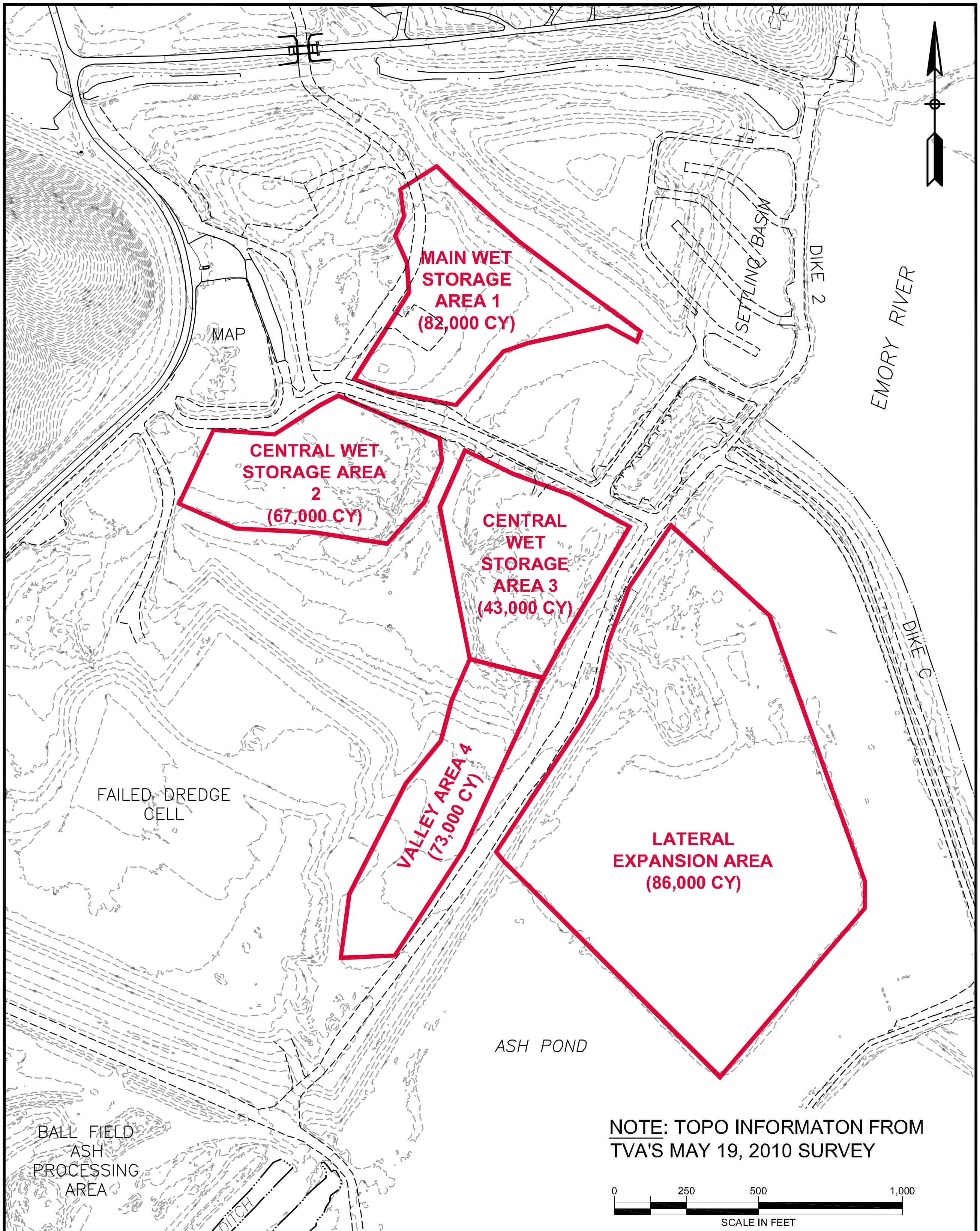
FIGURE 18
DRY ASH STORAGE AREAS

KINGSTON ASH RECOVERY PROJECT

DATE: 10 Mar 2011

PHASE: OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 18 Dry Ash Storage Areas.dwg Mar 10,2011 -bperatro



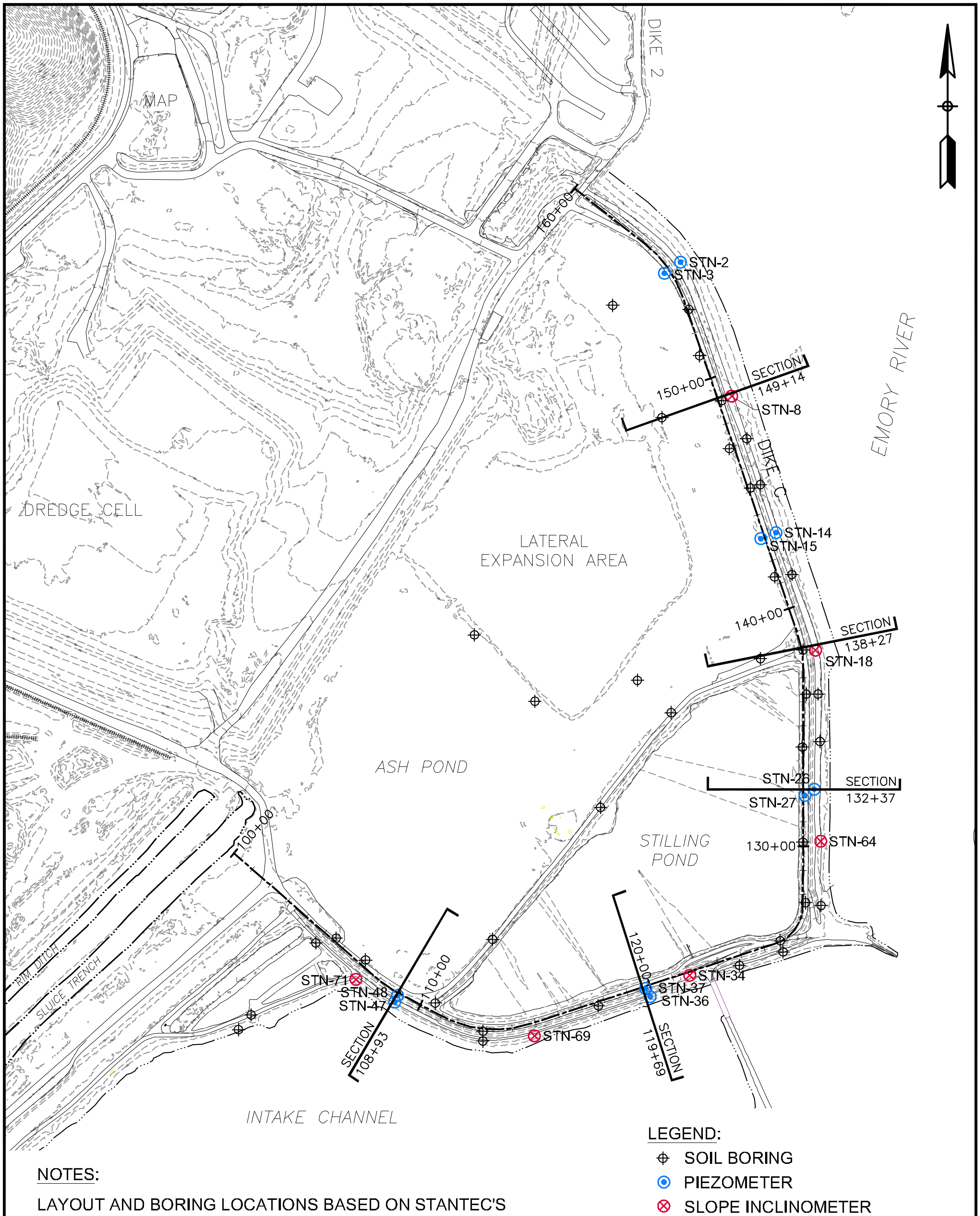
NOTE: TOPO INFORMATON FROM TVA'S MAY 19, 2010 SURVEY

FIGURE 19
WET ASH STORAGE AREAS

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
22 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 19 Wet Ash Storage Areas.dwg Mar 22,2011 -bperaro



NOTES:

LAYOUT AND BORING LOCATIONS BASED ON STANTEC'S "GEOTECHNICAL EXPLORATION ASH POND BORING PLAN AND BASELINE LAYOUT" DRAWING NO. 10W229-01

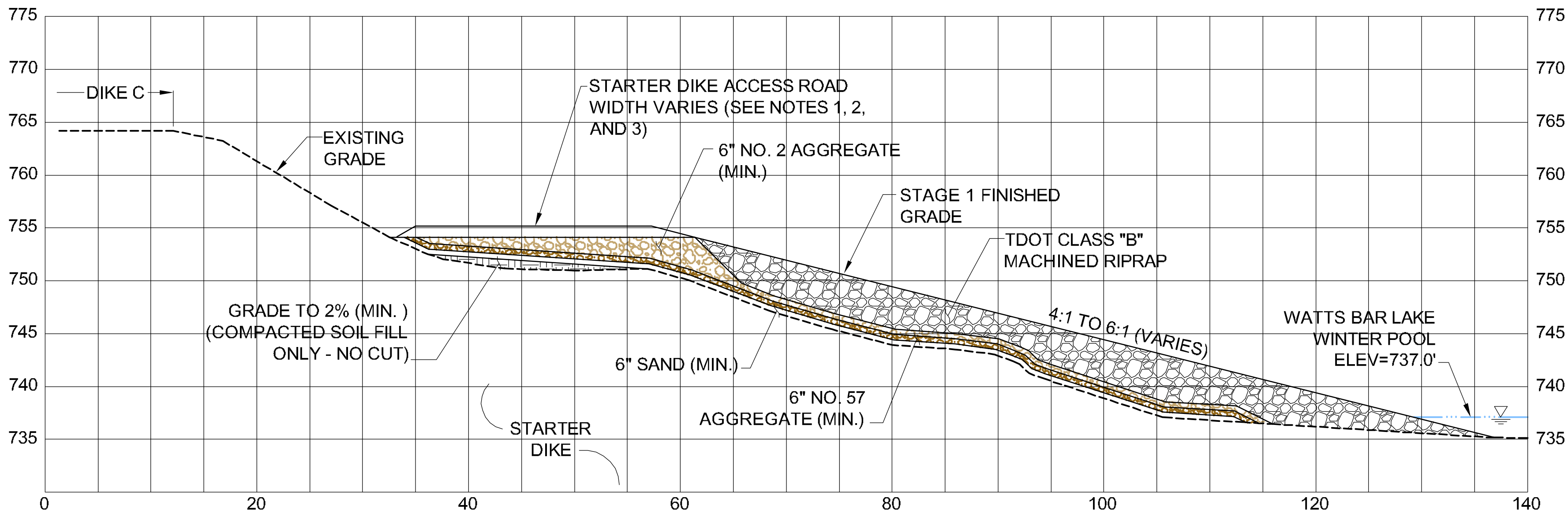
TOPO INFORMATON FROM TVA'S MAY 19, 2010 SURVEY

0 300 600 1,200
SCALE IN FEET

FIGURE 20
DIKE C REINFORCEMENT - BORING AND INSTRUMENTATION LOCATIONS
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 20 Dike C Boring Locations.dwg Mar 10,2011 -bperatro



NOTES:

1. THE MINIMUM COVER THICKNESS FROM ROAD SURFACE TO TOP OF SAND FILTER IS 36 INCHES.

2. PLACE NO. 2 AND 57 AGGREGRATE ON RIPRAP OR NO. 2 AGGREGATE AS APPLICABLE TO FORM A REVERSE FILTER FOR FOR ROAD SURFACE.

3. REMOVE AGGREGATE CONTAMINATED WITH ASH AS DIRECTED BY THE QC MANAGER.

4. FIGURE BASED ON STANTEC'S "DIKE C BUTTRESS, STAGE 1 CONSTRUCTION TYPICAL SECTIONS AND DETAILS" DRAWING 10W229-53.

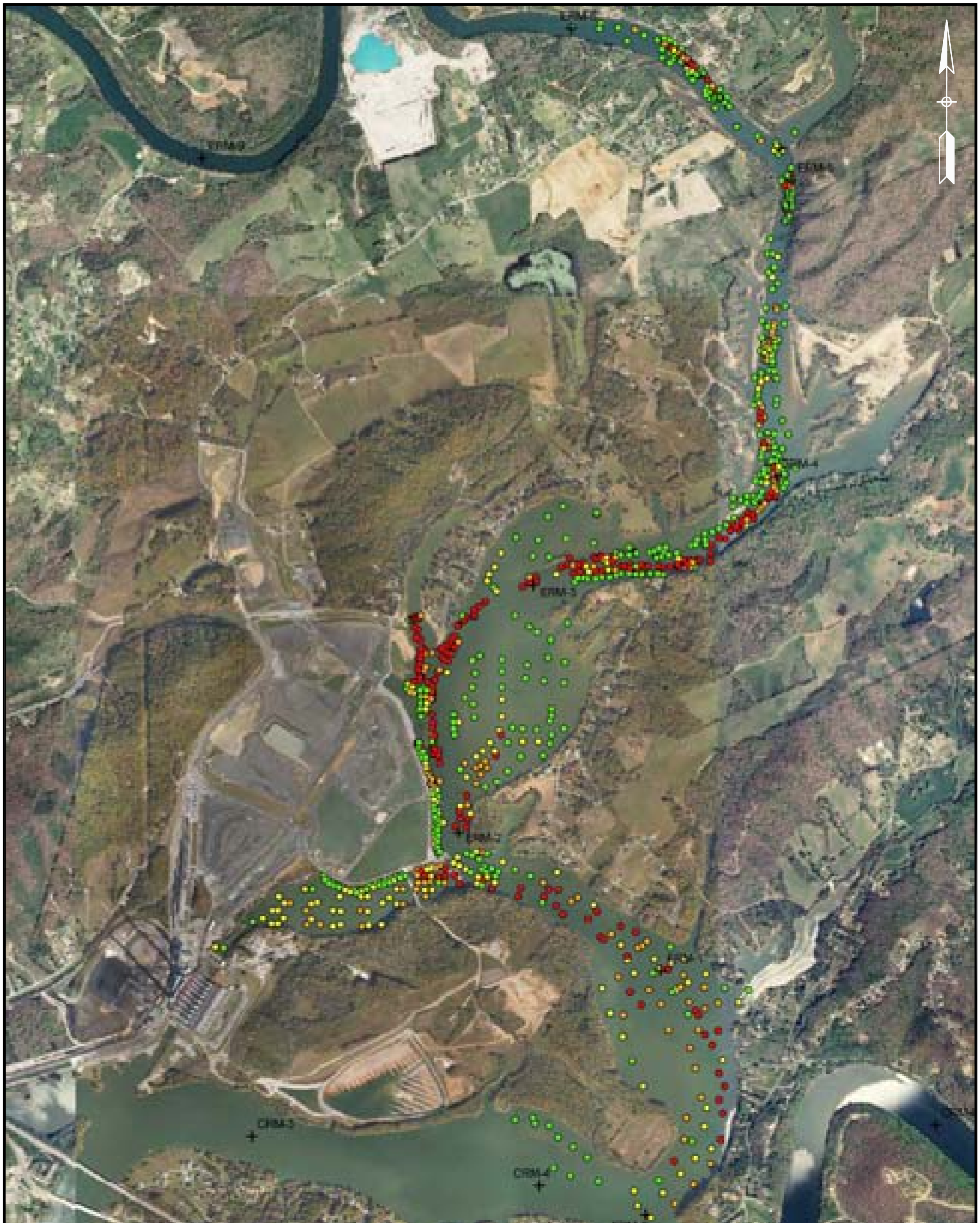
0 7.5 15 30

SCALE IN FEET

FIGURE 21
DIKE C REINFORCEMENT BUTTRESS TYPICAL SECTION

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report



THICKNESS OF ASH (FEET)

- NO RECOVERY
- 0.0
- 0.01 - 1.0
- 1.01 - 2.0
- 2.01 - 6.0

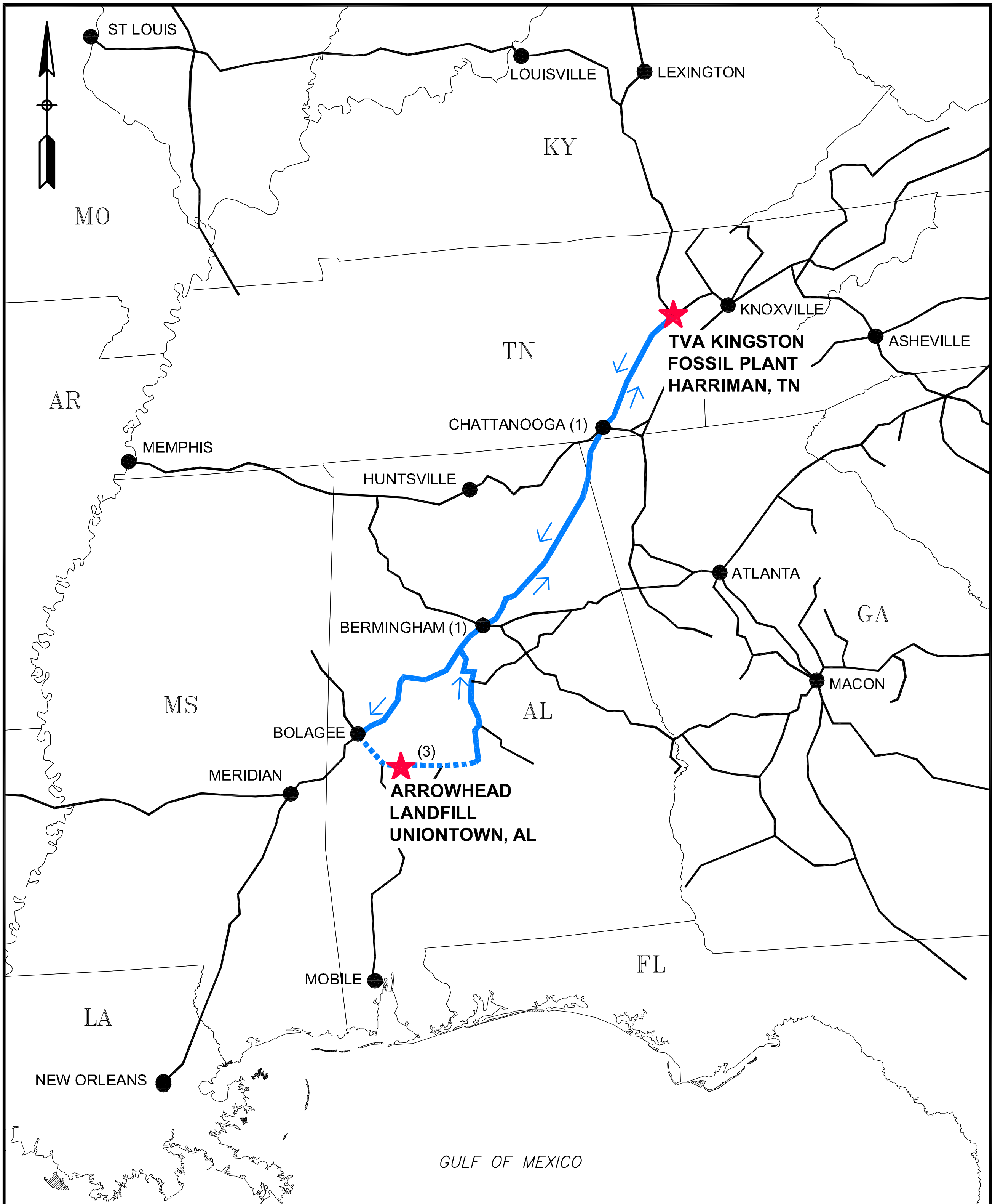
0 1,000 2,000 4,000
SCALE IN FEET

FIGURE 22
EMORY RIVER DREDGING LOCATION OF VIBECORE SAMPLES

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 22 Ph2 Vibecore Locations.dwg Mar 10,2011 -bperatro



NOTES:
(1) CREW CHANGE
(2) FUEL/SERVICE ENGINES AND INSPECT RAIL CARS
(3) FOR SHORT PERIOD NEAR END OF SHIPPING THIS TRACK WAS USED FOR TRANSPORT IN BOTH DIRECTIONS

LEGEND:
NORFOLK SOUTHERN TRACK
LEASED TRACK

FIGURE 23
RAIL ROUTE BETWEEN
HARRIMAN, TN AND UNIONTOWN, AL
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 23 NS Route from TN to AL.dwg Mar 10,2011 -bperatro

DATE OF PHOTO: AUGUST 14, 2009

LEGEND

⊕ DEC. 2008 ASH SAMPLING LOCATION

⊗ SEP. 2009 ASH SAMPLING LOCATION

0 500 1000 2000

SCALE IN FEET

FIGURE 24
LOCATIONS OF ASH
CHARACTERIZATION SAMPLES

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
11 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 24 Ash Characterization.dwg Mar 10,2011 -bperatro

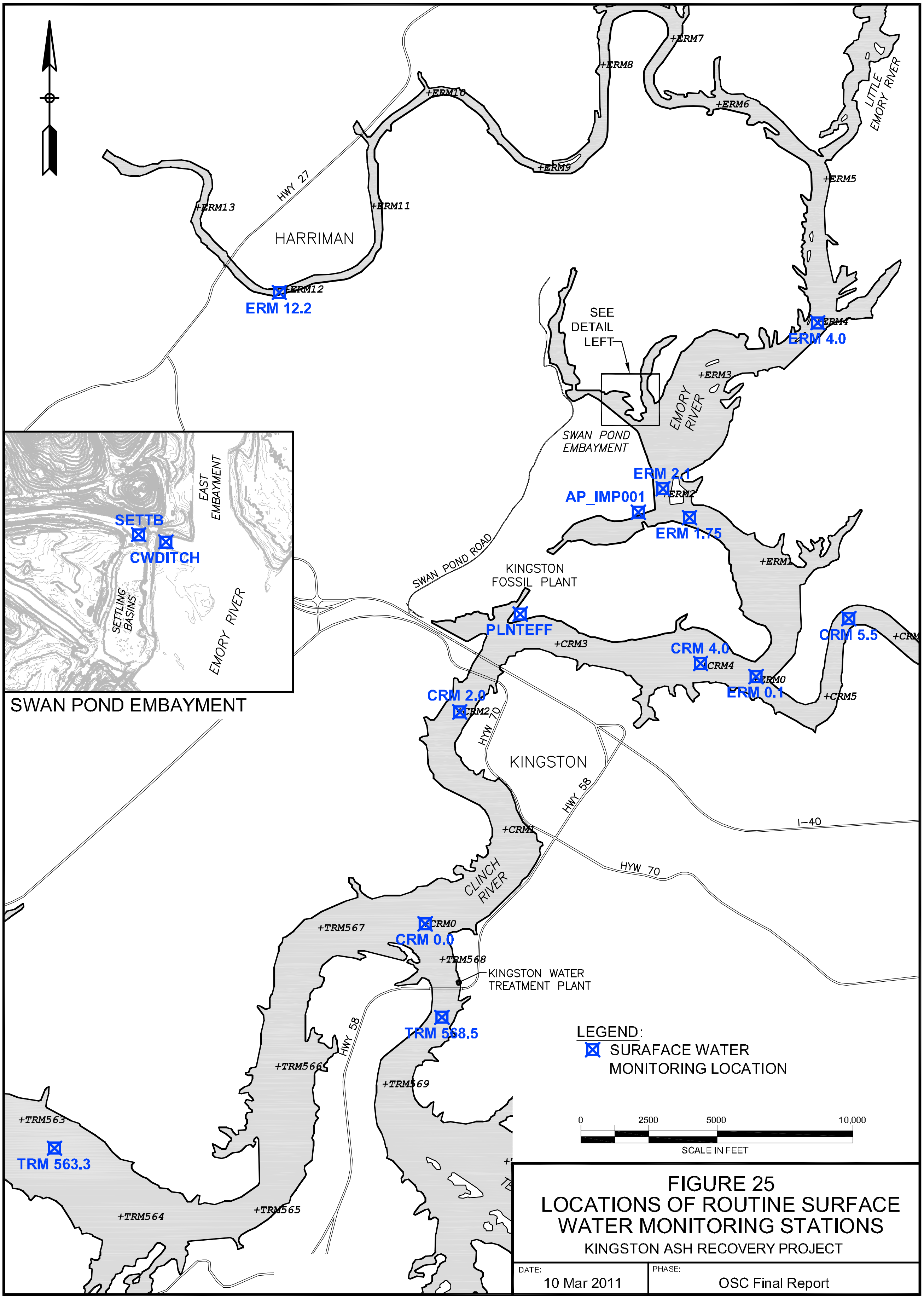
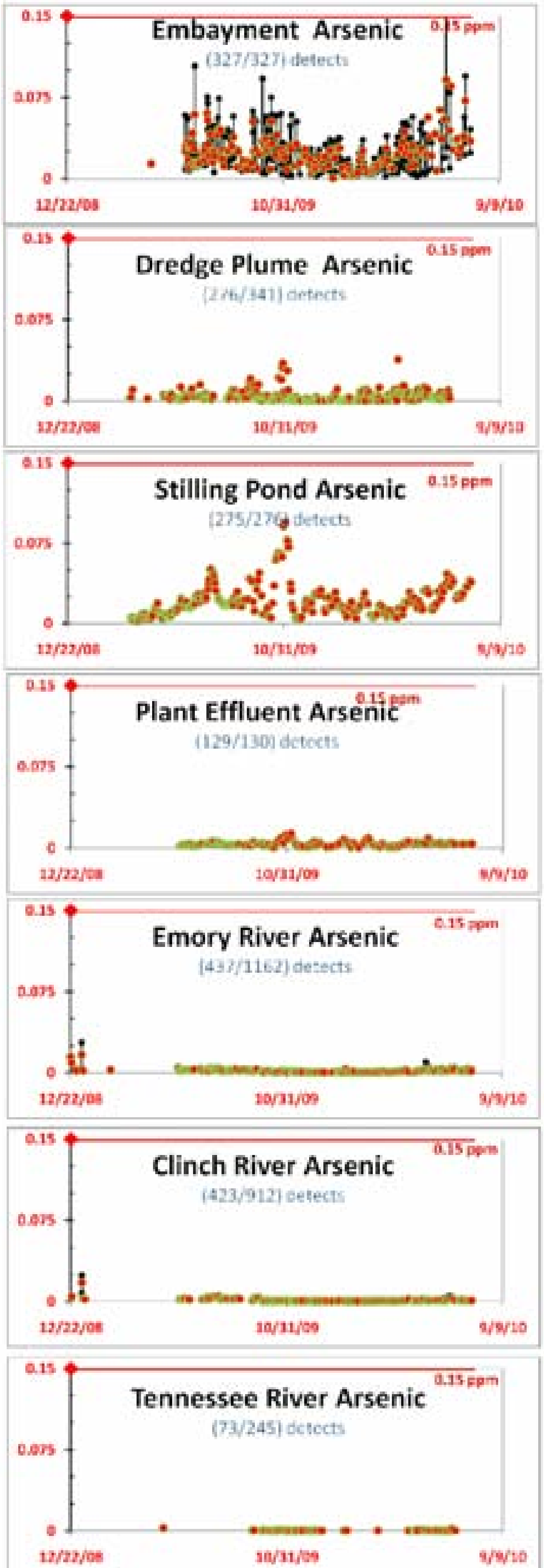


FIGURE 25
LOCATIONS OF ROUTINE SURFACE WATER MONITORING STATIONS
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
10 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 25 Surface Water Monitoring.dwg Mar 10,2011 -bperatro



NOTES:

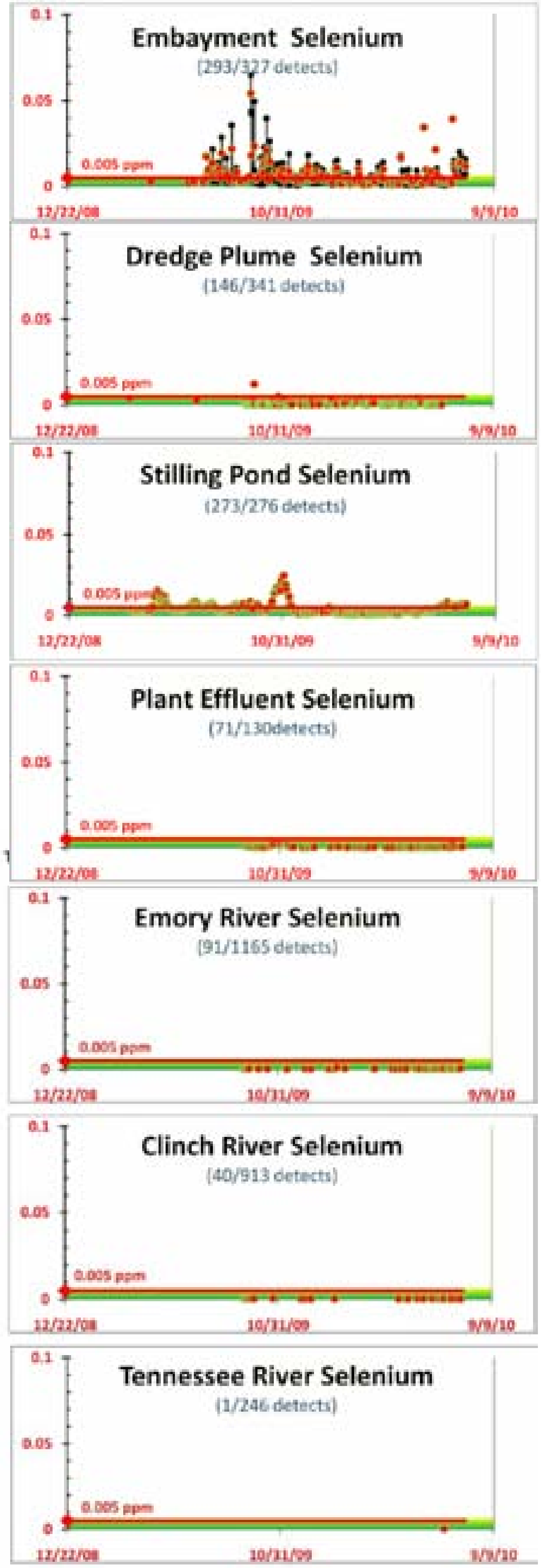
SPILL OCCURRED ON THE EMORY RIVER.

THE FOLLOWING APPLIES TO ALL GRAPHS ON THIS FIGURE:

- DISSOLVED CONCENTRATIONS ONLY ARE PLOTTED
- DETECTS ONLY ARE PLOTTED
- ALL CONCENTRATIONS ARE IN PARTS PER MILLION
- CHARTS DO NOT INCLUDE RAW, DRAFT DATA

FIGURE 26
TENNESSEE RIVER FISH & AQUATIC LIFE CRITERIA FOR ARSENIC
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
22 Mar 2011	OSC Final Report



NOTES:

SPILL OCCURRED ON THE EMORY RIVER.

THE FOLLOWING APPLIES TO ALL GRAPHS ON THIS FIGURE:

- DISSOLVED CONCENTRATIONS ONLY ARE PLOTTED
- DETECTS ONLY ARE PLOTTED
- ALL CONCENTRATIONS ARE IN PARTS PER MILLION
- CHARTS DO NOT INCLUDE RAW, DRAFT DATA

FIGURE 27
TENNESSEE RIVER FISH & AQUATIC LIFE CRITERIA FOR SELENIUM
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
22 Mar 2011	OSC Final Report

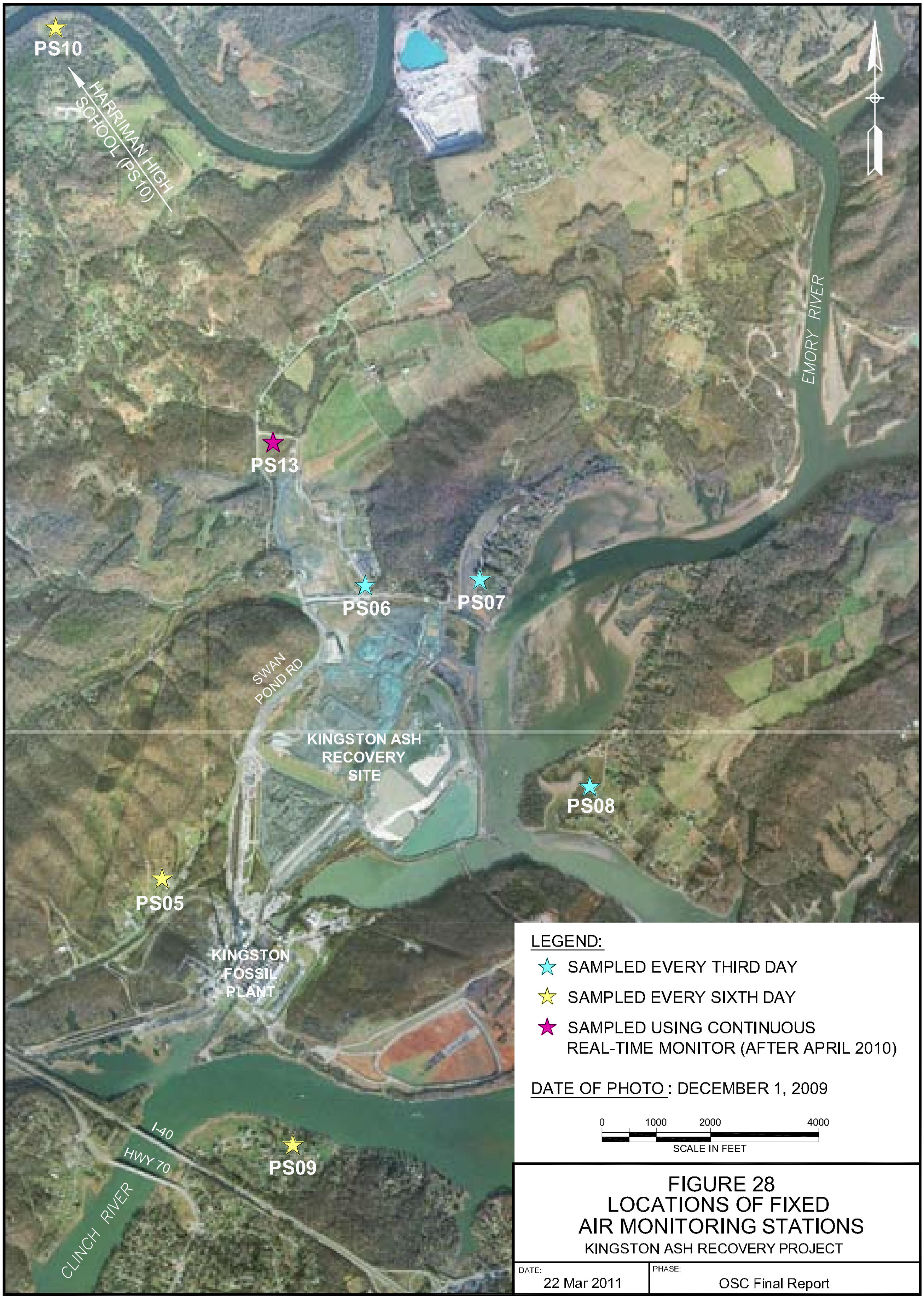
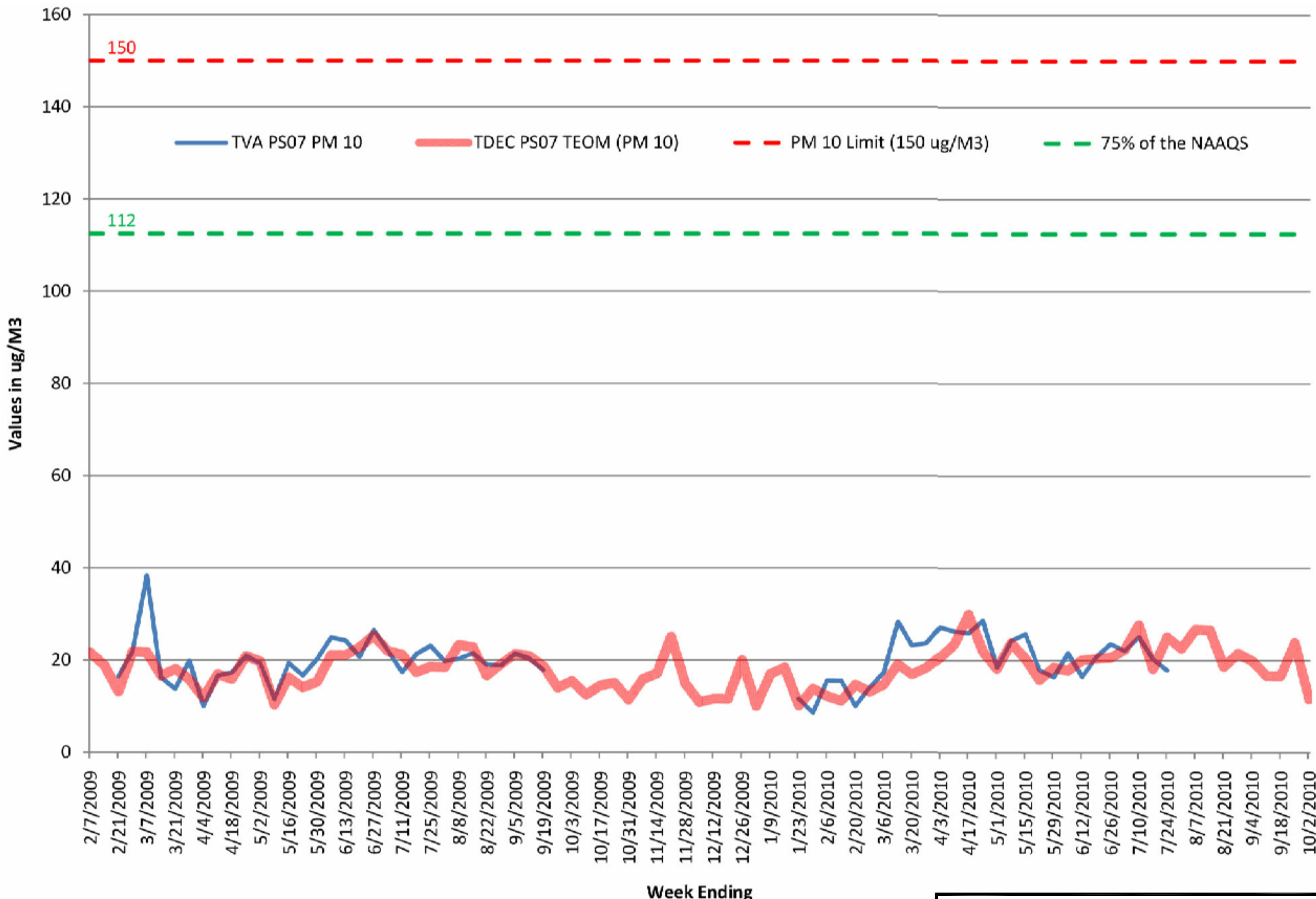


FIGURE 28
LOCATIONS OF FIXED
AIR MONITORING STATIONS
KINGSTON ASH RECOVERY PROJECT

DATE: 22 Mar 2011 | PHASE: OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 28 Air Monitoring Stations.dwg Mar 22,2011 -bperatro

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 29 Station 7 PM 10-FRM vs TEOM.dwg Mar 24,2011 -bperatro

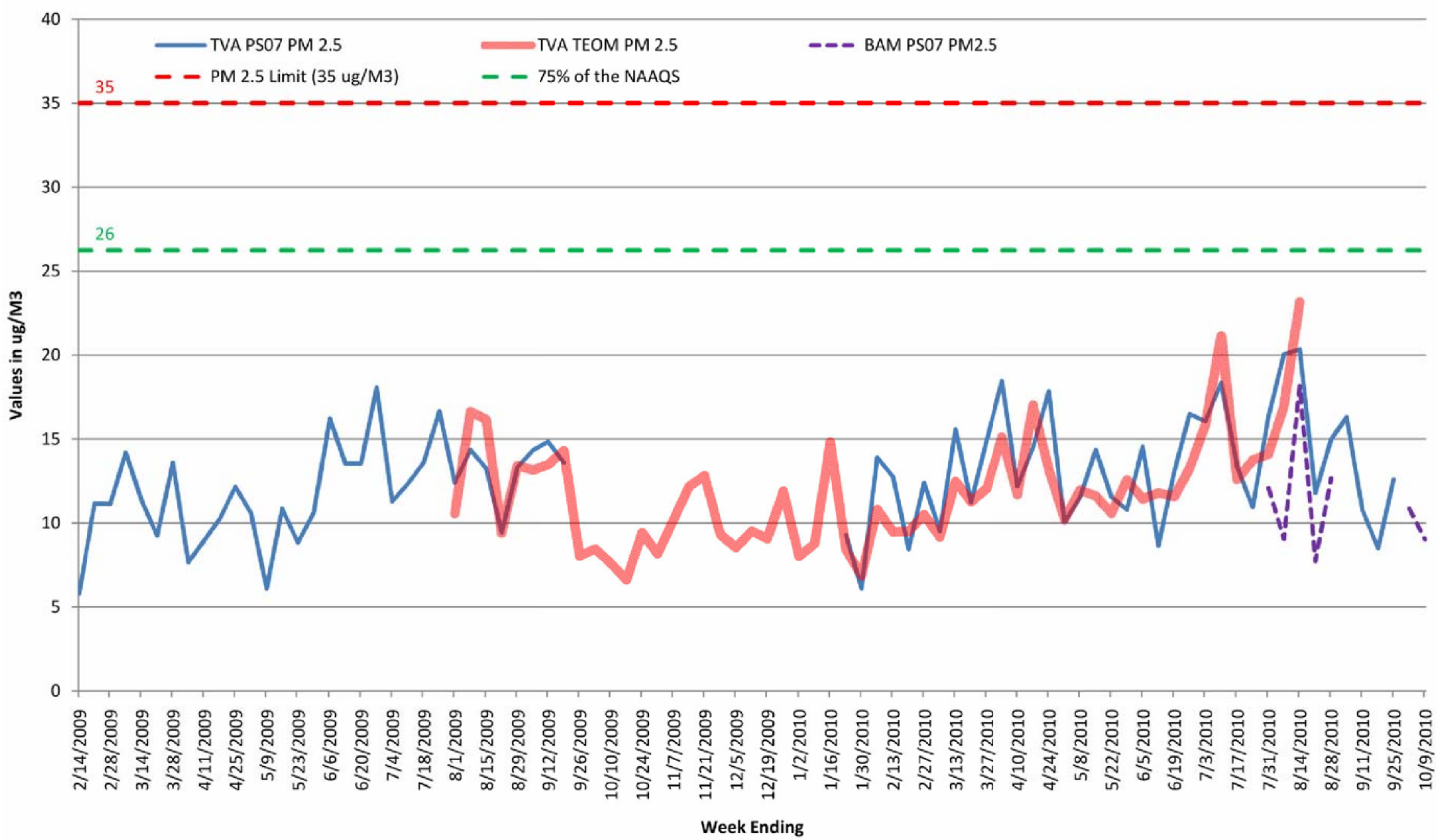


NOTE:
THIS FIGURE BASED ON AN EXISTING EPA-PRODUCED FIGURE AVAILABLE AT www.epakingstontva.com

FIGURE 29
STATION 7 PM 10 - FRM vs TEOM
(VERIFIED/VALIDATED DATA ONLY)

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
22 Mar 2011	OSC Final Report



NOTE:
THIS FIGURE BASED ON AN EXISTING EPA-PRODUCED FIGURE AVAILABLE AT www.epakingstontva.com

FIGURE 30
STATION 7 PM 2.5 - FRM vs TEOM-BAM
(VERIFIED/VALIDATED DATA ONLY)

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
22 Mar 2011	OSC Final Report

DATE OF PHOTO: AUGUST 14, 2009

LEGEND

GROUNDWATER MONITORING WELL

SURFACE WATER MONITORING STATION

0 500 1000 2000

SCALE IN FEET

FIGURE 31
LOCATIONS OF GROUNDWATER MONITORING WELLS
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
22 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 31 GW Monitoring Wells.dwg Mar 22,2011 -bperatro

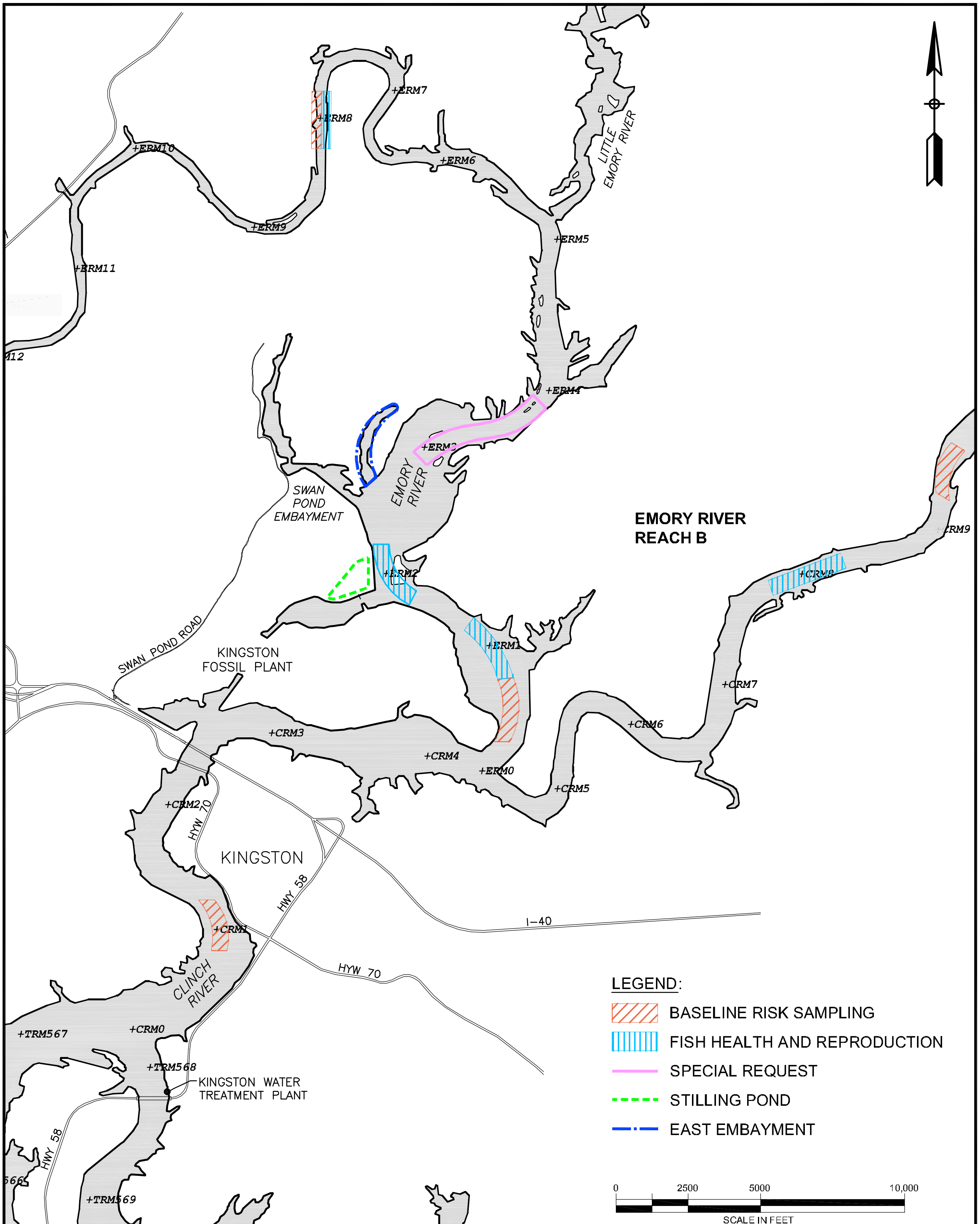


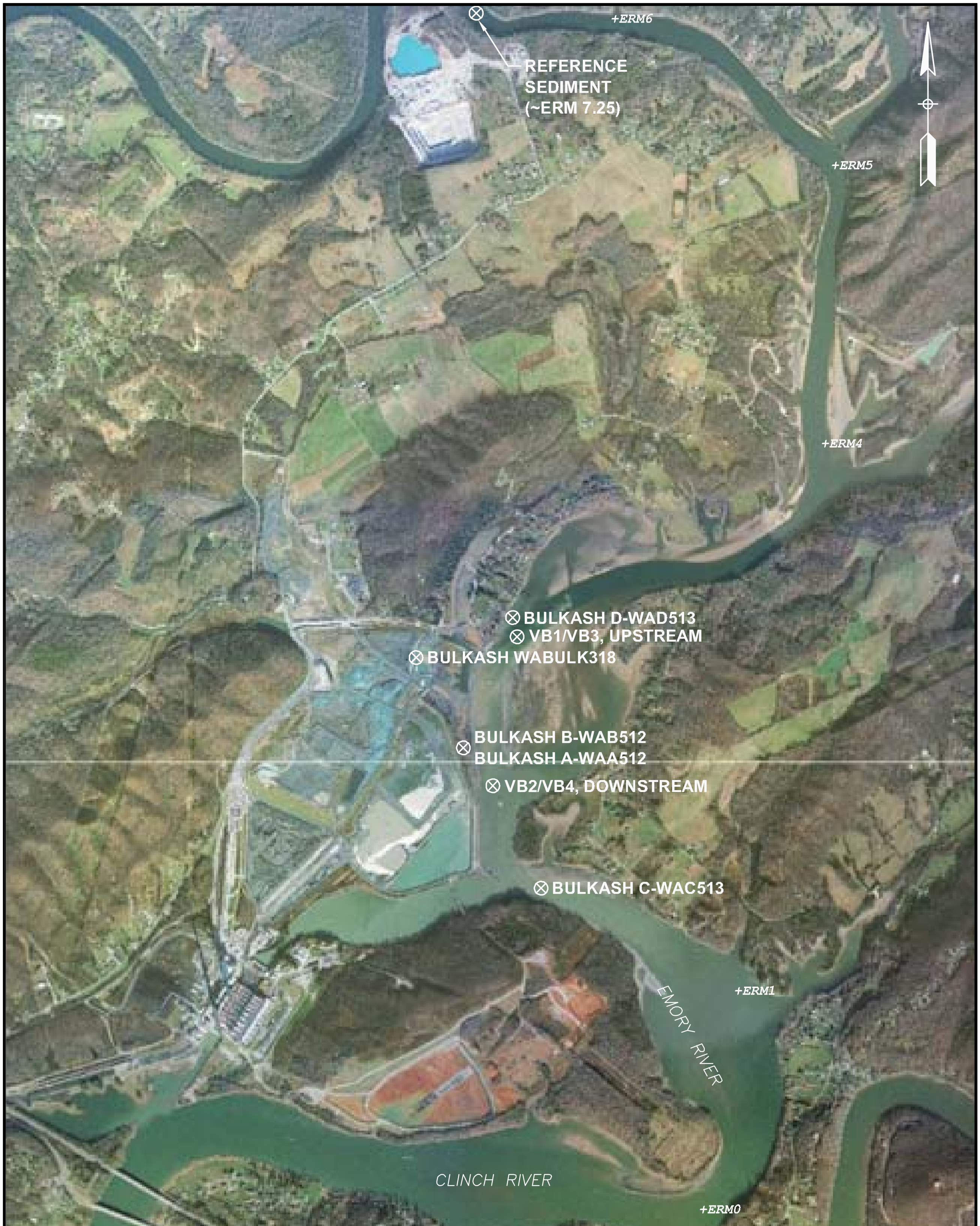
FIGURE 32
LOCATIONS OF FISH SAMPLING

KINGSTON ASH RECOVERY PROJECT

DATE: 22 Mar 2011

PHASE: OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 32 Fish Sampling.dwg Mar 22,2011 -bperatro



I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 33 Sed Toxicity Sampling.dwg Mar 22,2011 -bperatro

LEGEND:
⊗ SEDIMENT SAMPLE LOCATION
DATE OF PHOTO: DECEMBER 1, 2009

0 1000 2000 4000
SCALE IN FEET

FIGURE 33
LOCATIONS OF SEDIMENT TOXICITY SAMPLING

KINGSTON ASH RECOVERY PROJECT

DATE: 22 Mar 2011

PHASE: OSC Final Report

0 500 1000 2000
SCALE IN FEET

FIGURE 34
EXCLUSION & SUPPORT ZONES

KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
24 Mar 2011	OSC Final Report

I:\0002 ENGINEERING\Civil\Report Graphics\OSC Final Report\Fig 34 Exclusion Zone.dwg Mar 24,2011 -bperatro

Appendix A
Photo Log

APPENDIX A PHOTO LOG
1—Overall Time-Critical Ash Recovery

1A - Oblique of the Kingston Ash Recovery Project site after release (viewing from the east). December 29, 2008.

1B - Oblique of the Kingston Ash Recovery Project site after release (viewing from the west). December 29, 2008.

1C - BEFORE: Kingston Ash Recovery Project site after release. December 22, 2008.

1D - AFTER: Kingston Ash Recovery Project site after time-critical removal action. July 8, 2010.

APPENDIX A PHOTO LOG

1—Overall Time-Critical Ash Recovery

1E - BEFORE: Emory River at the Swan Pond Embayment after release. December 24, 2008.

1F - AFTER: Emory River at the Swan Pond Embayment after time-critical removal action. July 2010.

1G - BEFORE: East Embayment after release. December 23, 2008.

1H - AFTER: East Embayment after time-critical removal action. July 2010.

1I - BEFORE: North Embayment after release. December 23, 2008.

1J - AFTER: North Embayment after time-critical removal action. November 20, 2009.

APPENDIX A PHOTO LOG
1—Overall Time-Critical Ash Recovery

1K - BEFORE: Dredge Cell after release. December 28, 2008.

1L - AFTER: Dredge Cell after time-critical removal action. May 7, 2009.

2—Hydraulic and Mechanical Dredging

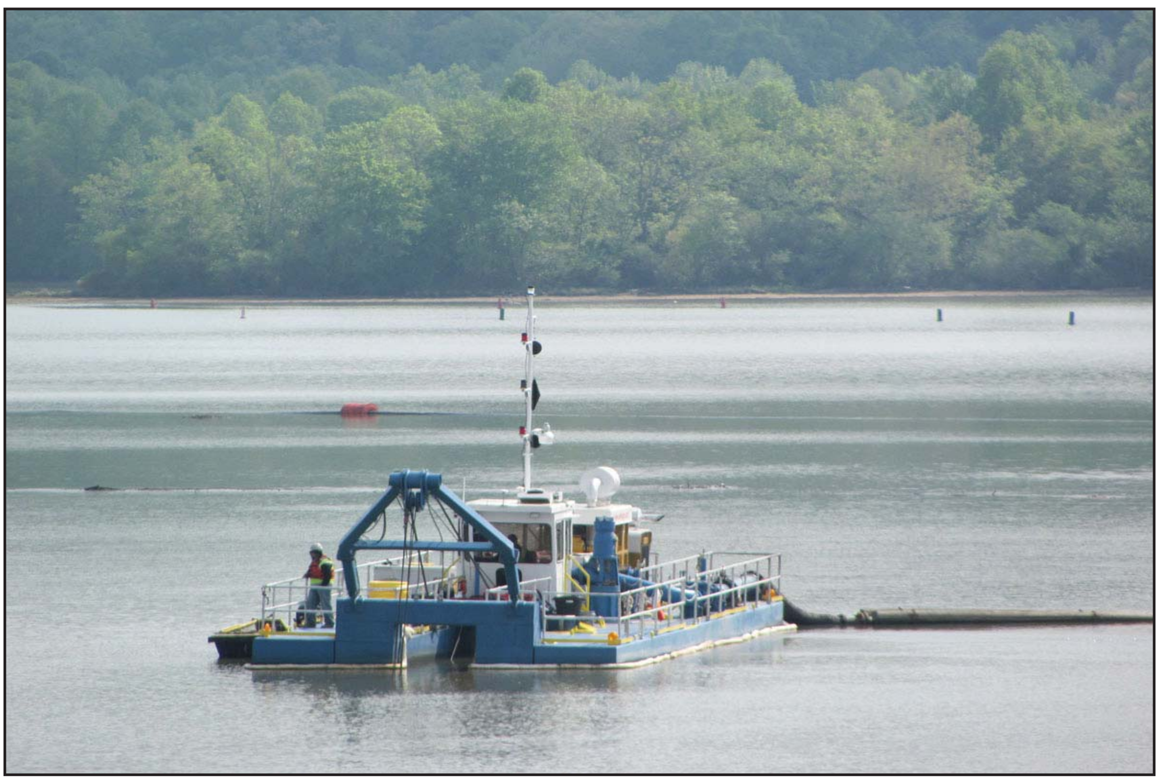
2A - TransAsh Emory dredge operating in the Emory River at the mouth of the clear water ditch. June 24, 2009.

2B - TransAsh Emory dredge cutter head; Southern Shores workers removing debris. April 24, 2009.

2C - Sevenson Kylie 16-inch dredge (Phase 1 dredging). December 17, 2009.

2D - Sevenson Sandpiper 20-inch dredge (Phase 1 dredging). December 17, 2009.

2E - Sevenson Shirley 16-inch dredge (Phase 2 dredging). February 26, 2010.



2F - Sevenson Adelyn 14-inch dredge (Phase 2 dredging). April 21, 2010.

2G - Sevenson 14-inch dredge cutter head showing wear due to dredging. August 1, 2009.

2H - Sevenson 20-inch cutter head with hard facing and teeth for hard dredging. May 5, 2010.

2I - Sevenson 16-inch cutter head and boom for deeper cut. September 1, 2009.

2J - Sevenson 16-inch cutter head and boom for shallower cut. May 18, 2010.

2K - Global Positioning Station (GPS) antennae atop dredge used to guide percision dredging. June 3, 2010.

2L - GPS equipment onboard dredge used to guide precision dredging. June 3, 2010.

2M - Dredge boom, hydraulic lines, and cables. May 22, 2010.

2N - Dredge boom, hydraulic lines, and cables. May 22, 2010.

2O - Dredge discharge line booster pump. November 7, 2009.

2P - Dredge discharge line booster pump showing noise muffler. November 7, 2009.

2Q - Sevenson mechanical dredging. May 23, 2010.

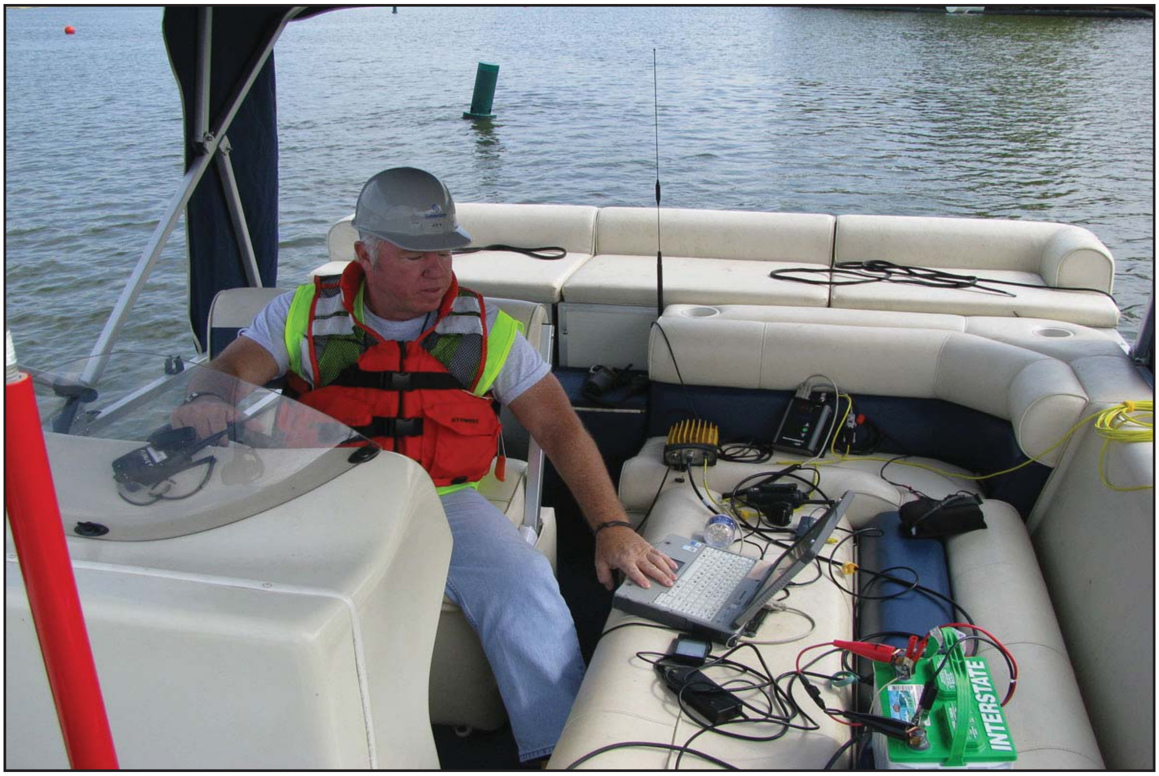
2R - Aquarious mechanical dredging. April 15, 2010.

2S - Aquarious mechanical dredging. April 15, 2010.

2T - Shore offloading of mechanical dredge barge. April 21, 2010.

2U - Debris boom downstream of dredging used to collect cenospheres or debris.
October 17, 2019.

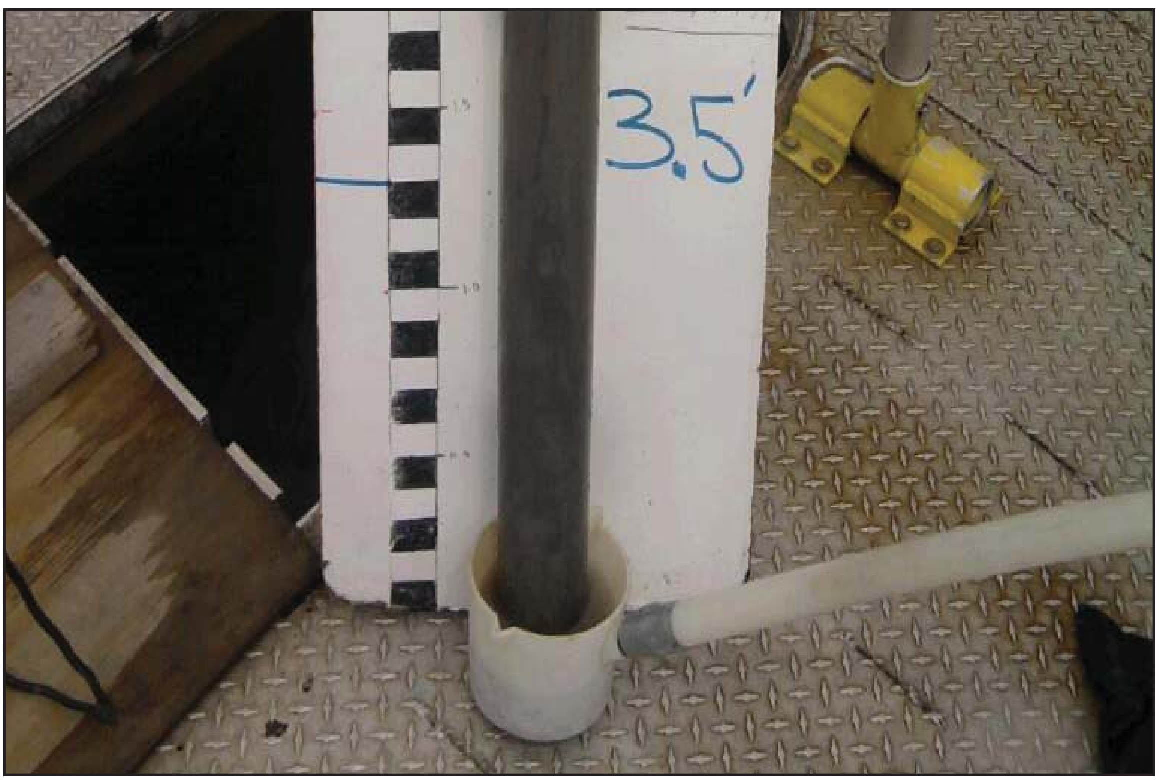
2V - Debris boom downstream of dredging used to collect cenospheres or debris.
October 17, 2019.



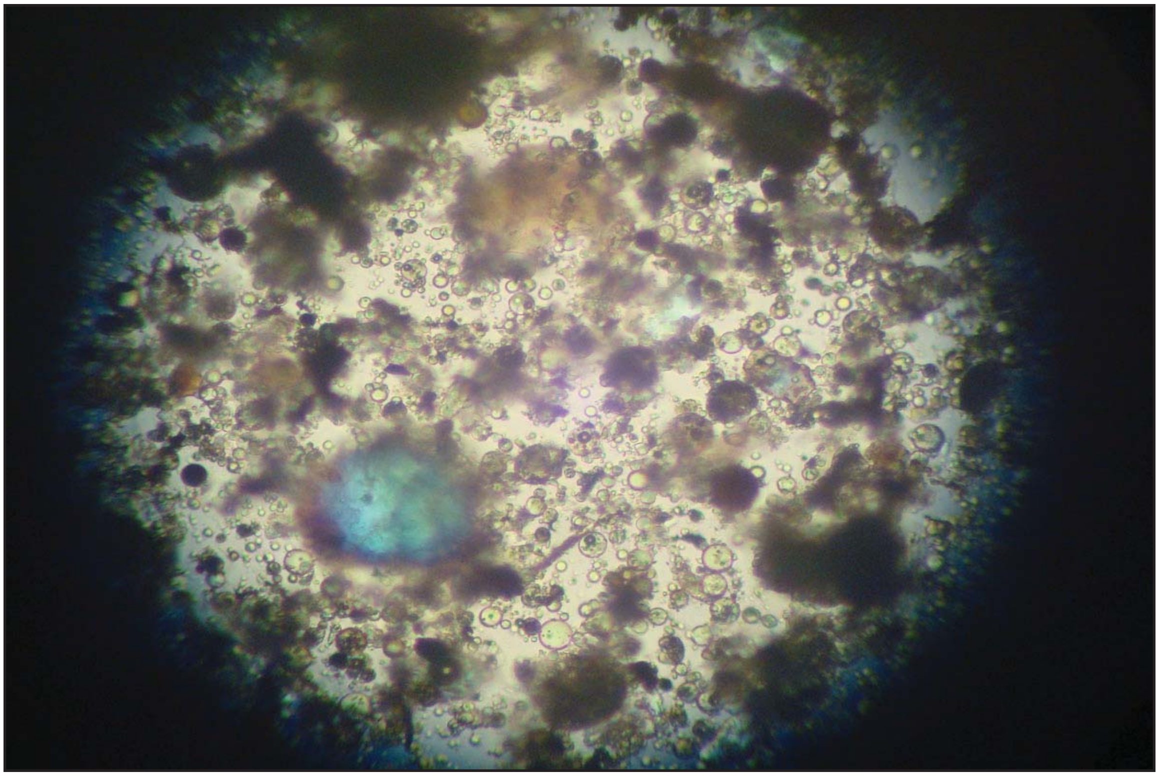
2W - Bathymetric survey boat and equipment used to measure elevation of river bottom.
October 29, 2009.

2X - Bathymetric survey data processing used to map elevation of river bottom.
October 29, 2009.

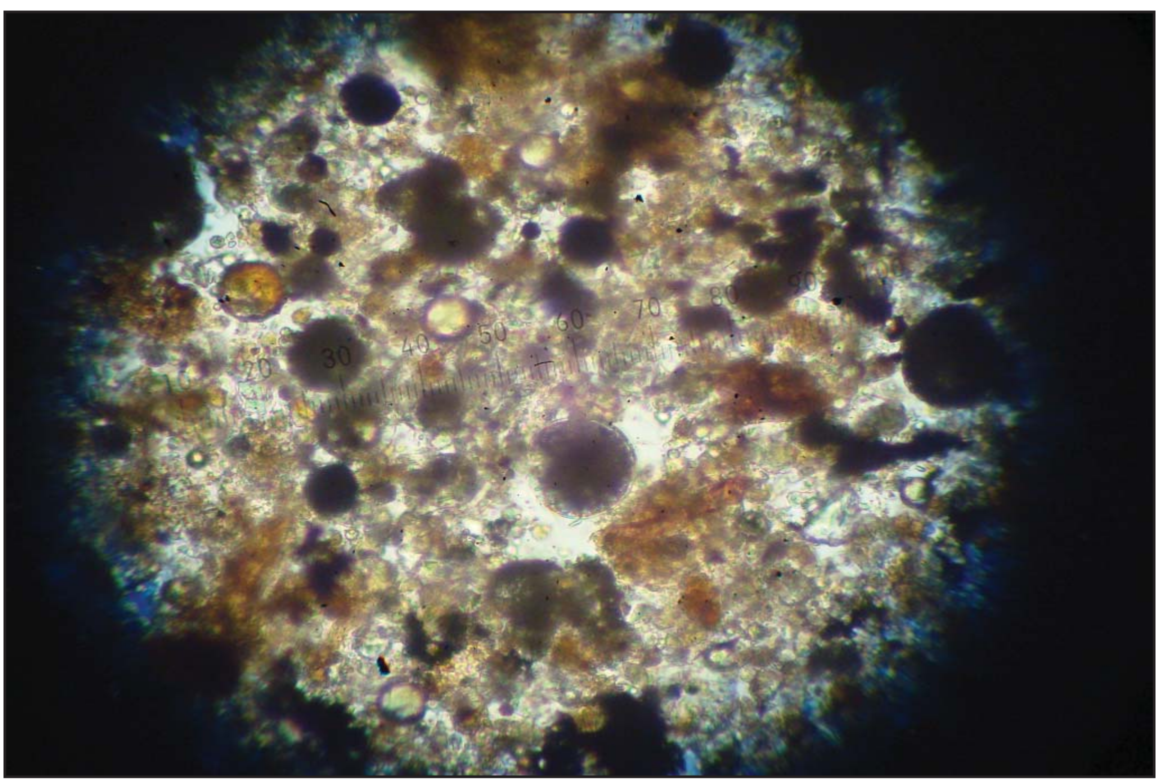
2Y - Vibecore sampling boat and equipment used to collect sediment samples to confirm ash removal. April 7, 2010.



2Z - Vibecore sampling, example sediment sample core extracted from botttom of river. June 9, 2010.



2ZA - Example polarized light microscopy image of extracted core used to determine amount of ash in sediment. December 17, 2009.



2ZB - Example polarized light microscopy image of extracted core used to determine amount of ash in sediment. April 5, 2010.

3A - Ball Field construction during installation of wick drains on grid pattern. March 20, 2009.

3B - Ball Field construction during installation of wick drains and gravel demarcation layer. March 30, 2009.

3C - Dredged ash processing showing discharge to Rim Ditch (top) and from Sliuce Trench (bottom). July 1, 2009.

3D - Dipping (excavating) dredged ash from Rim Ditch, showing sheet pile wall. April 10, 2010.

3E - Dipping from Rim Ditch (left) to Ball Field windrows (right). January 8, 2010.

3F - Dewatering ash in the Ball Field using windrows (piles of ash in long rows). July 8, 2010.

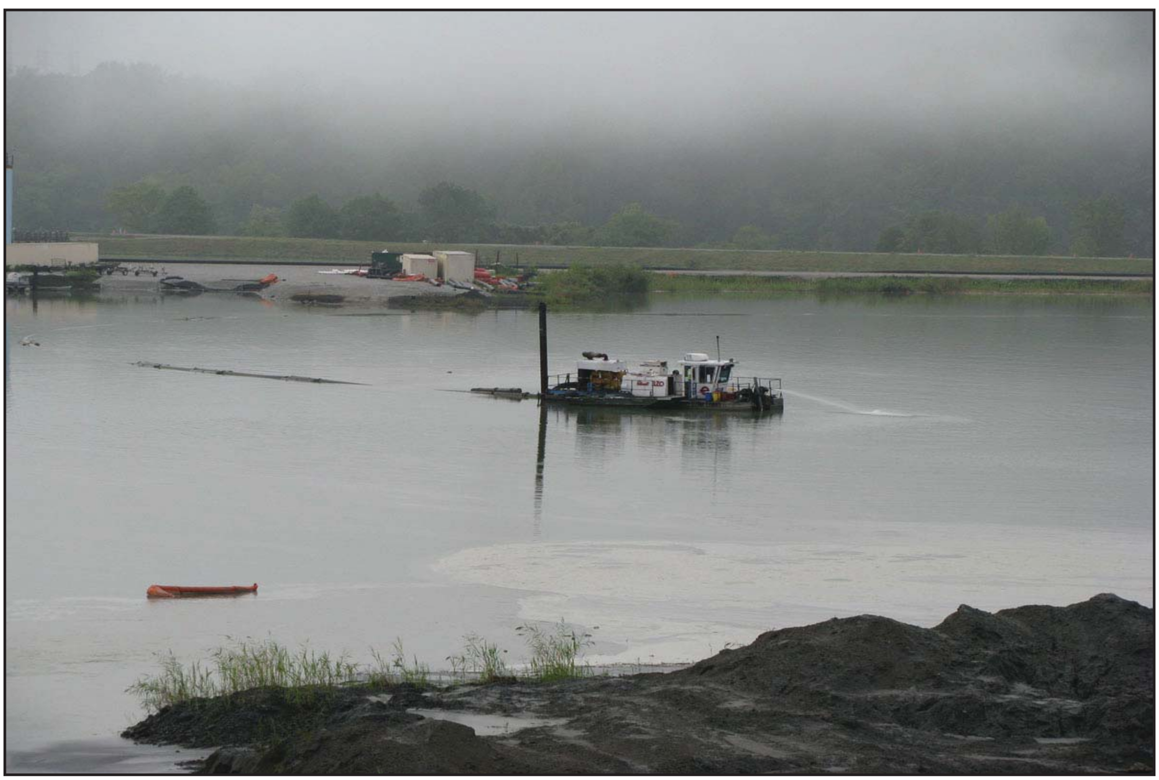
3G - Equipment in the Ball Field continuously moving ash in windrows to aid in drying.
October 8, 2010.

3H - Equipment in the Ball Field continuously moving ash in windrows to aid in drying.
January 8, 2010.

3I - Equipment in the Ball Field continuously moving ash in windwors to aid in drying.
April 5, 2010.

3J - Very wet conditions in Ball Field ash processing area during extended rainy weather.
January 18, 2010.

3K - Water treatment in settling ponds, including Ash Pond (top), Stilling Pond (left), and Lateral Expansion (right). November 20, 2009.



3L - Dredging of Ash Pond to remove settled ash and increase available free water volume. August 15, 2009.

3M - Lateral Expansion Area prior to use for ash recovery. November 20, 2009.

3N - Lateral Expansion Area converted to use for wet ash storage and ash recovery from Ash Pond dredge discharge. July 8, 2010.

3O - Filter presses used for ash recovery from Ash Pond dredge discharge. January 9, 2010.

3P - Filter presses used for ash recovery from Ash Pond dredge discharge. January 23, 2010.

4A - Excavation east of Dike 2 showing ash dike separating work area from Emory River. August 31, 2009.

4B - Excavation east of Dike 2 showing riprap-lined Dike 2 haul road (left). August 21, 2009.

4C - Amphibious long-neck backhoe excavator and tracked dump truck used to excavate ash east of Dike 2. August 31, 2009.

4D - Excavation east of Dike 2 using track-mounted backhoe excavators and rubber-tired articulated dump trucks. September 4, 2009.

APPENDIX A PHOTO LOG
4—Excavation East of Dike 2

4E - Excavation east of Dike 2 using track-mounted bulldozers and backhoe excavators. September 28, 2009.

4F - Excavation east of Dike 2 nearing bottom of excavation in Swan Pond Embayment. October 6, 2009.

4G - Excavation east of Dike 2 using track-mounted light dump trucks in soft terrain. December 16, 2009.

4H - Excavation east of Dike 2 nearing bottom of excavation (Dike 2 at left). October 6, 2009.

4I - Excavation east of Dike 2 nearing bottom of excavation (clean water ditch at left). October 18, 2009.

4J - Excavation east of Dike 2 nearing bottom of excavation (ash dike separating from Emory River at top). October 9, 2009.

4K - Excavation east of Dike 2 nearing bottom of excavation (ash dike separating from Emory River at top). October 9, 2009.

4L - Excavation east of Dike 2 nearing bottom of excavation (East Embayment at right). October 9, 2009.

4M - Excavation in East Embayment area with portadam containment. October 8, 2009.

4N - Removal of ash dike separating Swan Pond Embayment from Emory River. January 14, 2010.

4O - Addition of lime during excavation of East Embayment to reduce moisture content in the ash. March 4, 2010.

4P - Addition of lime to surface of excavation. March 4, 2010.

5—Temporary Ash Storage

5A - Ball Field, temporary dry ash processing and storage of dredged materials prior to offsite shipment. April 12, 2009.

5B - West Storage Area, temporary dry ash storage for materials excavated east of Dike 2. October 28, 2009.

5C - Test embankment, temporary storage of dry-stacked material in test fill. August 10, 2009.

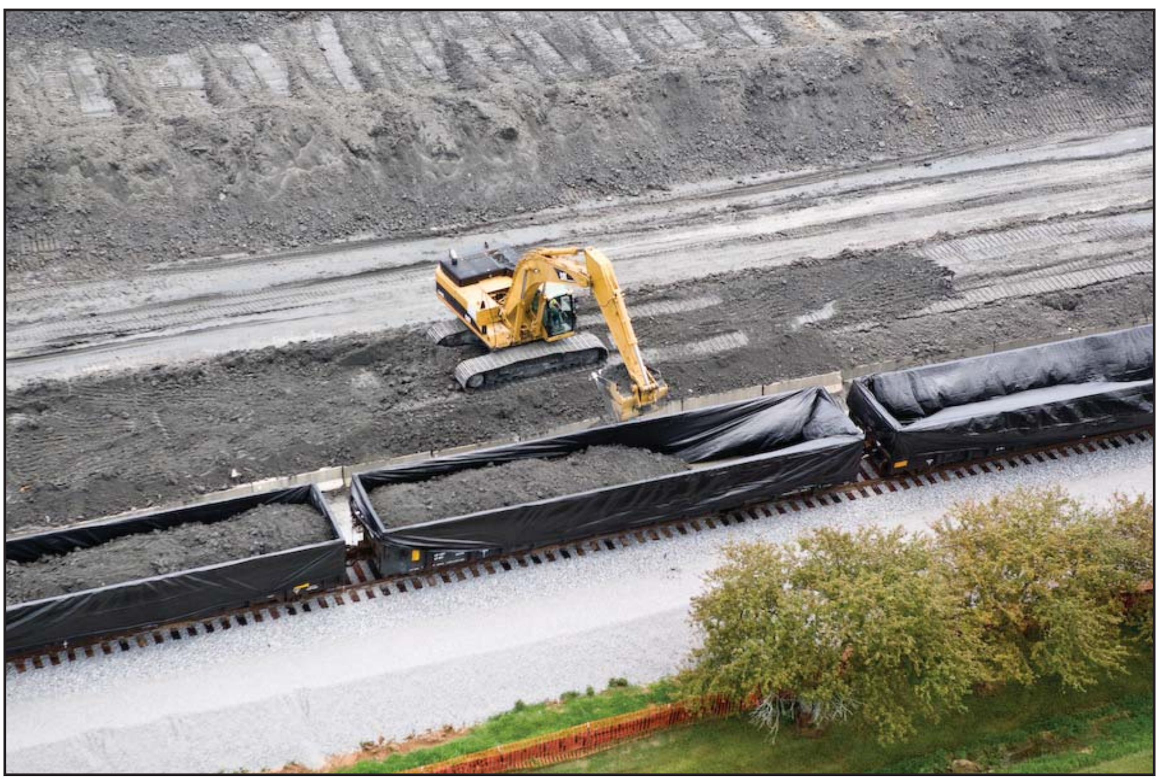
5D - Peninsula Storage area, constructed as alternate temporary storage site, but never used. July 2, 2009.

5E - Temporary storage of wet ash in Dredge Cell. November 5, 2009.

5F - Temporary storage of wetter ash in "valley area" of Dredge Cell next to Dike D.
February 19, 2010.

5G - Temporary storage of dry ash in “valley area” of Dredge Cell next to Dike D.
September 30, 2009.

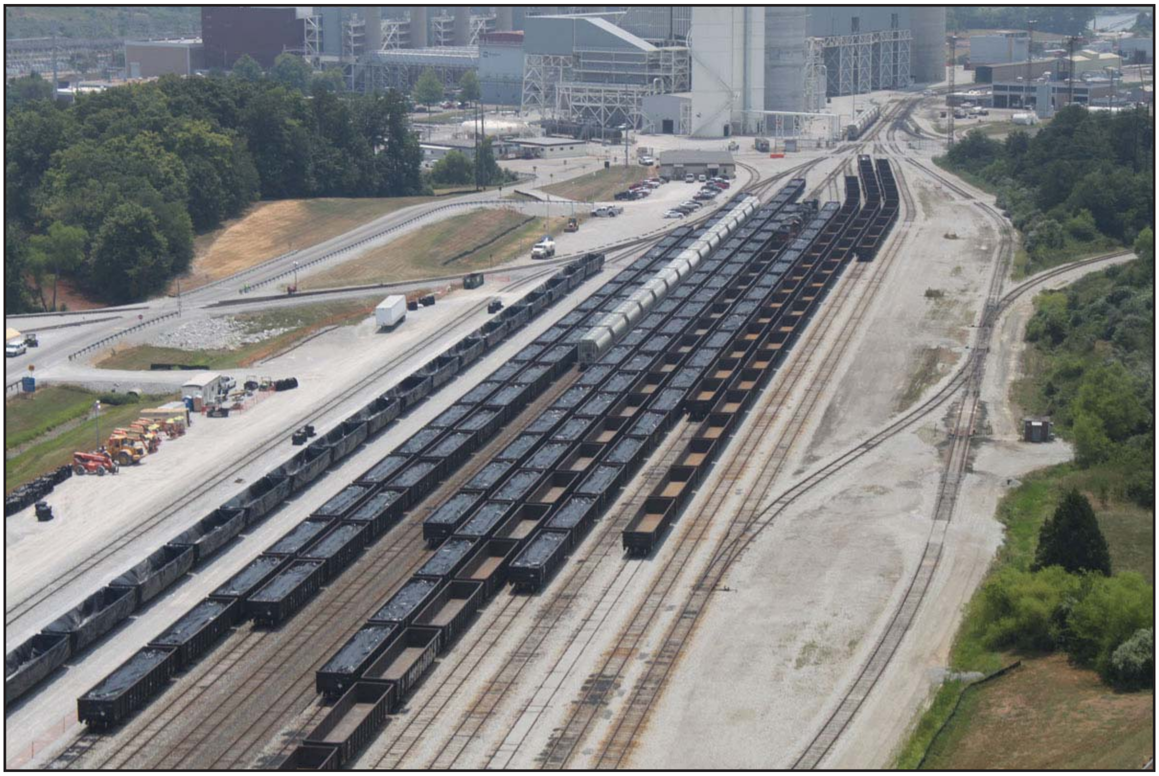
6A - Completed center rail spur in the Ball Field. April 14, 2010.



6B - Excavator filling railcars lined with "burrito bags." July 16, 2009.

6C - Cherry picker inspecting "burrito bags" in railcars. April 1, 2010.

6D - Sealed "burrito bag." April 1, 2010.



6E - Norfolk Southern railcars in the queue. November 10, 2009.

6F - Norfolk Southern trains used to transport ash to Uniontown, AL. July 2, 2009.

6G - Aerial lifts used for inspecting train shipments at Uniontown, AL. August 26, 2010.

6H - Unlodading railcars at Uniontown, AL. August 26, 2010.

6I - Cleaning railcars at Arrowhead Landfill, Uniontown, AL. August 26, 2010.

6J - Landfilling of ash material in the Arrowhead Landfill, Untiontown, AL. August 26, 2010.

6K - Roller compaction of ash material in lifts at the Arrowhead Landfill, Uniontown, AL. August 26, 2010.

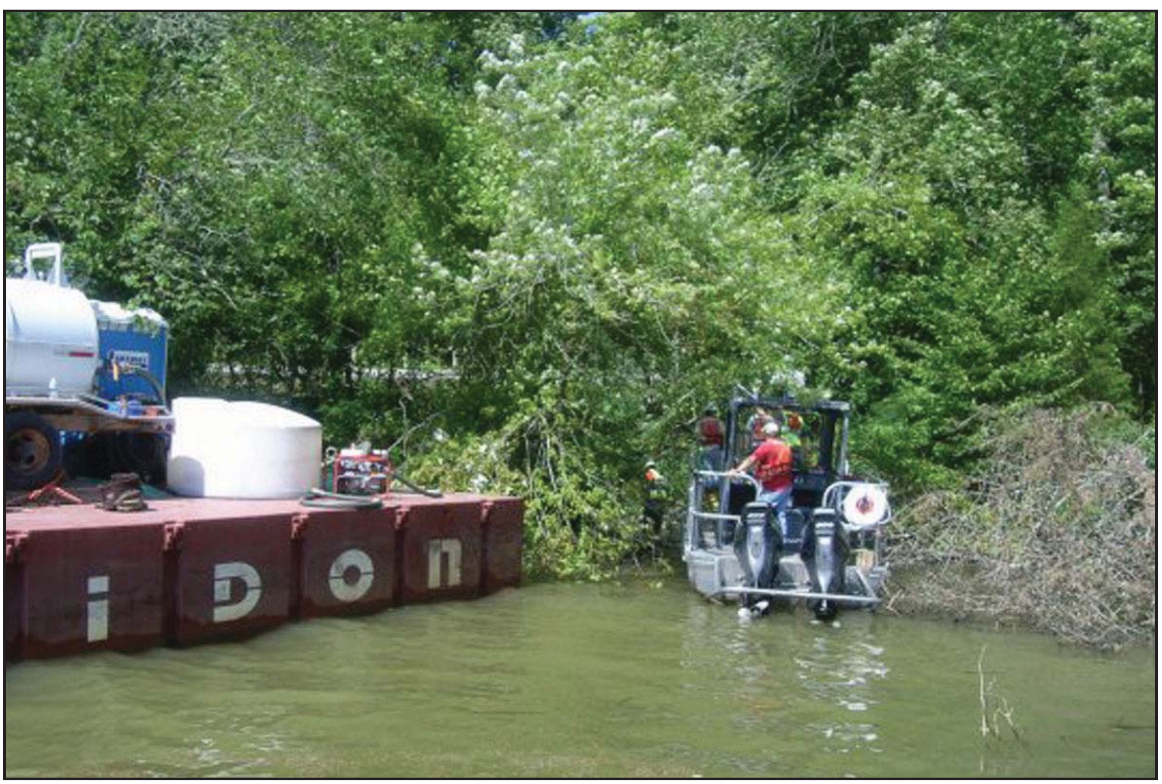
6L - Typical ash disposal railcar placarding.

7A - Floating boom used to trap cenospheres and entrained debris on the Emory, Clinch, and Tennessee Rivers. January 23, 2010.

7B - Floating boom used to trap cenospheres and entrained debris on the Emory, Clinch, and Tennessee Rivers. January 24, 2010.

7—Cenosphere and Debris Removal

7C - Workers and mechanical excavators used to remove trapped cenospheres and debris from cove. May 11, 2009.



7D - Vacuum removal of cenospheres into holding tank. July 14, 2009.

7E - Vacuum removal of cenospheres into holding tank. July 14, 2009.

7F - Vacuuming cenospheres. January 3, 2009.

7G - Shoreline debris removal on the Tennessee River. February 12, 2010.

7H - Shoreline debris removal using crane. July 13, 2009.

7I - Debris barge used to transport debris back to the Kingston Fossil Plant. August 24, 2009.

7J - Removal of skimmer wall debris at the Kingston Fossil Plant intake channel.
June 5, 2010.

7K - Onsite cenosphere storage area (southwest corner of Ash Pond). July 8, 2010.

7L - Emptying vacuum truck into cenosphere pond (southeast corner of the Ash Pond). February 17, 2009

8A - Excavating ash in “panels” from outboard slope of Dike C to expose dike material. June 5, 2010.

8B - Placing layer of sand on top of dike material in panel. December 29, 2009.

8C - Placing layer of gravel on top of sand material in panel. December 27, 2009.

8D - Placing riprap on top of gravel material. December 27, 2009.

8E - Excavation of subsequent panel next to a completed panel. February 12, 2010.

8F - Progress of overall Dike C reinforcement work as viewed from top of Dike C.
February 24, 2010.

8G - Below water excavation and sand, gravel, and riprap placement. April 23, 2010.

8H - Equipment used in placing sand, gravel, and riprap during Dike C reinforcement.
April 29, 2010.

9A - Preparing subgrade (placing geogrid reinforcement and stone). August 7, 2009.

9B - Placing initial lifts within the embankment. August 11, 2009.

9C - Disking ash in lifts for moisture conditioning. August 14, 2009.

9D - Filling enbankment against former relic dike. September 14, 2009.

9E - Shaping of side slope of test embankment. September 30, 2009.

9F - Monitoring of inclinometer instrumentation. August 13, 2009.

9G - Monitoring of piezometer instrumentation. September 30, 2009.

9H - Completed test embankment showing final benched slopes. May 2010.

10A - Dirty water ditch used to convey stormwater in contact with exposed ash on the site. November 5, 2009.

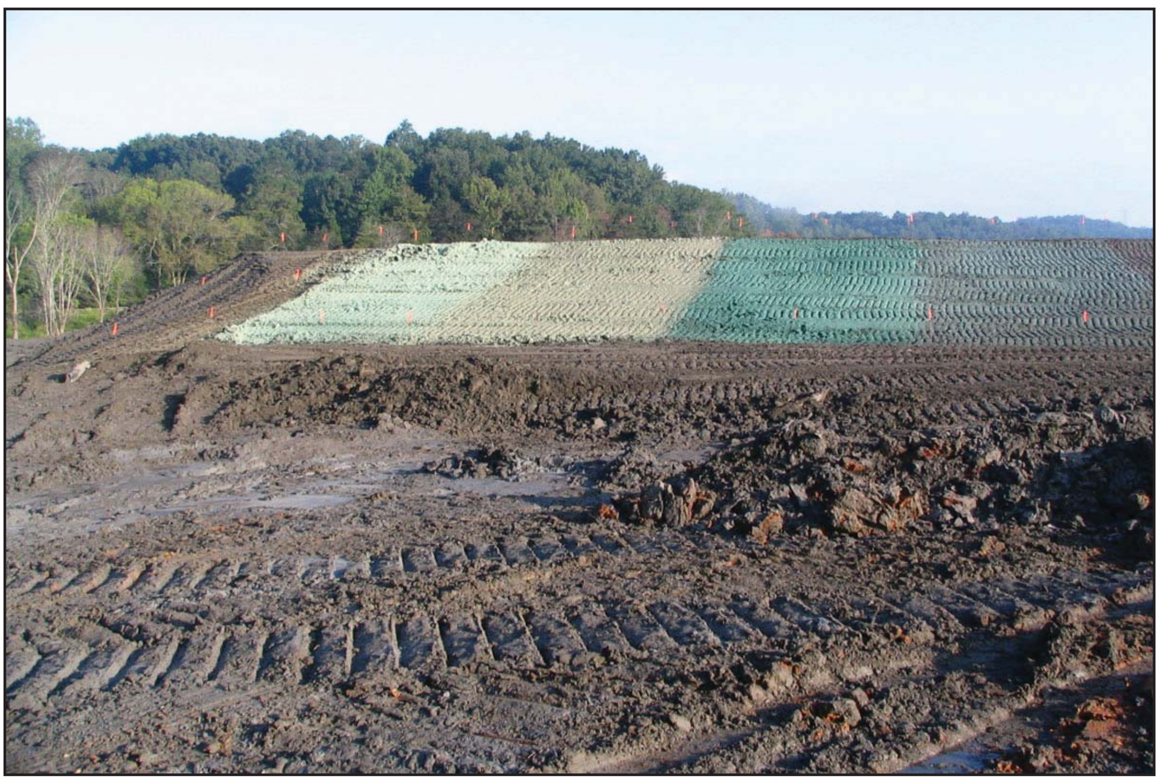
10B - Clean water ditch used to route clean stormwater around the ash in the Swan Pond Embayment. December 8, 2009.

APPENDIX A PHOTO LOG
10—Environmental Monitoring

10C - Sediment basins used to settle out ash particles from dirty water ditch stormwater flows. July 2, 2009.

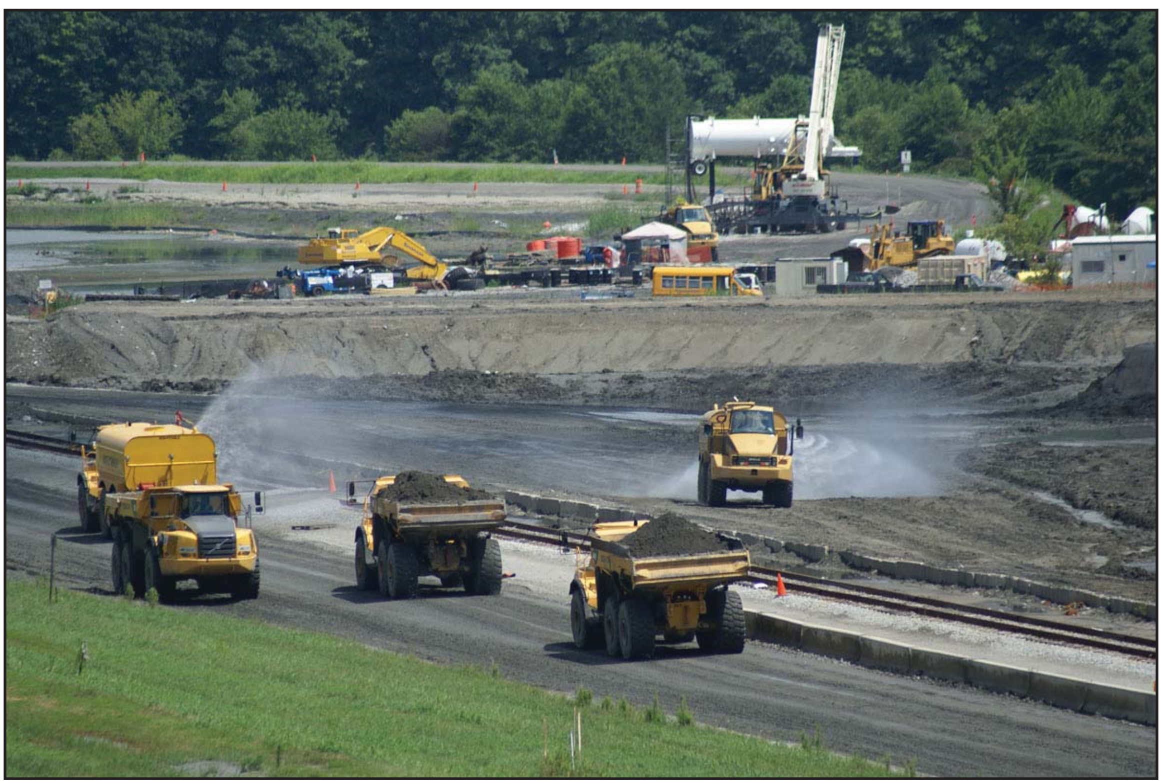
10D - Cleaning out accumulated sediment from the sediment basins. September 4, 2009.

10E - Erosion gulleys that formed in exposed ash following a storm event. December 16, 2009.



10F - Test plot of hydroseeded formulations to control erosion and reduce dust.
September 3, 2009.

10G - Grass stand following application of Flexterra® by hydroseeding. August 1, 2009.



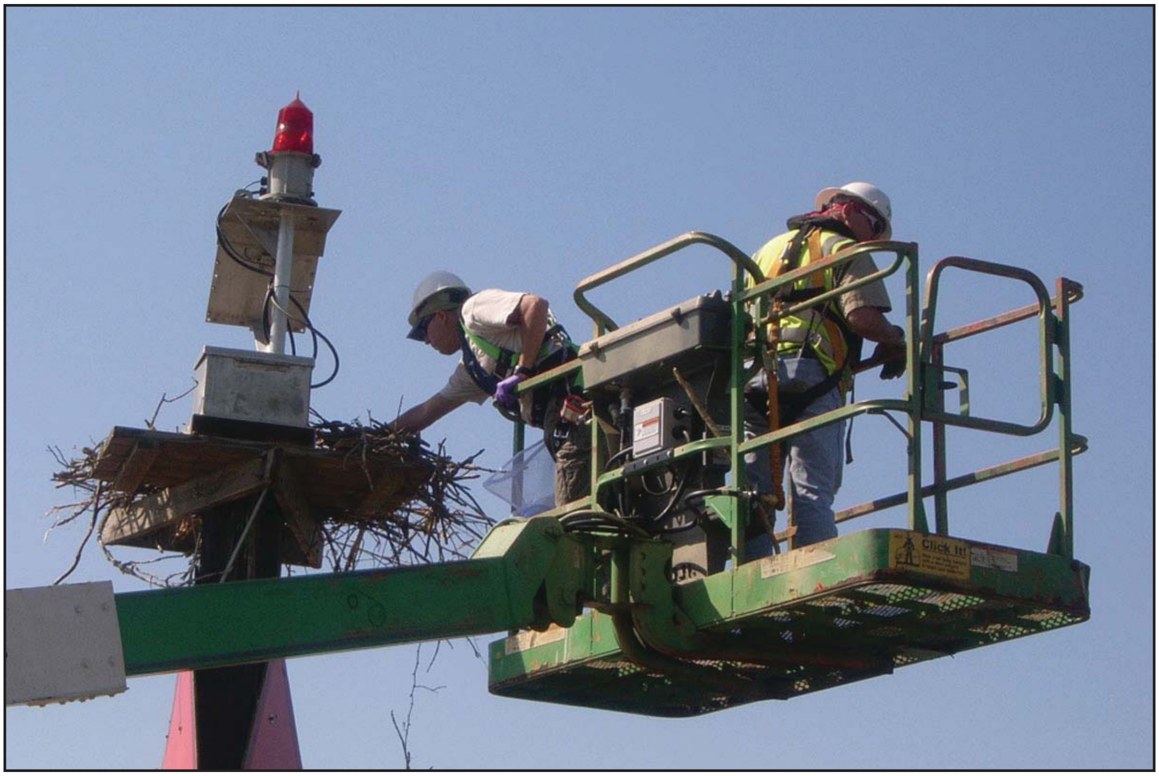
10H - Water spraying to control dust on haul roads and exposed ash surfaces. July 13, 2010.

10I - Air monitoring equipment used to measure dust particulate and metal concentrations in air around the site. September 22, 2009.

10J - Collection of surface water samples in Watts Bar Reservoir. October 26, 2010.

10K - Hydrolab equipment used to collect surface water samples in Watts Bar Reservoir.
January 27, 2010.

10L - Hydrolab equipment used to collect surface water samples in Watts Bar Reservoir.
December 15, 2009.



11A - Collection of osprey eggs for analysis of fish-feeding avian receptors. April 12, 2010.

11B - Osprey eggs in nest above Watts Bar Reservoir. April 12, 2010.

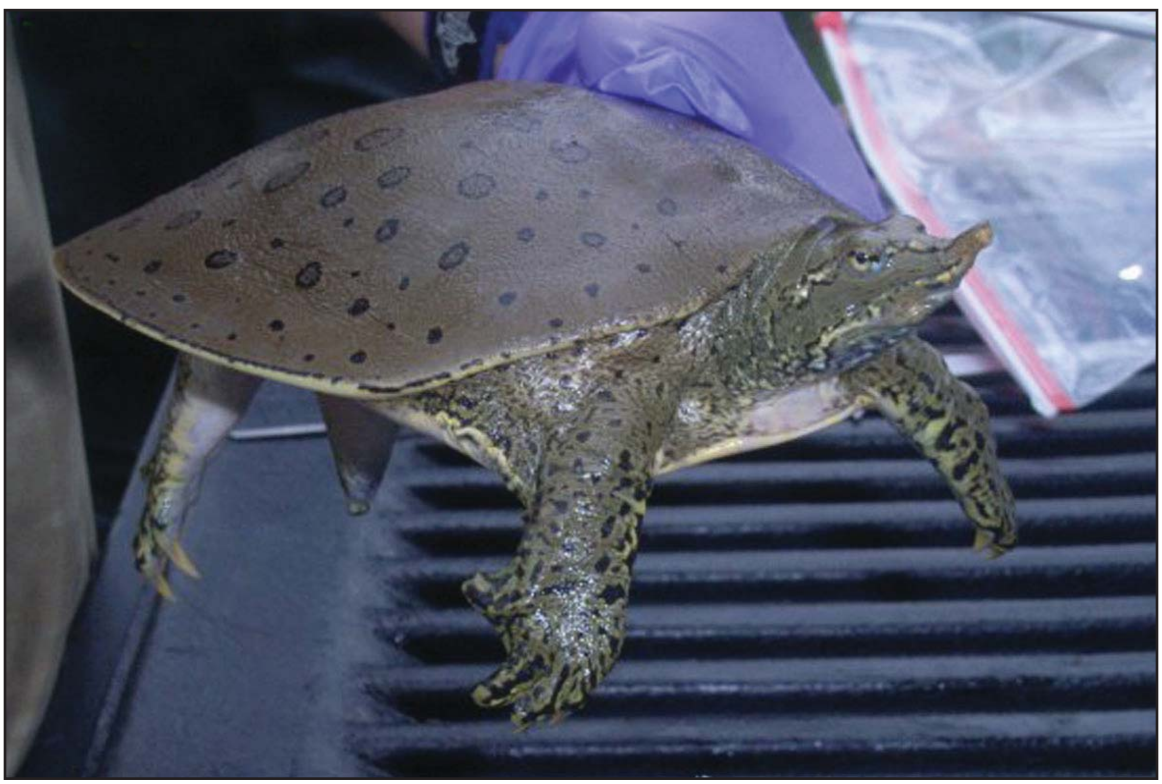
11C - Collection of Canada goose eggs for analysis of plant-feeding avian receptors.
April 15, 2010.

11D - Collection of tree swallow eggs for analysis of insect-feeding avian receptors. May 3, 2010.

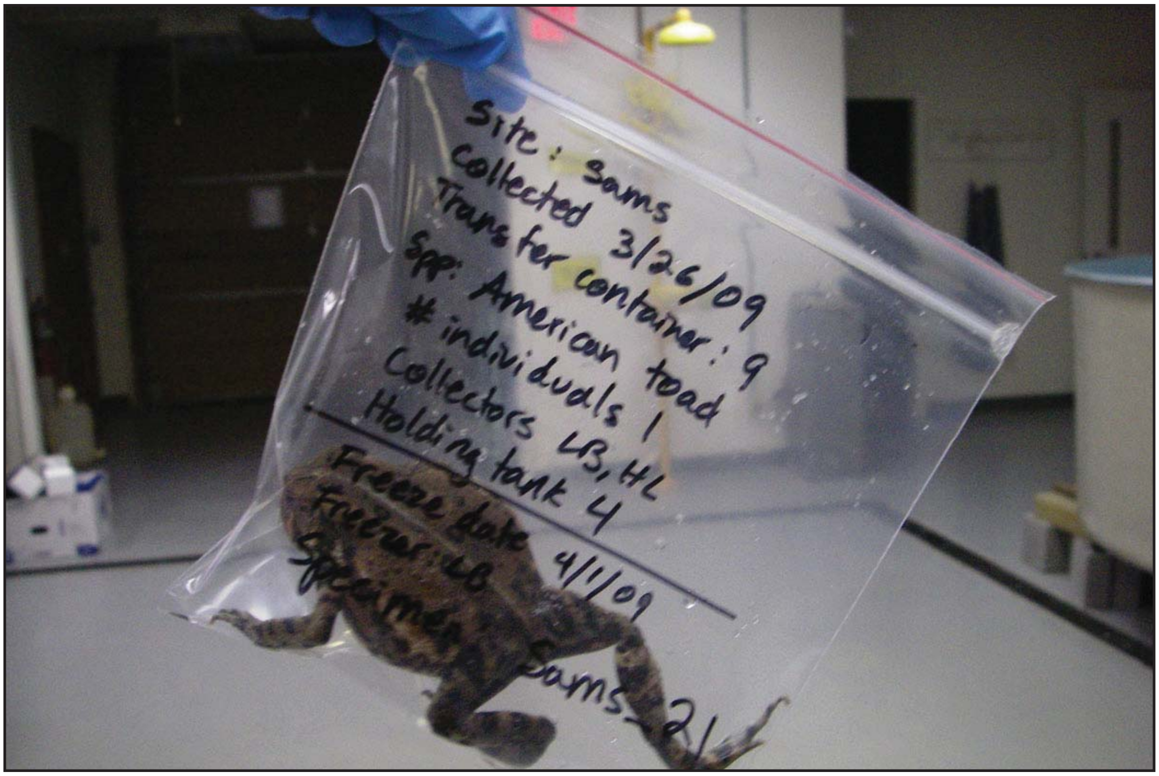
11E - Laboratory evaluation of tree swallow health. May 24, 2010.

11F - Collection of opossums for analysis of mammal receptors. October 1, 2009.

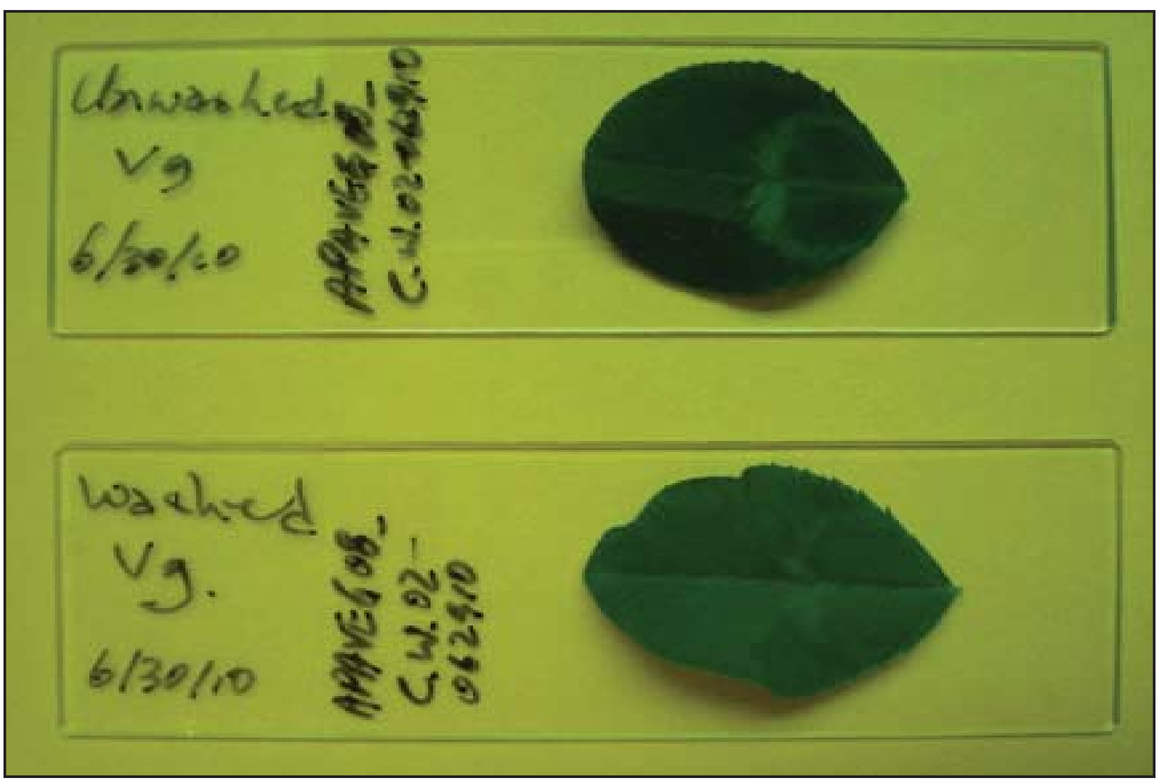
11G - Laboratory evaluation of turtle health and blood for analysis of reptile receptors in water. June 30, 2010.



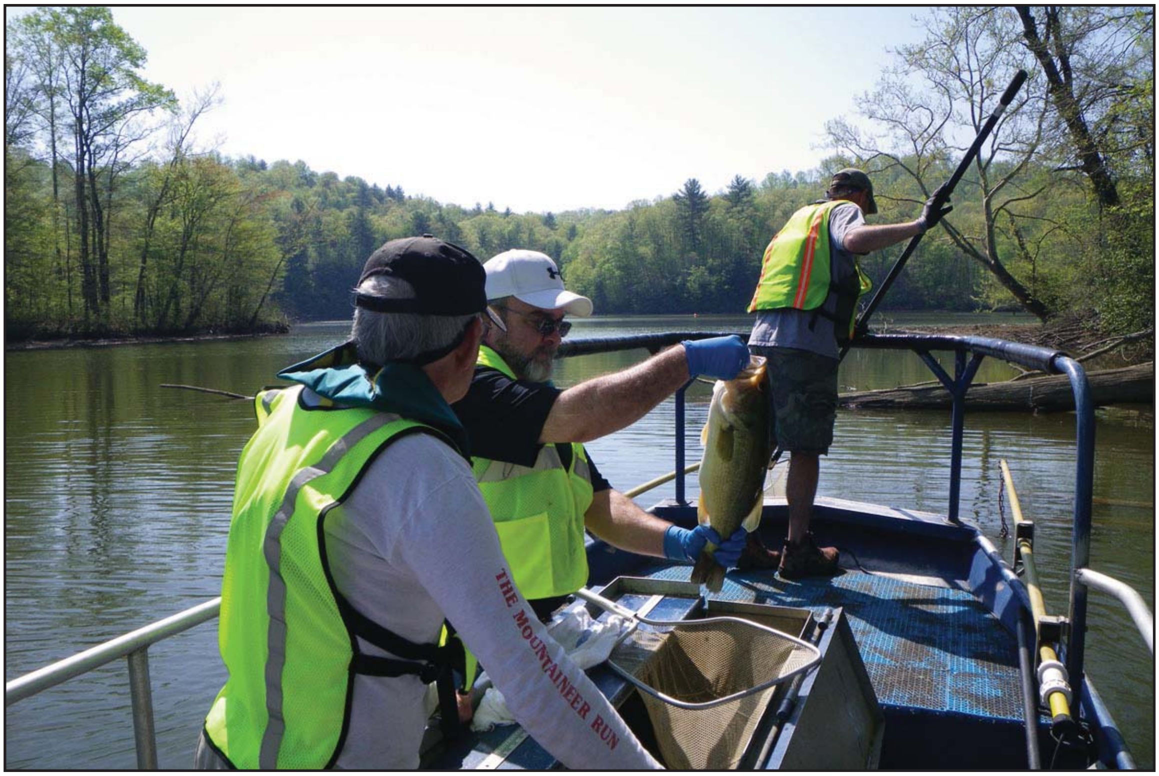
11H - Laboratory evaluation of turtle health and blood. June 30, 2010.



11I - Sampling of frogs for analysis of amphibian receptors in riparian zone. April 1, 2009.



11J - Vegetation sampling for analysis of biouptake in plants. June 30, 2010.



11K - Fish collection for analysis of bioaccumulation and fish health. November 2009.

11L - Fish collection for analysis of bioaccumulation and fish health. November 2009.

11M - Sampling of mussels and clams for analysis of benthic organisms bioaccumulation and population. September 27, 2010.

11N - Sampling of adult mayflies for analysis of bioaccumulation in benthic organisms. October 12, 2009.

Appendix B
Daily Dredge Volumes

FIGURE B-1 DAILY DREDGE AND EXCAVATION VOLUMES

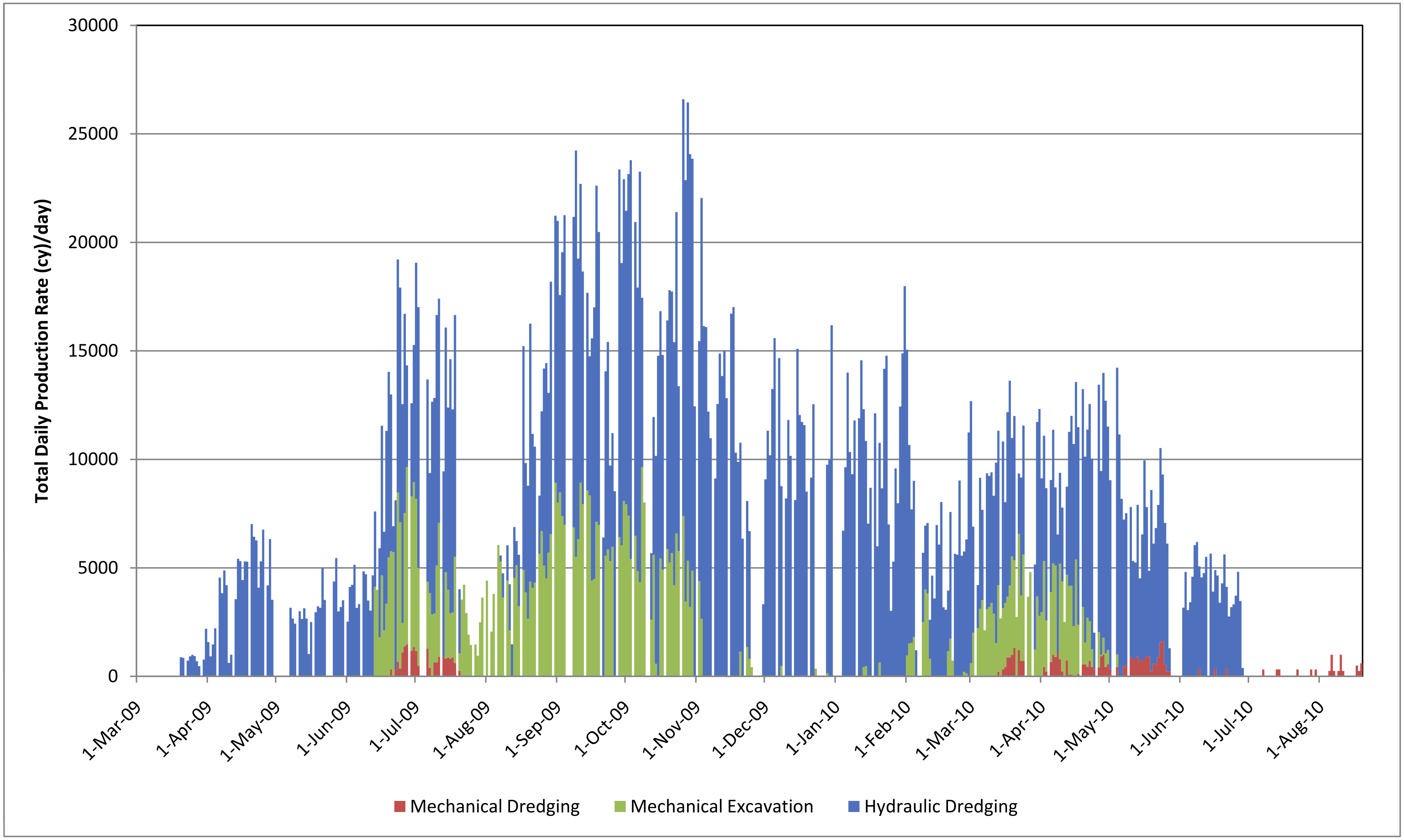


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TABLE B-1. SUMMARY OF HYDRAULIC DREDGING VOLUMES
DREDGING PILOT PROGRAM

	TransAsh D16 Emory 10"					TransAsh D14 Clyde 10-Inch					TransAsh D17 Luzon 10-Inch					TVA Dredge 14-Inch					TOTAL	
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
20-Mar-09		7.83	113	885	885	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	885	885
21-Mar-09		7.58	113	857	1,742	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	857	1,742
22-Mar-09	-	-	-	-	1,742	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,742
23-Mar-09		6.42	113	725	2,467	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	725	2,467
24-Mar-09		8.17	113	923	3,390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	923	3,390
25-Mar-09		8.77	113	991	4,381	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	991	4,381
26-Mar-09		8.25	113	932	5,313	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	932	5,313
27-Mar-09		6.17	113	697	6,010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	697	6,010
28-Mar-09		4.17	113	471	6,481	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	471	6,481
29-Mar-09	-	-	-	-	6,481	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,481
30-Mar-09		1.25	113	141	6,622		5.60	113	633	633	-	-	-	-	-	-	-	-	-	-	774	7,255
31-Mar-09		8.92	113	1008	7,629		10.50	113	1187	1,819	-	-	-	-	-	-	-	-	-	-	2,194	9,449
1-Apr-09		5.58	113	631	8,260		8.42	113	951	2,770	-	-	-	-	-	-	-	-	-	-	1,582	11,031
2-Apr-09	-	-	-	-	8,260		8.17	113	923	3,693	-	-	-	-	-	-	-	-	-	-	923	11,954
3-Apr-09		4.05	113	458	8,718		9.00	113	1017	4,710	-	-	-	-	-	-	-	-	-	-	1,475	13,428
4-Apr-09		11.92	113	1347	10,065		7.67	113	866	5,577	-	-	-	-	-	-	-	-	-	-	2,213	15,641
5-Apr-09	-	-	-	-	10,065	-	-	-	-	5,577	-	-	-	-	-	-	-	-	-	-	-	15,641
6-Apr-09		17.80	113	2011	12,076		19.20	113	2170	7,746		3.28	113	371	371	-	-	-	-	-	4,552	20,193
7-Apr-09		12.80	113	1446	13,522		11.67	113	1318	9,064		9.47	113	1070	1,441	-	-	-	-	-	3,834	24,028
8-Apr-09		19.52	113	2205	15,728		16.67	113	1883	10,948		7.02	113	793	2,234	-	-	-	-	-	4,882	28,909
9-Apr-09		24.00	113	2712	18,440		5.28	113	597	11,545		7.92	113	895	3,128	-	-	-	-	-	4,204	33,113
10-Apr-09		5.50	113	622	19,061	-	-	-	-	11,545	-	-	-	-	3,128	-	-	-	-	-	622	33,734
11-Apr-09		8.83	113	998	20,059	-	-	-	-	11,545	-	-	-	-	3,128	-	-	-	-	-	998	34,732
12-Apr-09	-	-	-	-	20,059	-	-	-	-	11,545	-	-	-	-	3,128	-	-	-	-	-	-	34,732
13-Apr-09		13.28	113	1501	21,560		15.78	113	1784	13,328		2.42	113	273	3,401	-	-	-	-	-	3,558	38,290
14-Apr-09		16.88	113	1908	23,468		19.83	113	2241	15,570		11.25	113	1271	4,673	-	-	-	-	-	5,420	43,710
15-Apr-09		19.42	113	2194	25,662		20.50	113	2317	17,886		7.08	113	800	5,473	-	-	-	-	-	5,311	49,021
16-Apr-09		20.22	113	2284	27,947		16.67	113	1883	19,769		2.42	113	273	5,746	-	-	-	-	-	4,441	53,462
17-Apr-09		19.88	113	2247	30,194		20.00	113	2260	22,029		7.00	113	791	6,537	-	-	-	-	-	5,298	58,760
18-Apr-09		22.38	113	2529	32,723		14.00	113	1582	23,611		10.42	113	1177	7,714	-	-	-	-	-	5,288	64,048
19-Apr-09	-	-	-	-	32,723	-	-	-	-	23,611	-	-	-	-	7,714	-	-	-	-	-	-	64,048
20-Apr-09		20.50	113	2317	35,039		22.83	113	2580	26,192		18.78	113	2123	9,837	-	-	-	-	-	7,019	71,068
21-Apr-09		21.50	113	2430	37,469		20.17	113	2279	28,470		15.27	113	1725	11,562	-	-	-	-	-	6,433	77,501
22-Apr-09		20.38	113	2303	39,772		20.00	113	2260	30,730		15.07	113	1703	13,264	-	-	-	-	-	6,266	83,767
23-Apr-09		9.83	113	1111	40,883		19.67	113	2222	32,953		6.67	113	753	14,018	-	-	-	-	-	4,087	87,854
24-Apr-09		16.25	113	1836	42,720		16.92	113	1912	34,864		13.75	113	1554	15,571	-	-	-	-	-	5,302	93,155
25-Apr-09		20.83	113	2354	45,074		20.25	113	2288	37,153		18.78	113	2123	17,694	-	-	-	-	-	6,765	99,920
26-Apr-09	-	-	-	-	45,074	-	-	-	-	37,153	-	-	-	-	17,694	-	-	-	-	-	-	99,920
27-Apr-09		6.50	113	735	45,808		17.42	113	1968	39,121		13.18	113	1490	19,184	-	-	-	-	-	4,192	104,113
28-Apr-09		17.75	113	2006	47,814		22.25	113	2514	41,635		16.00	113	1808	20,992	-	-	-	-	-	6,328	110,441
29-Apr-09		10.17	113	1149	48,963		11.08	113	1252	42,887		10.00	113	1130	22,122	-	-	-	-	-	3,531	113,972
30-Apr-09	-	-	-	-	48,963	-	-	-	-	42,887	-	-	-	-	22,122	-	-	-	-	-	-	113,972
1-May-09	-	-	-	-	48,963	-	-	-	-	42,887	-	-	-	-	22,122	-	-	-	-	-	-	113,972
2-May-09	-	-	-	-	48,963	-	-	-	-	42,887	-	-	-	-	22,122	-	-	-	-	-	-	113,972
3-May-09	-	-	-	-	48,963	-	-	-	-	42,887	-	-	-	-	22,122	-	-	-	-	-	-	113,972
4-May-09	-	-	-	-	48,963	-	-	-	-	42,887	-	-	-	-	22,122	-	-	-	-	-	-	113,972
5-May-09	-	-	-	-	48,963	-	-	-	-	42,887	-	-	-	-	22,122	-	-	-	-	-	-	113,972
6-May-09	-	-	-	-	48,963	-	-	-	-	42,887	-	-	-	-	22,122	-	-	-	-	-	-	113,972
7-May-09		0.75	113	85	49,048		15.25	113	1723	44,611		12.00	113	1356	23,478	-	-	-	-	-	3,164	117,136
8-May-09	-	-	-	-	49,048		13.58	113	1535	46,145		10.02	113	1132	24,610	-	-	-	-	-	2,667	119,803
9-May-09	-	-	-	-	49,048		12.55	113	1418	47,564		8.98	113	1015	25,625	-	-	-	-	-	2,433	122,236
10-May-09	-	-	-	-	49,048	-	-	-	-	47,564	-	-	-	-	25,625	-	-	-	-	-	-	122,236
11-May-09	-	-	-	-	49,048		15.42	113	1742	49,306		11.17	113	1262	26,886	-	-	-	-	-	3,004	125,240
12-May-09	-	-	-	-	49,048		14.08	113	1591	50,897		9.33	113	1055	27,941	-	-	-	-	-	2,646	127,886
13-May-09	-	-	-	-	49,048		12.75	113	1441	52,338		15.05	113	1701	29,642	-	-	-	-	-	3,141	131,027
14-May-09	-	-	-	-	49,048		11.33	113	1281	53,619		12.25	113	1384	31,026	-	-	-	-	-	2,665	133,692
15-May-09	-	-	-	-	49,048		8.38	113	947	54,566		0.77	113	87	31,113	-	-	-	-	-	1,034	134,726
16-May-09		7.58	113	857	49,905		14.58	113	1648	56,214	-	-	-	-	31,113	-	-	-	-	-	2,505	137,231
17-May-09		0.00	113	0	49,905	-	-	-	-	56,214	-	-	-	-	31,113	-	-	-	-	-	-	137,231
18-May-09		13.25	113	1497	51,402		12.92	113	1460	57,673	-	-	-	-	31,113	-	-	-	-	-	2,957	140,188
19-May-09		11.58	113	1309	52,711		17.00	113	1921	59,594	-	-	-	-	31,113	-	-	-	-	-	3,230	143,418
20-May-09		13.17	113	1488	54,199		14.65	113	1655	61,250		0.17	113	19	31,132	-	-	-	-	-	3,162	146,580
21-May-09		15.75	113	1780	55,978		17.75	113	2006	63,256		10.75	113	1215	32,346	-	-	-	-	-	5,000	151,580
22-May-09		15.00	113	1695	57,673		16.17	113	1827	65,082	-	-	-	-	32,346	-	-	-	-	-	3,522	155,102
23-May-09	-	-	-	-	57,673	-	-	-	-	65,082	-	-	-	-	32,346	-	-	-	-	-	-	155,102

TABLE B-1. SUMMARY OF HYDRAULIC DREDGING VOLUMES
DREDGING PILOT PROGRAM

	TransAsh D16 Emory 10"					TransAsh D14 Clyde 10-Inch					TransAsh D17 Luzon 10-Inch					TVA Dredge 14-Inch					TOTAL	
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
24-May-09	-	-	-	-	57,673	-	-	-	-	65,082	-	-	-	-	32,346	-	-	-	-	-	-	155,102
25-May-09	-	-	-	-	57,673	-	-	-	-	65,082	-	-	-	-	32,346	-	-	-	-	-	-	155,102
26-May-09		15.08	113	1704	59,378		16.58	113	1874	66,956		7.05	113	797	33,143	-	-	-	-	-	4,375	159,477
27-May-09		13.82	113	1561	60,939		18.20	113	2057	69,013		16.22	113	1832	34,975	-	-	-	-	-	5,450	164,927
28-May-09		4.00	113	452	61,391		7.08	113	800	69,813		15.38	113	1738	36,714	-	-	-	-	-	2,991	167,918
29-May-09		4.28	113	484	61,875		15.83	113	1789	71,602		8.17	113	923	37,637	-	-	-	-	-	3,196	171,114
30-May-09		12.13	113	1371	63,246		18.92	113	2138	73,740	-	-	-	-	37,637	-	-	-	-	-	3,509	174,623
31-May-09	-	-	-	-	63,246	-	-	-	-	73,740	-	-	-	-	37,637	-	-	-	-	-	-	174,623
1-Jun-09		4.83	113	546	63,792		17.50	113	1978	75,718	-	-	-	-	37,637	-	-	-	-	-	2,524	177,146
2-Jun-09		9.75	113	1102	64,894		17.67	113	1996	77,714		9.08	113	1026	38,663	-	-	-	-	-	4,125	181,271
3-Jun-09		14.02	113	1584	66,478		9.17	113	1036	78,750		14.17	113	1601	40,264	-	-	-	-	-	4,221	185,491
4-Jun-09		11.47	113	1296	67,774		14.18	113	1603	80,352		19.85	113	2243	42,507	-	-	-	-	-	5,142	190,633
5-Jun-09	-	-	-	-	67,774		10.25	113	1158	81,511		17.67	113	1996	44,503	-	-	-	-	-	3,155	193,787
6-Jun-09	-	-	-	-	67,774		12.08	113	1365	82,876		17.38	113	1964	46,467	-	-	-	-	-	3,330	197,117
7-Jun-09	-	-	-	-	67,774	-	-	-	-	82,876	-	-	-	-	46,467	-	-	-	-	-	-	197,117
8-Jun-09		16.13	113	1823	69,597		7.92	113	895	83,771		18.78	113	2123	48,590	-	-	-	-	-	4,840	201,957
9-Jun-09		12.03	113	1360	70,956		13.42	113	1516	85,287		16.18	113	1829	50,419	-	-	-	-	-	4,705	206,662
10-Jun-09		7.53	113	851	71,808		11.83	113	1337	86,624		11.58	113	1309	51,728	-	-	-	-	-	3,497	210,159
11-Jun-09		10.50	113	1187	72,994		6.08	113	687	87,311		10.25	113	1158	52,886	-	-	-	-	-	3,032	213,191
12-Jun-09		15.78	113	1784	74,778		16.00	113	1808	89,119		9.43	113	1066	53,952	-	-	-	-	-	4,657	217,849
13-Jun-09		5.67	113	640	75,418		7.50	113	848	89,967		17.50	113	1978	55,929	-	-	-	-	-	3,465	221,314
14-Jun-09	-	-	-	-	75,418	-	-	-	-	89,967	-	-	-	-	55,929	-	-	-	-	-	-	221,314
15-Jun-09		8.52	113	962	76,380		14.08	113	1591	91,558		13.68	113	1546	57,476	-	-	-	-	-	4,100	225,414
16-Jun-09		17.25	113	1949	78,330		16.58	113	1874	93,432		17.45	113	1972	59,447		4.5	244	1100	1100	6,895	232,309
17-Jun-09		6.63	113	750	79,079		3.75	113	424	93,856		9.42	113	1064	60,512		8	289	2310	3,410	4,547	236,857
18-Jun-09		12.73	113	1439	80,518		14.83	113	1676	95,532		16.17	113	1827	62,338		12	252	3026	6,436	7,968	244,825
19-Jun-09	-	-	-	-	80,518		18.82	113	2126	97,658		16.92	113	1912	64,250		12.25	368	4510	10,946	8,548	253,372
20-Jun-09	-	-	-	-	80,518		12.92	113	1460	99,118		14.20	113	1605	65,855		12	347	4160	15,106	7,224	260,597
21-Jun-09	-	-	-	-	80,518	-	-	-	-	99,118	-	-	-	-	65,855		3.75	320	1200	16,306	1,200	261,797
22-Jun-09	-	-	-	-	80,518		12.00	113	1356	100,474		11.52	113	1301	67,156		12.5	413	5160	21,466	7,817	269,614
23-Jun-09		11.40	113	1288	81,806		18.30	113	2068	102,542		18.80	113	2124	69,280		13.33	395	5260	26,726	10,741	280,355
24-Jun-09		18.40	113	2079	83,886		15.80	113	1785	104,327		15.10	113	1706	70,987		13.75	381	5240	31,966	10,811	291,165
25-Jun-09		12.80	113	1446	85,332		14.40	113	1627	105,954		17.50	113	1978	72,964		13.75	367	5040	37,006	10,091	301,257
26-Jun-09		14.45	113	1633	86,965		15.83	113	1789	107,744		17.55	113	1983	74,947		8.25	457	3770	40,776	9,175	310,432
27-Jun-09		8.37	113	945	87,910		16.58	113	1874	109,618		16.50	113	1865	76,812	-	-	-	-	40,776	4,684	315,116
28-Jun-09	-	-	-	-	87,910	-	-	-	-	109,618	-	-	-	-	76,812	-	-	-	-	40,776	-	315,116
29-Jun-09	-	-	-	-	87,910		19.33	113	2185	111,802		18.67	113	2109	78,921	-	-	-	-	40,776	4,294	319,410
30-Jun-09		5.32	113	601	88,511		12.90	113	1458	113,260		12.95	113	1463	80,384		9.5	295	2800	43,576	6,322	325,731
1-Jul-09		15.58	113	1761	90,272		18.08	113	2043	115,303		9.25	113	1045	81,430		16	377	6033	49,609	10,883	336,614
2-Jul-09		16.68	113	1885	92,157		19.33	113	2185	117,488		10.00	113	1130	82,560		19	359	6819	56,428	12,019	348,633
3-Jul-09	-	-	-	-	92,157	-	-	-	-	117,488	-	-	-	-	82,560	-	-	-	-	56,428	-	348,633
4-Jul-09	-	-	-	-	92,157	-	-	-	-	117,488	-	-	-	-	82,560	-	-	-	-	56,428	-	348,633
5-Jul-09	-	-	-	-	92,157	-	-	-	-	117,488	-	-	-	-	82,560	-	-	-	-	56,428	-	348,633
6-Jul-09		13.30	113	1503	93,660		14.33	113	1620	119,108		11.75	113	1328	83,887		11.5	423	4866	61,294	9,316	357,949
7-Jul-09		17.67	113	1996	95,656		17.17	113	1940	121,047		14.08	113	1591	85,479	-	-	-	-	61,294	5,528	363,477
8-Jul-09		15.78	113	1784	97,440		18.92	113	2138	123,185		15.83	113	1789	87,268		13.5	303	4093	65,387	9,803	373,280
9-Jul-09		12.12	113	1369	98,809		15.92	113	1799	124,984		8.83	113	998	88,266		14.75	391	5770	71,157	9,936	383,216
10-Jul-09		15.43	113	1744	100,553		19.58	113	2213	127,197		15.83	113	1789	90,055		18.5	314	5800	76,957	11,546	394,762
11-Jul-09		13.10	113	1480	102,033		15.83	113	1789	128,986		17.92	113	2025	92,080		18	280	5036	81,993	10,330	405,092
12-Jul-09	-	-	-	-	102,033	-	-	-	-	128,986	-	-	-	-	92,080	-	-	-	-	81,993	-	405,092
13-Jul-09		1.73	113	196	102,229		18.67	113	2109	131,095		16.92	113	1912	93,992		17	255	4333	86,326	8,550	413,642
14-Jul-09		17.55	113	1983	104,212		15.42	113	1742	132,837		10.08	113	1139	95,131		19.5	328	6400	92,726	11,265	424,906
15-Jul-09		13.33	113	1507	105,719		5.75	113	650	133,487		10.40	113	1175	96,306		17	298	5066	97,792	8,398	433,304
16-Jul-09		16.17	113	1827	107,546		16.58	113	1874	135,361		16.75	113	1893	98,199		17.2	355	6110	103,902	11,704	445,008
17-Jul-09		5.37	113	606	108,152		18.75	113	2119	137,480		18.25	113	2062	100,261		14.5	315	4570	108,472	9,357	454,365
18-Jul-09	-	-	-	-	108,152		15.92	113	1799	139,278		18.05	113	2040	102,301		19.5	374	7300	115,772	11,138	465,503
19-Jul-09	-	-	-	-	108,152	-	-	-	-	139,278	-	-	-	-	102,301	-	-	-	-	115,772	-	465,503
20-Jul-09	-	-	-	-	108,152		3.42	113	386	139,664		2.75	113	311	102,612		4	563	2250	118,022	2,947	468,450
Dredge days			**80**					**85**					**73**					**26**				
TOTAL		**957.1**	**-**	**108,152**	**108,152**		**1236.0**	**-**	**139,664**	**139,664**		**908.1**	**-**	**102,612**	**102,612**		**343.5**	**-**	**118,022**	**118,022**	**468,450**	**468,450**
AVERAGE		**12.0**	**113**	**1,352**	**-**		**14.5**	**113**	**1,643**	**-**		**12.4**	**113**	**1,406**	**-**		**13.2**	**349**	**4,539**	**-**	**4,880**	**-**

TABLE B-2. SUMMARY OF HYDRAULIC DREDGING VOLUMES
PHASE 1 DREDGING

	Sevenson McKenzie 14"					Sevenson Kylee 16-Inch					Sevenson Little Rock 20-Inch					Sevenson Sandpiper 20-Inch					TOTAL	
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
7-Aug-09	45B	9.00	30	273	273	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	273	273
8-Aug-09	45B	9.67	116	1120	1,393	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,120	1,393
9-Aug-09	-	-	-	-	1,393	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,393
10-Aug-09	44B/C	21.33	76	1625	3,018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,625	3,018
11-Aug-09	44B/C	17.00	125	2132	5,149	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,132	5,149
12-Aug-09	43B/C	13.80	107	1479	6,628	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,479	6,628
13-Aug-09	42B/C	12.90	182	2344	8,972	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,344	8,972
14-Aug-09	42B/C	16.40	68	1108	10,079	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,108	10,079
15-Aug-09	41B/C	18.80	126	2377	12,456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,377	12,456
16-Aug-09	-	-	-	-	12,456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12,456
17-Aug-09	41B/C	18.83	197	3704	16,160	-	-	-	-	-	46C	12.00	550	6604	6,604	-	-	-	-	-	10,307	22,763
18-Aug-09	41B/C	16.70	177	2958	19,118	-	-	-	-	-	46C	15.50	194	3004	9,607	-	-	-	-	-	5,962	28,725
19-Aug-09	40B/C	13.90	180	2507	21,624	-	-	-	-	-	46C	5.75	629	3619	13,226	-	-	-	-	-	6,126	34,850
20-Aug-09	46D/E	12.75	238	3030	24,654	-	-	-	-	-	44C	19.90	445	8856	22,082	-	-	-	-	-	11,886	46,736
21-Aug-09	46D/E	19.50	107	2089	26,743	-	-	-	-	-	45C/D	17.00	294	5000	27,082	-	-	-	-	-	7,089	53,825
22-Aug-09	46D/E	18.20	36	650	27,393	-	-	-	-	-	45C/D	17.00	330	5611	32,693	-	-	-	-	-	6,260	60,085
23-Aug-09	-	-	-	-	27,393	-	-	-	-	-	-	-	-	-	32,693	-	-	-	-	-	-	60,085
24-Aug-09	46D/E	17.25	155	2679	30,071	-	-	-	-	-	-	-	-	-	32,693	-	-	-	-	-	2,679	62,764
25-Aug-09	45D/E	19.00	110	2086	32,157	-	-	-	-	-	44D/E	6.00	573	3438	36,130	-	-	-	-	-	5,523	68,287
26-Aug-09	43D/E-44D/E	19.50	153	2991	35,148	-	-	-	-	-	44D/E	19.50	312	6090	42,220	-	-	-	-	-	9,081	77,368
27-Aug-09	41D/E-42D/E	19.25	260	5008	40,156	-	-	-	-	-	44D/E	15.75	312	4919	47,139	-	-	-	-	-	9,927	87,295
28-Aug-09	40D/E-41D/E	17.00	172	2919	43,075	-	-	-	-	-	43D/E	14.25	312	4450	51,589	-	-	-	-	-	7,369	94,664
29-Aug-09	33C/D-40D/E	18.50	312	5766	48,840	-	-	-	-	-	43D/E	22.00	267	5871	57,460	-	-	-	-	-	11,637	106,300
30-Aug-09	-	-	-	-	48,840	-	-	-	-	-	-	-	-	-	57,460	-	-	-	-	-	-	106,300
31-Aug-09	33C/D-40D/E	20.25	311	6305	55,145	-	-	-	-	-	43D/E	16.00	375	5997	63,457	-	-	-	-	-	12,302	118,602
1-Sep-09	37E/D	19.00	269	5119	60,264	-	-	-	-	-	41/42C/D	20.00	393	7864	71,320	-	-	-	-	-	12,983	131,584
2-Sep-09	44E	18.00	177	3185	63,449	-	-	-	-	-	41C/D-40C/D	13.00	455	5912	77,232	-	-	-	-	-	9,097	140,681
3-Sep-09	44E	20.00	258	5159	68,608	-	-	-	-	-	41C/D-40C/D	13.00	538	7000	84,232	-	-	-	-	-	12,159	152,840
4-Sep-09	43E	19.75	299	5909	74,517	-	-	-	-	-	40C,D	19.00	440	8361	92,593	-	-	-	-	-	14,270	167,110
5-Sep-09	-	-	-	-	74,517	-	-	-	-	-	-	-	-	-	92,593	-	-	-	-	-	-	167,110
6-Sep-09	-	-	-	-	74,517	-	-	-	-	-	-	-	-	-	92,593	-	-	-	-	-	-	167,110
7-Sep-09	-	-	-	-	74,517	-	-	-	-	-	-	-	-	-	92,593	-	-	-	-	-	-	167,110
8-Sep-09	42E	17.00	195	3312	77,828	-	-	-	-	-	39C/D	18.25	603	11000	103,593	-	-	-	-	-	14,312	181,421
9-Sep-09	41E-42E	17.75	226	4009	81,837	-	-	-	-	-	38C/D	20.00	736	14712	118,305	-	-	-	-	-	18,721	200,142
10-Sep-09	40E	13.00	161	2089	83,926	-	-	-	-	-	38C/D	21.75	499	10846	129,151	-	-	-	-	-	12,935	213,077
11-Sep-09	40E	18.20	249	4539	88,465	-	-	-	-	-	37C/D	17.50	527	9223	138,374	-	-	-	-	-	13,762	226,839
12-Sep-09	49E	13.00	198	2574	91,039	-	-	-	-	-	37C/D	15.50	526	8149	146,523	-	-	-	-	-	10,723	237,562
13-Sep-09	-	-	-	-	91,039	-	-	-	-	-	-	-	-	-	146,523	-	-	-	-	-	-	237,562
14-Sep-09	36E-37E	20.00	249	4989	96,027	-	-	-	-	-	36C	7.30	564	4114	150,637	-	-	-	-	-	9,103	246,664
15-Sep-09	35E-36E	19.25	333	6408	102,435	-	-	-	-	-	-	-	-	-	150,637	-	-	-	-	-	6,408	253,072
16-Sep-09	35E-46C	18.00	208	3743	106,178	-	-	-	-	-	36C	10.00	742	7424	158,062	-	-	-	-	-	11,167	264,239
17-Sep-09	44C/D-45C/D	19.25	179	3444	109,621	-	-	-	-	-	36C,D	18.50	490	9068	167,130	-	-	-	-	-	12,512	276,751
18-Sep-09	43C/D-44C/D	19.00	234	4439	114,060	-	-	-	-	-	35C,D	21.50	514	11052	178,181	-	-	-	-	-	15,490	292,241
19-Sep-09	41C/D-42C/D	21.75	185	4026	118,086	-	-	-	-	-	34C,D	21.50	440	9470	187,651	-	-	-	-	-	13,496	305,737
20-Sep-09	-	-	-	-	118,086	-	-	-	-	-	-	-	-	-	187,651	-	-	-	-	-	-	305,737
21-Sep-09	40C/D-41C/D	20.60	203	4173	122,259	-	-	-	-	-	33D,C	17.50	127	2227	189,878	-	-	-	-	-	6,400	312,136
22-Sep-09	39C/D-40C/D	21.50	149	3201	125,460	-	-	-	-	-	33D	21.00	253	5303	195,180	-	-	-	-	-	8,504	320,640
23-Sep-09	38C/D-39C/D	20.00	283	5651	131,111	-	-	-	-	-	33D	19.50	201	3910	199,090	-	-	-	-	-	9,561	330,201
24-Sep-09	37C/D	20.25	218	4408	135,519	-	-	-	-	-	-	-	-	-	199,090	-	-	-	-	-	4,408	334,609
25-Sep-09	37C/D-40B/C	14.00	152	2122	137,640	-	-	-	-	-	33D	8.50	366	3115	202,205	-	-	-	-	-	5,237	339,845
26-Sep-09	39B/C	18.91	195	3681	141,321	-	-	-	-	-	33D	21.00	231	4854	207,059	-	-	-	-	-	8,535	348,380
27-Sep-09	-	-	-	-	141,321	-	-	-	-	-	-	-	-	-	207,059	-	-	-	-	-	-	348,380
28-Sep-09	38B/C	15.30	172	2635	143,956	-	-	-	-	-	31E	20.75	690	14312	221,370	-	-	-	-	-	16,946	365,326
29-Sep-09	37B	13.50	256	3455	147,410	-	-	-	-	-	30E	21.00	455	9557	230,927	-	-	-	-	-	13,011	378,337
30-Sep-09	36B-37B	18.00	131	2361	149,771	-	-	-	-	-	29E	21.00	593	12458	243,384	-	-	-	-	-	14,819	393,155
1-Oct-09	-	-	-	-	149,771	17D	17.75	214	3793.00	3,793	28D	19.00	512	9736	253,120	-	-	-	-	-	13,529	406,684
2-Oct-09	36B/C	4.00	293	1171	150,942	16E-17D	21.75	160	3484	7,277	27D	20.30	546	11082	264,201	-	-	-	-	-	15,737	422,420
3-Oct-09	34B-35C	22.00	121	2652	153,594	16D/E-17D	23.25	184	4267	11,544	25D	22.50	509	11452	275,653	-	-	-	-	-	18,371	440,791
4-Oct-09	-	-	-	-	153,594	-	-	-	-	11,544	-	-	-	-	275,653	-	-	-	-	-	-	440,791
5-Oct-09	34B-35C	8.75	137	1197	154,791	15E-16E/F	22.00	216	4750	16,294	24D	14.30	595	8512	284,165	-	-	-	-	-	14,459	455,249
6-Oct-09	46E	13.50	110	1483	156,273	15E-16E	15.50	259	4014	20,308	24D	15.50	488	7571	291,736	-	-	-	-	-	13,068	468,317

TABLE B-2. SUMMARY OF HYDRAULIC DREDGING VOLUMES
PHASE 1 DREDGING

	Sevenson McKenzie 14"					Sevenson Kylee 16-Inch					Sevenson Little Rock 20-Inch					Sevenson Sandpiper 20-Inch					TOTAL	
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
7-Oct-09	44E-45E-46E	16.00	106	1702	157,975	15E/F	20.70	274	5682	25,990	23D	21.30	541	11527	303,263	-	-	-	-	-	18,911	487,228
8-Oct-09	45E	3.30	106	350	158,325	15E/F	3.30	307	1014	27,004	22D	3.80	1694	6438	309,701	-	-	-	-	-	7,802	495,030
9-Oct-09	-	-	-	-	158,325	-	-	-	-	27,004	-	-	-	-	309,701	-	-	-	-	-	-	495,030
10-Oct-09	-	-	-	-	158,325	-	-	-	-	27,004	-	-	-	-	309,701	-	-	-	-	-	-	495,030
11-Oct-09	-	-	-	-	158,325	-	-	-	-	27,004	-	-	-	-	309,701	-	-	-	-	-	-	495,030
12-Oct-09	45E	6.75	156	1050	159,375	15E/F-18C	16.25	124	2020	29,024	-	-	-	-	309,701	-	-	-	-	-	3,070	498,100
13-Oct-09	44E	22.50	116	2621	161,996	19B	22.50	166	3732	32,756	-	-	-	-	309,701	-	-	-	-	-	6,353	504,453
14-Oct-09	43E-44E	22.50	91	2048	164,044	20B-21B	23.00	327	7528	40,284	-	-	-	-	309,701	-	-	-	-	-	9,576	514,029
15-Oct-09	43E-44E	1.50	216	324	164,368	20B-21B	18.00	360	6476	46,760	25C	17.50	456	7977	317,678	-	-	-	-	-	14,777	528,806
16-Oct-09	42E	20.25	130	2633	167,001	23A/B-24A/B	21.75	386	8396	55,156	25C	2.00	184	368	318,046	-	-	-	-	-	11,397	540,203
17-Oct-09	42E	23.00	117	2686	169,687	21B	22.50	321	7216	62,372	-	-	-	-	318,046	-	-	-	-	-	9,902	550,105
18-Oct-09	-	-	-	-	169,687	-	-	-	-	62,372	-	-	-	-	318,046	-	-	-	-	-	-	550,105
19-Oct-09	42E	19.75	150	2968	172,655	26B	20.50	369	7564	69,936	-	-	-	-	318,046	-	-	-	-	-	10,532	560,637
20-Oct-09	40E-41E	21.00	159	3334	175,989	27A-28A	21.00	439	9217	79,153	-	-	-	-	318,046	-	-	-	-	-	12,551	573,188
21-Oct-09	40E	16.50	143	2361	178,350	28A-29A	21.50	451	9695	88,848	-	-	-	-	318,046	-	-	-	-	-	12,056	585,244
22-Oct-09	39E	5.50	109	600	178,950	20B-21A/B	15.50	94	1464	90,312	-	-	-	-	318,046	24B,C	17.50	522	9130	9130	11,194	596,438
23-Oct-09	-	-	-	-	178,950	21B-22A/B	22.25	203	4509.00	94,821	-	-	-	-	318,046	24,23B	16.50	625	10306	19,436	14,815	611,252
24-Oct-09	39E	14.00	151	2115	181,065	23A/B	21.00	187	3922	98,743	-	-	-	-	318,046	23B	3.25	480	1560	20,996	7,597	618,849
25-Oct-09	-	-	-	-	181,065	-	-	-	-	98,743	-	-	-	-	318,046	-	-	-	-	20,996	-	618,849
26-Oct-09	-	-	-	-	181,065	24A/B	17.50	272	4754.00	103,497	-	-	-	-	318,046	23B	19.00	760	14449	35,445	19,203	638,052
27-Oct-09	-	-	-	-	181,065	26A	19.50	264	5146.00	108,643	-	-	-	-	318,046	22B	19.75	723	14273	49,718	19,419	657,471
28-Oct-09	-	-	-	-	181,065	26A/B-27A/B	20.50	252	5159.00	113,802	-	-	-	-	318,046	21B,A	19.25	829	15961	65,679	21,120	678,591
29-Oct-09	-	-	-	-	181,065	26A/B-27A/B	16.50	245	4044.00	117,846	-	-	-	-	318,046	20A,B	19.75	852	16825	82,504	20,869	699,460
30-Oct-09	38E	11.80	201	2367	183,432	27A/B-28A/B	16.50	296	4884	122,730	-	-	-	-	318,046	19A,B	18.00	652	11735	94,239	18,986	718,446
31-Oct-09	46B/C	2.00	193	385	183,817	30A/B	23.00	225	5185	127,915	-	-	-	-	318,046	18A,B	11.00	625	6875	101,114	12,445	730,891
1-Nov-09	-	-	-	-	183,817	-	-	-	-	127,915	-	-	-	-	318,046	-	-	-	-	101,114	-	730,891
2-Nov-09	-	-	-	-	183,817	31A/B-32A/B	21.75	249	5417.00	133,332	-	-	-	-	318,046	17A	9.00	627	5647	106,761	11,064	741,955
3-Nov-09	-	-	-	-	183,817	32A/B-33A/B	20.75	301	6244.00	139,576	-	-	-	-	318,046	16A	20.00	657	13147	119,908	19,391	761,346
4-Nov-09	-	-	-	-	183,817	32A/B-33A/B	18.75	165	3088.00	142,664	-	-	-	-	318,046	15A 14A	19.00	687	13056	132,964	16,144	777,490
5-Nov-09	45B/C-46B/C	5.75	105	606	184,423	32A/B-33A/B	16.80	68	1144	143,807	-	-	-	-	318,046	13A	21.00	683	14348	147,312	16,098	793,588
6-Nov-09	-	-	-	-	184,423	22/23B	17.80	185	3294.00	147,101	-	-	-	-	318,046	2A then 23D	17.00	524	8909	156,221	12,203	805,791
7-Nov-09	44A/B	6.25	195	1220	185,643	22/23B	15.00	193	2890	149,991	-	-	-	-	318,046	22C,D	17.00	404	6864	163,085	10,974	816,765
8-Nov-09	-	-	-	-	185,643	-	-	-	-	149,991	-	-	-	-	318,046	-	-	-	-	163,085	-	816,765
9-Nov-09	44A/B	3.20	91	292	185,935	22/23B	15.50	347	5380	155,371	-	-	-	-	318,046	22C,D	12.50	276	3452	166,536	9,124	825,888
10-Nov-09	44A/B	3.50	106	370	186,305	22/23B	16.80	229	3855	159,226	-	-	-	-	318,046	21C	13.30	626	8330	174,866	12,555	838,443
11-Nov-09	44A/B	3.00	133	400	186,705	22/23B	12.50	336	4204	163,430	-	-	-	-	318,046	20C 19C	14.30	718	10273	185,139	14,877	853,320
12-Nov-09	52D	1.25	142	178	186,883	724.1	21.33	236	5026	168,456	-	-	-	-	318,046	19C	15.16	570	8640	193,779	13,844	867,164
13-Nov-09	-	-	-	-	186,883	724.10	16.25	310	5041.00	173,497	-	-	-	-	318,046	18C	15.30	651	9966	203,745	15,007	882,171
14-Nov-09	52D	3.00	111	333	187,216	4D/24D	17.50	315	5519	179,016	-	-	-	-	318,046	18C	16.25	429	6970	210,715	12,822	894,993
15-Nov-09	-	-	-	-	187,216	-	-	-	-	179,016	-	-	-	-	318,046	-	-	-	-	210,715	-	894,993
16-Nov-09	51D	6.00	111	667	187,883	728.1	18.50	249	4598	183,614	-	-	-	-	318,046	17C	12.25	935	11452	222,167	16,717	911,710
17-Nov-09	51D	3.50	191	667	188,550	728.1	19.75	373	7360	190,974	-	-	-	-	318,046	16C	15.25	590	8994	231,161	17,021	928,731
18-Nov-09	50D	18.25	126	2295	190,845	722.8	19.75	406	8014	198,988	-	-	-	-	318,046	-	-	-	-	231,161	10,309	939,040
19-Nov-09	49/50D	18.00	119	2134	192,979	39/40D	18.50	419	7752	206,740	-	-	-	-	318,046	-	-	-	-	231,161	9,886	948,926
20-Nov-09	52/53D	13.50	132	1783	194,762	37/39E	20.25	388	7850	214,590	-	-	-	-	318,046	-	-	-	-	231,161	9,633	958,559
21-Nov-09	52D	14.75	169	2500	197,262	37/39E	13.50	285	3844	218,434	-	-	-	-	318,046	-	-	-	-	231,161	6,344	964,903
22-Nov-09	-	-	-	-	197,262	-	-	-	-	218,434	-	-	-	-	318,046	-	-	-	-	231,161	-	964,903
23-Nov-09	52D	17.50	143	2500	199,762	37/39E	14.00	302	4227	222,661	-	-	-	-	318,046	-	-	-	-	231,161	6,727	971,630
24-Nov-09	51/52D	8.33	166	1385	201,147	34D/36E	15.00	184	2755	225,416	-	-	-	-	318,046	16C	3.50	499	1748	232,909	5,888	977,518
25-Nov-09	-	-	-	-	201,147	-	-	-	-	225,416	-	-	-	-	318,046	-	-	-	-	232,909	-	977,518
26-Nov-09	-	-	-	-	201,147	-	-	-	-	225,416	-	-	-	-	318,046	-	-	-	-	232,909	-	977,518
27-Nov-09	-	-	-	-	201,147	-	-	-	-	225,416	-	-	-	-	318,046	-	-	-	-	232,909	-	977,518
28-Nov-09	-	-	-	-	201,147	-	-	-	-	225,416	-	-	-	-	318,046	-	-	-	-	232,909	-	977,518
29-Nov-09	-	-	-	-	201,147	-	-	-	-	225,416	-	-	-	-	318,046	-	-	-	-	232,909	-	977,518
30-Nov-09	51/52D	19.00	89	1700	202,847	34C/E	16.25	100	1628	227,044	-	-	-	-	318,046	-	-	-	-	232,909	3,328	980,846
1-Dec-09	50/51E	7.50	198	1484	204,331	34C	17.25	105	1803	228,847	-	-	-	-	318,046	15C	11.50	504	5792	238,701	9,079	989,925
2-Dec-09	50/51E	5.5	197	1083	205,414	31D	17.5	114	2003	230,850	-	-	-	-	318,046	14C	15.5	531	8232	246,933	11,318	1,001,243
3-Dec-09	49E	8	199	1589	207,003	31D	16.25	73	1183	232,033	-	-	-	-	318,046	13C	14.75	503	7416	254,349	10,188	1,011,431
4-Dec-09	49E	5.25	193	1011	208,014	31D	16	266	4260	236,293	-	-	-	-	318,046	12C,11C	18.25	437	7974	262,323	13,245	1,024,676
5-Dec-09	50/51D	1.25	8	10	208,024	31C/D	19.5	292	5700	241,993	-	-	-	-	318,046	11C	15	659	9878	272,201	15,588	1,040,264
6-Dec-09	-	-	-	-	208,024	-	-	-	-	241,993	-	-	-	-	318,046	-	-	-	-	272,201	-	1,040,264

TABLE B-2. SUMMARY OF HYDRAULIC DREDGING VOLUMES
PHASE 1 DREDGING

	Sevenson McKenzie 14"					Sevenson Kylee 16-Inch					Sevenson Little Rock 20-Inch					Sevenson Sandpiper 20-Inch					TOTAL	
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
7-Dec-09	-	-	-	-	208,024	30D	18.75	265	4971.00	246,964	-	-	-	-	318,046	8C	17.5	554	9694	281,895	14,665	1,054,929
8-Dec-09	50/51D-50E	2.75	65	180	208,204	29/30D	20.5	209	4285	251,249	-	-	-	-	318,046	7/8C	14.75	259	3819	285,714	8,284	1,063,213
9-Dec-09	-	-	-	-	208,204	-	-	-	-	251,249	-	-	-	-	318,046	-	-	-	-	285,714	-	1,063,213
10-Dec-09	50/51D-50E	12.75	94	1200	209,404	29D	17.25	192	3320	254,569	-	-	-	-	318,046	7/8C	6	613	3677	289,391	8,197	1,071,410
11-Dec-09	-	-	-	-	209,404	28/29D	20.30	264	5353.00	259,922	-	-	-	-	318,046	7/8C	17	380	6461	295,852	11,814	1,083,224
12-Dec-09	49E	5	140	701	210,105	27/28D	18.25	233	4256	264,178	-	-	-	-	318,046	7/8C	17.5	297	5203	301,055	10,160	1,093,384
13-Dec-09	-	-	-	-	210,105	-	-	-	-	264,178	-	-	-	-	318,046	-	-	-	-	301,055	-	1,093,384
14-Dec-09	49E	11.8	112	1324	211,429	27/28D	17.05	244	4153	268,331	-	-	-	-	318,046	7/8C	8.75	303	2650	303,705	8,127	1,101,511
15-Dec-09	-	-	-	-	211,429	25C/D	19.50	231	4504.00	272,835	-	-	-	-	318,046	7C	18.25	580	10590	314,295	15,094	1,116,605
16-Dec-09	48E	6	165	989	212,418	24/25C	19.5	218	4250	277,085	-	-	-	-	318,046	7C	15.25	446	6806	321,101	12,045	1,128,650
17-Dec-09	-	-	-	-	212,418	23/24C	19.00	261	4965.00	282,050	-	-	-	-	318,046	9A	18.25	371	6764	327,865	11,729	1,140,379
18-Dec-09	48E	8	196	1567	213,985	22B/C	19.25	237	4563	286,613	-	-	-	-	318,046	8A	15.25	357	5451	333,316	11,581	1,151,960
19-Dec-09	48E	7	165	1152	215,137	22/23B	20.5	270	5525	292,138	-	-	-	-	318,046	8A	16.75	110	1839	335,155	8,516	1,160,476
20-Dec-09	-	-	-	-	215,137	-	-	-	-	292,138	-	-	-	-	318,046	-	-	-	-	335,155	-	1,160,476
21-Dec-09	47E	8	195	1558	216,695	27C	20	221	4426	296,564	-	-	-	-	318,046	51F	11.25	282	3174	338,329	9,158	1,169,634
22-Dec-09	46E	6.5	128	835	217,530	28C	19.5	290	5656	302,220	-	-	-	-	318,046	51E,F	15.75	384	6051	344,380	12,542	1,182,176
23-Dec-09	-	-	-	-	217,530	-	-	-	-	302,220	-	-	-	-	318,046	-	-	-	-	344,380	-	1,182,176
24-Dec-09	-	-	-	-	217,530	-	-	-	-	302,220	-	-	-	-	318,046	-	-	-	-	344,380	-	1,182,176
25-Dec-09	-	-	-	-	217,530	-	-	-	-	302,220	-	-	-	-	318,046	-	-	-	-	344,380	-	1,182,176
26-Dec-09	-	-	-	-	217,530	-	-	-	-	302,220	-	-	-	-	318,046	-	-	-	-	344,380	-	1,182,176
27-Dec-09	-	-	-	-	217,530	-	-	-	-	302,220	-	-	-	-	318,046	-	-	-	-	344,380	-	1,182,176
28-Dec-09	-	-	-	-	217,530	28C	20.25	203	4107.00	306,327	-	-	-	-	318,046	52F	14.25	386	5501	349,881	9,608	1,191,784
29-Dec-09	-	-	-	-	217,530	29C	21.00	246	5167.00	311,494	-	-	-	-	318,046	52F	12.5	385	4817	354,698	9,984	1,201,768
30-Dec-09	-	-	-	-	217,530	29/30C	21.50	305	6563.00	318,057	-	-	-	-	318,046	50F	18.5	520	9619	364,317	16,182	1,217,950
31-Dec-09	-	-	-	-	217,530	-	-	-	-	318,057	-	-	-	-	318,046	-	-	-	-	364,317	-	1,217,950
1-Jan-10	-	-	-	-	217,530	-	-	-	-	318,057	-	-	-	-	318,046	-	-	-	-	364,317	-	1,217,950
2-Jan-10	-	-	-	-	217,530	-	-	-	-	318,057	-	-	-	-	318,046	-	-	-	-	364,317	-	1,217,950
3-Jan-10	-	-	-	-	217,530	-	-	-	-	318,057	-	-	-	-	318,046	-	-	-	-	364,317	-	1,217,950
4-Jan-10	46E	12.25	126	1538	219,068	30C	13	188	2447	320,504	-	-	-	-	318,046	51F	5.75	474	2728	367,045	6,713	1,224,663
5-Jan-10	46E/49D	20.25	140	2829	221,897	30C	20.5	233	4774	325,278	-	-	-	-	318,046	51F/55F	4.15	491	2036	369,081	9,639	1,234,302
6-Jan-10	48D	21.25	158	3348	225,245	31C	21.25	220	4679	329,957	-	-	-	-	318,046	50G	16.5	362	5972	375,053	13,999	1,248,301
7-Jan-10	47D	23	113	2608	227,853	31C	12.8	285	3654	333,611	-	-	-	-	318,046	50G	16.25	251	4081	379,134	10,343	1,258,644
8-Jan-10	46/47D	13.5	120	1620	229,473	32/33C	21.5	179	3851	337,462	-	-	-	-	318,046	53/54F	13.75	280	3849	382,983	9,320	1,267,964
9-Jan-10	45/46D	18.3	138	2526	231,999	32/33C	21	162	3411	340,873	-	-	-	-	318,046	53/54F	14.5	404	5860	388,843	11,797	1,279,761
10-Jan-10	-	-	-	-	231,999	-	-	-	-	340,873	-	-	-	-	318,046	-	-	-	-	388,843	-	1,279,761
11-Jan-10	46D/47C	21.5	167	3580	235,579	33/34C	20	127	2535	343,408	-	-	-	-	318,046	53/54E	14.75	392	5784	394,627	11,899	1,291,660
12-Jan-10	46/47C	22.5	188	4239	239,818	31B	18.75	117	2190	345,598	-	-	-	-	318,046	54/55E	19.75	412	8138	402,765	14,567	1,306,227
13-Jan-10	46C	22	120	2648	242,466	31B	17	107	1815	347,413	-	-	-	-	318,046	55/56E	20	371	7423	410,188	11,886	1,318,113
14-Jan-10	46C	22	116	2542	245,008	31/32B	16.5	73	1201	348,614	-	-	-	-	318,046	50E/F	14.25	465	6626	416,814	10,369	1,328,482
15-Jan-10	45C	17	112	1900	246,908	32B	18	108	1943	350,557	-	-	-	-	318,046	50E/F	17	188	3196	420,010	7,039	1,335,521
16-Jan-10	45C	17	132	2244	249,152	32B	18	202	3630	354,187	-	-	-	-	318,046	51/52F/G	20.5	137	2815	422,825	8,689	1,344,210
17-Jan-10	-	-	-	-	249,152	-	-	-	-	354,187	-	-	-	-	318,046	-	-	-	-	422,825	-	1,344,210
18-Jan-10	44/45C	19	131	2488	251,640	Levee	16.75	186	3118	357,305	-	-	-	-	318,046	53F/G	20.5	318	6518	429,343	12,124	1,356,334
19-Jan-10	44/45C	17	126	2136	253,776	Levee	16.75	134	2244	359,549	-	-	-	-	318,046	53F/G	16	101	1614	430,957	5,994	1,362,328
20-Jan-10	44/43C	16.5	146	2403	256,179	Levee	18.5	96	1769	361,318	-	-	-	-	318,046	53F/G	12.25	486	5948	436,905	10,120	1,372,448
21-Jan-10	43C	14.4	120	1723	257,902	Levee	14.5	79	1148	362,466	-	-	-	-	318,046	65E/F	14.5	400	5797	442,702	8,668	1,381,116
22-Jan-10	43C	17.3	189	3265	261,167	Levee	5.9	267	1574	364,040	-	-	-	-	318,046	65E/F	15.9	587	9334	452,036	14,173	1,395,289
23-Jan-10	43C	19.1	131	2500	263,667	Levee	19.6	150	2948	366,988	-	-	-	-	318,046	65E/F	12.2	765	9333	461,369	14,781	1,410,070
24-Jan-10	43C	8.25	169	1394	265,061	Levee	5.25	293	1537	368,525	-	-	-	-	318,046	65E/F	5.33	764	4070	465,439	7,001	1,417,071
25-Jan-10	41/43C	9.4	154	1445	266,506	Levee	13.6	116	1574	370,099	-	-	-	-	318,046	-	-	-	-	465,439	3,019	1,420,090
26-Jan-10	50/51E	19.8	128	2525	269,031	Levee/34B	17.2	161	2761	372,860	-	-	-	-	318,046	-	-	-	-	465,439	5,286	1,425,376
27-Jan-10	51E	17.65	107	1887	270,918	34/35B	17	126	2146	375,006	-	-	-	-	318,046	65E/F	13.4	414	5554	470,993	9,587	1,434,963
28-Jan-10	51E	16.75	97	1633	272,551	24/25B	19.25	175	3371	378,377	-	-	-	-	318,046	66E/F	7	425	2974	473,967	7,978	1,442,941
29-Jan-10	52/53E	13.5	177	2388	274,939	24B	15.25	168	2560	380,937	-	-	-	-	318,046	70E/F	16.75	447	7487	481,454	12,435	1,455,376
30-Jan-10	53/55E	18.75	164	3077	278,016	24/23B	19.75	204	4038	384,975	-	-	-	-	318,046	64D/E	16.75	332	5557	487,011	12,672	1,468,048
31-Jan-10	54/55E	19.5	174	3396	281,412	23B	17.25	225	3874	388,849	-	-	-	-	318,046	72E/F	16.75	398	6667	493,678	13,937	1,481,985
1-Feb-10	55/56E	19.5	166	3244	284,656	22B	18.25	272	4970	393,819	-	-	-	-	318,046	73E/F	9.75	221	2154	495,832	10,368	1,492,353
Dredge days			**121**					**94**					**43**					**70**				
TOTAL		**1756.2**	**-**	**284,656**	**284,656**		**1701.4**	**-**	**393,819**	**393,819**		**703.9**	**-**	**318,046**	**318,046**		**1031.5**	**-**	**495,832**	**495,832**	**1,492,353**	**1,492,353**
AVERAGE		**14.5**	**159**	**2,353**	**-**		**18.1**	**230**	**4,190**	**-**		**16.4**	**477**	**7,396**	**-**		**14.7**	**481**	**7,083**	**-**	**10,736**	**-**

TABLE B-3. SUMMARY OF HYDRAULIC DREDGING VOLUMES
PHASE 2 DREDGING

	Sevenson Addison 14-Inch					Sevenson Adelyn 14-Inch					Sevenson McKenzie 14-Inch					Sevenson Kylee 16-Inch				
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)
30-Jan-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31-Jan-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-Feb-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Feb-10	-	-	-	-	-	-	-	-	-	-	56/57E	20.25	-	3223	3,223	20/21B	21.25	176	3741	3741
3-Feb-10	-	-	-	-	-	-	-	-	-	-	56/57E	18.00	-	1660	4,883	20B	14	177	2472	6,213
4-Feb-10	-	-	-	-	-	-	-	-	-	-	50F	22.90	-	2003	6,886	18/19B	20.8	161	3355	9,568
5-Feb-10	-	-	-	-	-	-	-	-	-	-	50F	6.00	-	0	6,886	18/19C	4.6	230	1056	10,624
6-Feb-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,886	-	-	-	-	10,624
7-Feb-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,886	-	-	-	-	10,624
8-Feb-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,886	18C/D	13.25	232	3070	13,694
9-Feb-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,886	18D	4	264	1056	14,750
10-Feb-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,886	17/18B	14.25	213	3031	17,781
11-Feb-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,886	17/18B	12.25	146	1792	19,573
12-Feb-10	-	-	-	-	-	-	-	-	-	-	50/51F	18.50	72	1330	8,216	19A	17.25	192	3315	22,888
13-Feb-10	-	-	-	-	-	-	-	-	-	-	51E/F	21.00	61	1286	9,502	24/25C	21.25	56	1190	24,078
14-Feb-10	-	-	-	-	-	-	-	-	-	-	52F	22.75	31	711.00	10,213	27C/13A	21.25	134	2850	26,928
15-Feb-10	-	-	-	-	-	-	-	-	-	-	53F	19.00	85	1612.00	11,825	12/13A	13	225	2923	29,851
16-Feb-10	-	-	-	-	-	-	-	-	-	-	53F	15.95	54	867	12,692	12/13A/B	19.4	224	4345	34,196
17-Feb-10	-	-	-	-	-	-	-	-	-	-	53F	14.50	73	1055	13,747	12A	4.25	105	448	34,644
18-Feb-10	-	-	-	-	-	-	-	-	-	-	53/54F	18.00	69	1237	14,984	-	-	-	-	34,644
19-Feb-10	-	-	-	-	-	-	-	-	-	-	54F	21.25	56	1191	16,175	-	-	-	-	34,644
20-Feb-10	-	-	-	-	-	-	-	-	-	-	55F	20.25	80	1629	17,804	12/13A/B	8.75	293	2566	37,210
21-Feb-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17,804	-	-	-	-	37,210
22-Feb-10	-	-	-	-	-	-	-	-	-	-	55F	17.50	81	1417	19,221	12A	20	81	1620	38,830
23-Feb-10	-	-	-	-	-	-	-	-	-	-	55F	12.50	78	970	20,191	9/10A/B	19.25	184	3548	42,378
24-Feb-10	-	-	-	-	-	-	-	-	-	-	55/56F	22.50	77	1742	21,933	9/10A/B	18.75	203	3806	46,184
25-Feb-10	-	-	-	-	-	-	-	-	-	-	56F	21.00	69	1448	23,381	11/12A	13.25	123	1630	47,814
26-Feb-10	-	-	-	-	-	-	-	-	-	-	56F	20.50	71	1453	24,834	12/13A	8.75	212	1852	49,666
27-Feb-10	-	-	-	-	-	1B/C	1.00	-	10	10	47E/D	4.25	318	1352.00	26,186	13A	19.75	179	3539	53,205
28-Feb-10	-	-	-	-	-	1B/C	13.00	-	1092	1,102	47C/D/E	20.00	83	1654.00	27,840	14A	12	258	3091	56,296
1-Mar-10	-	-	-	-	-	129A	3.00	-	142	1,244	47-B/C/D	21.00	119	2491	30,331	8-A/B	15.75	143	2256	58,552
2-Mar-10	-	-	-	-	-	129A	13.00	-	949	2,193	46/47B	19.00	72	1377	31,708	7/8A/B	14	85	1196	59,748
3-Mar-10	-	-	-	-	-	-	-	-	-	2,193	-	-	-	-	31,708	-	-	-	-	59,748
4-Mar-10	-	-	-	-	-	129A	1.00	-	290	2,483	-	-	-	-	31,708	9A/10B	19.5	55	1081	60,829
5-Mar-10	-	-	-	-	-	129A	4.00	-	433	2,916	46B	16.75	106	1771	33,479	8/9B	16	131	2097	62,926
6-Mar-10	-	-	-	-	-	129A	3.25	-	396	3,312	46B	14.50	80	1154	34,633	8B	11.75	136	1594	64,520
7-Mar-10	-	-	-	-	-	-	-	-	-	3,312	-	-	-	-	34,633	-	-	-	-	64,520
8-Mar-10	-	-	-	-	-	128A	12.00	-	349	3,661	44B/C	24.00	67	1608	36,241	11B	24	106	2541	67,061
9-Mar-10	-	-	-	-	-	128A	11.25	-	502	4,163	44/45B	24.00	69	1659.00	37,900	12B	19	136	2580	69,641
10-Mar-10	-	-	-	-	-	128A	12.00	-	300	4,463	44/45B	24.00	103	2478	40,378	12B	7.75	199	1545	71,186
11-Mar-10	44B	10.00	80	800	800	-	-	-	-	4,463	44B	1.00	139	139	40,517	13B	24	96	2305	73,491
12-Mar-10	44B	16.00	139	2230	3,030	-	-	-	-	4,463	-	-	-	-	40,517	12B	18.5	208	3841	77,332
13-Mar-10	43B/C	20.25	50	1003	4,033	-	-	-	-	4,463	-	-	-	-	40,517	11B	24	146	3500	80,832
14-Mar-10	-	-	-	-	4,033	-	-	-	-	4,463	-	-	-	-	40,517	-	-	-	-	80,832
15-Mar-10	43B	18.50	49	898	4,931	128A	10.75	-	710	5,173	-	-	-	-	40,517	17B	24	154	3697	84,529
16-Mar-10	43B	15.50	62	964	5,895	127A	10.50	-	158	5,331	-	-	-	-	40,517	8B	16.5	119	1968	86,497
17-Mar-10	43B	15.25	62	943	6,838	127A	10.75	-	350	5,681	-	-	-	-	40,517	8B	19.25	259	4990	91,487
18-Mar-10	43B	19.50	16	319	7,157	127A	10.00	-	294	5,975	31C	19.75	69	1360.00	41,877	6B	20.75	288	5978	97,465
19-Mar-10	43B	19.25	54	1037	8,194	127A	7.75	-	430	6,405	31C	16.00	64	1024	42,901	6B	20	88	1769	99,234
20-Mar-10	43B	18.50	57	1063	9,257	127A	6.25	-	127	6,532	31B/C	10.25	85	868	43,769	4B	13.75	272	3746	102,980
21-Mar-10	-	-	-	-	9,257	-	-	-	-	6,532	-	-	-	-	43,769	-	-	-	-	102,980
22-Mar-10	42B	17.75	61	1078	10,335	127B	7.75	-	210	6,742	31B/C	13.25	68	896	44,665	-	-	-	-	102,980
23-Mar-10	43B	8.75	60	521	10,856	127B	2.75	-	202	6,944	35D	12.75	76	968	45,633	4B	7.25	290	2104	105,084
24-Mar-10	41/42/B/C	14.25	71	1015	11,871	-	-	-	-	6,944	33/34D	22.25	73	1616	47,249	4B	5.75	348	2000	107,084
25-Mar-10	-	-	-	-	11,871	-	-	-	-	6,944	-	-	-	-	47,249	-	-	-	-	107,084
26-Mar-10	-	-	-	-	11,871	-	-	-	-	6,944	-	-	-	-	47,249	-	-	-	-	107,084
27-Mar-10	-	-	-	-	11,871	-	-	-	-	6,944	-	-	-	-	47,249	-	-	-	-	107,084
28-Mar-10	-	-	-	-	11,871	-	-	-	-	6,944	-	-	-	-	47,249	-	-	-	-	107,084
29-Mar-10	-	-	-	-	11,871	-	-	-	-	6,944	D-33	9.00	49	443	47,692	B-3	7.75	330	2554	109,638
30-Mar-10	-	-	-	-	11,871	A-127	7.25	98	711	7,655	C-37	17.25	89	1539	49,231	B-3,2	13.25	291	3850	113,488
31-Mar-10	B-42	12.50	85	1061	12,932	B-127	8.25	102	843	8,498	C-37	16.50	158	2606	51,837	B-3,2	10.25	321	3293	116,781

TABLE B-3. SUMMARY OF HYDRAULIC DREDGING VOLUMES
PHASE 2 DREDGING

	Sevenson Addison 14-Inch					Sevenson Adelyn 14-Inch					Sevenson McKenzie 14-Inch					Sevenson Kylee 16-Inch				
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)
1-Apr-10	B-42	15.50	58	900	13,832	C/D-127	7.25	156	1128	9,626	C-36	16.00	71	1134	52,971	B-2,1	15.5	95	1470	118,251
2-Apr-10	B-41,42	19.00	67	1272.00	15,104	-	-	-	-	9,626	C-36	9.00	43	383.00	53,354	B-2,1	17.25	123	2116	120,367
3-Apr-10	B-41,42	12.00	135	1617.00	16,721	D-126	2.00	88	176.00	9,802	C-35	9.75	74	720.00	54,074	C-3,2	14.75	74	1095	121,462
4-Apr-10	-	-	-	-	16,721	-	-	-	-	9,802	-	-	-	-	54,074	-	-	-	-	121,462
5-Apr-10	B-41,C-41	16.00	55	884	17,605	C-125	6.50	95	618	10,420	C-35	18.25	33	609.00	54,683	C-3,2	16.25	101	1644	123,106
6-Apr-10	B-41	18.25	34	616	18,221	B,C-126,5	10.25	84	861	11,281	C-34	18.50	118	2180.00	56,863	-	-	-	-	123,106
7-Apr-10	B-41	20.75	43	888	19,109	B,C-126,5	0.50	38	19	11,300	C-34	17.25	44	764.00	57,627	-	-	-	-	123,106
8-Apr-10	B-41	18.75	73	1378	20,487	B,C-125	15.25	81	1238	12,538	C-34,33	16.75	74	1239	58,866	-	-	-	-	123,106
9-Apr-10	B-41	9.25	54	500	20,987	D-125	7.75	141	1096	13,634	C-31	8.50	80	678	59,544	-	-	-	-	123,106
10-Apr-10	B,C-40	13.25	46	603	21,590	C-124	9.75	95	926	14,560	C-31	4.50	52	234.00	59,778	C-3	1	128	128	123,234
11-Apr-10	-	-	-	-	21,590	-	-	-	-	14,560	-	-	-	-	59,778	-	-	-	-	123,234
12-Apr-10	C-124	19.50	35	679	22,269	B-40	13.00	106	1372	15,932	C-31	15.50	64	989.00	60,767	C-3	18.00	56	1015.00	124,249
13-Apr-10	C-123	16.00	48	768	23,037	B-40	18.50	129	2378	18,310	C-31,30	15.50	101	1570.00	62,337	C-2,1	20.75	115	2390.00	126,639
14-Apr-10	C-123	11.05	144	1590	24,627	B-40	21.00	85	1790	20,100	Mv B-24	8.30	86	711.00	63,048	B-100	19.00	197	3735.00	130,374
15-Apr-10	C,B-122	17.00	131	2235	26,862	B-39	12.50	101	1267	21,367	B-24	15.75	52	815.00	63,863	B-100	9.00	136	1225	131,599
16-Apr-10	C,B-121	14.75	92	1356.00	28,218	B-39	15.50	131	2037.00	23,404	B,A-24	10.75	102	1096.00	64,959	-	-	-	-	131,599
17-Apr-10	C-121,120	14.50	112	1628	29,846	B-39	13.25	96	1278	24,682	A-23,24	16.00	104	1667.00	66,626	D-58	14.50	113	1637	133,236
18-Apr-10	-	-	-	-	29,846	-	-	-	-	24,682	-	-	-	-	66,626	-	-	-	-	133,236
19-Apr-10	C,D-121,122	15.50	132	2041.00	31,887	B-39	20.25	82	1667.00	26,349	A-23	4.50	156	703.00	67,329	D-58,59	17.50	111	1944	135,180
20-Apr-10	C,D-121	18.25	74	1359.00	33,246	B-39	17.50	167	2922.00	29,271	A-23	2.75	131	359.00	67,688	D-58,59	13.75	79	1083	136,263
21-Apr-10	C,D-120,119	19.00	111	2103.00	35,349	B-38	13.50	130	1751.00	31,022	A-22	16.50	54	886.00	68,574	D-59	12.75	85	1083	137,346
22-Apr-10	C,D-119	18.00	102	1828.00	37,177	B-38	16.75	108	1813.00	32,835	A-22, B-25	13.00	92	1200.00	69,774	E-60	17.50	122	2133	139,479
23-Apr-10	C,D-118	16.00	116	1852	39,029	B-38	19.75	99	1954	34,789	B-25	8.25	48	400.00	70,174	E-60,59	17.50	68	1191	140,670
24-Apr-10	C,D-117	3.75	39	147	39,176	B-38	2.00	204	407	35,196	-	-	-	-	70,174	E-59	4.25	82	347	141,017
25-Apr-10	-	-	-	-	39,176	-	-	-	-	35,196	-	-	-	-	70,174	-	-	-	-	141,017
26-Apr-10	C,D-117	16.00	125	2003.40	41,179	B-37	15.00	86	1297.00	36,493	B-25	13.50	111	1493.00	71,667	E-59	20.50	118	2421	143,438
27-Apr-10	C,D-116	16.75	84	1411.00	42,590	B-37	20.50	95	1953.00	38,446	B-25	13.00	66	858.00	72,525	F-59	18.00	57	1023	144,461
28-Apr-10	C,D-116,115	18.25	94	1711.00	44,301	B-37	7.50	82	613.00	39,059	A-21	17.75	148	2629.00	75,154	F/G-60	12.25	252	3082	147,543
29-Apr-10	B/A-1,A-2,3	11.00	265	2920	47,221	B-37	18.00	102	1838	40,897	A-20	16.00	168	2687.00	77,841	F/G-59,58	11.25	207	2333	149,876
30-Apr-10	A-3,4	17.75	105	1859.00	49,080	B-36	17.25	67	1159.00	42,056	A-20	17.50	121	2116.00	79,957	F/G-57	20.25	144	2908	152,784
1-May-10	A-4	6.50	232	1510	50,590	B-36	8.75	55	485	42,541	A-19	9.25	217	2005.00	81,962	E/F-57	9.00	315	2833	155,617
2-May-10	-	-	-	-	50,590	-	-	-	-	42,541	-	-	-	-	81,962	-	-	-	-	155,617
3-May-10	-	-	-	-	50,590	-	-	-	-	42,541	-	-	-	-	81,962	-	-	-	-	155,617
4-May-10	A-5,6	3.00	353	1058	51,648	-	-	-	-	42,541	A-19	8.25	306	2521.00	84,483	E-56	10.75	472	5072	160,689
5-May-10	A/B-6,7	20.30	80	1620	53,268	B-36	14.25	96	1363	43,904	A-19	14.00	75	1047.00	85,530	E-55,56	20.00	90	1806	162,495
6-May-10	A/B-7	20.10	52	1052	54,320	B-36,35	17.25	126	2175	46,079	A-18	18.00	56	1003.00	86,533	E-55	18.75	84	1569	164,064
7-May-10	A/B-8	13.10	80	1050.00	55,370	B-35	16.00	63	1001.00	47,080	A-18	13.20	88	1156.00	87,689	E-55	18.40	90	1662	165,726
8-May-10	A-9,10	19.40	61	1191	56,561	B-35	14.60	17	253	47,333	A/B-18	20.00	68	1353.00	89,042	E-54	21.70	101	2184	167,910
9-May-10	-	-	-	-	56,561	-	-	-	-	47,333	-	-	-	-	89,042	-	-	-	-	167,910
10-May-10	A-10,11	16.80	99	1667	58,228	B-34	10.40	20	213	47,546	A/B-17	11.80	79	937.00	89,979	-	-	-	-	167,910
11-May-10	A-11	19.05	73	1389	59,617	B-34	11.00	23	254	47,800	A/B-17	20.55	57	1181.00	91,160	-	-	-	-	167,910
12-May-10	A-11,12	18.00	76	1365	60,982	B-34	11.65	20	231	48,031	A/B-17,16	20.75	56	1165.00	92,325	-	-	-	-	167,910
13-May-10	A-12,13	17.75	57	1015	61,997	C-26	17.75	22	387	48,418	A/B-16	19.50	70	1372.00	93,697	E-67,68	11.80	63	742.00	168,652
14-May-10	A-13	12.50	42	519	62,516	C-26	16.25	22	356	48,774	A/B-15	9.30	123	1143.00	94,840	E-68,69	14.30	64	911.00	169,563
15-May-10	A-13	14.10	32	448	62,964	C-25,26	16.00	18	281	49,055	A/B-15	4.30	195	840.00	95,680	E-70	15.70	81	1266.00	170,829
16-May-10	A-14	15.00	55	818.00	63,782	B/C-25	9.80	47	456.00	49,511	E.of Dike 2	12.30	114	1403.00	97,083	D-70,D-67,6	16.60	248	4114.00	174,943
17-May-10	B-18,19	14.20	49	694	64,476	B/C-25,24	13.90	31	431	49,942	E.of Dike 2	17.00	104	1765.00	98,848	D-69,70	9.00	295	2652.00	177,595
18-May-10	B-19	15.30	43	663	65,139	A/B-25,24	12.25	36	440	50,382	E.of Dike 2	16.35	115	1884.00	100,732	-	-	-	-	177,595
19-May-10	B-20	16.30	45	734.00	65,873	A/B-25,24	11.00	43	477.00	50,859	E.of Dike 2	19.25	93	1796.00	102,528	C-46	16.60	167	2780.00	180,375
20-May-10	B-21	17.00	44	747.00	66,620	A-23,24/B-23,24	14.75	13	189.00	51,048	E.of Dike 2	18.50	116	2139.00	104,667	B-46,C-46	16.75	45	750.00	181,125
21-May-10	B-21,22	15.25	35	535.00	67,155	-	-	-	-	51,048	E.of Dike 2	6.75	100	678.00	105,345	B-46,C-45	20.50	75	1539.00	182,664
22-May-10	C-27	18.75	115	2154.00	69,309	-	-	-	-	51,048	E.of Dike 2	15.50	103	1593.00	106,938	B-45,C-45	20.50	77	1585.00	184,249
23-May-10	C-27, D-28	20.15	151	3037.00	72,346	B-42	15.70	77	1216.00	52,264	E.of Dike 2	12.70	73	929.00	107,867	B-45	19.50	73	1421.00	185,670
24-May-10	C-28	19.80	158	3120	75,466	B-42	18.60	49	917	53,181	B-38,37	19.00	107	2041.00	109,908	B-44,45	19.25	72	1394.00	187,064
25-May-10	B-28,29 C-28,29	18.20	110	2005	77,471	B-41,42	15.55	79	1231	54,412	B-38,39	18.80	112	2102.00	112,010	B-44,46	15.75	75	1188	188,252
26-May-10	B-29 C-29	16.65	169	2807	80,278	B-41	15.9	41	659	55,071	B-40	11.70	116	1352.00	113,362	B-46	14.15	76	1079	189,331
27-May-10	B-29	7.4	146	1078	81,356	-	-	-	-	55,071	-	-	-	-	113,362	-	-	-	-	189,331
28-May-10	-	-	-	-	81,356	-	-	-	-	55,071	-	-	-	-	113,362	-	-	-	-	189,331
29-May-10	-	-	-	-	81,356	-	-	-	-	55,071	-	-	-	-	113,362	-	-	-	-	189,331
30-May-10	-	-	-	-	81,356	-	-	-	-	55,071	-	-	-	-	113,362	-	-	-	-	189,331
31-May-10	-	-	-	-	81,356	-	-	-	-	55,071	-	-	-	-	113,362	-	-	-	-	189,331

TABLE B-3. SUMMARY OF HYDRAULIC DREDGING VOLUMES
PHASE 2 DREDGING

	Sevenson Addison 14-Inch					Sevenson Adelyn 14-Inch					Sevenson McKenzie 14-Inch					Sevenson Kylee 16-Inch				
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)
1-Jun-10	-	-	-	-	81,356	-	-	-	-	55,071	-	-	-	-	113,362	-	-	-	-	189,331
2-Jun-10	30A1	11.40	185	2104.00	83,460	-	-	-	-	55,071	37A1	11.00	97	1066.00	114,428	-	-	-	-	189,331
3-Jun-10	30B1	18.9	172	3257	86,717	-	-	-	-	55,071	38A1	14.40	95	1370.00	115,798	38A1	2.5	75	188	189,519
4-Jun-10	30B1	12.00	154	1852.00	88,569	-	-	-	-	55,071	-	-	-	-	115,798	38A1	20.75	58	1204	190,723
5-Jun-10	30C1	12.75	149	1906	90,475	-	-	-	-	55,071	-	-	-	-	115,798	38A1	19.75	76	1510	192,233
6-Jun-10	30C1 30D1	17.25	204	3522.00	93,997	-	-	-	-	55,071	-	-	-	-	115,798	39A1	20.50	52	1073.00	193,306
7-Jun-10	29B1	18.25	198	3609	97,606	-	-	-	-	55,071	-	-	-	-	115,798	39A1	18	135	2436	195,742
8-Jun-10	28B1	18.50	120	2227.00	99,833	-	-	-	-	55,071	-	-	-	-	115,798	40A1	19	209	3966	199,708
9-Jun-10	29C1	14	143	2000	101,833	-	-	-	-	55,071	-	-	-	-	115,798	41A1	15.25	178	2710	202,418
10-Jun-10	29D1	19.50	151	2953.00	104,786	-	-	-	-	55,071	-	-	-	-	115,798	42A1	20.5	79	1614	204,032
11-Jun-10	29D1	16.5	157	2593	107,379	-	-	-	-	55,071	-	-	-	-	115,798	42A1	20.25	107	2167	206,199
12-Jun-10	29E1	13.5	182	2455	109,834	-	-	-	-	55,071	-	-	-	-	115,798	36B1	20.75	147	3055	209,254
13-Jun-10	-	-	-	-	109,834	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
14-Jun-10	31B1	18	124	2224	112,058	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
15-Jun-10	32B1	13.75	203	2787	114,845	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
16-Jun-10	32B1 33B1	17.00	181	3069.00	117,914	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
17-Jun-10	33B1	19.95	182	3625.00	121,539	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
18-Jun-10	34B1	18.60	128	2382.00	123,921	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
19-Jun-10	35B1	18.60	169	3147.00	127,068	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
20-Jun-10	36B1, 34A1	20.55	200	4106.00	131,174	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
21-Jun-10	30D	13.25	217	2873.00	134,047	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
22-Jun-10	29D 28D	18.75	29	553.00	134,600	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
23-Jun-10	29C 30C	18.50	29	545.00	135,145	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
24-Jun-10	29C	19.25	29	566.00	135,711	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
25-Jun-10	29C 29A1	16.00	64	1023.00	136,734	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
26-Jun-10	29A1 30-B1	17.75	41	727.00	137,461	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
27-Jun-10	31 to 32-B1	15.25	30	452.00	137,913	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
28-Jun-10	33-36-B1	4.75	82	388	138,301	-	-	-	-	55,071	-	-	-	-	115,798	-	-	-	-	209,254
Dredge days			**89**					**47**					**83**					**94**		
TOTAL		**1408.9**	**-**	**138,301**	**138,301**		**757.9**	**-**	**55,071**	**55,071**		**1323.1**	**-**	**115,798**	**115,798**		**1471.8**	**-**	**209,254**	**209,254**
AVERAGE		**15.8**	**102**	**1,554**	**-**		**11.7**	**80**	**847**	**-**		**15.2**	**94**	**1,331**	**-**		**15.7**	**153**	**2,226**	**-**

TABLE B-3. SUMMARY OF HYDRAULIC DREDGING VOLUMES
PHASE 2 DREDGING

	Sevenson Shirley 16"					TOTAL	
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
30-Jan-10	64D/E	9.5	-	2218	2,218	2,218	2,218
31-Jan-10	65E	19.75	-	4042	6,260	4,042	6,260
1-Feb-10	65D/E	14	-	3726	9,986	3,726	9,986
2-Feb-10	65D	13.5	-	2176	12,162	9,140	19,126
3-Feb-10	66D	10.75	-	2020	14,182	6,152	25,278
4-Feb-10	66D	17.2	-	1837	16,019	7,195	32,473
5-Feb-10	66D	3.25	-	150	16,169	1,206	33,679
6-Feb-10	-	-	-	-	16,169	-	33,679
7-Feb-10	-	-	-	-	16,169	-	33,679
8-Feb-10	66/67D	1.5	-	115	16,284	3,185	36,864
9-Feb-10	67D	16.25	-	1883	18,167	2,939	39,803
10-Feb-10	67D	1.75	-	214	18,381	3,245	43,048
11-Feb-10	-	-	-	-	18,381	1,792	44,840
12-Feb-10	-	-	-	-	18,381	4,645	49,485
13-Feb-10	68/69D	12.75	-	1118	19,499	3,594	53,079
14-Feb-10	69/70D	18.5	-	3412	22,911	6,973	60,052
15-Feb-10	70/71D	12	-	1538	24,449	6,073	66,125
16-Feb-10	64E	13	-	2825	27,274	8,037	74,162
17-Feb-10	64E	14.75	-	1682	28,956	3,185	77,347
18-Feb-10	67/68E	15.4	-	1837	30,793	3,074	80,421
19-Feb-10	68E	14.95	-	1611	32,404	2,802	83,223
20-Feb-10	68/69E	14.95	-	1642	34,046	5,837	89,060
21-Feb-10	-	-	-	-	34,046	-	89,060
22-Feb-10	68/69E	15.5	-	2611	36,657	5,648	94,708
23-Feb-10	64F	16.75	-	1093	37,750	5,611	100,319
24-Feb-10	66/67F	18	-	3475	41,225	9,023	109,342
25-Feb-10	68F/64G	14	-	2483	43,708	5,561	114,903
26-Feb-10	64/65G	14.75	-	2236	45,944	5,541	120,444
27-Feb-10	65/66G	14.25	-	1268	47,212	6,169	126,613
28-Feb-10	66G	14.5	-	5403	52,615	11,240	137,853
1-Mar-10	skimmer	18.25	-	7187	59,802	12,076	149,929
2-Mar-10	skimmer	16	-	1363	61,165	4,885	154,814
3-Mar-10	-	-	-	-	61,165	-	154,814
4-Mar-10	Intake	5.5	-	617	61,782	1,988	156,802
5-Mar-10	54/55D	11.75	-	1733	63,515	6,034	162,836
6-Mar-10	53E	13.25	-	1014	64,529	4,158	166,994
7-Mar-10	-	-	-	-	64,529	-	166,994
8-Mar-10	52E	22.25	-	1765	66,294	6,263	173,257
9-Mar-10	50/51E	23	-	1305	67,599	6,046	179,303
10-Mar-10	50/51E	24	-	1698	69,297	6,021	185,324
11-Mar-10	50/51E	24	-	2191	71,488	5,435	190,759
12-Mar-10	50/51E	15.5	-	2239	73,727	8,310	199,069
13-Mar-10	50/51E	24	-	2607	76,334	7,110	206,179
14-Mar-10	-	-	-	-	76,334	-	206,179
15-Mar-10	48F	24	-	2375	78,709	7,680	213,859
16-Mar-10	48F	12.5	-	1555	80,264	4,645	218,504
17-Mar-10	48F	17.25	-	2216	82,480	8,499	227,003
18-Mar-10	48F	17	-	1489	83,969	9,440	236,443
19-Mar-10	48F	16.25	-	1197	85,166	5,457	241,900
20-Mar-10	46/47/48E	14	-	845	86,011	6,649	248,549
21-Mar-10	-	-	-	-	86,011	-	248,549
22-Mar-10	49/50D	7.75	-	596	86,607	2,780	251,329
23-Mar-10	48D/50C	14.5	-	1638	88,245	5,433	256,762
24-Mar-10	48D/50C	14.75	-	1312	89,557	5,943	262,705
25-Mar-10	-	-	-	-	89,557	-	262,705
26-Mar-10	-	-	-	-	89,557	-	262,705
27-Mar-10	-	-	-	-	89,557	-	262,705
28-Mar-10	-	-	-	-	89,557	-	262,705
29-Mar-10	48C	10.75	-	918	90,475	3,915	266,620
30-Mar-10	C-47	13	-	1938	92,413	8,038	274,658
31-Mar-10	C-47	20	-	1727	94,140	9,530	284,188

TABLE B-3. SUMMARY OF HYDRAULIC DREDGING VOLUMES
PHASE 2 DREDGING

	Sevenson Shirley 16"					TOTAL	
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
1-Apr-10	C-47	14.5	-	1530	95,670	6,162	290,350
2-Apr-10	B-47	13.25	-	1996	97,666	5,767	296,117
3-Apr-10	B-46	15	-	2492	100,158	6,100	302,217
4-Apr-10	-	-	-	-	100,158	-	302,217
5-Apr-10	NA	14.5	-	1402	101,560	5,157	307,374
6-Apr-10	B-46	15.5	-	2500	104,060	6,157	313,531
7-Apr-10	B-46,45	13	-	1927	105,987	3,598	317,129
8-Apr-10	B-46,45	16.25	-	1637	107,624	5,492	322,621
9-Apr-10	B-46,45	16.75	-	1907	109,531	4,181	326,802
10-Apr-10	B-45,49	10.5	-	1514	111,045	3,405	330,207
11-Apr-10	-	-	-	-	111,045	-	330,207
12-Apr-10	-	-	-	-	111,045	4,055	334,262
13-Apr-10	-	-	-	-	111,045	7,106	341,368
14-Apr-10	-	-	-	-	111,045	7,826	349,194
15-Apr-10	B-100	5.25	543	2852	113,897	8,394	357,588
16-Apr-10	B-101,2	19.00	194	3689	117,586	8,178	365,766
17-Apr-10	B-102,3	10.75	270	2900	120,486	9,110	374,876
18-Apr-10	-	-	-	-	120,486	-	374,876
19-Apr-10	B-102,3	18.00	204	3679	124,165	10,034	384,910
20-Apr-10	B-106,7	12.75	223	2844	127,009	8,567	393,477
21-Apr-10	B,C-107	8.75	325	2844	129,853	8,667	402,144
22-Apr-10	C-104,5	12.50	243	3038	132,891	10,012	412,156
23-Apr-10	C-105,6	16.00	211	3383	136,274	8,780	420,936
24-Apr-10	C,D-106	3.25	241	782	137,056	1,683	422,619
25-Apr-10	-	-	-	-	137,056	-	422,619
26-Apr-10	C,D-107,8	18.00	233	4187	141,243	11,401	434,020
27-Apr-10	C,D-108,9	15.75	204	3219	144,462	8,464	442,484
28-Apr-10	C,D-109,110	15.75	264	4159	148,621	12,194	454,678
29-Apr-10	C,D-110	11.15	167	1862	150,483	11,640	466,318
30-Apr-10	D-111,112	10.00	225	2253	152,736	10,295	476,613
1-May-10	D-112,113	3.50	537	1880	154,616	8,713	485,326
2-May-10	-	-	-	-	154,616	-	485,326
3-May-10	-	-	-	-	154,616	-	485,326
4-May-10	D-113,114	8.50	537	4567	159,183	13,218	498,544
5-May-10	C/D-114	12.75	417	5312	164,495	11,148	509,692
6-May-10	D-115,117	13.50	177	2384	166,879	8,183	517,875
7-May-10	D-117,118	11.30	170	1917	168,796	6,786	524,661
8-May-10	C/D-118,119	6.00	331	1988	170,784	6,969	531,630
9-May-10	-	-	-	-	170,784	-	531,630
10-May-10	C/D-122	10.30	399	4105	174,889	6,922	538,552
11-May-10	C/D-121	8.05	210	1693	176,582	4,517	543,069
12-May-10	C/D-121,122	12.15	139	1688.00	178,270	4,449	547,518
13-May-10	C-117,118,119	13.00	267	3477.00	181,747	6,993	554,511
14-May-10	C-117,116	8.20	110	899.00	182,646	3,828	558,339
15-May-10	C-115,C/D108	8.35	349	2910.00	185,556	5,745	564,084
16-May-10	C/D-107,108	13.35	177	2361.00	187,917	9,152	573,236
17-May-10	B/C/106,107 &E-106	13.90	95	1321.00	189,238	6,863	580,099
18-May-10	B/C-103	8.50	115	974	190,212	3,961	584,060
19-May-10	B/C-102,3	13.25	195	2585.00	192,797	8,372	592,432
20-May-10	B-101,2/C-101,2	10.25	167	1713.00	194,510	5,538	597,970
21-May-10	B-100,1,2/C-100,1	16.25	218	3537.00	198,047	6,289	604,259
22-May-10	B-4,5/C-4,100	14.00	121	1687.00	199,734	7,019	611,278
23-May-10	A-6,7/B-6,7	16.30	144	2349.00	202,083	8,952	620,230
24-May-10	B-7	1.10	165	182.00	202,265	7,654	627,884
25-May-10	-	-	-	-	202,265	6,526	634,410
26-May-10	-	-	-	-	202,265	5,897	640,307
27-May-10	-	-	-	-	202,265	1,078	641,385
28-May-10	-	-	-	-	202,265	-	641,385
29-May-10	-	-	-	-	202,265	-	641,385
30-May-10	-	-	-	-	202,265	-	641,385
31-May-10	-	-	-	-	202,265	-	641,385

TABLE B-3. SUMMARY OF HYDRAULIC DREDGING VOLUMES
PHASE 2 DREDGING

	Sevenson Shirley 16"					TOTAL	
Date	Dredging Location[1]	Dredge Time (Hours)	Dredge Rate (CY/Hr)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
1-Jun-10	-	-	-	-	202,265	-	641,385
2-Jun-10	-	-	-	-	202,265	3,170	644,555
3-Jun-10	-	-	-	-	202,265	4,815	649,370
4-Jun-10	-	-	-	-	202,265	3,056	652,426
5-Jun-10	-	-	-	-	202,265	3,416	655,842
6-Jun-10	-	-	-	-	202,265	4,595	660,437
7-Jun-10	-	-	-	-	202,265	6,045	666,482
8-Jun-10	-	-	-	-	202,265	6,193	672,675
9-Jun-10	-	-	-	-	202,265	4,710	677,385
10-Jun-10	-	-	-	-	202,265	4,567	681,952
11-Jun-10	-	-	-	-	202,265	4,760	686,712
12-Jun-10	-	-	-	-	202,265	5,510	692,222
13-Jun-10	-	-	-	-	202,265	-	692,222
14-Jun-10	36B1	16.75	205	3429	205,694	5,653	697,875
15-Jun-10	37C1	11.75	95	1119	206,813	3,906	701,781
16-Jun-10	37D1	15.00	98	1469.00	208,282	4,538	706,319
17-Jun-10	B-35/B-36/B-37	17.35	59	1022.00	209,304	4,647	710,966
18-Jun-10	B-37 B-38	16.70	61	1012.00	210,316	3,394	714,360
19-Jun-10	B-38 B-39	11.60	98	1139.00	211,455	4,286	718,646
20-Jun-10	B-39 B-40	17.50	87	1516.00	212,971	5,622	724,268
21-Jun-10	B-40,B-41,B-42	17.75	50	893	213,864	3,766	728,034
22-Jun-10	42B 43B	19	116	2210	216,074	2,763	730,797
23-Jun-10	43B 44B	20.75	127	2643	218,717	3,188	733,985
24-Jun-10	44B	20.75	133	2754.00	221,471	3,320	737,305
25-Jun-10	44B 45B	19.25	140	2696.00	224,167	3,719	741,024
26-Jun-10	45B	21.30	192	4090.00	228,257	4,817	745,841
27-Jun-10	46B	15.50	195	3020.00	231,277	3,472	749,313
28-Jun-10	-	-	-	-	231,277	388	749,701
Dredge days			**49**				
TOTAL		**1480.4**	**-**	**231,277**	**231,277**	**749,701**	**749,701**
AVERAGE		**14.0**	**209**	**2,182**	**-**	**5,950**	**-**

TABLE B-4. SUMMARY OF MECHANICAL DREDGING VOLUMES
DREDGING PILOT PROGRAM

	Southern Shores				
Date	Dredging Location[1]	No. of Barges[2]	Barge Load (CY/ea)	Daily Volume (CY)	Cumulative Volume (CY)
20-Jun-09		15	22	330	330
21-Jun-09		-	-	-	330
22-Jun-09	-	15	20	300	630
23-Jun-09		34	20	680	1,310
24-Jun-09		18	20	360	1,670
25-Jun-09		55	20	1100	2,770
26-Jun-09		69	20	1380	4,150
27-Jun-09		74	20	1480	5,630
28-Jun-09		-	-	-	5,630
29-Jun-09	-	65	18	1170	6,800
30-Jun-09		75	18	1350	8,150
1-Jul-09		65	18	1170	9,320
2-Jul-09		27	18	486	9,806
3-Jul-09	-	-	-	-	9,806
4-Jul-09		-	-	-	9,806
5-Jul-09		-	-	-	9,806
6-Jul-09	-	71	18	1278	11,084
7-Jul-09		22	18	396	11,480
8-Jul-09		-	-	-	11,480
9-Jul-09		32	20	640	12,120
10-Jul-09		32	20	640	12,760
11-Jul-09		45	20	900	13,660
12-Jul-09		-	-	-	13,660
13-Jul-09	-	45	20	900	14,560
14-Jul-09		41	20	820	15,380
15-Jul-09		44	20	880	16,260
16-Jul-09		41	20	820	17,080
17-Jul-09		44	20	880	17,960
18-Jul-09		31	20	620	18,580
19-Jul-09		-	-	-	18,580
20-Jul-09	-	13	20	260	18,840
Dredge days			**23**		
TOTAL		**973.0**	**-**	**18,840**	**18,840**
AVERAGE		**42.3**	**20**	**819**	**-**

TABLE B-5. SUMMARY OF MECHANICAL DREDGING VOLUMES
PHASE 2 DREDGING

	Sevenson					Aquarius					TOTAL	
Date	Dredging Location[1]	No. of Barges[2]	Barge Load (CY/ea)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	No. of Barges[2]	Barge Load (CY/ea)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
13-Mar-10	Weir 1	2	110	220	220	-	-	-	-	-	220	220
14-Mar-10	-	-	-	-	220	-	-	-	-	-	-	220
15-Mar-10	Weir 1	3	110	330	550	-	-	-	-	-	330	550
16-Mar-10	Weir 1	4	110	440	990	-	-	-	-	-	440	990
17-Mar-10	Weir 1	8	110	880	1,870	-	-	-	-	-	880	1,870
18-Mar-10	Weir 1	8	110	880	2,750	-	-	-	-	-	880	2,750
19-Mar-10	Weir 1	9	110	990	3,740	-	-	-	-	-	990	3,740
20-Mar-10	Weir 1	12	110	1320	5,060	-	-	-	-	-	1,320	5,060
21-Mar-10	-	-	-	-	5,060	-	-	-	-	-	-	5,060
22-Mar-10	Weir 1	11	110	1210	6,270	-	-	-	-	-	1,210	6,270
23-Mar-10	Weir 1	7	110	715	6,985	-	-	-	-	-	715	6,985
24-Mar-10	Weir 1	7	110	715	7,700	-	-	-	-	-	715	7,700
25-Mar-10	-	-	-	-	7,700	-	-	-	-	-	-	7,700
26-Mar-10	-	-	-	-	7,700	-	-	-	-	-	-	7,700
27-Mar-10	-	-	-	-	7,700	-	-	-	-	-	-	7,700
28-Mar-10	-	-	-	-	7,700	-	-	-	-	-	-	7,700
29-Mar-10	-	-	-	-	7,700	-	-	-	-	-	-	7,700
30-Mar-10	-	-	-	-	7,700	-	-	-	-	-	-	7,700
31-Mar-10	-	-	-	-	7,700	-	-	-	-	-	-	7,700
1-Apr-10	-	-	-	-	7,700	-	-	-	-	-	-	7,700
2-Apr-10	Weir 1	4	110	440	8,140	-	-	-	-	-	440	8,140
3-Apr-10	Weir 1	2	110	220	8,360	-	-	-	-	-	220	8,360
4-Apr-10	-	-	-	-	8,360	-	-	-	-	-	-	8,360
5-Apr-10	Weir 1	6	110	660	9,020	-	-	-	-	-	660	9,020
6-Apr-10	Weir 1	9	110	990	10,010	-	-	-	-	-	990	10,010
7-Apr-10	Weir 1	6	110	660	10,670	Skimmer	300	0.77	231	231	891	10,901
8-Apr-10	Weir 1	6	110	660	11,330	Skimmer	500	0.77	385	615	1,045	11,945
9-Apr-10	Weir 1	3	110	330	11,660	Skimmer	600	0.77	462	1,077	792	12,737
10-Apr-10	-	-	-	-	11,660	Skimmer	300	0.77	231	1,308	231	12,968
11-Apr-10	-	-	-	-	11,660	-	-	-	-	1,308	-	12,968
12-Apr-10	Weir 1	6	110	660	12,320	Skimmer	100	0.77	77	1,385	737	13,705
13-Apr-10	-	-	-	-	12,320	Skimmer	100	0.77	77	1,462	77	13,782
14-Apr-10	-	-	-	-	12,320	Skimmer	100	0.77	77	1,538	77	13,858
15-Apr-10	-	-	-	-	12,320	-	-	-	-	1,538	-	13,858
16-Apr-10	-	-	-	-	12,320	Skimmer	40	0.77	31	1,569	31	13,889
17-Apr-10	-	-	-	-	12,320	Skimmer	150	0.77	115	1,685	115	14,005
18-Apr-10	-	-	-	-	12,320	-	-	-	-	1,685	-	14,005
19-Apr-10	AA5, Area 2	3	110	330	12,650	Skimmer	300	0.77	231	1,915	561	14,565
20-Apr-10	AA5, Area 2	4	110	440	13,090	Skimmer	150	0.77	115	2,031	555	15,121
21-Apr-10	AA5, Area 2	3	110	330	13,420	Skimmer	150	0.77	115	2,146	445	15,566
22-Apr-10	AA5, Area 2	3	110	330	13,750	Skimmer	500	0.77	385	2,531	715	16,281
23-Apr-10	AA5, Area 2	4	110	440	14,190	-	-	-	-	2,531	440	16,721
24-Apr-10	AA5, Area 2	3	110	330	14,520	-	-	-	-	2,531	330	17,051
25-Apr-10	-	-	-	-	14,520	-	-	-	-	2,531	-	17,051
26-Apr-10	AA5, Area 3	3	110	330	14,850	Skimmer	100	0.77	77	2,608	407	17,458
27-Apr-10	AA5, Area 3	7	110	770	15,620	Skimmer	200	0.77	154	2,762	924	18,382
28-Apr-10	AA5, Area 3	9	110	990	16,610	-	-	-	-	2,762	990	19,372
29-Apr-10	AA5, Area 3	4	110	440	17,050	-	-	-	-	2,762	440	19,812
30-Apr-10	AA5, Area 3	5	110	550	17,600	-	-	-	-	2,762	550	20,362
1-May-10	AA5, Area 3	3	110	330	17,930	-	-	-	-	2,762	330	20,692
2-May-10	-	-	-	-	17,930	-	-	-	-	2,762	-	20,692

TABLE B-5. SUMMARY OF MECHANICAL DREDGING VOLUMES
PHASE 2 DREDGING

	Sevenson					Aquarius					TOTAL	
Date	Dredging Location[1]	No. of Barges[2]	Barge Load (CY/ea)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	No. of Barges[2]	Barge Load (CY/ea)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
3-May-10	-	-	-	-	17,930	-	-	-	-	2,762	-	20,692
4-May-10	AA5, Area 3	4	110	440	18,370	-	-	-	-	2,762	440	21,132
5-May-10	-	-	-	-	18,370	-	-	-	-	2,762	-	21,132
6-May-10	-	-	-	-	18,370	-	-	-	-	2,762	-	21,132
7-May-10	-	-	-	-	18,370	AA5,Area 2	1	440	440	3,202	440	21,572
8-May-10	AA5, Area 4	5	110	550	18,920	-	-	-	-	3,202	550	22,122
9-May-10	-	-	-	-	18,920	-	-	-	-	3,202	-	22,122
10-May-10	AA5, Area 4	4	110	440	19,360	AA5,Area 2	1	440	440	3,642	880	23,002
11-May-10	AA5, Area 4	4	110	440	19,800	AA5,Area 2	1	360	360	4,002	800	23,802
12-May-10	AA5, Area 4	4	110	440	20,240	AA5,Area 2	1	360	360	4,362	800	24,602
13-May-10	AA5, Area 4	5	110	550	20,790	AA5,Area 2	1	360	360	4,722	910	25,512
14-May-10	AA5, Area 4	3	110	330	21,120	AA5,Area 2	1	360	360	5,082	690	26,202
15-May-10	AA5, Area 4	4	110	440	21,560	AA5,Area 2	1	360	360	5,442	800	27,002
16-May-10	AA5, Area 4	4	110	440	22,000	AA5,Area 2	1	360	360	5,802	800	27,802
17-May-10	AA5, Area 4	2	110	220	22,220	AA5,Area 2	2	360	720	6,522	940	28,742
18-May-10	AA5, Area 3	5	110	550	22,770	AA5,Area 2	1	360	360	6,882	910	29,652
19-May-10	AA5, Area 3	2	110	220	22,990	-	-	-	-	6,882	220	29,872
20-May-10	D-111	2	110	220	23,210	D-115	1	360	360	7,242	580	30,452
21-May-10	N Dock	5	110	550	23,760	-	-	-	-	7,242	550	31,002
22-May-10	B-29,30	8	110	880	24,640	-	-	-	-	7,242	880	31,882
23-May-10	B-29,30	11	110	1210	25,850	Skimmer	1	360	360	7,602	1,570	33,452
24-May-10	B-30	15	110	1650	27,500	-	-	-	-	7,602	1,650	35,102
25-May-10	B-30	5	110	550	28,050	-	-	-	-	7,602	550	35,652
26-May-10	B-30	2	110	220	28,270	-	-	-	-	7,602	220	35,872
27-May-10	B-30	2	110	220	28,490	-	-	-	-	7,602	220	36,092
28-May-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
29-May-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
30-May-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
31-May-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
1-Jun-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
2-Jun-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
3-Jun-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
4-Jun-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
5-Jun-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
6-Jun-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
7-Jun-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
8-Jun-10	-	-	-	-	28,490	-	-	-	-	7,602	-	36,092
9-Jun-10	-	-	-	-	28,490	Skimmer	1	360	360	7,962	360	36,452
10-Jun-10	-	-	-	-	28,490	-	-	-	-	7,962	-	36,452
11-Jun-10	-	-	-	-	28,490	-	-	-	-	7,962	-	36,452
12-Jun-10	-	-	-	-	28,490	-	-	-	-	7,962	-	36,452
13-Jun-10	-	-	-	-	28,490	-	-	-	-	7,962	-	36,452
14-Jun-10	-	-	-	-	28,490	-	-	-	-	7,962	-	36,452
15-Jun-10	-	-	-	-	28,490	-	-	-	-	7,962	-	36,452
16-Jun-10	-	-	-	-	28,490	Skimmer	1	360	360	8,322	360	36,812
17-Jun-10	-	-	-	-	28,490	-	-	-	-	8,322	-	36,812
18-Jun-10	-	-	-	-	28,490	-	-	-	-	8,322	-	36,812
19-Jun-10	-	-	-	-	28,490	-	-	-	-	8,322	-	36,812
20-Jun-10	-	-	-	-	28,490	-	-	-	-	8,322	-	36,812
21-Jun-10	-	-	-	-	28,490	Skimmer	1	360	360	8,682	360	37,172
22-Jun-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172

TABLE B-5. SUMMARY OF MECHANICAL DREDGING VOLUMES
PHASE 2 DREDGING

Date	Sevenson					Aquarius					TOTAL	
	Dredging Location[1]	No. of Barges[2]	Barge Load (CY/ea)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	No. of Barges[2]	Barge Load (CY/ea)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
23-Jun-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
24-Jun-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
25-Jun-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
26-Jun-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
27-Jun-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
28-Jun-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
29-Jun-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
30-Jun-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
1-Jul-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
2-Jul-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
3-Jul-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
4-Jul-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
5-Jul-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
6-Jul-10	-	-	-	-	28,490	-	-	-	-	8,682	-	37,172
7-Jul-10	-	-	-	-	28,490	Skimmer	1	320	320	9,002	320	37,492
8-Jul-10	-	-	-	-	28,490	-	-	-	-	9,002	-	37,492
9-Jul-10	-	-	-	-	28,490	-	-	-	-	9,002	-	37,492
10-Jul-10	-	-	-	-	28,490	-	-	-	-	9,002	-	37,492
11-Jul-10	-	-	-	-	28,490	-	-	-	-	9,002	-	37,492
12-Jul-10	-	-	-	-	28,490	-	-	-	-	9,002	-	37,492
13-Jul-10	-	-	-	-	28,490	Skimmer	1	320	320	9,322	320	37,812
14-Jul-10	-	-	-	-	28,490	Skimmer	1	320	320	9,642	320	38,132
15-Jul-10	-	-	-	-	28,490	-	-	-	-	9,642	-	38,132
16-Jul-10	-	-	-	-	28,490	-	-	-	-	9,642	-	38,132
17-Jul-10	-	-	-	-	28,490	-	-	-	-	9,642	-	38,132
18-Jul-10	-	-	-	-	28,490	-	-	-	-	9,642	-	38,132
19-Jul-10	-	-	-	-	28,490	-	-	-	-	9,642	-	38,132
20-Jul-10	-	-	-	-	28,490	-	-	-	-	9,642	-	38,132
21-Jul-10	-	-	-	-	28,490	-	-	-	-	9,642	-	38,132
22-Jul-10	-	-	-	-	28,490	Skimmer	1	320	320	9,962	320	38,452
23-Jul-10	-	-	-	-	28,490	-	-	-	-	9,962	-	38,452
24-Jul-10	-	-	-	-	28,490	-	-	-	-	9,962	-	38,452
25-Jul-10	-	-	-	-	28,490	-	-	-	-	9,962	-	38,452
26-Jul-10	-	-	-	-	28,490	-	-	-	-	9,962	-	38,452
27-Jul-10	-	-	-	-	28,490	-	-	-	-	9,962	-	38,452
28-Jul-10	-	-	-	-	28,490	Skimmer	1	320	320	10,282	320	38,772
29-Jul-10	-	-	-	-	28,490	-	-	-	-	10,282	-	38,772
30-Jul-10	-	-	-	-	28,490	Skimmer	1	320	320	10,602	320	39,092
31-Jul-10	-	-	-	-	28,490	-	-	-	-	10,602	-	39,092
1-Aug-10	-	-	-	-	28,490	-	-	-	-	10,602	-	39,092
2-Aug-10	-	-	-	-	28,490	-	-	-	-	10,602	-	39,092
3-Aug-10	-	-	-	-	28,490	-	-	-	-	10,602	-	39,092
4-Aug-10	-	-	-	-	28,490	-	-	-	-	10,602	-	39,092
5-Aug-10	-	-	-	-	28,490	Bob Summers Road	1	250	250	10,852	250	39,342
6-Aug-10	-	-	-	-	28,490	Bob Summers Road	2	500	1000	11,852	1,000	40,342
7-Aug-10	-	-	-	-	28,490	Bob Summers Road	1	250	250	12,102	250	40,592
8-Aug-10	-	-	-	-	28,490	-	-	-	-	12,102	-	40,592
9-Aug-10	-	-	-	-	28,490	Bob Summers Road	1	250	250	12,352	250	40,842
10-Aug-10	-	-	-	-	28,490	Bob Summers Road	2	500	1000	13,352	1,000	41,842
11-Aug-10	-	-	-	-	28,490	Bob Summers Road	1	250	250	13,602	250	42,092
12-Aug-10	-	-	-	-	28,490	-	-	-	-	13,602	-	42,092

TABLE B-5. SUMMARY OF MECHANICAL DREDGING VOLUMES
PHASE 2 DREDGING

Date	Sevenson					Aquarius					TOTAL	
	Dredging Location[1]	No. of Barges[2]	Barge Load (CY/ea)	Daily Volume (CY)	Cumulative Volume (CY)	Dredging Location[1]	No. of Barges[2]	Barge Load (CY/ea)	Daily Volume (CY)	Cumulative Volume (CY)	Daily Volume (CY)	Cumulative Volume (CY)
13-Aug-10	-	-	-	-	28,490	-	-	-	-	13,602	-	42,092
14-Aug-10	-	-	-	-	28,490	-	-	-	-	13,602	-	42,092
15-Aug-10	-	-	-	-	28,490	-	-	-	-	13,602	-	42,092
16-Aug-10	-	-	-	-	28,490	-	-	-	-	13,602	-	42,092
17-Aug-10	-	-	-	-	28,490	Bob Summers Road	1	500	500	14,102	500	42,592
18-Aug-10	-	-	-	-	28,490	Bob Summers Road	1	250	250	14,352	250	42,842
19-Aug-10	-	-	-	-	28,490	Bob Summers Road	2	300	600	14,952	600	43,442
Dredge days			**50**					**45**				
TOTAL		**259.0**	**-**	**28,490**	**28,490**		**3624.0**	**-**	**14,952**	**14,952**	**43,442**	**43,442**
AVERAGE		**5.2**	**110**	**570**	**-**		**80.5**	**234**	**332**	**-**	**587**	**-**

TABLE B-6. SUMMARY OF MECHANICAL EXCAVATION VOLUMES
EXCAVATION EASE OF DIKE 2

Date	East Embayment							Between Dike 2 and River							TOTAL	
	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	Daily Volume (in-place CY)	Cumulative Volume (in-place CY)
13-Jun-09	0	25	0	25	0	-	-	174	25	0	25	4,350	4,133	4,133	4,133	4,133
14-Jun-09	0	25	0	25	0	-	-	168	25	0	25	4,200	3,990	8,123	3,990	8,123
15-Jun-09	0	25	0	25	0	-	-	76	25	0	25	1,900	1,805	9,928	1,805	9,928
16-Jun-09	0	25	0	25	0	-	-	196	25	0	25	4,900	4,655	14,583	4,655	14,583
17-Jun-09	0	25	0	25	0	-	-	89	25	0	25	2,225	2,114	16,696	2,114	16,696
18-Jun-09	0	25	0	25	0	-	-	141	25	0	25	3,525	3,349	20,045	3,349	20,045
19-Jun-09	0	25	0	25	0	-	-	231	25	0	25	5,775	5,486	25,531	5,486	25,531
20-Jun-09	0	25	0	25	0	-	-	229	25	0	25	5,725	5,439	30,970	5,439	30,970
21-Jun-09	0	25	0	25	0	-	-	241	25	0	25	6,025	5,724	36,694	5,724	36,694
22-Jun-09	0	25	0	25	0	-	-	0	25	0	25	0	-	36,694	-	36,694
23-Jun-09	0	25	0	25	0	-	-	328	25	0	25	8,200	7,790	44,484	7,790	44,484
24-Jun-09	0	25	0	25	0	-	-	284	25	0	25	7,100	6,745	51,229	6,745	51,229
25-Jun-09	0	25	0	25	0	-	-	57	25	0	25	1,425	1,354	52,583	1,354	52,583
26-Jun-09	0	25	0	25	0	-	-	259	25	0	25	6,475	6,151	58,734	6,151	58,734
27-Jun-09	0	25	0	25	0	-	-	344	25	0	25	8,600	8,170	66,904	8,170	66,904
28-Jun-09	0	25	0	25	0	-	-	0	25	0	25	0	-	66,904	-	66,904
29-Jun-09	0	25	0	25	0	-	-	300	25	0	25	7,500	7,125	74,029	7,125	74,029
30-Jun-09	0	25	0	25	0	-	-	320	25	0	25	8,000	7,600	81,629	7,600	81,629
1-Jul-09	0	25	0	25	0	-	-	295	25	0	25	7,375	7,006	88,635	7,006	88,635
2-Jul-09	0	25	0	25	0	-	-	190	25	0	25	4,750	4,513	93,148	4,513	93,148
3-Jul-09	0	25	0	25	0	-	-	0	25	0	25	0	-	93,148	-	93,148
4-Jul-09	0	25	0	25	0	-	-	0	25	0	25	0	-	93,148	-	93,148
5-Jul-09	0	25	0	25	0	-	-	0	25	0	25	0	-	93,148	-	93,148
6-Jul-09	0	25	0	25	0	-	-	130	25	0	25	3,250	3,088	96,235	3,088	96,235
7-Jul-09	0	25	0	25	0	-	-	145	25	0	25	3,625	3,444	99,679	3,444	99,679
8-Jul-09	0	25	0	25	0	-	-	120	25	0	25	3,000	2,850	102,529	2,850	102,529
9-Jul-09	0	25	0	25	0	-	-	95	25	0	25	2,375	2,256	104,785	2,256	104,785
10-Jul-09	0	25	0	25	0	-	-	188	25	0	25	4,700	4,465	109,250	4,465	109,250
11-Jul-09	135	25	0	25	3,375	3,206	3,206	125	25	0	25	3,125	2,969	112,219	6,175	115,425
12-Jul-09	0	25	0	25	0	-	3,206	0	25	0	25	0	-	112,219	-	115,425
13-Jul-09	0	25	0	25	0	-	3,206	0	25	0	25	0	-	112,219	-	115,425
14-Jul-09	0	25	0	25	0	-	3,206	168	25	0	25	4,200	3,990	116,209	3,990	119,415
15-Jul-09	29	25	0	25	725	689	3,895	102	25	0	25	2,550	2,423	118,631	3,111	122,526
16-Jul-09	88	25	0	25	2,200	2,090	5,985	0	25	0	25	0	-	118,631	2,090	124,616
17-Jul-09	0	25	0	25	0	-	5,985	87	25	0	25	2,175	2,066	120,698	2,066	126,683
18-Jul-09	206	25	0	25	5,150	4,893	10,878	0	25	0	25	0	-	120,698	4,893	131,575
19-Jul-09	0	25	0	25	0	-	10,878	0	25	0	25	0	-	120,698	-	131,575
20-Jul-09	0	25	0	25	0	-	10,878	34	25	0	25	850	808	121,505	808	132,383
21-Jul-09	108	25	0	25	2,700	2,565	13,443	41	25	0	25	1,025	974	122,479	3,539	135,921
22-Jul-09	70	25	0	25	1,750	1,663	15,105	108	25	0	25	2,700	2,565	125,044	4,228	140,149
23-Jul-09	58	25	0	25	1,450	1,378	16,483	65	25	0	25	1,625	1,544	126,588	2,921	143,070
24-Jul-09	0	25	0	25	0	-	16,483	81	25	0	25	2,025	1,924	128,511	1,924	144,994
25-Jul-09	22	25	0	25	550	523	17,005	39	25	0	25	975	926	129,438	1,449	146,443
26-Jul-09	0	25	0	25	0	-	17,005	0	25	0	25	0	-	129,438	-	146,443
27-Jul-09	0	25	0	25	0	-	17,005	62	25	0	25	1,550	1,473	130,910	1,473	147,915
28-Jul-09	0	25	0	25	0	-	17,005	40	25	0	25	1,000	950	131,860	950	148,865
29-Jul-09	0	25	0	25	0	-	17,005	105	25	0	25	2,625	2,494	134,354	2,494	151,359
30-Jul-09	0	25	0	25	0	-	17,005	153	25	0	25	3,825	3,634	137,988	3,634	154,993
31-Jul-09	0	25	0	25	0	-	17,005	0	25	0	25	0	-	137,988	-	154,993
1-Aug-09	0	25	0	25	0	-	17,005	186	25	0	25	4,650	4,418	142,405	4,418	159,410

TABLE B-6. SUMMARY OF MECHANICAL EXCAVATION VOLUMES
EXCAVATION EASE OF DIKE 2

	East Embayment							Between Dike 2 and River							TOTAL	
Date	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	Daily Volume (in-place CY)	Cumulative Volume (in-place CY)
2-Aug-09	0	25	0	25	0	-	17,005	0	25	0	25	0	-	142,405	-	159,410
3-Aug-09	0	25	0	25	0	-	17,005	87	25	0	25	2,175	2,066	144,471	2,066	161,476
4-Aug-09	0	25	0	25	0	-	17,005	160	25	0	25	4,000	3,800	148,271	3,800	165,276
5-Aug-09	0	25	0	25	0	-	17,005	0	25	0	25	0	-	148,271	-	165,276
6-Aug-09	78	25	0	25	1,950	1,853	18,858	177	25	0	25	4,425	4,204	152,475	6,056	171,333
7-Aug-09	149	25	0	25	3,725	3,539	22,396	74	25	0	25	1,850	1,758	154,233	5,296	176,629
8-Aug-09	109	25	0	25	2,725	2,589	24,985	44	25	0	25	1,100	1,045	155,278	3,634	180,263
9-Aug-09	0	25	0	25	0	-	24,985	0	25	0	25	0	-	155,278	-	180,263
10-Aug-09	100	25	0	25	2,500	2,375	27,360	86	25	0	25	2,150	2,043	157,320	4,418	184,680
11-Aug-09	52	25	0	25	1,300	1,235	28,595	37	25	0	25	925	879	158,199	2,114	186,794
12-Aug-09	0	25	0	25	0	-	28,595	0	25	0	25	0	-	158,199	-	186,794
13-Aug-09	76	25	0	25	1,900	1,805	30,400	115	25	0	25	2,875	2,731	160,930	4,536	191,330
14-Aug-09	0	25	0	25	0	-	30,400	216	25	0	25	5,400	5,130	166,060	5,130	196,460
15-Aug-09	0	25	0	25	0	-	30,400	136	25	0	25	3,400	3,230	169,290	3,230	199,690
16-Aug-09	0	25	0	25	0	-	30,400	0	25	0	25	0	-	169,290	-	199,690
17-Aug-09	0	25	0	25	0	-	30,400	207	25	0	25	5,175	4,916	174,206	4,916	204,606
18-Aug-09	0	25	0	25	0	-	30,400	163	25	0	25	4,075	3,871	178,078	3,871	208,478
19-Aug-09	0	25	0	25	0	-	30,400	112	25	0	25	2,800	2,660	180,738	2,660	211,138
20-Aug-09	0	25	0	25	0	-	30,400	184	25	0	25	4,600	4,370	185,108	4,370	215,508
21-Aug-09	0	25	0	25	0	-	30,400	172	25	0	25	4,300	4,085	189,193	4,085	219,593
22-Aug-09	0	25	0	25	0	-	30,400	182	25	0	25	4,550	4,323	193,515	4,323	223,915
23-Aug-09	0	25	0	25	0	-	30,400	0	25	0	25	0	-	193,515	-	223,915
24-Aug-09	89	25	0	25	2,225	2,114	32,514	149	25	0	25	3,725	3,539	197,054	5,653	229,568
25-Aug-09	67	25	0	25	1,675	1,591	34,105	215	25	0	25	5,375	5,106	202,160	6,698	236,265
26-Aug-09	0	25	0	25	0	-	34,105	215	25	0	25	5,375	5,106	207,266	5,106	241,371
27-Aug-09	0	25	0	25	0	-	34,105	190	25	0	25	4,750	4,513	211,779	4,513	245,884
28-Aug-09	0	25	0	25	0	-	34,105	240	25	0	25	6,000	5,700	217,479	5,700	251,584
29-Aug-09	41	25	0	25	1,025	974	35,079	235	25	0	25	5,875	5,581	223,060	6,555	258,139
30-Aug-09	0	25	0	25	0	-	35,079	0	25	0	25	0	-	223,060	-	258,139
31-Aug-09	91	25	0	25	2,275	2,161	37,240	285	25	0	25	7,125	6,769	229,829	8,930	267,069
1-Sep-09	19	25	0	25	475	451	37,691	318	25	0	25	7,950	7,553	237,381	8,004	275,073
2-Sep-09	0	25	0	25	0	-	37,691	357	25	0	25	8,925	8,479	245,860	8,479	283,551
3-Sep-09	0	25	0	25	0	-	37,691	311	25	0	25	7,775	7,386	253,246	7,386	290,938
4-Sep-09	0	25	0	25	0	-	37,691	294	25	0	25	7,350	6,983	260,229	6,983	297,920
5-Sep-09	0	25	0	25	0	-	37,691	0	25	0	25	0	-	260,229	-	297,920
6-Sep-09	0	25	0	25	0	-	37,691	0	25	0	25	0	-	260,229	-	297,920
7-Sep-09	0	25	0	25	0	-	37,691	0	25	0	25	0	-	260,229	-	297,920
8-Sep-09	42	25	0	25	1,050	998	38,689	247	25	0	25	6,175	5,866	266,095	6,864	304,784
9-Sep-09	59	25	0	25	1,475	1,401	40,090	173	25	0	25	4,325	4,109	270,204	5,510	310,294
10-Sep-09	105	25	0	25	2,625	2,494	42,584	161	25	0	25	4,025	3,824	274,028	6,318	316,611
11-Sep-09	62	25	0	25	1,550	1,473	44,056	314	25	0	25	7,850	7,458	281,485	8,930	325,541
12-Sep-09	143	25	0	25	3,575	3,396	47,453	191	25	0	25	4,775	4,536	286,021	7,933	333,474
13-Sep-09	0	25	0	25	0	-	47,453	0	25	0	25	0	-	286,021	-	333,474
14-Sep-09	118	25	0	22	2,950	2,803	50,255	243	25	0	22	6,075	5,771	291,793	8,574	342,048
15-Sep-09	59	25	73	22	3,081	2,927	53,182	133	25	108	22	5,701	5,416	297,208	8,343	350,390
16-Sep-09	0	25	109	22	2,398	2,278	55,460	0	25	102	22	2,244	2,132	299,340	4,410	354,800
17-Sep-09	0	25	95	22	2,090	1,986	57,446	0	25	120	22	2,640	2,508	301,848	4,494	359,294
18-Sep-09	0	25	108	22	2,376	2,257	59,703	0	25	233	22	5,126	4,870	306,718	7,127	366,421
19-Sep-09	0	25	162	22	3,564	3,386	63,089	0	25	172	22	3,784	3,595	310,313	6,981	373,401
20-Sep-09	0	25	0	22	0	-	63,089	0	25	0	22	0	-	310,313	-	373,401

TABLE B-6. SUMMARY OF MECHANICAL EXCAVATION VOLUMES
EXCAVATION EASE OF DIKE 2

	East Embayment							Between Dike 2 and River							TOTAL	
Date	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	Daily Volume (in-place CY)	Cumulative Volume (in-place CY)
21-Sep-09	0	25	0	22	0	-	63,089	0	25	0	22	0	-	310,313	-	373,401
22-Sep-09	0	25	108	22	2,376	2,257	65,346	0	25	158	22	3,476	3,302	313,615	5,559	378,961
23-Sep-09	0	25	116	22	2,552	2,424	67,770	0	25	164	22	3,608	3,428	317,043	5,852	384,813
24-Sep-09	0	25	98	22	2,156	2,048	69,818	0	25	156	22	3,432	3,260	320,303	5,309	390,121
25-Sep-09	0	25	123	22	2,706	2,571	72,389	0	25	163	22	3,586	3,407	323,710	5,977	396,099
26-Sep-09	0	25	0	22	0	-	72,389	0	25	0	22	0	-	323,710	-	396,099
27-Sep-09	0	25	0	22	0	-	72,389	0	25	0	22	0	-	323,710	-	396,099
28-Sep-09	0	25	110	22	2,420	2,299	74,688	59	25	130	22	4,335	4,118	327,828	6,417	402,516
29-Sep-09	0	25	81	22	1,782	1,693	76,381	183	25	0	22	4,575	4,346	332,174	6,039	408,555
30-Sep-09	175	25	0	22	4,375	4,156	80,537	111	25	62	22	4,139	3,932	336,106	8,088	416,643
1-Oct-09	183	25	0	22	4,575	4,346	84,883	98	25	60	22	3,770	3,582	339,688	7,928	424,571
2-Oct-09	17	25	160	22	3,945	3,748	88,631	45	25	124	22	3,853	3,660	343,348	7,408	431,979
3-Oct-09	105	25	0	22	2,625	2,494	91,125	123	25	0	22	3,075	2,921	346,269	5,415	437,394
4-Oct-09	0	25	0	22	0	-	91,125	0	25	0	22	0	-	346,269	-	437,394
5-Oct-09	0	25	156	22	3,432	3,260	94,385	0	25	154	22	3,388	3,219	349,488	6,479	443,873
6-Oct-09	0	25	122	22	2,684	2,550	96,935	0	25	110	22	2,420	2,299	351,787	4,849	448,722
7-Oct-09	0	25	59	22	1,298	1,233	98,168	0	25	149	22	3,278	3,114	354,901	4,347	453,069
8-Oct-09	210	25	78	22	6,966	6,618	104,786	0	25	145	22	3,190	3,031	357,932	9,648	462,717
9-Oct-09	62	25	62	22	2,914	2,768	107,554	0	25	251	22	5,522	5,246	363,177	8,014	470,732
10-Oct-09	0	25	0	22	0	-	107,554	0	25	0	22	0	-	363,177	-	470,732
11-Oct-09	0	25	0	22	0	-	107,554	0	25	0	22	0	-	363,177	-	470,732
12-Oct-09	0	25	55	22	1,210	1,150	108,704	0	25	70	22	1,540	1,463	364,640	2,613	473,344
13-Oct-09	0	25	112	22	2,464	2,341	111,045	0	25	156	22	3,432	3,260	367,901	5,601	478,945
14-Oct-09	0	25	11	22	242	230	111,274	0	25	17	22	374	355	368,256	585	479,531
15-Oct-09	0	25	0	22	0	-	111,274	0	25	0	22	0	-	368,256	-	479,531
16-Oct-09	0	25	88	22	1,936	1,839	113,114	0	25	172	22	3,784	3,595	371,851	5,434	484,965
17-Oct-09	0	25	100	22	2,200	2,090	115,204	0	25	135	22	2,970	2,822	374,672	4,912	489,876
18-Oct-09	0	25	0	22	0	-	115,204	0	25	0	22	0	-	374,672	-	489,876
19-Oct-09	0	25	146	22	3,212	3,051	118,255	0	25	135	22	2,970	2,822	377,494	5,873	495,749
20-Oct-09	0	25	112	22	2,464	2,341	120,596	0	25	139	22	3,058	2,905	380,399	5,246	500,995
21-Oct-09	0	25	90	22	1,980	1,881	122,477	160	25	0	22	4,000	3,800	384,199	5,681	506,676
22-Oct-09	0	25	71	22	1,562	1,484	123,961	69	25	52	22	2,869	2,726	386,925	4,209	510,885
23-Oct-09	0	25	44	22	968	920	124,880	29	25	238	22	5,961	5,663	392,588	6,583	517,468
24-Oct-09	0	25	54	22	1,188	1,129	126,009	46	25	170	22	4,890	4,646	397,233	5,774	523,242
25-Oct-09	0	25	0	22	0	-	126,009	0	25	0	22	0	-	397,233	-	523,242
26-Oct-09	0	25	10	22	220	209	126,218	100	25	230	22	7,560	7,182	404,415	7,391	530,633
27-Oct-09	0	25	0	22	0	-	126,218	0	25	165	22	3,630	3,449	407,864	3,449	534,081
28-Oct-09	0	25	59	22	1,298	1,233	127,451	0	25	196	22	4,312	4,096	411,960	5,330	539,411
29-Oct-09	0	25	43	22	946	899	128,350	0	25	110	22	2,420	2,299	414,259	3,198	542,609
30-Oct-09	0	25	0	22	0	-	128,350	0	25	233	22	5,126	4,870	419,129	4,870	547,478
31-Oct-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	419,129	-	547,478
1-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	419,129	-	547,478
2-Nov-09	0	25	0	22	0	-	128,350	0	25	210	22	4,620	4,389	423,518	4,389	551,867
3-Nov-09	0	25	0	22	0	-	128,350	0	25	127	22	2,794	2,654	426,172	2,654	554,522
4-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
5-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
6-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
7-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
8-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
9-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522

TABLE B-6. SUMMARY OF MECHANICAL EXCAVATION VOLUMES
EXCAVATION EASE OF DIKE 2

Date	East Embayment							Between Dike 2 and River							TOTAL	
	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	Daily Volume (in-place CY)	Cumulative Volume (in-place CY)
10-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
11-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
12-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
13-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
14-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
15-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
16-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
17-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
18-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
19-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	426,172	-	554,522
20-Nov-09	0	25	0	22	0	-	128,350	48	25	0	22	1,200	1,140	427,312	1,140	555,662
21-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	427,312	-	555,662
22-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	427,312	-	555,662
23-Nov-09	0	25	0	22	0	-	128,350	57	25	0	22	1,425	1,354	428,666	1,354	557,015
24-Nov-09	0	25	0	22	0	-	128,350	34	25	0	22	850	808	429,473	808	557,823
25-Nov-09	0	25	0	22	0	-	128,350	18	25	0	22	450	428	429,901	428	558,250
26-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
27-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
28-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
29-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
30-Nov-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
1-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
2-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
3-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
4-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
5-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
6-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
7-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	429,901	-	558,250
8-Dec-09	0	25	0	22	0	-	128,350	0	25	23	22	506	481	430,381	481	558,731
9-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
10-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
11-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
12-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
13-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
14-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
15-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
16-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
17-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
18-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
19-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
20-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
21-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
22-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,381	-	558,731
23-Dec-09	0	25	0	22	0	-	128,350	0	25	17	22	374	355	430,737	355	559,086
24-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,737	-	559,086
25-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,737	-	559,086
26-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,737	-	559,086
27-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,737	-	559,086
28-Dec-09	0	25	0	22	0	-	128,350	0	25	7	22	154	146	430,883	146	559,233
29-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233

TABLE B-6. SUMMARY OF MECHANICAL EXCAVATION VOLUMES
EXCAVATION EASE OF DIKE 2

	East Embayment							Between Dike 2 and River							TOTAL	
Date	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	Daily Volume (in-place CY)	Cumulative Volume (in-place CY)
30-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
31-Dec-09	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
1-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
2-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
3-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
4-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
5-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
6-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
7-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
8-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
9-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
10-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
11-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
12-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	430,883	-	559,233
13-Jan-10	0	25	0	22	0	-	128,350	18	25	0	22	450	428	431,310	428	559,660
14-Jan-10	0	25	0	22	0	-	128,350	20	25	0	22	500	475	431,785	475	560,135
15-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	431,785	-	560,135
16-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	431,785	-	560,135
17-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	431,785	-	560,135
18-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	431,785	-	560,135
19-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	431,785	-	560,135
20-Jan-10	0	25	0	22	0	-	128,350	27	25	0	22	675	641	432,427	641	560,776
21-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
22-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
23-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
24-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
25-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
26-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
27-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
28-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
29-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
30-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
31-Jan-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	432,427	-	560,776
1-Feb-10	0	25	0	22	0	-	128,350	0	25	46	22	1,012	961	433,388	961	561,738
2-Feb-10	0	25	0	22	0	-	128,350	0	25	73	22	1,606	1,526	434,914	1,526	563,264
3-Feb-10	0	25	0	22	0	-	128,350	0	25	74	22	1,628	1,547	436,460	1,547	564,810
4-Feb-10	0	25	0	22	0	-	128,350	0	25	87	22	1,914	1,818	438,279	1,818	566,628
5-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	438,279	-	566,628
6-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	438,279	-	566,628
7-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	438,279	-	566,628
8-Feb-10	0	25	0	22	0	-	128,350	0	25	120	22	2,640	2,508	440,787	2,508	569,136
9-Feb-10	0	25	0	22	0	-	128,350	0	25	192	22	4,224	4,013	444,800	4,013	573,149
10-Feb-10	0	25	0	22	0	-	128,350	0	25	183	22	4,026	3,825	448,624	3,825	576,974
11-Feb-10	0	25	0	22	0	-	128,350	0	25	39	22	858	815	449,439	815	577,789
12-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	449,439	-	577,789
13-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	449,439	-	577,789
14-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	449,439	-	577,789
15-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	449,439	-	577,789
16-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	449,439	-	577,789
17-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	449,439	-	577,789

TABLE B-6. SUMMARY OF MECHANICAL EXCAVATION VOLUMES
EXCAVATION EASE OF DIKE 2

	East Embayment							Between Dike 2 and River							TOTAL	
Date	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	Daily Volume (in-place CY)	Cumulative Volume (in-place CY)
18-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	449,439	-	577,789
19-Feb-10	0	15	0	22	0	-	128,350	81	15	0	22	1,215	1,154	450,594	1,154	578,943
20-Feb-10	0	15	0	22	0	-	128,350	122	15	0	22	1,830	1,739	452,332	1,739	580,682
21-Feb-10	0	15	0	22	0	-	128,350	51	15	0	22	765	727	453,059	727	581,409
22-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	453,059	-	581,409
23-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	453,059	-	581,409
24-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	453,059	-	581,409
25-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	453,059	-	581,409
26-Feb-10	0	25	0	22	0	-	128,350	9	25	0	22	225	214	453,273	214	581,622
27-Feb-10	0	25	0	22	0	-	128,350	6	25	0	22	150	143	453,415	143	581,765
28-Feb-10	0	25	0	22	0	-	128,350	0	25	0	22	0	-	453,415	-	581,765
1-Mar-10	32	20	0	20	640	608	128,958	0	20	0	20	0	-	453,415	608	582,373
2-Mar-10	77	20	0	20	1,540	1,463	130,421	29	20	0	20	580	551	453,966	2,014	584,387
3-Mar-10	0	20	0	20	0	-	130,421	0	20	0	20	0	-	453,966	-	584,387
4-Mar-10	42	20	0	20	840	798	131,219	75	20	0	20	1,500	1,425	455,391	2,223	586,610
5-Mar-10	106	20	0	20	2,120	2,014	133,233	16	20	42	20	1,160	1,102	456,493	3,116	589,726
6-Mar-10	166	20	0	20	3,320	3,154	136,387	19	20	0	20	380	361	456,854	3,515	593,241
7-Mar-10	78	20	0	20	1,560	1,482	137,869	0	20	34	20	680	646	457,500	2,128	595,369
8-Mar-10	134	20	0	20	2,680	2,546	140,415	29	20	0	20	580	551	458,051	3,097	598,466
9-Mar-10	148	20	0	20	2,960	2,812	143,227	20	20	0	20	400	380	458,431	3,192	601,658
10-Mar-10	172	20	0	20	3,440	3,268	146,495	6	20	0	20	120	114	458,545	3,382	605,040
11-Mar-10	130	20	0	20	2,600	2,470	148,965	22	20	0	20	440	418	458,963	2,888	607,928
12-Mar-10	81	20	0	20	1,620	1,539	150,504	0	20	0	20	0	-	458,963	1,539	609,467
13-Mar-10	141	20	0	20	2,820	2,679	153,183	69	20	0	20	1,380	1,311	460,274	3,990	613,457
14-Mar-10	141	20	0	20	2,820	2,679	155,862	0	20	0	20	0	-	460,274	2,679	616,136
15-Mar-10	148	20	0	20	2,960	2,812	158,674	0	20	0	20	0	-	460,274	2,812	618,948
16-Mar-10	123	20	0	20	2,460	2,337	161,011	32	20	0	20	640	608	460,882	2,945	621,893
17-Mar-10	120	20	0	20	2,400	2,280	163,291	27	20	0	20	540	513	461,395	2,793	624,686
18-Mar-10	132	20	0	20	2,640	2,508	165,799	42	20	0	20	840	798	462,193	3,306	627,992
19-Mar-10	103	20	0	20	2,060	1,957	167,756	136	20	0	20	2,720	2,584	464,777	4,541	632,533
20-Mar-10	164	20	0	20	3,280	3,116	170,872	48	20	0	20	960	912	465,689	4,028	636,561
21-Mar-10	144	20	0	20	2,880	2,736	173,608	0	20	0	20	0	-	465,689	2,736	639,297
22-Mar-10	260	20	0	20	5,200	4,940	178,548	22	20	0	20	440	418	466,107	5,358	644,655
23-Mar-10	139	20	0	20	2,780	2,641	181,189	20	20	0	20	400	380	466,487	3,021	647,676
24-Mar-10	234	20	0	20	4,680	4,446	185,635	24	20	0	20	480	456	466,943	4,902	652,578
25-Mar-10	0	20	0	20	0	-	185,635	0	20	0	20	0	-	466,943	-	652,578
26-Mar-10	193	20	0	20	3,860	3,667	189,302	0	20	0	20	0	-	466,943	3,667	656,245
27-Mar-10	253	20	0	20	5,060	4,807	194,109	0	20	0	20	0	-	466,943	4,807	661,052
28-Mar-10	0	20	0	20	0	-	194,109	0	20	0	20	0	-	466,943	-	661,052
29-Mar-10	65	20	0	20	1,300	1,235	195,344	0	20	0	20	0	-	466,943	1,235	662,287
30-Mar-10	150	20	0	20	3,000	2,850	198,194	44	20	0	20	880	836	467,779	3,686	665,973
31-Mar-10	102	20	0	20	2,040	1,938	200,132	45	20	0	20	900	855	468,634	2,793	668,766
1-Apr-10	69	20	0	20	1,380	1,311	201,443	87	20	0	20	1,740	1,653	470,287	2,964	671,730
2-Apr-10	120	20	0	20	2,400	2,280	203,723	137	20	0	20	2,740	2,603	472,890	4,883	676,613
3-Apr-10	124	20	0	20	2,480	2,356	206,079	0	20	0	20	0	-	472,890	2,356	678,969
4-Apr-10	0	20	0	20	0	-	206,079	0	20	0	20	0	-	472,890	-	678,969
5-Apr-10	143	20	0	20	2,860	2,717	208,796	27	20	0	20	540	513	473,403	3,230	682,199
6-Apr-10	173	20	0	20	3,460	3,287	212,083	49	20	0	20	980	931	474,334	4,218	686,417
7-Apr-10	142	20	0	20	2,840	2,698	214,781	80	20	0	20	1,600	1,520	475,854	4,218	690,635
8-Apr-10	0	20	0	20	0	-	214,781	0	20	0	20	0	-	475,854	-	690,635

TABLE B-6. SUMMARY OF MECHANICAL EXCAVATION VOLUMES
EXCAVATION EASE OF DIKE 2

	East Embayment							Between Dike 2 and River							TOTAL	
Date	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	No. of Trucks (dry load)	Truck Load (CY/ea)	No. of Trucks (wet load)	Truck Load (CY/ea)	Daily Volume (loose CY)	Daily Volume (in-place CY)	Cumulative Volume (CY)	Daily Volume (in-place CY)	Cumulative Volume (in-place CY)
9-Apr-10	163	20	0	20	3,260	3,097	217,878	69	20	0	20	1,380	1,311	477,165	4,408	695,043
10-Apr-10	163	20	0	20	3,260	3,097	220,975	55	20	0	20	1,100	1,045	478,210	4,142	699,185
11-Apr-10	132	20	0	20	2,640	2,508	223,483	0	20	0	20	0	-	478,210	2,508	701,693
12-Apr-10	144	20	0	20	2,880	2,736	226,219	64	20	0	20	1,280	1,216	479,426	3,952	705,645
13-Apr-10	144	20	0	20	2,880	2,736	228,955	71	20	0	20	1,420	1,349	480,775	4,085	709,730
14-Apr-10	140	20	0	20	2,800	2,660	231,615	76	20	0	20	1,520	1,444	482,219	4,104	713,834
15-Apr-10	34	20	0	20	680	646	232,261	88	20	0	20	1,760	1,672	483,891	2,318	716,152
16-Apr-10	89	20	0	20	1,780	1,691	233,952	193	20	0	20	3,860	3,667	487,558	5,358	721,510
17-Apr-10	0	20	0	20	0	-	233,952	119	20	0	20	2,380	2,261	489,819	2,261	723,771
18-Apr-10	0	20	0	20	0	-	233,952	0	20	0	20	0	-	489,819	-	723,771
19-Apr-10	139	20	0	20	2,780	2,641	236,593	0	20	0	20	0	-	489,819	2,641	726,412
20-Apr-10	37	20	16	20	1,060	1,007	237,600	0	20	0	20	0	-	489,819	1,007	727,419
21-Apr-10	66	20	0	20	1,320	1,254	238,854	53	20	0	20	1,060	1,007	490,826	2,261	729,680
22-Apr-10	96	20	0	20	1,920	1,824	240,678	0	20	0	20	0	-	490,826	1,824	731,504
23-Apr-10	43	20	0	20	860	817	241,495	0	20	0	20	0	-	490,826	817	732,321
24-Apr-10	0	20	0	20	0	-	241,495	0	20	0	20	0	-	490,826	-	732,321
25-Apr-10	0	20	0	20	0	-	241,495	0	20	0	20	0	-	490,826	-	732,321
26-Apr-10	73	20	0	20	1,460	1,387	242,882	13	20	0	20	260	247	491,073	1,634	733,955
27-Apr-10	0	20	0	20	0	-	242,882	4	20	0	20	80	76	491,149	76	734,031
28-Apr-10	38	20	0	20	760	722	243,604	4	20	0	20	80	76	491,225	798	734,829
29-Apr-10	27	20	0	20	540	513	244,117	6	20	0	20	120	114	491,339	627	735,456
30-Apr-10	29	20	0	20	580	551	244,668	6	20	0	20	120	114	491,453	665	736,121
1-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	491,453	-	736,121
2-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	491,453	-	736,121
3-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	491,453	-	736,121
4-May-10	0	20	0	20	0	-	244,668	30	20	0	20	600	570	492,023	570	736,691
5-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
6-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
7-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
8-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
9-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
10-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
11-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
12-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
13-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
14-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
15-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
16-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
17-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
18-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
19-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
20-May-10	0	20	0	20	0	-	244,668	0	20	0	20	0	-	492,023	-	736,691
Excavation days				**110**							**172**					
TOTAL	**9,033**	**-**	**2,831**	**-**	**257,545**	**244,668**	**244,668**	**15,889**	**-**	**6,053**	**-**	**517,919**	**492,023**	**492,023**	**736,691**	**736,691**
AVERAGE	**-**	**-**	**-**	**-**	**2,341**	**2,224**	**-**	**-**	**-**	**-**	**-**	**3,011**	**2,861**	**-**	**3,919**	**-**

Appendix C
Concurrence Forms

(Located on the Reference DVD)

Appendix D
Polymer Addition Rates

FIGURE D-1 POLYMER ADDITION VS. EFFLUENT TSS

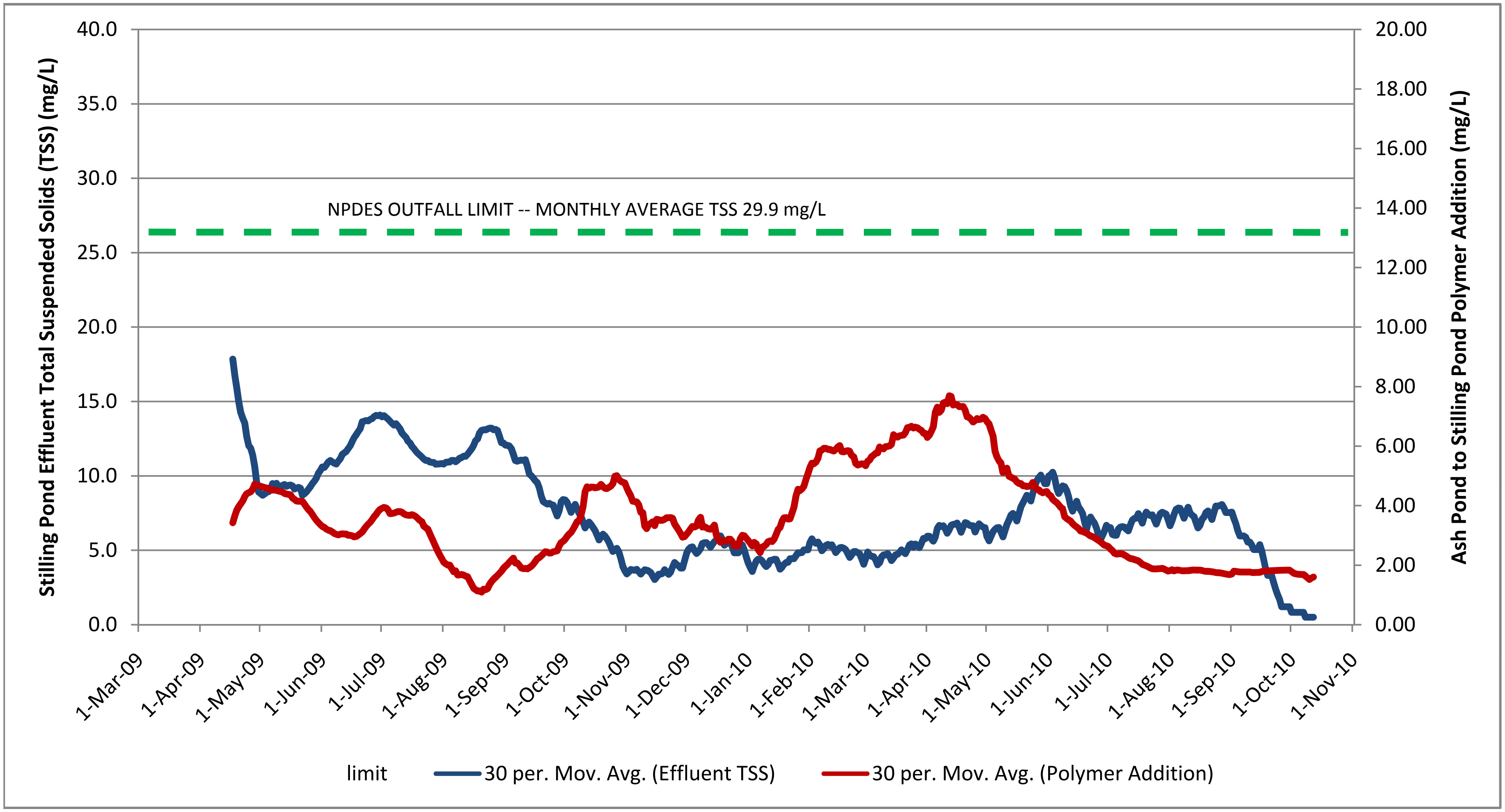

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
19-Mar-09	-	-	-	-	-	-	-	-	-	46.2	-	46.2	-
20-Mar-09	-	-	-	-	-	-	-	-	-	31.7	-	39.0	-
21-Mar-09	-	-	-	-	-	-	-	-	-	35.8	-	37.9	-
22-Mar-09	-	-	-	-	-	-	-	-	-	29.0	-	35.7	-
23-Mar-09	-	-	-	-	-	-	-	-	-	25.8	-	33.7	-
24-Mar-09	-	-	-	-	-	-	-	-	-	20.0	-	31.4	23,189
25-Mar-09	-	-	-	-	-	-	-	200	1.74	35.1	-	31.9	30,397
26-Mar-09	-	-	-	-	-	-	-	370	3.32	24.4	-	31.0	29,410
27-Mar-09	-	-	-	-	-	-	-	383	3.72	8.7	-	28.5	27,229
28-Mar-09	-	-	-	-	-	-	-	200	1.74	18.9	-	27.6	30,397
29-Mar-09	-	-	-	-	-	-	-	-	-	27.8	-	27.6	-
30-Mar-09	-	-	-	-	-	-	-	500	5.46	36.3	-	28.3	24,177
31-Mar-09	-	-	-	-	-	-	-	500	4.49	23.9	-	28.0	29,410
1-Apr-09	-	-	-	-	-	-	-	500	4.49	7.5	-	26.5	29,410
2-Apr-09	-	-	-	-	-	-	-	500	4.49	12.6	-	25.6	29,410
3-Apr-09	-	-	-	-	-	-	-	500	4.49	7.5	-	24.5	29,410
4-Apr-09	-	-	-	-	-	-	-	500	4.49	5.6	-	23.3	29,410
5-Apr-09	-	-	-	-	-	-	-	500	4.49	7.8	-	22.5	29,410
6-Apr-09	-	-	-	-	-	-	-	500	6.21	6.9	-	21.7	21,255
7-Apr-09	-	-	-	-	-	-	-	500	4.49	8.5	-	21.0	29,410
8-Apr-09	-	-	-	-	-	-	-	500	4.49	19.6	-	20.9	29,410
9-Apr-09	-	-	-	-	-	-	-	500	4.49	11.4	-	20.5	29,410
10-Apr-09	-	-	-	-	-	-	-	500	4.49	18.9	-	20.4	29,410
11-Apr-09	-	-	-	-	-	-	-	500	4.49	5.9	-	19.8	29,410
12-Apr-09	-	-	-	-	-	-	-	500	4.49	8.0	-	19.4	29,410
13-Apr-09	-	-	-	-	-	-	-	500	6.21	8.4	-	18.9	21,255
14-Apr-09	-	-	-	-	-	-	-	500	4.49	15.4	-	18.8	29,410
15-Apr-09	-	-	-	-	-	-	-	500	4.49	9.0	-	18.5	29,410
16-Apr-09	-	-	-	-	-	-	-	500	4.49	8.4	-	18.1	29,410
17-Apr-09	-	-	-	-	-	-	-	750	7.01	10.4	-	17.8	28,274
18-Apr-09	-	-	-	-	-	-	-	750	7.01	13.2	-	16.7	28,274
19-Apr-09	-	-	-	-	-	-	-	625	5.61	7.2	-	15.9	29,410
20-Apr-09	-	-	-	-	-	-	-	400	3.59	6.6	-	15.0	29,410

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
21-Apr-09	-	-	-	-	-	-	-	300	2.80	8.5	-	14.3	28,274
22-Apr-09	-	-	-	-	-	-	-	300	2.91	13.9	-	13.9	27,229
23-Apr-09	-	-	-	-	-	-	-	500	4.49	10.2	-	13.6	29,410
24-Apr-09	-	-	-	-	-	-	-	500	4.49	8.1	-	12.7	29,410
25-Apr-09	-	-	-	-	-	-	-	500	4.49	5.8	-	12.0	29,410
26-Apr-09	-	-	-	-	-	-	-	500	4.49	3.9	-	11.9	29,410
27-Apr-09	-	-	-	-	-	-	-	500	4.49	5.0	-	11.4	29,410
28-Apr-09	-	-	-	-	-	-	-	500	5.04	4.5	-	10.6	26,196
29-Apr-09	-	-	-	-	-	-	-	450	4.54	4.8	-	9.6	26,196
30-Apr-09	-	-	-	-	-	-	-	400	3.88	3.9	-	8.9	27,229
1-May-09	-	-	-	-	-	-	-	400	3.88	4.3	-	8.8	27,229
2-May-09	-	-	-	-	-	-	-	400	3.88	9.3	-	8.7	27,229
3-May-09	-	-	-	-	-	-	-	400	3.88	10.3	-	8.8	27,229
4-May-09	-	-	-	-	-	-	-	400	4.03	8.8	-	8.9	26,196
5-May-09	-	-	-	-	-	-	-	450	4.04	8.9	-	8.9	29,410
6-May-09	-	-	-	-	-	-	-	500	4.49	12.6	-	9.1	29,410
7-May-09	-	-	-	-	-	-	-	500	4.49	19.3	-	9.5	29,410
8-May-09	-	-	-	-	-	-	-	500	4.49	18.0	-	9.4	29,410
9-May-09	-	-	-	-	-	-	-	450	4.04	13.5	-	9.5	29,410
10-May-09	-	-	-	-	-	-	-	450	4.04	10.5	-	9.2	29,410
11-May-09	-	-	-	-	-	-	-	400	3.88	8.9	-	9.3	27,229
12-May-09	-	-	-	-	-	-	-	450	4.04	9.2	-	9.4	29,410
13-May-09	-	-	-	-	-	-	-	450	4.72	10.3	-	9.4	25,182
14-May-09	-	-	-	-	-	-	-	450	4.04	11.7	-	9.3	29,410
15-May-09	-	-	-	-	-	-	-	450	4.04	10.9	-	9.4	29,410
16-May-09	-	-	-	-	-	-	-	450	4.04	8.9	-	9.4	29,410
17-May-09	-	-	-	-	-	-	-	400	3.88	8.8	-	9.3	27,229
18-May-09	-	-	-	-	-	-	-	450	5.59	7.1	-	9.1	21,255
19-May-09	-	-	-	-	-	-	-	450	4.04	8.8	-	9.2	29,410
20-May-09	-	-	-	-	-	-	-	350	3.27	8.1	-	9.2	28,274
21-May-09	-	-	-	-	-	-	-	300	2.80	6.6	-	9.2	28,274
22-May-09	-	-	-	-	-	-	-	300	2.80	-	-	9.0	28,274
23-May-09	-	-	-	-	-	-	-	180	1.68	13.3	-	9.1	28,274

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
24-May-09	-	-	-	-	-	-	-	200	1.74	11.7	-	9.2	30,397
25-May-09	-	-	-	-	-	-	-	200	1.74	11.1	-	9.4	30,397
26-May-09	-	-	-	-	-	-	-	200	2.49	9.1	-	9.6	21,255
27-May-09	-	-	-	-	-	-	-	200	1.74	11.4	-	9.8	30,397
28-May-09	-	-	-	-	-	-	-	200	1.74	9.4	-	10.0	30,397
29-May-09	-	-	-	-	-	-	-	200	1.74	11.1	-	10.2	30,397
30-May-09	-	-	-	-	-	-	-	200	1.74	13.4	-	10.5	30,397
31-May-09	-	-	-	-	-	-	-	200	1.74	10.0	-	10.7	30,397
1-Jun-09	-	-	-	-	-	-	-	225	2.10	16.3	-	11.0	28,274
2-Jun-09	-	-	-	-	-	-	-	250	2.85	9.3	-	10.9	23,189
3-Jun-09	-	-	-	-	-	-	-	250	2.34	14.3	-	11.1	28,274
4-Jun-09	-	-	-	-	-	-	-	325	3.04	14.3	-	11.3	28,274
5-Jun-09	-	-	-	-	-	-	-	400	3.88	15.5	-	11.4	27,229
6-Jun-09	-	-	-	-	-	-	-	360	3.36	17.0	-	11.3	28,274
7-Jun-09	-	-	-	-	-	-	-	300	2.80	14.9	-	11.2	28,274
8-Jun-09	-	-	-	-	-	-	-	320	3.23	12.0	-	11.2	26,196
9-Jun-09	-	-	-	117	-	-	24.0	450	3.53	15.8	-	11.4	33,682
10-Jun-09	-	-	-	-	-	-	-	500	4.49	14.1	-	11.5	29,410
11-Jun-09	-	-	-	67	-	-	16.4	500	4.49	17.7	-	11.8	29,410
12-Jun-09	-	-	-	-	-	-	-	500	4.49	13.8	-	11.9	29,410
13-Jun-09	-	-	-	-	-	-	-	400	4.03	14.7	-	12.0	26,196
14-Jun-09	-	-	-	-	-	-	-	300	2.80	16.4	-	12.2	28,274
15-Jun-09	-	-	-	-	-	-	-	400	4.03	14.6	-	12.4	26,196
16-Jun-09	-	-	-	80	-	-	15.3	500	3.25	17.3	-	12.7	40,585
17-Jun-09	-	-	-	-	-	-	-	500	4.49	14.9	-	13.0	29,410
18-Jun-09	-	-	-	106	-	-	15.5	500	4.49	15.1	-	13.2	29,410
19-Jun-09	-	-	-	-	-	-	-	500	4.49	13.9	-	13.4	29,410
20-Jun-09	-	-	-	-	-	-	-	500	4.49	12.5	-	13.6	29,410
21-Jun-09	-	-	-	-	-	-	-	500	4.49	14.1	-	13.6	29,410
22-Jun-09	-	-	-	-	-	-	-	500	4.49	14.4	-	13.7	29,410
23-Jun-09	-	-	-	202	-	-	11.1	500	4.49	13.2	-	13.7	29,410
24-Jun-09	-	-	-	-	-	-	-	500	3.92	10.4	-	13.7	33,682
25-Jun-09	-	-	-	3,390	-	-	8.5	500	4.49	12.1	-	13.8	29,410

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
26-Jun-09	-	-	-	-	-	-	-	500	4.49	13.0	-	13.9	29,410
27-Jun-09	-	-	-	-	-	-	-	450	4.54	13.4	-	14.0	26,196
28-Jun-09	-	-	-	-	-	-	-	400	4.03	13.7	-	14.1	26,196
29-Jun-09	-	-	-	-	-	-	-	450	4.54	12.5	-	14.0	26,196
30-Jun-09	-	-	-	741	-	-	12.9	425	4.12	11.5	-	14.1	27,229
1-Jul-09	-	-	-	-	-	-	-	470	3.25	12.5	-	14.0	38,238
2-Jul-09	-	-	-	5,450	-	-	8.1	385	3.74	12.0	-	14.1	27,229
3-Jul-09	-	-	-	-	-	-	-	200	1.74	10.7	-	13.9	30,397
4-Jul-09	-	-	-	-	-	-	-	120	1.12	11.0	-	13.8	28,274
5-Jul-09	-	-	-	-	-	-	-	-	-	11.2	-	13.7	-
6-Jul-09	-	-	-	-	-	-	-	380	3.55	12.4	-	13.5	28,274
7-Jul-09	-	-	-	-	-	-	-	350	3.27	11.5	-	13.4	28,274
8-Jul-09	-	-	-	-	-	-	-	425	3.97	15.0	-	13.5	28,274
9-Jul-09	-	-	-	-	-	-	-	500	4.20	11.1	-	13.4	31,483
10-Jul-09	-	-	-	-	-	-	-	500	4.49	8.7	-	13.2	29,410
11-Jul-09	-	-	-	-	-	-	-	400	3.88	8.9	-	12.9	27,229
12-Jul-09	-	-	-	-	-	-	-	300	2.91	9.4	-	12.7	27,229
13-Jul-09	-	-	-	-	-	-	-	300	2.91	10.3	-	12.6	27,229
14-Jul-09	-	-	-	-	-	-	-	340	2.50	8.8	-	12.3	35,935
15-Jul-09	-	-	-	-	-	-	-	400	3.88	11.0	-	12.2	27,229
16-Jul-09	-	-	-	-	-	-	-	400	3.88	10.4	-	12.0	27,229
17-Jul-09	-	-	-	-	-	-	-	400	3.88	10.6	-	11.8	27,229
18-Jul-09	-	-	-	-	-	-	-	350	3.27	9.3	-	11.7	28,274
19-Jul-09	-	-	-	-	-	-	-	270	2.52	9.5	-	11.5	28,274
20-Jul-09	-	-	-	-	-	-	-	280	2.62	9.3	-	11.4	28,274
21-Jul-09	-	-	-	-	-	-	-	280	3.19	10.2	-	11.3	23,189
22-Jul-09	-	-	-	-	-	-	-	-	-	10.3	-	11.1	-
23-Jul-09	-	-	-	-	-	-	-	375	2.85	10.6	-	11.0	34,804
24-Jul-09	-	-	-	-	-	-	-	250	2.43	10.1	-	11.0	27,229
25-Jul-09	-	-	-	-	-	-	-	-	-	9.1	-	10.9	-
26-Jul-09	-	-	-	-	-	-	-	-	-	12.2	-	10.9	-
27-Jul-09	-	-	-	-	-	-	-	-	-	13.2	-	10.9	-
28-Jul-09	-	-	-	-	-	-	-	-	-	10.3	-	10.8	23,189

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
29-Jul-09	-	-	-	-	-	-	-	-	-	12.9	-	10.8	-
30-Jul-09	-	-	-	-	-	-	-	-	-	11.5	-	10.8	-
31-Jul-09	-	-	-	-	-	-	-	-	-	13.3	-	10.8	-
1-Aug-09	-	-	-	-	-	-	-	-	-	10.9	-	10.8	28,274
2-Aug-09	-	-	-	-	-	-	-	-	-	14.3	-	10.9	28,274
3-Aug-09	-	-	-	97	-	-	30.9	-	-	11.7	-	10.9	31,483
4-Aug-09	-	-	-	92	-	-	27.3	-	-	11.2	-	10.9	25,182
5-Aug-09	-	-	-	-	-	-	-	-	-	15.7	-	11.0	25,182
6-Aug-09	-	-	-	130	-	-	-	-	-	11.6	-	11.0	24,177
7-Aug-09	-	-	-	136	-	-	-	420	4.99	12.2	-	11.0	22,216
8-Aug-09	-	-	-	69	-	-	-	-	-	14.4	-	11.1	24,177
9-Aug-09	-	-	-	-	-	-	-	420	4.59	12.5	-	11.2	24,177
10-Aug-09	-	-	-	102	-	-	-	420	4.24	10.3	-	11.2	26,196
11-Aug-09	-	-	-	89	-	-	-	300	2.35	12.1	-	11.3	33,682
12-Aug-09	-	-	-	196	-	-	-	240	1.82	10.1	-	11.3	34,804
13-Aug-09	-	-	-	270	-	-	-	240	1.88	13.1	-	11.5	33,682
14-Aug-09	-	-	-	272	-	-	-	-	-	16.2	-	11.6	31,483
15-Aug-09	-	-	-	214	-	-	-	-	-	15.7	-	11.8	33,682
16-Aug-09	-	-	-	-	-	-	-	-	-	17.9	-	12.1	34,804
17-Aug-09	-	-	-	104	-	-	-	200	2.02	18.7	-	12.4	26,196
18-Aug-09	-	-	-	72	-	-	-	200	1.13	13.0	-	12.5	46,657
19-Aug-09	-	-	-	730	-	-	-	350	2.66	21.1	-	12.9	34,804
20-Aug-09	-	-	-	2,400	-	-	-	300	1.90	15.7	-	13.1	41,779
21-Aug-09	-	-	-	2,080	-	-	-	400	3.04	11.4	-	13.1	34,804
22-Aug-09	-	-	-	1,160	-	-	-	400	2.26	10.4	-	13.1	46,657
23-Aug-09	-	-	-	-	-	-	-	400	3.48	12.0	-	13.2	30,397
24-Aug-09	-	-	-	1,500	-	-	-	425	4.12	10.8	-	13.2	27,229
25-Aug-09	-	-	-	614	-	-	-	425	3.12	12.0	-	13.2	35,935
26-Aug-09	-	-	-	1,280	-	-	-	370	2.21	10.1	-	13.1	44,198
27-Aug-09	-	-	-	1,660	-	-	-	340	1.93	11.0	-	13.1	46,657
28-Aug-09	-	-	-	8,980	-	-	-	340	2.03	10.8	-	13.1	44,198
29-Aug-09	-	-	-	3,440	-	-	-	340	1.98	-	-	13.1	45,423
30-Aug-09	-	-	-	-	-	-	-	340	2.21	-	-	13.1	40,585

TABLE D-1 POLYMER ADDITION RATES

Date	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
31-Aug-09	-	-	-	32,200	-	-	-	340	3.05	10.5	-	13.1	29,410
1-Sep-09	-	-	-	20,600	-	-	30.0	340	1.93	9.9	-	12.9	46,657
2-Sep-09	-	-	-	1,540	-	-	25.0	340	1.93	11.4	-	12.9	46,657
3-Sep-09	-	-	-	69,300	-	-	45.0	340	2.09	9.7	-	12.9	42,982
4-Sep-09	-	-	-	160,000	-	-	9.0	340	2.09	10.1	-	12.7	42,982
5-Sep-09	-	-	-	-	-	-	-	340	2.09	-	-	12.7	42,982
6-Sep-09	-	-	-	-	-	-	-	-	-	-	-	12.7	27,229
7-Sep-09	-	-	-	-	-	-	-	-	-	13.2	-	12.7	24,177
8-Sep-09	-	-	-	1,000	-	-	32.0	310	2.14	14.1	-	12.7	38,238
9-Sep-09	-	-	-	18,200	-	-	25.0	300	1.70	10.7	-	12.8	46,657
10-Sep-09	-	-	-	27,600	-	-	27.0	320	1.81	11.4	-	12.7	46,657
11-Sep-09	-	-	-	32,000	170	0.99	33.0	320	1.86	11.8	-	12.8	45,423
12-Sep-09	-	-	-	9,740	247	1.47	30.0	265	1.58	-	-	12.8	44,198
13-Sep-09	-	-	-	-	210	1.29	-	210	1.29	-	-	12.6	42,982
14-Sep-09	-	-	-	47,400	210	1.26	-	210	1.26	12.7	-	12.5	44,198
15-Sep-09	-	-	-	15,300	255	1.57	70.0	355	2.18	13.1	-	12.3	42,982
16-Sep-09	-	-	-	17,000	300	2.01	47.0	700	4.69	13.5	-	12.1	39,405
17-Sep-09	-	-	-	13,700	300	1.70	53.0	700	3.96	9.0	-	11.9	46,657
18-Sep-09	-	-	-	23,200	300	1.90	43.0	600	3.79	10.1	-	11.5	41,779
19-Sep-09	-	-	-	20,900	300	1.79	-	600	3.59	-	-	11.3	44,198
20-Sep-09	-	-	-	-	300	2.52	-	600	5.03	-	-	11.3	31,483
21-Sep-09	-	-	-	8,820	300	2.43	-	550	4.46	7.7	-	11.2	32,578
22-Sep-09	-	-	-	18,700	300	1.70	30.0	550	3.11	9.5	-	11.1	46,657
23-Sep-09	-	-	-	43,200	300	1.84	56.0	500	3.07	12.6	-	11.1	42,982
24-Sep-09	-	-	-	104,200	300	1.95	54.0	500	3.25	9.3	-	11.0	40,585
25-Sep-09	-	-	-	30,800	300	2.61	34.0	400	3.48	9.0	-	11.0	30,397
26-Sep-09	-	-	-	-	300	1.74	74.0	400	2.33	-	-	11.0	45,423
27-Sep-09	-	-	-	-	300	1.95	-	400	2.60	-	-	11.0	40,585
28-Sep-09	-	-	-	36,000	400	4.56	70.0	600	6.84	10.4	-	10.9	23,189
29-Sep-09	-	-	-	26,000	550	3.92	175.0	775	5.52	18.1	-	11.3	37,080
30-Sep-09	-	-	-	32,000	800	5.06	129.0	700	4.43	15.2	-	11.5	41,779
1-Oct-09	-	-	-	-	800	5.21	104.0	600	3.91	8.9	-	11.4	40,585
2-Oct-09	-	-	-	35,600	800	5.70	100.0	700	4.99	6.2	-	11.2	37,080

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
3-Oct-09	-	-	-	-	800	5.88	109.5	600	4.41	-	8.0	11.3	35,935
4-Oct-09	-	-	-	-	800	4.92	72.5	600	3.69	-	4.0	11.3	42,982
5-Oct-09	-	-	-	247,200	800	7.19	88.0	600	5.39	8.0	12.0	11.2	29,410
6-Oct-09	-	-	-	-	700	4.69	82.0	550	3.69	8.1	8.0	11.0	39,405
7-Oct-09	-	-	-	-	600	3.69	142.5	600	3.69	4.2	4.0	10.6	42,982
8-Oct-09	-	-	-	137,400	450	2.55	127.0	550	3.11	5.0	8.0	10.2	46,657
9-Oct-09	-	-	-	19,500	300	4.51	30.0	500	7.52	4.6	6.0	9.9	17,557
10-Oct-09	-	-	-	-	300	5.97	-	500	9.94	-	-	9.9	13,284
11-Oct-09	-	-	-	-	300	13.04	-	400	17.39	-	-	9.8	6,077
12-Oct-09	-	-	-	131,400	300	6.35	22.0	300	6.35	5.9	6.0	9.6	12,481
13-Oct-09	-	-	-	64,800	300	3.57	56.0	-	-	5.8	8.0	9.4	22,216
14-Oct-09	-	-	-	57,600	300	2.35	56.0	300	2.35	8.2	8.0	9.2	33,682
15-Oct-09	-	-	-	34,800	300	2.21	112.0	300	2.21	7.0	6.0	8.9	35,935
16-Oct-09	-	-	-	30,000	300	3.90	84.0	300	3.90	7.2	8.0	8.6	20,308
17-Oct-09	-	-	-	30,800	300	4.29	64.0	300	4.29	-	8.0	8.6	18,459
18-Oct-09	-	-	-	-	300	4.51	30.0	300	4.51	-	6.0	8.5	17,557
19-Oct-09	-	-	-	79,700	300	5.97	38.0	300	5.97	5.8	6.0	8.4	13,284
20-Oct-09	-	-	-	95,400	300	2.80	42.0	300	2.80	5.8	6.0	8.3	28,274
21-Oct-09	-	-	-	207,000	300	2.80	39.0	300	2.80	4.1	6.0	8.1	28,274
22-Oct-09	-	-	-	157,300	300	2.80	34.0	300	2.80	4.1	6.0	7.9	28,274
23-Oct-09	-	-	-	187,800	300	4.29	54.0	300	4.29	5.1	6.0	7.5	18,459
24-Oct-09	-	-	-	256,500	300	4.51	44.0	300	4.51	-	4.0	7.5	17,557
25-Oct-09	-	-	-	-	300	5.97	30.0	300	5.97	-	4.0	7.4	13,284
26-Oct-09	-	-	-	162,800	300	9.87	46.0	300	9.87	2.3	4.0	7.1	8,034
27-Oct-09	-	-	-	162,801	300	3.15	74.2	300	3.15	3.9	8.2	7.0	25,182
28-Oct-09	-	-	-	159,924	300	3.03	50.0	300	3.03	2.9	4.0	6.7	26,196
29-Oct-09	-	-	-	49,000	300	3.03	76.0	350	3.53	4.4	4.0	6.0	26,196
30-Oct-09	-	-	-	60,300	300	2.69	52.0	400	3.59	-	12.1	5.6	29,410
31-Oct-09	-	-	-	92,644	300	2.35	66.8	400	3.14	-	6.1	5.4	33,682
1-Nov-09	-	-	-	1,077	300	3.57	14.1	-	-	-	2.0	5.4	22,216
2-Nov-09	-	-	-	214,880	300	8.39	30.2	-	-	3.9	10.2	5.3	9,443
3-Nov-09	-	-	-	114,000	150	2.15	77.6	-	-	5.2	14.1	5.3	18,459
4-Nov-09	-	-	-	603,000	-	-	52.5	-	-	6.9	10.1	5.3	26,196

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
5-Nov-09	-	-	-	167,000	150	1.51	113.0	325	3.28	7.5	12.0	5.2	26,196
6-Nov-09	-	-	-	30,200	300	3.03	79.1	350	3.53	6.0	6.1	5.3	26,196
7-Nov-09	-	-	-	28,200	300	3.15	50.5	-	-	-	6.0	5.3	25,182
8-Nov-09	-	-	-	17,300	300	4.09	22.2	-	-	-	6.1	5.4	19,375
9-Nov-09	-	-	-	-	300	9.87	12.1	300	9.87	4.4	6.1	5.3	8,034
10-Nov-09	-	425	4.19	4,780	300	3.15	88.0	350	3.67	4.5	4.0	5.3	25,182
11-Nov-09	-	400	3.94	5,200	300	2.91	60.0	400	3.88	4.9	8.0	5.2	27,229
12-Nov-09	-	400	3.79	46,400	300	2.91	132.0	400	3.88	4.0	4.0	5.1	27,229
13-Nov-09	-	400	3.79	17,100	300	2.80	130.0	400	3.74	5.3	6.1	5.0	28,274
14-Nov-09	-	600	5.69	9,820	300	2.52	43.7	450	3.78	-	6.0	4.9	31,483
15-Nov-09	-	-	-	8,920	300	2.43	32.0	-	-	-	4.0	4.8	32,578
16-Nov-09	-	600	12.19	53,500	150	3.17	60.9	500	10.58	4.7	8.1	4.8	12,481
17-Nov-09	-	500	4.93	-	150	1.26	131.0	500	4.20	6.2	4.1	4.9	31,483
18-Nov-09	-	450	5.00	39,700	225	2.36	129.2	500	5.25	6.0	10.2	4.9	25,182
19-Nov-09	-	300	2.85	18,600	-	-	242.0	300	3.15	7.1	20.2	4.9	25,182
20-Nov-09	-	-	-	38,100	300	3.15	195.3	350	3.67	11.4	10.4	5.3	25,182
21-Nov-09	-	-	-	5,342	300	3.28	188.9	400	4.37	-	9.9	5.3	24,177
22-Nov-09	-	-	-	338	300	3.15	57.8	400	4.20	-	6.4	5.3	25,182
23-Nov-09	-	-	-	30,300	300	3.15	65.8	450	4.72	4.7	8.1	5.3	25,182
24-Nov-09	-	400	3.53	27,300	300	3.15	196.7	500	5.25	10.2	10.3	5.5	25,182
25-Nov-09	-	400	5.30	10,000	300	3.15	214.9	400	4.20	11.2	18.2	6.0	25,182
26-Nov-09	-	-	-	10,500	300	3.57	91.5	-	-	-	8.1	6.1	22,216
27-Nov-09	-	-	-	5,600	300	4.29	169.2	-	-	-	6.3	6.2	18,459
28-Nov-09	-	-	-	3,200	300	4.29	106.5	-	-	-	16.2	6.3	18,459
29-Nov-09	-	-	-	16,000	300	5.02	169.7	-	-	-	20.5	6.3	15,798
30-Nov-09	-	400	5.83	30,600	300	3.57	125.3	300	3.57	15.0	6.1	6.8	22,216
1-Dec-09	-	400	3.53	29,400	300	2.52	140.0	300	2.52	14.6	6.4	7.2	31,483
2-Dec-09	-	400	3.53	41,600	300	2.35	200.0	300	2.35	11.9	14.5	7.6	33,682
3-Dec-09	-	400	3.94	26,200	300	2.80	149.0	300	2.80	9.3	12.3	7.8	28,274
4-Dec-09	-	400	3.66	30,800	300	2.69	183.0	300	2.69	8.0	8.1	7.8	29,410
5-Dec-09	-	-	-	37,100	300	2.69	99.0	300	2.69	-	8.3	7.9	29,410
6-Dec-09	-	-	-	33,400	300	4.51	90.3	300	4.51	-	4.1	8.0	17,557
7-Dec-09	-	300	6.93	35,000	300	5.97	69.5	300	5.97	3.6	10.4	7.7	13,284

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
8-Dec-09	-	300	3.33	41,800	300	2.80	166.7	300	2.80	5.8	14.3	7.6	28,274
9-Dec-09	-	300	2.65	2,207	300	2.61	-	-	-	15.3	12.8	8.2	30,397
10-Dec-09	-	300	2.85	2,200	300	4.09	50.0	300	4.09	6.3	6.3	8.3	19,375
11-Dec-09	-	300	3.07	55,100	300	2.69	80.0	300	2.69	4.9	8.1	8.3	29,410
12-Dec-09	-	300	6.09	67,700	300	2.91	160.0	300	2.91	-	12.2	8.5	27,229
13-Dec-09	-	300	3.79	82,000	300	3.28	135.0	300	3.28	-	8.2	8.7	24,177
14-Dec-09	-	300	2.65	27,100	300	5.30	57.0	300	5.30	5.7	10.0	8.5	14,945
15-Dec-09	-	300	3.07	22,600	300	2.69	81.0	300	2.69	5.6	14.3	8.4	29,410
16-Dec-09	-	-	-	44,000	300	2.43	85.0	-	-	8.5	6.1	8.6	32,578
17-Dec-09	-	-	-	40,000	300	2.69	94.0	-	-	9.2	14.2	8.7	29,410
18-Dec-09	-	300	2.10	25,800	300	2.35	63.0	350	2.75	10.5	12.3	8.9	33,682
19-Dec-09	-	300	2.31	35,200	300	4.29	73.0	350	5.01	-	10.2	9.0	18,459
20-Dec-09	-	300	2.65	35,100	300	2.69	69.0	300	2.69	-	16.2	8.9	29,410
21-Dec-09	-	300	2.96	2,000	300	4.29	73.0	300	4.29	3.0	4.1	8.6	18,459
22-Dec-09	-	300	2.85	14,300	300	6.35	76.0	300	6.35	7.7	10.2	8.6	12,481
23-Dec-09	-	-	-	10,400	150	3.17	95.0	225	4.76	-	15.0	8.8	12,481
24-Dec-09	-	-	-	1,400	-	-	21.0	150	2.81	-	17.2	8.7	14,106
25-Dec-09	-	-	-	-	-	-		-	-	-	-	8.5	10,924
26-Dec-09	-	-	-	200	-	-	64.0	-	-	-	21.7	8.5	10,174
27-Dec-09	-	-	-	163	-	-	40.0	-	-	-	8.5	8.5	26,196
28-Dec-09	-	300	9.31	25,000	300	7.25	87.0	300	7.25	6.1	8.5	8.4	10,924
29-Dec-09	-	300	3.97	51,600	300	3.42	60.0	300	3.42	9.8	10.2	8.5	23,189
30-Dec-09	-	300	3.63	48,900	300	3.15	34.0	300	3.15	5.3	4.2	8.0	25,182
31-Dec-09	-	-	-	85,500	-	-	78.0	-	-	-	12.2	7.6	11,696
1-Jan-10	-	-	-	800	-	-	48.0	-	-	-	8.2	7.3	11,696
2-Jan-10	-	-	-	7,100	-	-	53.0	-	-	-	8.1	7.2	12,481
3-Jan-10	-	-	-	14,700	-	-	60.0	-	-	-	28.9	7.2	12,481
4-Jan-10	-	300	6.93	20,300	300	6.35	41.0	300	6.35	11.2	34.1	7.4	12,481
5-Jan-10	-	300	2.85	7,000	300	3.03	63.0	300	3.03	9.6	8.1	7.5	26,196
6-Jan-10	-	300	3.20	33,600	0	0.00	160.0	-	-	7.4	18.7	7.8	26,196
7-Jan-10	-	300	3.07	36,100	0	0.00	151.0	-	-	5.7	6.4	7.8	27,229
8-Jan-10	-	400	2.89	28,000	500	3.45	138.0	800	5.53	12.0	10.1	7.6	38,238
9-Jan-10	-	400	3.66	21,680	600	4.15	258.0	700	4.84	-	6.0	7.6	38,238

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
10-Jan-10	-	400	2.64	8,600	0	0.00	222.0	700	4.43	-	8.2	7.8	41,779
11-Jan-10	-	300	2.47	1,200	285	2.39	11.0	700	5.87	3.4	6.2	7.5	31,483
12-Jan-10	-	300	2.10	36,500	350	2.35	494.0	600	4.02	8.9	8.0	7.6	39,405
13-Jan-10	-	350	2.45	23,100	600	4.02	266.0	700	4.69	6.1	8.1	7.6	39,405
14-Jan-10	-	400	2.49	55,500	800	4.92	136.3	800	4.92	7.7	8.0	7.8	42,982
15-Jan-10	-	400	2.72	68,900	800	4.92	348.0	800	4.92	8.0	8.1	7.7	42,982
16-Jan-10	-	-	-	42,700	800	5.21	287.0	800	5.21	-	6.0	7.7	40,585
17-Jan-10	-	-	-	11,300	800	4.53	210.0	800	4.53	-	8.2	7.5	46,657
18-Jan-10	-	-	-	22,600	600	8.59	120.0	800	11.45	4.1	8.1	7.3	18,459
19-Jan-10	-	-	-	26,800	600	4.41	180.6	800	5.88	5.5	12.5	7.1	35,935
20-Jan-10	-	-	-	25,700	600	3.49	234.0	800	4.65	7.0	16.8	7.4	45,423
21-Jan-10	-	-	-	34,450	600	3.59	392.1	800	4.78	8.2	14.6	7.4	44,198
22-Jan-10	-	-	-	32,586	600	3.79	175.2	800	5.06	7.2	6.0	7.4	41,779
23-Jan-10	-	400	3.79	45,689	600	6.56	149.9	800	8.74	-	9.4	7.4	24,177
24-Jan-10	-	400	2.98	18,656	600	4.27	396.0	800	5.70	-	11.1	7.4	37,080
25-Jan-10	-	400	7.22	7,596	600	8.59	52.8	800	11.45	5.9	4.8	7.3	18,459
26-Jan-10	-	400	3.79	27,600	600	5.03	153.4	800	6.71	6.1	8.5	7.3	31,483
27-Jan-10	-	400	2.89	19,800	600	4.41	133.7	800	5.88	5.6	16.6	7.2	35,935
28-Jan-10	-	400	2.72	9,100	600	3.91	160.5	800	5.21	10.5	9.4	7.3	40,585
29-Jan-10	-	400	2.72	12,400	600	4.27	197.6	800	5.70	10.9	9.5	7.6	37,080
30-Jan-10	-	400	2.56	25,700	600	4.15	349.5	1,000	6.91	-	16.4	7.6	38,238
31-Jan-10	-	400	0.00	9,600	600	3.49	195.5	1,000	5.82	-	9.7	7.6	45,423
1-Feb-10	-	700	4.12	4,100	650	4.00	133.5	1,000	6.15	14.4	21.3	7.9	42,982
2-Feb-10	-	600	3.53	27,600	500	2.83	215.0	800	4.53	7.8	7.3	7.9	46,657
3-Feb-10	-	600	5.48	23,950	500	4.05	124.2	700	5.68	5.1	3.5	7.6	32,578
4-Feb-10	-	300	2.17	36,500	500	3.80	124.2	600	4.55	6.5	5.7	7.5	34,804
5-Feb-10	-	600	3.63	13,550	500	3.25	287.6	600	3.91	10.0	8.7	7.6	40,585
6-Feb-10	-	450	6.56	600	500	7.52	89.7	500	7.52	-	3.7	7.7	17,557
7-Feb-10	-	300	4.85	4,750	500	7.92	46.9	400	6.34	-	3.0	7.4	16,668
8-Feb-10	-	-	-	32,300	500	8.36	13.3	400	6.69	4.1	2.6	7.3	15,798
9-Feb-10	-	-	-	36,800	500	5.46	75.2	400	4.37	6.7	4.8	7.3	24,177
10-Feb-10	-	-	-	6,100	500	5.95	213.2	400	4.76	5.6	6.7	7.4	22,216
11-Feb-10	-	-	-	2,105	500	5.04	42.2	400	4.03	5.5	3.3	7.2	26,196

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
12-Feb-10	-	600	5.69	1,700	500	4.67	35.7	400	3.74	8.7	3.3	7.3	28,274
13-Feb-10	-	600	5.69	42,000	500	3.56	224.0	600	4.27	-	6.1	7.3	37,080
14-Feb-10	-	600	4.93	8,800	500	4.05	188.6	800	6.49	-	7.5	7.3	32,578
15-Feb-10	-	600	5.48	9,100	500	4.85	78.4	800	7.76	5.0	3.7	7.2	27,229
16-Feb-10	-	600	5.29	30,700	500	4.20	252.8	700	5.87	4.7	2.8	7.1	31,483
17-Feb-10	-	600	5.69	47,400	500	4.49	202.0	600	5.39	5.0	2.2	7.1	29,410
18-Feb-10	-	700	6.64	24,500	500	4.67	164.0	600	5.61	3.8	1.0	7.0	28,274
19-Feb-10	-	600	6.66	13,833	500	4.49	156.5	600	5.39	3.8	1.0	6.9	29,410
20-Feb-10	-	600	5.69	62,500	500	4.35	110.9	600	5.21	-	3.3	6.8	30,397
21-Feb-10	-	-	-	4,667	500	4.49	93.8	500	4.49	-	9.6	6.8	29,410
22-Feb-10	-	600	7.95	38,167	500	4.49	83.7	500	4.49	5.0	4.4	6.7	29,410
23-Feb-10	-	600	4.93	87,500	500	3.68	104.4	600	4.41	6.7	3.7	6.7	35,935
24-Feb-10	-	600	4.77	16,833	500	3.92	59.3	600	4.71	6.2	2.0	6.7	33,682
25-Feb-10	-	600	5.29	13,500	500	4.20	113.2	600	5.03	3.5	4.0	6.6	31,483
26-Feb-10	-	600	7.95	27,083	500	5.46	79.6	600	6.56	3.8	2.0	6.5	24,177
27-Feb-10	-	600	6.15	95,833	500	4.85	141.8	600	5.82	-	2.3	6.3	27,229
28-Feb-10	-	600	5.69	56,750	500	4.67	135.0	600	5.61	-	7.3	6.1	28,274
1-Mar-10	-	600	5.29	83,750	500	4.20	220.0	600	5.03	11.1	12.8	6.3	31,483
2-Mar-10	-	600	5.91	52,500	500	3.92	316.6	1,325	10.39	13.5	12.1	6.7	33,682
3-Mar-10	-	600	12.19	6,000	400	3.59	232.2	800	7.19	8.4	6.7	6.4	29,410
4-Mar-10	-	-	-	2,167	300	4.09	54.3	600	8.18	5.1	6.9	6.3	19,375
5-Mar-10	-	600	7.95	64,084	400	4.76	29.9	600	7.13	4.6	3.3	6.2	22,216
6-Mar-10	-	450	4.61	29,417	500	5.25	95.1	600	6.29	-	4.5	6.2	25,182
7-Mar-10	-	-	-	1,167	300	3.28	18.7	400	4.37	-	2.6	6.0	24,177
8-Mar-10	-	600	13.86	7,500	400	9.03	11.0	600	13.55	4.3	3.8	6.0	11,696
9-Mar-10	-	600	6.95	4,500	400	3.36	33.2	600	5.03	11.6	7.8	6.2	31,483
10-Mar-10	-	600	6.15	4,417	400	4.03	34.2	600	6.05	8.1	8.1	6.4	26,196
11-Mar-10	-	450	4.61	3,542	400	4.37	17.6	600	6.56	6.4	7.3	6.4	24,177
12-Mar-10	-	300	2.65	2,667	400	3.74	18.4	550	5.14	8.7	15.1	6.5	28,274
13-Mar-10	-	300	2.74	1,333	400	3.48	13.0	500	4.35	-	18.6	6.6	30,397
14-Mar-10	-	300	3.97	500	400	4.37	22.4	500	5.46	-	5.3	6.5	24,177
15-Mar-10	-	400	6.46	25,833	400	11.19	16.8	500	13.99	5.1	4.4	6.4	9,443
16-Mar-10	-	400	5.55	33,750	400	3.74	77.8	500	4.67	6.4	7.7	6.4	28,274

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
17-Mar-10	-	500	4.11	44,084	450	4.92	126.8	650	7.10	6.1	18.7	6.5	24,177
18-Mar-10	-	600	4.93	48,917	500	4.85	94.7	750	7.28	8.5	6.0	6.6	27,229
19-Mar-10	-	600	4.77	20,667	500	3.80	78.0	750	5.69	10.2	9.9	6.9	34,804
20-Mar-10	-	600	4.93	37,084	500	4.20	110.3	700	5.87	-	12.8	7.0	31,483
21-Mar-10	-	300	5.41	7,333	400	5.72	92.0	550	7.87	-	7.7	7.2	18,459
22-Mar-10	-	600	18.62	56,167	300	7.79	48.8	400	10.39	8.2	13.2	7.2	10,174
23-Mar-10	-	600	5.91	2,240	300	3.42	67.6	400	4.56	9.2	9.7	7.3	23,189
24-Mar-10	-	450	6.90	6,700	300	4.29	27.8	400	5.72	7.2	8.8	7.4	18,459
25-Mar-10	-	300	6.49	7,833	300	2.61	14.2	300	2.61	-	7.1	7.4	30,397
26-Mar-10	-	-	-	3,183	-	-	151.0	200	5.60	12.6	13.2	7.7	9,443
27-Mar-10	-	-	-	1,657	-	-	22.4	200	4.52	-	5.4	8.0	11,696
28-Mar-10	-	-	-	1,657	-	-	28.5	200	4.84	-	1.2	8.2	10,924
29-Mar-10	-	-	-	1,657	-	-	33.2	200	4.84	8.4	9.7	8.2	10,924
30-Mar-10	-	500	6.62	50,250	150	1.40	78.8	300	2.80	10.3	8.1	8.3	28,274
31-Mar-10	-	600	7.59	121,167	350	3.27	85.1	500	4.67	10.6	19.9	8.3	28,274
1-Apr-10	-	700	6.90	233,167	400	3.24	90.6	800	6.49	18.4	21.8	8.5	32,578
2-Apr-10	-	700	8.47	85,333	400	3.74	82.9	1,000	9.34	8.3	9.6	8.5	28,274
3-Apr-10	-	600	7.26	38,167	400	4.76	126.6	1,000	11.89	-	7.6	8.7	22,216
4-Apr-10	-	300	3.97	38,167	200	3.17	-	750	11.89	-	-	8.9	16,668
5-Apr-10	-	450	5.69	25,333	400	13.15	38.0	650	21.37	8.6	7.7	8.9	8,034
6-Apr-10	-	600	7.59	13,000	400	4.56	106.9	800	9.11	16.9	14.6	9.2	23,189
7-Apr-10	-	600	7.95	14,453	400	4.76	66.3	700	8.32	10.4	9.7	9.5	22,216
8-Apr-10	-	550	6.65	26,500	400	4.76	44.5	600	7.13	9.2	10.3	9.4	22,216
9-Apr-10	-	500	6.05	12,250	350	8.46	33.5	550	13.30	9.9	13.0	9.5	10,924
10-Apr-10	-	500	8.08	5,785	300	4.51	9.1	500	7.52	-	1.2	9.7	17,557
11-Apr-10	-	250	5.08	19,211	300	4.29	34.6	250	3.58	-	9.3	9.7	18,459
12-Apr-10	-	450	16.58	10,858	350	11.51	19.4	375	12.33	6.9	5.3	9.6	8,034
13-Apr-10	-	600	5.29	28,996	400	3.48	26.5	550	4.78	9.0	9.1	9.5	30,397
14-Apr-10	-	600	5.29	33,034	400	3.59	72.4	600	5.39	6.9	6.8	9.6	29,410
15-Apr-10	-	600	5.69	34,685	400	3.59	46.4	600	5.39	7.0	9.1	9.7	29,410
16-Apr-10	-	600	6.15	17,771	400	4.37	26.3	600	6.56	8.3	6.3	9.8	24,177
17-Apr-10	-	600	5.69	6,412	400	3.59	41.5	600	5.39	-	7.4	9.8	29,410
18-Apr-10	-	600	6.15	8,436	300	2.91	21.3	600	5.82	-	9.6	9.8	27,229

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
19-Apr-10	-	600	4.93	15,450	300	5.97	27.1	300	5.97	10.4	10.5	9.8	13,284
20-Apr-10	-	550	4.52	31,237	400	3.48	39.4	450	3.91	9.0	7.3	9.8	30,397
21-Apr-10	-	500	5.33	26,817	400	3.48	45.3	450	3.91	6.9	8.0	9.7	30,397
22-Apr-10	-	500	4.11	65,333	400	3.14	62.7	500	3.92	5.7	8.7	9.6	33,682
23-Apr-10	-	500	3.98	9,500	400	3.36	41.7	450	3.78	5.8	8.9	9.5	31,483
24-Apr-10	-	250	2.06	27,333	400	3.48	38.7	-	-	-	8.0	9.5	30,397
25-Apr-10	-	-	-	800	300	5.62	37.5	375	7.02	-	11.3	9.3	14,106
26-Apr-10	-	600	8.75	27,644	250	4.42	51.8	375	6.63	9.0	8.5	9.3	14,945
27-Apr-10	-	600	4.93	29,808	300	2.21	63.6	500	3.68	7.4	8.4	9.2	35,935
28-Apr-10	-	600	6.15	22,334	300	3.15	85.3	500	5.25	4.5	16.4	9.1	25,182
29-Apr-10	-	600	6.84	23,834	300	3.15	60.4	450	4.72	7.6	8.8	8.9	25,182
30-Apr-10	-	500	4.67	8,233	300	2.35	50.7	450	3.53	9.7	10.8	8.9	33,682
1-May-10	-	400	3.36	13,917	300	2.43	66.3	400	3.24	-	9.3	8.4	32,578
2-May-10	-	200	2.10	472	300	5.30	10.9	400	7.07	-	4.1	8.5	14,945
3-May-10	-	300	3.73	431	300	4.09	59.6	400	5.45	9.6	7.8	8.5	19,375
4-May-10	-	450	6.14	2,989	300	4.29	45.1	450	6.44	8.8	8.3	8.5	18,459
5-May-10	-	600	4.87	5,749	300	3.42	55.4	500	5.70	13.5	15.4	8.7	23,189
6-May-10	-	600	5.11	6,541	300	2.07	52.3	500	3.45	19.9	31.0	8.9	38,238
7-May-10	-	600	5.48	5,380	300	2.61	52.2	500	4.35	11.0	10.4	8.9	30,397
8-May-10	-	600	5.91	5,226	300	2.91	57.5	500	4.85	-	9.2	8.9	27,229
9-May-10	-	600	6.15	731	250	2.10	16.7	450	3.78	-	17.7	8.8	31,483
10-May-10	-	600	17.19	242	250	6.05	44.0	450	10.88	13.0	13.2	9.0	10,924
11-May-10	-	550	7.28	799	300	3.42	30.2	400	4.56	12.2	14.7	9.2	23,189
12-May-10	-	500	5.55	722	300	3.28	45.0	400	4.37	15.6	9.9	9.6	24,177
13-May-10	-	500	5.55	1,203	300	2.80	37.9	400	3.74	19.3	8.5	10.1	28,274
14-May-10	-	500	5.55	671	300	2.91	56.7	450	4.37	10.1	17.1	10.2	27,229
15-May-10	-	500	4.74	167	300	2.69	33.4	475	4.27	-	12.1	10.3	29,410
16-May-10	-	500	4.74	126	300	2.61	32.9	450	3.91	-	9.1	10.5	30,397
17-May-10	-	500	4.74	408	300	2.69	44.4	425	3.82	14.5	11.8	10.6	29,410
18-May-10	-	450	5.44	241	300	4.29	45.5	400	5.72	14.2	13.7	10.8	18,459
19-May-10	-	450	5.00	12,316	300	2.80	43.4	400	3.74	17.9	11.7	11.1	28,274
20-May-10	-	500	4.41	14,626	300	2.52	80.4	450	3.78	17.1	11.7	11.5	31,483
21-May-10	-	500	3.85	15,364	300	2.43	50.3	400	3.24	14.6	11.1	11.9	32,578

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
22-May-10	-	500	5.55	3,750	300	2.80	60.5	450	4.20	-	9.7	12.2	28,274
23-May-10	-	600	5.29	1,117	300	2.80	45.6	450	4.20	-	20.5	12.5	28,274
24-May-10	-	600	5.91	10,019	300	2.61	41.5	400	3.48	15.1	13.2	12.6	30,397
25-May-10	-	600	5.29	5,337	300	2.35	52.9	400	3.14	14.8	13.3	12.7	33,682
26-May-10	-	550	5.22	5,989	300	2.69	39.3	400	3.59	19.6	15.7	13.2	29,410
27-May-10	-	500	4.74	1,509	300	2.35	26.0	400	3.14	14.0	9.2	13.5	33,682
28-May-10	-	250	5.08	372	250	2.34	17.9	350	3.27	9.4	12.5	13.7	28,274
29-May-10	-	-	-	-	200	2.49	-	300	3.73	-	22.0	14.0	21,255
30-May-10	-	-	-	-	200	2.86	-	300	4.29	-	19.6	14.2	18,459
31-May-10	-	-	-	-	200	2.49	-	300	3.73	-	-	14.2	21,255
1-Jun-10	-	250	3.31	485	300	3.42	27.5	350	3.99	15.7	10.0	14.3	23,189
2-Jun-10	-	250	2.78	149	300	3.15	20.2	400	4.20	12.0	13.5	14.4	25,182
3-Jun-10	-	350	2.88	1,184	300	2.21	14.4	400	2.94	13.9	9.8	14.6	35,935
4-Jun-10	-	400	2.72	1,333	300	3.28	20.0	350	3.82	1.6	19.9	14.1	24,177
5-Jun-10	-	350	2.69	116	300	2.07	18.7	300	2.07	-	10.1	13.8	38,238
6-Jun-10	-	300	2.39	90	300	2.07	15.1	300	2.07	-	11.8	13.9	38,238
7-Jun-10	-	350	2.53	55,290	300	1.95	27.4	350	2.28	6.9	9.0	13.6	40,585
8-Jun-10	-	400	3.18	26,646	300	1.90	49.1	400	2.53	8.3	12.9	13.3	41,779
9-Jun-10	-	400	3.08	39,167	300	2.01	22.7	400	2.68	11.4	15.5	13.2	39,405
10-Jun-10	-	400	2.89	21,000	350	2.35	32.2	400	2.68	4.7	5.5	12.9	39,405
11-Jun-10	-	400	2.89	49,500	400	3.14	44.3	400	3.14	3.2	13.1	12.3	33,682
12-Jun-10	-	400	3.40	5,500	350	2.49	31.4	350	2.49	-	9.1	12.0	37,080
13-Jun-10	-	400	3.40	-	330	2.35	-	250	1.78	-	-	12.0	37,080
14-Jun-10	-	400	4.26	54,667	300	2.91	22.2	250	2.43	9.1	8.5	11.9	27,229
15-Jun-10	-	400	3.29	5,642	400	3.14	41.2	300	2.35	10.9	7.8	11.9	33,682
16-Jun-10	-	400	3.29	57,167	400	2.68	23.2	350	2.35	2.3	7.3	11.3	39,405
17-Jun-10	-	400	3.29	17,500	350	2.75	23.5	400	3.14	9.0	12.5	11.0	33,682
18-Jun-10	-	400	3.40	13,833	300	2.69	33.0	400	3.59	10.3	13.1	10.7	29,410
19-Jun-10	-	400	2.72	8,667	300	1.90	35.3	400	2.53	-	13.9	10.3	41,779
20-Jun-10	-	400	2.72	19,000	300	2.01	28.5	400	2.68	-	19.6	10.1	39,405
21-Jun-10	-	400	3.18	83,833	400	2.60	22.7	400	2.60	15.5	12.8	10.4	40,585
22-Jun-10	-	400	3.08	8,500	400	2.85	23.6	400	2.85	9.5	16.3	10.3	37,080
23-Jun-10	-	400	2.64	16,500	400	2.68	22.1	400	2.68	8.2	10.5	10.0	39,405

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
24-Jun-10	-	300	2.17	6,833	400	2.46	21.2	350	2.15	9.5	9.8	9.8	42,982
25-Jun-10	-	300	1.92	10,289	350	2.57	19.9	300	2.21	9.3	13.5	9.3	35,935
26-Jun-10	-	300	1.77	15,833	350	2.09	20.7	300	1.79	-	16.8	9.0	44,198
27-Jun-10	-	300	1.81	10,333	350	2.15	18.7	300	1.84	-	10.4	9.0	42,982
28-Jun-10	-	300	2.31	54,333	300	1.90	26.7	300	1.90	8.9	9.9	9.0	41,779
29-Jun-10	-	275	2.43	24,667	300	2.69	21.4	300	2.69	8.6	9.0	9.0	29,410
30-Jun-10	-	250	3.16	27,667	300	3.15	24.4	300	3.15	11.6	15.3	9.1	25,182
1-Jul-10	102,833	225	2.50	3,167	250	2.62	26.2	300	3.15	11.0	15.3	8.9	25,182
2-Jul-10	-	100	0.91	177	150	1.51	18.0	175	1.76	12.1	21.5	8.9	26,196
3-Jul-10	-	-	-	-	100	0.84	-	150	1.26	-	-	8.7	31,483
4-Jul-10	-	-	-	-	100	0.84	-	150	1.26	-	-	9.0	31,483
5-Jul-10	-	-	-	-	100	0.87	-	150	1.30	-	-	9.0	30,397
6-Jul-10	463	150	1.60	377	200	1.87	20.9	225	2.10	12.4	10.4	9.2	28,274
7-Jul-10	235	-	-	310	300	2.61	19.6	300	2.61	10.9	9.0	9.4	30,397
8-Jul-10	572	-	-	735	300	2.61	17.7	250	2.17	9.6	10.7	9.4	30,397
9-Jul-10	335	-	-	113	300	2.52	28.3	200	1.68	10.5	14.4	9.4	31,483
10-Jul-10	-	-	-	-	250	2.03	-	200	1.62	-	-	9.6	32,578
11-Jul-10	-	-	-	-	200	1.68	-	200	1.68	-	-	10.0	31,483
12-Jul-10	No flow	-	-	130	200	1.47	27.9	200	1.47	11.7	21.9	10.0	35,935
13-Jul-10	No flow	-	-	122	200	1.52	23.5	200	1.52	10.2	21.0	10.1	34,804
14-Jul-10	2,896	150	1.42	81	150	1.22	23.1	200	1.62	12.2	11.5	10.2	32,578
15-Jul-10	12,651	150	1.28	294	200	1.68	17.9	200	1.68	11.6	10.9	10.2	31,483
16-Jul-10	89	150	1.23	190	200	1.68	25.7	200	1.68	11.4	12.4	10.7	31,483
17-Jul-10	-	150	1.60	-	200	1.68	-	200	1.68	-	-	10.8	31,483
18-Jul-10	-	0	0.00	-	200	1.62	-	200	1.62	-	-	10.8	32,578
19-Jul-10	63,000	150	1.32	302	200	1.80	25.9	200	1.80	13.1	11.7	10.9	29,410
20-Jul-10	86,458	-	-	51	200	1.80	20.4	200	1.80	9.2	14.7	10.8	29,410
21-Jul-10	79,667	150	1.42	59	200	1.68	18.8	200	1.68	10.7	13.0	10.6	31,483
22-Jul-10	77,000	100	1.11	88	225	1.96	36.9	200	1.74	7.3	20.4	10.5	30,397
23-Jul-10	95,667	300	2.65	65	275	2.23	19.0	225	1.82	9.7	9.3	10.5	32,578
24-Jul-10	-	300	2.74	-	275	2.31	-	250	2.10	-	-	10.6	31,483
25-Jul-10	-	-	-	-	250	2.10	-	250	2.10	-	-	10.7	31,483
26-Jul-10	No flow	300	2.47	284	225	1.82	29.7	250	2.03	11.7	15.1	10.7	32,578

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
27-Jul-10	No flow	200	1.64	339	225	1.76	31.2	250	1.96	9.0	13.0	10.6	33,682
28-Jul-10	71,333	200	2.05	12,500	275	2.31	24.2	250	2.10	12.3	9.1	10.8	31,483
29-Jul-10	188,667	200	1.83	194	325	2.64	26.1	250	2.03	6.9	13.7	10.7	32,578
30-Jul-10	91,667	200	1.90	29,167	250	2.10	24.0	250	2.10	9.2	13.4	10.6	31,483
31-Jul-10	-	200	1.44	-	-	-	-	250	2.17	-	-	10.6	30,397
1-Aug-10	-	-	-	-	250	2.10	-	250	2.10	-	-	10.5	31,483
2-Aug-10	76,933	200	1.97	3,530	300	2.52	24.1	275	2.31	10.3	12.2	10.5	31,483
3-Aug-10	9,667	200	2.05	15,634	325	2.92	22.3	-	-	12.7	14.2	10.6	29,410
4-Aug-10	No flow	200	1.97	6,333	300	2.61	22.3	250	2.17	10.1	9.9	10.6	30,397
5-Aug-10	No flow	-	-	239	250	2.17	19.6	250	2.17	14.8	12.1	10.7	30,397
6-Aug-10	No flow	-	-	953	225	1.96	24.4	250	2.17	10.5	23.1	10.7	30,397
7-Aug-10	-	-	-	-	175	1.52	-	200	1.74	-	-	10.7	30,397
8-Aug-10	-	-	-	-	150	1.30	-	200	1.74	-	-	10.7	30,397
9-Aug-10	No flow	-	-	284	175	1.52	19.1	200	1.74	12.5	15.6	10.8	30,397
10-Aug-10	No flow	-	-	127	200	1.74	25.8	200	1.74	9.8	18.4	10.8	30,397
11-Aug-10	No flow	-	-	205	200	1.74	18.1	200	1.74	-	12.3	10.7	30,397
12-Aug-10	No flow	-	-	109	200	1.74	20.1	200	1.74	5.8	11.6	10.5	30,397
13-Aug-10	106,167	75	0.66	388	200	1.74	15.3	200	1.74	9.4	13.3	10.4	30,397
14-Aug-10	-	150	1.42	-	200	1.62	-	200	1.62	-	-	10.3	32,578
15-Aug-10	-	150	1.32	-	200	1.68	-	200	1.68	-	-	10.3	31,483
16-Aug-10	852	150	1.15	350	250	2.10	24.0	200	1.68	5.0	14.5	10.0	31,483
17-Aug-10	No flow	150	1.23	76	225	1.76	20.0	150	1.18	12.3	15.1	10.1	33,682
18-Aug-10	51,000	225	2.13	4,333	275	2.23	18.5	150	1.22	18.0	20.4	10.3	32,578
19-Aug-10	48,833	300	2.47	10,333	325	2.47	25.6	200	1.52	18.0	18.0	10.8	34,804
20-Aug-10	5,667	300	2.65	4,167	350	2.94	31.4	200	1.68	13.8	13.4	10.9	31,483
21-Aug-10	-	300	2.47	-	300	2.43	-	200	1.62	-	-	11.1	32,578
22-Aug-10	-	300	2.55	-	150	1.22	-	200	1.62	-	-	11.2	32,578
23-Aug-10	5,000	300	2.96	7,000	300	2.43	28.6	200	1.62	14.3	14.6	11.3	32,578
24-Aug-10	57,333	300	2.85	4,333	300	2.52	37.6	200	1.68	12.8	13.7	11.4	31,483
25-Aug-10	28,833	300	3.07	7,000	300	2.91	28.6	200	1.94	11.4	14.6	11.4	27,229
26-Aug-10	3,500	300	2.85	667	300	2.61	29.7	200	1.74	10.2	11.5	11.4	30,397
27-Aug-10	27,167	300	2.65	1,000	300	2.52	27.7	200	1.68	14.4	16.2	11.5	31,483
28-Aug-10	-	300	2.65	-	300	2.61	-	200	1.74	-	-	11.8	30,397

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
29-Aug-10	-	300	2.65	-	150	1.26	-	200	1.68	-	-	11.9	31,483
30-Aug-10	150,167	300	2.85	16,333	300	2.61	31.2	200	1.74	-	13.3	11.9	30,397
31-Aug-10	111,833	300	3.07	8,833	450	3.78	27.0	225	1.89	-	12.0	11.9	31,483
1-Sep-10	42,667	300	2.65	5,833	450	3.65	28.6	350	2.84	11.2	12.1	11.9	32,578
2-Sep-10	201,500	300	2.85	8,333	350	2.94	30.8	350	2.94	-	9.7	11.9	31,483
3-Sep-10	67,500	375	3.43	2,667	350	2.94	56.6	250	2.10	-	8.7	12.0	31,483
4-Sep-10	-	250	2.56	-	200	1.74	-	200	1.74	-	-	11.8	30,397
5-Sep-10	-	250	2.37	-	200	1.80	-	200	1.80	-	-	11.9	29,410
6-Sep-10	-	250	2.37	-	200	1.80	-	200	1.80	-	-	11.9	29,410
7-Sep-10	84,500	325	3.61	3,667	325	2.92	18.5	200	1.80	-	11.6	11.9	29,410
8-Sep-10	5,500	325	3.08	3,333	275	2.31	22.5	200	1.68	10.0	11.1	11.8	31,483
9-Sep-10	-	325	3.08	7,833	275	2.31	29.7	200	1.68	-	12.8	11.9	31,483
10-Sep-10	-	325	3.08	1,229	275	2.39	30.6	200	1.74	-	14.2	11.9	30,397
11-Sep-10	-	250	1.75	-	150	1.01	-	200	1.34	-	-	12.4	39,405
12-Sep-10	-	250	2.37	-	150	1.26	-	200	1.68	-	-	12.6	31,483
13-Sep-10	-	325	3.08	69,500	250	2.17	20.5	200	1.74	-	14.3	12.6	30,397
14-Sep-10	-	325	3.08	14,167	250	2.17	35.9	200	1.74	-	12.3	12.6	30,397
15-Sep-10	-	250	2.37	10,167	150	1.35	30.6	200	1.80	15.1	16.8	13.5	29,410
16-Sep-10	-	250	2.37	4,000	150	1.35	34.4	200	1.80	-	14.8	13.6	29,410
17-Sep-10	-	250	2.29	2,000	150	1.22	22.4	200	1.62	-	14.3	13.1	32,578
18-Sep-10	-	250	2.20	-	150	1.30	-	200	1.74	-	-	12.6	30,397
19-Sep-10	-	250	2.29	-	150	1.30	-	200	1.74	-	-	12.4	30,397
20-Sep-10	-	250	2.37	228	150	1.30	17.1	200	1.74	-	12.0	12.4	30,397
21-Sep-10	No Flow	250	2.29	1,487	150	1.35	9.5	200	1.80	-	10.3	12.4	29,410
22-Sep-10	103,000	325	3.08	1,016	250	2.25	15.7	200	1.80	-	13.3	12.2	29,410
23-Sep-10	51,167	325	3.08	274	250	2.25	30.1	200	1.80	-	15.3	12.1	29,410
24-Sep-10	No Flow	250	2.29	-	150	1.40	25.4	200	1.87	-	11.7	12.2	28,274
25-Sep-10	-	250	2.37	-	150	1.35	-	200	1.80	-	-	12.7	29,410
26-Sep-10	-	250	2.37	-	150	1.35	-	200	1.80	-	-	12.1	29,410
27-Sep-10	No Flow	325	3.08	238	250	2.25	16.4	200	1.80	-	6.0	12.1	29,410
28-Sep-10	51,667	325	3.33	16,000	250	2.17	28.4	200	1.74	-	19.4	12.1	30,397
29-Sep-10	No Flow	225	2.30	5,000	150	1.30	28.3	200	1.74	-	8.0	12.1	30,397
30-Sep-10	No Flow	200	1.90	403	150	1.40	22.6	200	1.87	-	10.2	12.1	28,274

TABLE D-1 POLYMER ADDITION RATES

	RIM DITCH			SLUICE TRENCH			ASH POND			STILLING POND			
Date	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Polymer (ml/min)	Polymer (mg/L)	Effluent TSS	Effluent TSS (Field Lab)	30-day Average (TSS)	Effluent Flow (gpm)
1-Oct-10	No Flow	200	1.90	1,851	150	1.30	39.5	175	1.52	-	15.9	12.6	30,397
2-Oct-10	-	200	2.05	-	125	1.12	-	150	1.35	-	-	12.6	29,410
3-Oct-10	-	200	1.97	-	-	-	-	150	1.40	-	-	12.6	28,274
4-Oct-10	No Flow	200	1.90	409	150	1.35	23.4	150	1.35	-	16.5	12.6	29,410
5-Oct-10	No Flow	200	1.90	196	150	1.40	18.7	175	1.64	-	11.7	12.6	28,274
6-Oct-10	No Flow	200	1.90	2,183	150	1.40	23.7	175	1.64	-	10.6	12.6	28,274
7-Oct-10	No Flow	200	1.90	69	150	1.35	18.0	200	1.80	-	9.1	12.6	29,410
8-Oct-10	No Flow	200	1.90	-	150	#DIV/0!	-	200	#DIV/0!	-	-	15.1	0
9-Oct-10	No Flow	200	2.05	-	75	#DIV/0!	-	200	#DIV/0!	-	-	15.1	0
10-Oct-10	No Flow	200	2.50	-	-	-	-	200	#DIV/0!	-	-	15.1	0
11-Oct-10	No Flow	200	3.07	592	150	2.05	26.3	200	2.73	-	9.9	15.1	19,375
12-Oct-10	No Flow	200	3.23	105	150	2.05	19.6	200	2.73	-	11.9	15.1	19,375

Note: NPDES-permitted Monthly Maximum TSS = 29.9 mg/L
NPDES-permitted Daily Maximum TSS = 90 mg/L

Appendix E
Acid Addition Rates

FIGURE E-1 ACID ADDITION vs. EFFLUENT pH

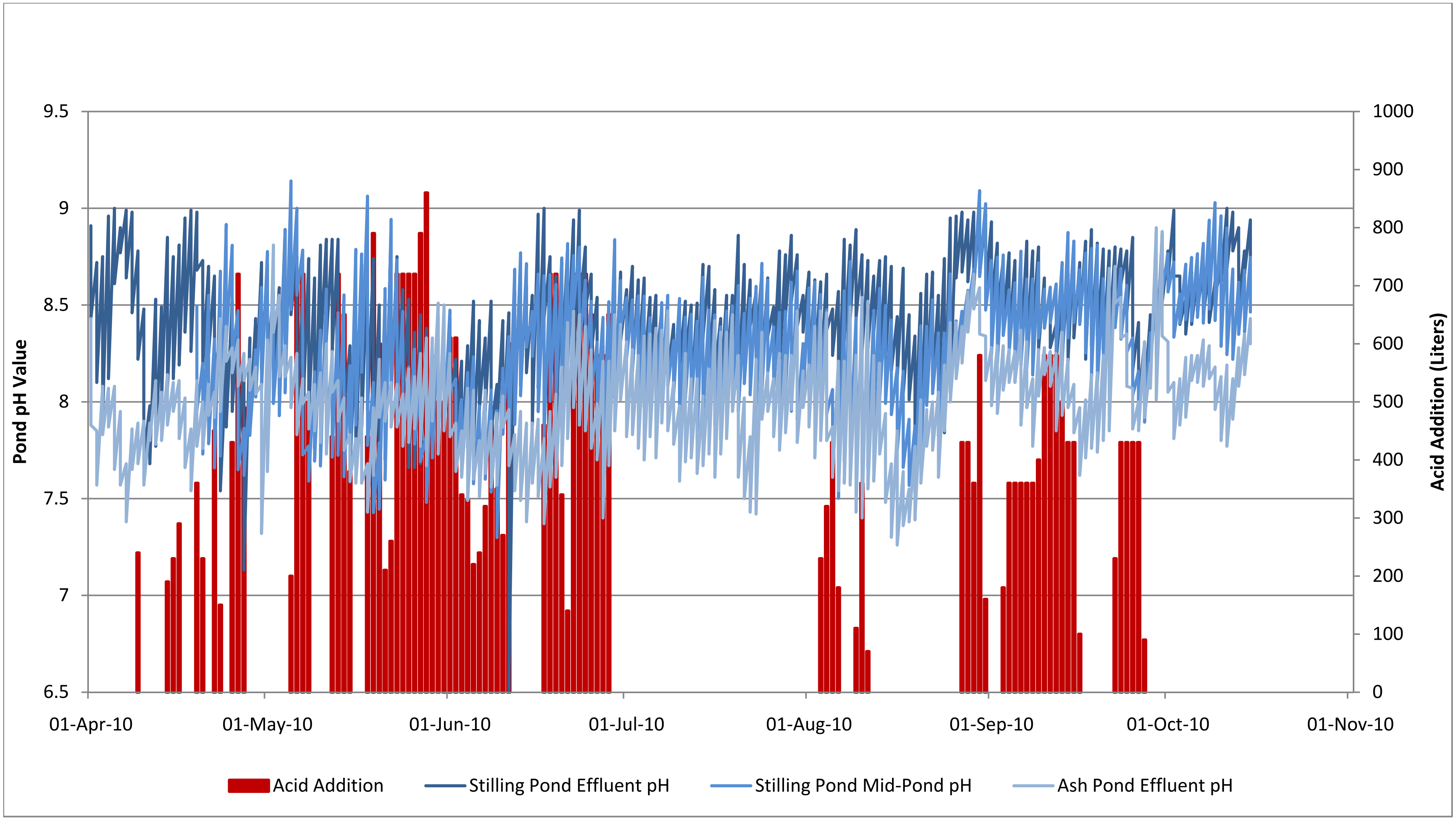

TABLE E-1 ACID ADDITION RATES

Date	ASH POND						STILLING POND				
	Grab Sample Effluent pH	Station HY-109 Effluent pH (daily max)	Station HY-109 Effluent pH (daily min)	Acid Addition (ml/min)	Acid Addition Duration (min)	Acid Addition Volume (Liters)	Station HY-148 Mid-Pond pH (daily max)	Station HY-148 Mid-Pond pH (daily min)	Grab Sample Effluent pH	Station HY-54 Effluent pH (daily max)	Station HY-54 Effluent pH (daily min)
1-Apr-10	8.2	8.4	7.9	-	-	-	-	-	8.7	8.9	8.4
2-Apr-10	7.6	7.9	7.6	-	-	-	-	-	8.3	8.7	8.1
3-Apr-10	8.0	8.1	7.8	-	-	-	-	-	8.3	8.8	7.9
4-Apr-10	-	8.1	7.9	-	-	-	-	-	-	9.0	8.1
5-Apr-10	7.9	8.1	7.7	-	-	-	-	-	9.4	9.0	8.6
6-Apr-10	8.0	8.0	7.6	-	-	-	-	-	9.2	8.9	8.8
7-Apr-10	7.4	7.7	7.4	-	-	-	-	-	9.2	9.0	8.6
8-Apr-10	7.6	7.9	7.7	-	-	-	-	-	8.4	9.0	8.5
9-Apr-10	8.0	7.9	7.7	500	8	240	-	-	8.5	8.8	8.2
10-Apr-10	7.5	7.9	7.6	-	-	-	-	-	7.7	8.5	7.7
11-Apr-10	7.5	7.9	7.8	-	-	-	-	-	7.5	8.0	7.7
12-Apr-10	7.5	8.1	7.8	-	-	-	-	-	7.5	8.5	7.8
13-Apr-10	7.7	8.1	7.8	-	-	-	-	-	8.0	8.5	8.0
14-Apr-10	8.0	8.1	7.9	400	8	190	-	-	8.1	8.9	8.1
15-Apr-10	7.7	8.1	8.0	550	7	230	-	-	7.8	8.8	8.1
16-Apr-10	7.5	8.1	7.8	600	8	290	-	-	7.8	8.8	8.2
17-Apr-10	7.3	8.0	7.7	-	-	-	-	-	7.8	9.0	8.4
18-Apr-10	7.6	7.9	7.5	-	-	-	-	-	8.3	9.0	8.3
19-Apr-10	7.9	8.1	7.8	400	15	360	8.5	8.0	8.7	9.0	8.7
20-Apr-10	7.7	8.0	7.8	400	10	230	8.2	7.7	8.1	8.7	8.2
21-Apr-10	7.5	8.1	7.9	-	-	-	8.6	7.8	7.7	8.7	8.3
22-Apr-10	7.9	8.1	7.9	500	15	450	8.3	7.7	8.2	8.7	8.1
23-Apr-10	7.7	8.4	8.0	500	5	150	8.7	7.7	7.4	8.4	7.5
24-Apr-10	8.1	8.4	8.2	-	-	-	8.9	8.3	8.1	8.2	7.9
25-Apr-10	8.0	8.3	8.2	500	14	430	8.8	8.2	8.0	8.5	8.0
26-Apr-10	8.1	8.3	8.1	500	24	720	8.5	7.6	8.7	8.5	7.8
27-Apr-10	8.0	8.3	8.1	500	16	490	7.9	7.6	8.7	8.2	7.1
28-Apr-10	7.7	8.2	8.1	-	-	-	8.1	7.8	7.4	8.3	7.9
29-Apr-10	7.9	8.2	8.0	-	-	-	8.3	8.0	8.1	8.4	8.0
30-Apr-10	7.9	8.1	7.3	-	-	-	8.6	8.1	7.8	8.7	8.2

TABLE E-1 ACID ADDITION RATES

	ASH POND						STILLING POND				
Date	Grab Sample Effluent pH	Station HY-109 Effluent pH (daily max)	Station HY-109 Effluent pH (daily min)	Acid Addition (ml/min)	Acid Addition Duration (min)	Acid Addition Volume (Liters)	Station HY-148 Mid-Pond pH (daily max)	Station HY-148 Mid-Pond pH (daily min)	Grab Sample Effluent pH	Station HY-54 Effluent pH (daily max)	Station HY-54 Effluent pH (daily min)
1-May-10	7.9	8.3	7.6	-	-	-	8.8	8.2	8.4	8.7	8.2
2-May-10	8.3	8.8	8.4	-	-	-	8.4	8.0	7.8	8.6	8.2
3-May-10	7.6	8.6	8.1	-	-	-	8.4	7.9	7.9	8.6	8.0
4-May-10	8.4	8.3	8.1	-	-	-	8.9	8.0	9.1	8.9	8.1
5-May-10	8.5	8.2	8.0	500	7	200	9.1	8.5	8.8	9.0	8.5
6-May-10	7.9	8.3	7.8	500	24	720	9.0	8.6	8.3	8.8	7.9
7-May-10	9.1	8.1	8.0	500	24	720	8.8	7.7	8.2	8.5	7.9
8-May-10	7.8	8.1	7.9	500	17	500	7.8	7.6	8.0	8.7	7.9
9-May-10	7.6	8.1	7.9	-	-	-	8.2	7.7	7.2	8.6	7.8
10-May-10	7.7	8.2	7.8	-	-	-	8.4	7.7	8.4	8.8	8.3
11-May-10	7.9	8.3	7.7	-	-	-	8.6	7.9	8.1	8.8	8.3
12-May-10	8.4	8.3	8.1	500	15	440	8.2	7.7	7.7	8.8	8.3
13-May-10	8.0	8.1	7.9	500	24	720	8.5	7.7	8.4	8.8	7.8
14-May-10	8.5	8.0	7.8	450	24	650	8.6	7.6	8.4	8.4	8.0
15-May-10	8.1	7.8	7.6	500	13	380	8.2	7.6	7.3	8.3	7.6
16-May-10	7.8	7.8	7.6	-	-	-	8.8	7.9	7.8	8.4	7.7
17-May-10	6.9	8.0	7.6	-	-	-	8.8	8.2	7.5	8.7	7.9
18-May-10	7.6	7.7	7.4	500	15	440	9.1	7.8	8.3	8.7	8.0
19-May-10	7.6	8.0	7.6	550	24	790	8.1	7.4	8.0	8.7	7.8
20-May-10	9.1	8.2	7.9	500	20	600	7.8	7.4	8.4	8.5	7.5
21-May-10	7.7	8.1	7.9	400	9	210	8.6	7.6	7.8	8.5	7.7
22-May-10	7.6	8.1	7.9	500	9	260	8.9	8.0	8.5	8.9	8.0
23-May-10	8.7	8.1	7.9	500	24	720	8.7	8.0	8.7	8.8	8.2
24-May-10	8.3	8.0	7.8	500	24	720	8.5	7.8	9.0	8.6	8.0
25-May-10	8.2	8.2	7.8	500	24	720	8.2	7.8	8.2	8.5	7.7
26-May-10	8.1	8.1	7.9	500	24	720	8.3	7.8	7.8	8.4	7.7
27-May-10	8.5	8.3	7.8	550	24	790	8.1	7.7	8.6	8.5	7.7
28-May-10	7.1	8.3	7.7	600	24	860	7.8	7.5	7.2	8.4	7.8
29-May-10	-	8.3	7.9	350	24	500	8.2	7.7	8.7	-	-
30-May-10	-	8.5	7.7	350	24	500	8.4	7.8	7.8	-	-

TABLE E-1 ACID ADDITION RATES

	ASH POND						STILLING POND				
Date	Grab Sample Effluent pH	Station HY-109 Effluent pH (daily max)	Station HY-109 Effluent pH (daily min)	Acid Addition (ml/min)	Acid Addition Duration (min)	Acid Addition Volume (Liters)	Station HY-148 Mid-Pond pH (daily max)	Station HY-148 Mid-Pond pH (daily min)	Grab Sample Effluent pH	Station HY-54 Effluent pH (daily max)	Station HY-54 Effluent pH (daily min)
31-May-10	-	8.5	7.9	350	24	500	8.4	7.9	-	-	-
1-Jun-10	8.3	8.3	7.8	425	24	610	8.5	8.1	7.8	8.4	8.0
2-Jun-10	8.4	7.9	7.6	425	24	610	8.1	7.7	8.5	8.2	7.9
3-Jun-10	8.3	7.9	7.6	350	16	340	8.0	7.6	8.3	8.2	7.7
4-Jun-10	7.3	8.1	7.5	425	13	330	8.2	7.8	7.5	8.3	7.9
5-Jun-10	8.3	8.1	7.6	350	11	220	8.2	7.6	8.0	8.5	7.8
6-Jun-10	7.9	7.8	7.5	350	12	240	8.0	7.6	8.4	8.4	8.0
7-Jun-10	7.6	8.1	7.6	375	14	320	8.0	7.6	8.0	8.3	8.0
8-Jun-10	7.9	7.9	7.6	400	20	480	8.1	7.5	8.5	8.5	7.9
9-Jun-10	7.5	7.9	7.6	400	15	350	8.0	7.3	7.1	8.1	7.9
10-Jun-10	7.4	8.0	7.9	475	10	270	8.2	7.8	7.6	8.4	7.9
11-Jun-10	7.3	8.0	7.7	500	20	600	8.3	7.7	7.6	8.5	6.5
12-Jun-10	7.8	7.8	7.5	-	-	-	8.7	7.9	8.0	8.6	8.0
13-Jun-10	-	8.0	7.5	-	-	-	8.8	8.0	8.1	8.7	8.1
14-Jun-10	8.8	7.9	7.4	-	-	-	8.7	8.3	8.1	8.6	8.2
15-Jun-10	7.1	7.9	7.6	-	-	-	8.5	8.2	8.1	8.6	7.9
16-Jun-10	8.0	7.9	7.5	-	-	-	8.7	7.9	7.4	9.0	8.1
17-Jun-10	8.1	7.8	7.4	550	14	460	8.7	7.8	8.4	9.0	8.4
18-Jun-10	8.1	8.0	7.6	500	24	720	8.7	8.0	8.7	8.8	8.2
19-Jun-10	8.1	8.0	7.6	500	24	720	8.6	8.0	8.2	8.7	7.8
20-Jun-10	7.8	8.2	7.7	500	11	340	8.7	7.9	8.2	8.7	8.2
21-Jun-10	7.9	8.4	7.8	250	9	140	8.8	8.2	8.2	8.8	8.3
22-Jun-10	8.4	8.5	8.0	500	24	720	8.8	8.5	8.2	8.9	8.2
23-Jun-10	8.1	8.5	7.9	500	24	720	8.8	8.3	8.2	9.0	8.5
24-Jun-10	7.7	8.4	7.9	500	24	720	8.6	8.2	8.2	8.8	8.5
25-Jun-10	7.9	8.3	7.8	450	24	650	8.5	8.0	7.8	8.7	8.3
26-Jun-10	8.2	8.0	7.7	400	24	580	8.3	8.0	8.5	8.5	8.0
27-Jun-10	7.4	8.2	7.4	400	24	580	8.4	7.8	8.0	8.3	7.8
28-Jun-10	7.8	8.2	7.7	450	24	650	8.5	7.9	7.8	8.3	7.8
29-Jun-10	7.7	8.5	7.9	-	-	-	8.8	8.1	8.3	8.6	8.0

TABLE E-1 ACID ADDITION RATES

	ASH POND						STILLING POND				
Date	Grab Sample Effluent pH	Station HY-109 Effluent pH (daily max)	Station HY-109 Effluent pH (daily min)	Acid Addition (ml/min)	Acid Addition Duration (min)	Acid Addition Volume (Liters)	Station HY-148 Mid-Pond pH (daily max)	Station HY-148 Mid-Pond pH (daily min)	Grab Sample Effluent pH	Station HY-54 Effluent pH (daily max)	Station HY-54 Effluent pH (daily min)
30-Jun-10	8.3	8.4	8.0	-	-	-	8.6	8.4	8.6	8.7	8.3
1-Jul-10	8.3	8.3	7.8	-	-	-	8.5	8.2	8.2	8.6	8.3
2-Jul-10	8.0	8.3	7.8	-	-	-	8.5	8.2	8.1	8.7	8.2
3-Jul-10	-	8.2	7.8	-	-	-	8.5	8.0	-	8.6	8.2
4-Jul-10	-	8.3	7.7	-	-	-	8.5	8.0	-	8.6	8.2
5-Jul-10	-	8.4	7.8	-	-	-	8.4	8.1	-	8.5	8.2
6-Jul-10	7.8	8.4	7.7	-	-	-	8.4	7.9	8.3	8.6	8.2
7-Jul-10	8.1	8.4	7.9	-	-	-	8.5	8.1	8.2	8.5	8.2
8-Jul-10	8.6	8.5	7.9	-	-	-	8.6	8.1	8.9	8.4	8.1
9-Jul-10	8.3	8.1	7.8	-	-	-	8.3	8.0	8.3	8.4	8.1
10-Jul-10	-	8.0	7.6	-	-	-	8.5	7.9	-	8.5	8.2
11-Jul-10	-	8.3	7.7	-	-	-	8.4	8.0	-	8.5	8.2
12-Jul-10	7.1	8.1	7.7	-	-	-	8.5	8.0	7.2	8.5	8.0
13-Jul-10	7.3	8.1	7.6	-	-	-	8.4	7.8	7.4	8.5	8.0
14-Jul-10	7.8	8.0	7.7	-	-	-	8.6	7.9	8.1	8.7	8.3
15-Jul-10	7.4	8.2	7.7	-	-	-	8.5	8.0	7.7	8.7	8.2
16-Jul-10	8.1	8.4	7.6	-	-	-	8.4	7.9	7.6	8.6	8.2
17-Jul-10	-	8.4	7.7	-	-	-	8.4	7.8	-	8.4	8.1
18-Jul-10	-	8.4	7.8	-	-	-	8.5	7.9	-	8.6	8.2
19-Jul-10	7.8	8.5	8.0	-	-	-	8.5	8.0	7.8	8.6	8.2
20-Jul-10	7.9	8.2	7.6	-	-	-	8.6	8.0	7.6	8.9	8.1
21-Jul-10	7.8	8.0	7.5	-	-	-	8.5	8.1	7.9	8.7	8.3
22-Jul-10	8.1	7.8	7.4	-	-	-	8.5	8.0	8.2	8.6	8.4
23-Jul-10	7.2	8.2	7.4	-	-	-	8.6	7.9	7.5	8.6	8.3
24-Jul-10	-	8.4	7.9	-	-	-	8.7	8.0	-	8.7	8.2
25-Jul-10	-	8.2	8.0	-	-	-	8.6	8.2	-	8.6	8.3
26-Jul-10	8.3	8.1	7.8	-	-	-	8.4	8.1	8.3	8.5	8.2
27-Jul-10	8.0	8.3	7.8	-	-	-	8.5	7.9	7.8	8.8	8.2
28-Jul-10	7.4	8.2	7.8	-	-	-	8.5	8.1	8.3	8.8	8.4
29-Jul-10	7.8	8.2	8.0	-	-	-	8.6	8.0	8.0	8.9	8.5

TABLE E-1 ACID ADDITION RATES

	ASH POND						STILLING POND				
Date	Grab Sample Effluent pH	Station HY-109 Effluent pH (daily max)	Station HY-109 Effluent pH (daily min)	Acid Addition (ml/min)	Acid Addition Duration (min)	Acid Addition Volume (Liters)	Station HY-148 Mid-Pond pH (daily max)	Station HY-148 Mid-Pond pH (daily min)	Grab Sample Effluent pH	Station HY-54 Effluent pH (daily max)	Station HY-54 Effluent pH (daily min)
30-Jul-10	7.8	8.5	7.8	-	-	-	8.7	7.9	8.4	8.8	8.4
31-Jul-10	-	8.2	8.0	-	-	-	8.3	8.0	-	8.6	8.4
1-Aug-10	-	8.2	7.9	-	-	-	8.6	8.0	-	8.7	8.2
2-Aug-10	7.5	8.4	7.7	-	-	-	8.6	8.0	7.7	8.6	8.2
3-Aug-10	7.7	8.5	7.8	300	13	230	8.6	8.1	7.7	8.6	8.1
4-Aug-10	7.9	8.5	7.8	300	18	320	8.5	7.9	7.9	8.7	8.4
5-Aug-10	7.6	7.9	7.6	300	24	430	8.1	7.7	7.7	8.5	8.2
6-Aug-10	6.9	8.2	7.5	300	10	180	8.2	7.5	6.7	8.6	7.9
7-Aug-10	-	8.2	7.6	-	-	-	8.6	7.7	-	8.8	8.3
8-Aug-10	-	8.5	7.6	-	-	-	8.7	7.8	-	8.8	8.4
9-Aug-10	7.6	8.2	7.4	300	6	110	8.4	7.8	8.5	8.9	8.4
10-Aug-10	7.5	8.5	7.4	300	20	360	8.4	7.7	8.2	8.8	8.3
11-Aug-10	7.7	8.5	7.6	300	4	70	8.3	7.7	7.6	8.7	8.3
12-Aug-10	8.0	8.2	7.6	-	-	-	8.5	7.9	8.5	8.7	8.4
13-Aug-10	7.6	8.2	7.7	-	-	-	8.6	8.0	8.3	8.7	8.2
14-Aug-10	-	7.9	7.5	-	-	-	8.5	8.0	-	8.8	8.2
15-Aug-10	-	7.7	7.3	-	-	-	8.4	7.9	-	8.7	8.2
16-Aug-10	7.5	7.9	7.3	-	-	-	8.2	7.7	8.2	8.4	8.1
17-Aug-10	7.6	7.6	7.4	-	-	-	8.2	7.7	8.3	8.7	8.0
18-Aug-10	7.1	7.6	7.4	-	-	-	7.9	7.6	7.1	8.5	8.0
19-Aug-10	7.3	7.8	7.4	-	-	-	7.9	7.5	7.6	8.3	7.8
20-Aug-10	7.6	8.0	7.6	-	-	-	8.4	7.7	8.2	8.6	7.9
21-Aug-10	-	8.0	7.8	-	-	-	8.4	8.0	-	8.7	8.1
22-Aug-10	-	8.0	7.8	-	-	-	8.5	8.0	-	8.7	8.1
23-Aug-10	7.5	8.1	7.6	-	-	-	8.4	7.8	8.2	8.6	8.0
24-Aug-10	7.5	8.2	7.9	-	-	-	8.4	7.9	7.8	8.7	7.8
25-Aug-10	7.5	8.4	8.0	-	-	-	8.7	8.1	8.2	9.0	8.1
26-Aug-10	7.4	8.4	8.1	-	-	-	8.4	8.2	7.6	9.0	8.6
27-Aug-10	8.0	8.4	8.2	300	24	430	8.5	8.4	7.8	9.0	8.7
28-Aug-10	-	8.6	8.4	300	24	430	8.6	8.5	-	8.9	8.6

TABLE E-1 ACID ADDITION RATES

Date	ASH POND						STILLING POND				
	Grab Sample Effluent pH	Station HY-109 Effluent pH (daily max)	Station HY-109 Effluent pH (daily min)	Acid Addition (ml/min)	Acid Addition Duration (min)	Acid Addition Volume (Liters)	Station HY-148 Mid-Pond pH (daily max)	Station HY-148 Mid-Pond pH (daily min)	Grab Sample Effluent pH	Station HY-54 Effluent pH (daily max)	Station HY-54 Effluent pH (daily min)
29-Aug-10	-	8.7	8.5	300	20	360	8.7	8.6	-	9.0	8.6
30-Aug-10	8.1	8.6	8.4	400	24	580	9.1	8.6	8.5	9.0	8.7
31-Aug-10	7.8	8.3	8.1	400	7	160	9.0	8.5	8.2	9.0	8.6
1-Sep-10	8.0	8.3	8.0	-	-	-	8.7	8.2	8.3	8.9	8.5
2-Sep-10	7.3	8.3	7.9	-	-	-	8.7	8.2	8.4	8.8	8.5
3-Sep-10	7.8	8.3	8.1	300	10	180	8.8	8.3	8.3	8.7	8.4
4-Sep-10	-	8.3	8.1	250	24	360	8.6	8.3	-	8.8	8.3
5-Sep-10	-	8.3	8.1	250	24	360	8.6	8.1	-	8.7	8.3
6-Sep-10	-	8.4	7.9	250	24	360	8.8	8.2	-	8.6	8.3
7-Sep-10	7.5	8.3	8.0	250	24	360	8.6	8.2	8.2	8.8	8.3
8-Sep-10	6.8	8.1	7.8	250	24	360	8.6	8.1	7.0	8.8	8.4
9-Sep-10	7.5	8.3	8.0	275	24	400	8.7	8.3	7.2	8.8	8.3
10-Sep-10	7.9	8.3	8.1	400	24	580	8.6	8.4	8.1	8.6	8.4
11-Sep-10	-	8.3	8.1	400	24	580	8.6	8.4	-	8.6	8.3
12-Sep-10	-	8.3	7.9	400	24	580	8.6	8.3	-	8.4	8.2
13-Sep-10	7.7	8.4	7.9	350	24	500	8.7	8.2	7.0	8.6	8.2
14-Sep-10	7.3	8.2	8.0	300	24	430	8.9	8.3	7.0	8.7	8.2
15-Sep-10	7.2	8.1	7.8	300	24	430	8.8	8.4	8.2	8.8	8.3
16-Sep-10	7.5	8.0	7.6	150	12	100	8.7	8.4	8.0	8.7	8.4
17-Sep-10	7.0	8.0	7.7	-	-	-	8.8	8.3	7.0	8.8	8.2
18-Sep-10	-	8.1	7.8	-	-	-	8.8	8.1	-	8.9	8.3
19-Sep-10	-	8.2	7.7	-	-	-	8.8	8.1	-	8.8	8.3
20-Sep-10	7.6	8.2	7.8	-	-	-	8.6	8.2	8.2	8.8	8.3
21-Sep-10	7.6	8.7	7.9	-	-	-	8.7	8.1	7.4	8.8	8.3
22-Sep-10	8.2	8.7	8.5	300	13	230	8.7	8.4	7.8	8.8	8.6
23-Sep-10	7.9	8.5	8.3	300	24	430	8.7	8.3	8.5	8.8	8.6
24-Sep-10	7.9	8.4	8.1	300	24	430	8.6	8.3	8.0	8.8	8.5
25-Sep-10	-	8.1	7.9	300	24	430	8.3	8.0	-	8.9	8.2
26-Sep-10	-	8.0	7.9	300	24	430	8.2	7.9	-	8.4	8.0
27-Sep-10	-	8.3	7.9	150	10.25	90	8.3	7.9	-	8.3	8.0

TABLE E-1 ACID ADDITION RATES

	ASH POND						STILLING POND				
Date	Grab Sample Effluent pH	Station HY-109 Effluent pH (daily max)	Station HY-109 Effluent pH (daily min)	Acid Addition (ml/min)	Acid Addition Duration (min)	Acid Addition Volume (Liters)	Station HY-148 Mid-Pond pH (daily max)	Station HY-148 Mid-Pond pH (daily min)	Grab Sample Effluent pH	Station HY-54 Effluent pH (daily max)	Station HY-54 Effluent pH (daily min)
28-Sep-10	7.0	8.2	8.1	-	-	-	8.4	8.2	7.5	8.5	8.3
29-Sep-10	6.9	8.9	8.0	-	-	-	8.6	8.3	6.8	8.6	8.2
30-Sep-10	8.2	8.9	8.3	-	-	-	8.8	8.6	8.2	8.9	8.5
1-Oct-10	7.7	8.3	8.1	-	-	-	8.8	8.6	8.0	8.8	8.6
2-Oct-10	-	8.1	7.8	-	-	-	8.7	8.3	-	9.0	8.7
3-Oct-10	-	8.1	7.9	-	-	-	8.6	8.4	-	8.7	8.4
4-Oct-10	7.1	8.2	7.9	-	-	-	8.7	8.4	6.5	8.5	8.4
5-Oct-10	7.1	8.2	8.1	-	-	-	8.7	8.4	7.1	8.7	8.4
6-Oct-10	6.9	8.2	8.1	-	-	-	8.8	8.4	6.9	8.7	8.5
7-Oct-10	7.8	8.3	8.1	-	-	-	8.8	8.4	8.1	8.7	8.5
8-Oct-10	-	8.3	8.1	-	-	-	8.9	8.5	-	8.7	8.4
9-Oct-10	-	8.2	8.0	-	-	-	9.0	8.4	-	8.6	8.6
10-Oct-10	-	8.1	7.8	-	-	-	9.0	8.3	-	8.7	8.6
11-Oct-10	6.5	8.2	7.8	-	-	-	8.9	8.2	7.0	9.0	8.7
12-Oct-10	6.7	8.1	7.9	-	-	-	8.7	8.2	7.4	9.0	8.8
13-Oct-10		8.3	8.1				8.6	8.3		8.9	8.5
14-Oct-10		8.4	8.1				8.7	8.4		8.8	8.7
15-Oct-10		8.4	8.3				8.7	8.5		8.9	8.7
16-Oct-10											
17-Oct-10											

Appendix F
Daily Transported Quantities

FIGURE F-1 DAILY TRANSPORTED QUANTITIES

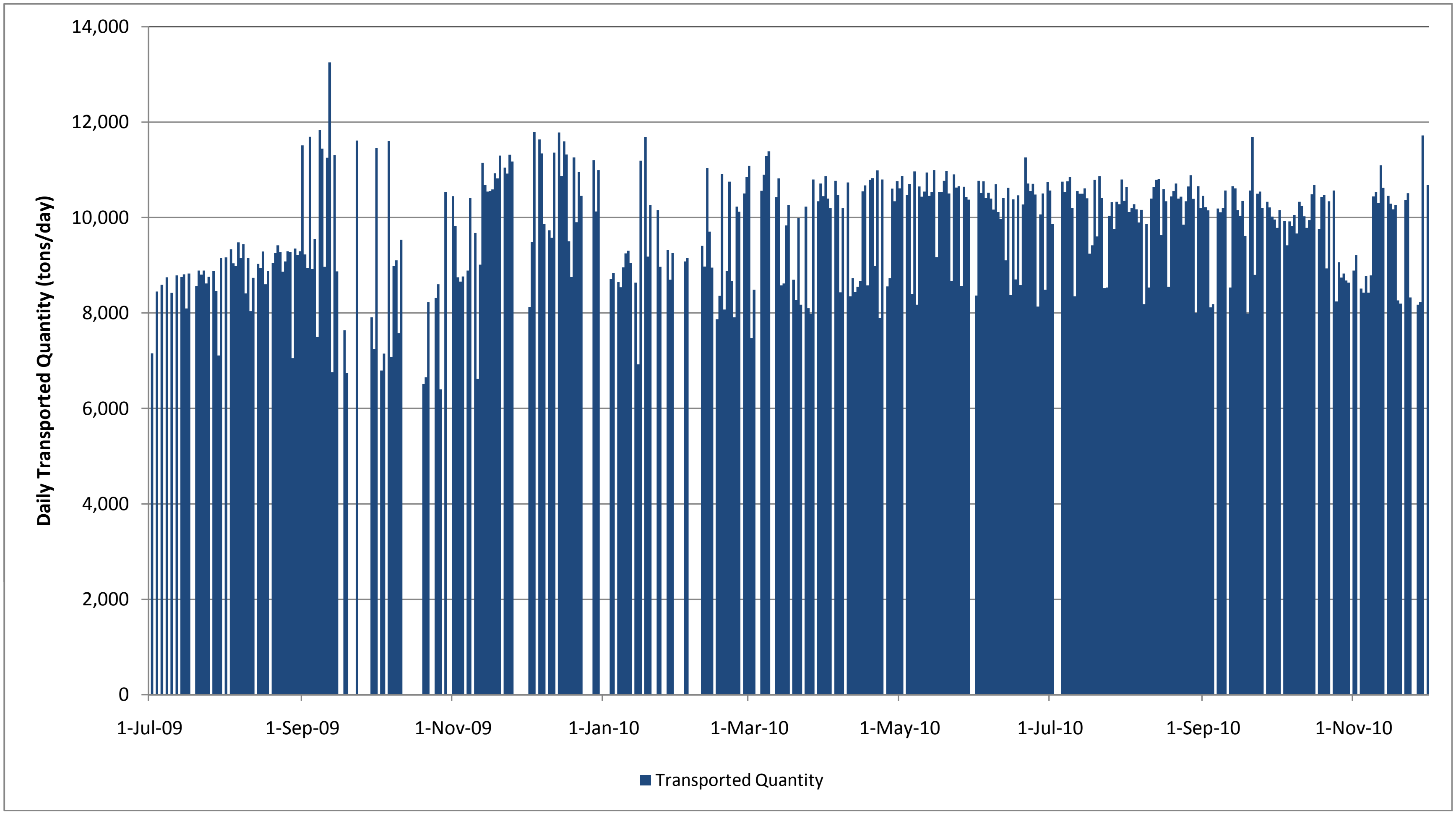

TABLE F-1 MONTHLY ASH TOTALS SHIPPED JULY 2009 THROUGH DECEMBER 2010

Month	Cars Shipped	Tons Shipped Monthly	Average Tons per Car
July 2009	1,668	170,751	102.4
August 2009	2,361	252,085	106.8
September 2009	1,826	192,188	105.3
October 2009	1,315	134,526	102.3
November 2009	2,190	222,064	101.4
December 2009	2,208	231,655	104.9
January 2010	1,696	175,557	103.5
February 2010	1,755	179,445	102.2
March 2010	2,291	233,472	101.9
April 2010	2,594	263,900	101.7
May 2010	2,925	296,415	101.3
June 2010	2,993	301,270	100.7
July 2010	2,839	283,714	99.9
August 2010	3,159	313,311	99.2
September 2010	2,750	268,965	97.8
October 2010	2,726	262,945	96.5
November 2010	2,310	228,989	99.1
December 2010	106	10,685	100.8
January 2011[a]	-	3,133	-
TOTAL	**39,712**	**4,025,068**	**101.4**

[a] Final railyard cleanup quantity

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
1-Jul-09	-	-	-	-	0	0
2-Jul-09	1	ALT01	80	89.41	7,153	7,153
3-Jul-09	-	-	-	-	0	7,153
4-Jul-09	2	ALT02	85	99.38	8,448	15,601
5-Jul-09	-	-	-	-	0	15,601
6-Jul-09	3	ALT03	85	101.06	8,590	24,190
7-Jul-09	-	-	-	-	0	24,190
8-Jul-09	4	ALT04	85	102.90	8,747	32,937
9-Jul-09	-	-	-	-	0	32,937
10-Jul-09	5	ALT05	85	99.08	8,422	41,359
11-Jul-09	-	-	-	-	0	41,359
12-Jul-09	6	ALT06	85	103.41	8,790	50,149
13-Jul-09	-	-	-	-		50,149
14-Jul-09	7	ALT07	85	102.99	8,754	58,903
15-Jul-09	8	ALT08	85	103.64	8,809	67,712
16-Jul-09	9	ALT09	80	101.20	8,096	75,808
17-Jul-09	10	ALT10	84	105.09	8,827	84,635
18-Jul-09	-	-	-	-	0	84,635
19-Jul-09	-	-	-	-	0	84,635
20-Jul-09	11	ALT11	83	103.17	8,563	93,199
21-Jul-09	12	ALT12	85	104.56	8,887	102,086
22-Jul-09	13	ALT13	85	103.59	8,805	110,891
23-Jul-09	14	ALT14	85	104.54	8,886	119,777
24-Jul-09	15	ALT15	85	101.36	8,616	128,393
25-Jul-09	16	ALT16	85	103.02	8,757	137,150
26-Jul-09	-	-	-	-	0	137,150
27-Jul-09	17	ALT17	85	104.42	8,876	146,026
28-Jul-09	18	ALT18	85	99.55	8,461	154,488
29-Jul-09	19	ALT19	66	107.70	7,108	161,596
30-Jul-09	20	ALT20	85	107.71	9,155	170,751
31-Jul-09	-	-	-	-	0	170,751
1-Aug-09	21	ALT21	84	109.10	9,164	179,915
2-Aug-09	-	-	-	-	0	179,915
3-Aug-09	22	ALT22	86	108.50	9,331	189,246
4-Aug-09	23	ALT23	85	106.36	9,041	198,287
5-Aug-09	24	ALT24	85	105.72	8,986	207,273
6-Aug-09	25	ALT25	85	111.54	9,481	216,753
7-Aug-09	26	ALT26	85	107.66	9,151	225,904
8-Aug-09	27	ALT27	85	111.05	9,439	235,344
9-Aug-09	28	ALT28	85	98.93	8,409	243,753
10-Aug-09	29	ALT29	85	107.66	9,151	252,903

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
11-Aug-09	30	ALT30	85	94.56	8,038	260,941
12-Aug-09	31	ALT31	85	102.81	8,739	269,680
13-Aug-09	-	-	-	-	0	269,680
14-Aug-09	32	ALT32	85	106.20	9,027	278,707
15-Aug-09	33	ALT33	85	105.23	8,945	287,652
16-Aug-09	34	ALT34	85	109.30	9,291	296,943
17-Aug-09	35	ALT35	85	101.18	8,601	305,543
18-Aug-09	36	ALT36	85	104.46	8,879	314,422
19-Aug-09	-	-	-	-	0	314,422
20-Aug-09	37	ALT37	85	106.40	9,044	323,466
21-Aug-09	38	ALT38	85	108.90	9,257	332,723
22-Aug-09	39	ALT39	85	110.77	9,415	342,138
23-Aug-09	40	ALT40	85	109.06	9,270	351,408
24-Aug-09	41	ALT41	85	104.28	8,864	360,272
25-Aug-09	42	ALT42	85	106.82	9,079	369,351
26-Aug-09	43	ALT43	85	109.33	9,293	378,645
27-Aug-09	44	ALT44	85	109.15	9,277	387,922
28-Aug-09	45	ALT45	66	106.83	7,051	394,973
29-Aug-09	46	ALT46	85	110.04	9,353	404,326
30-Aug-09	47	ALT47	85	108.42	9,216	413,542
31-Aug-09	48	ALT48	85	109.34	9,294	422,836
1-Sep-09	49	ALT49	110	104.66	11,513	434,349
2-Sep-09	50	ALT50	85	108.54	9,226	443,575
3-Sep-09	51	ALT51	85	105.16	8,938	452,513
4-Sep-09	52	ALT52	110	106.31	11,695	464,208
5-Sep-09	53	ALT53	85	104.97	8,922	473,130
6-Sep-09	54	ALT54	85	112.39	9,553	482,683
7-Sep-09	55	ALT55	70	107.10	7,497	490,180
8-Sep-09	56	ALT56	110	107.66	11,842	502,022
9-Sep-09	57	ALT57	110	104.05	11,446	513,468
10-Sep-09	58	ALT58	85	105.52	8,969	522,437
11-Sep-09	59	ALT59	110	102.29	11,252	533,689
12-Sep-09	60	ALT60	110	120.46	13,251	546,940
13-Sep-09	61	ALT61	85	79.50	6,757	553,697
14-Sep-09	62	ALT62	110	102.83	11,311	565,008
15-Sep-09	63	ALT63	85	104.40	8,874	573,882
16-Sep-09	-	-	-	-	0	573,882
17-Sep-09	-	-	-	-	0	573,882
18-Sep-09	64	ALT64	73	104.63	7,638	581,520
19-Sep-09	65	ALT65	64	105.28	6,738	588,258
20-Sep-09	-	-	-	-	0	588,258
21-Sep-09	-	-	-	-	0	588,258

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
22-Sep-09	-	-	-	-	0	588,258
23-Sep-09	66	ALT66	100	116.14	11,614	599,872
24-Sep-09	-	-	-	-	0	599,872
25-Sep-09	-	-	-	-	0	599,872
26-Sep-09	-	-	-	-	0	599,872
27-Sep-09	-	-	-	-	0	599,872
28-Sep-09	-	-	-	-	0	599,872
29-Sep-09	67	ALT67	85	93.02	7,907	607,779
30-Sep-09	68	ALT68	69	105.00	7,245	615,024
1-Oct-09	69	ALT69	110	104.15	11,457	626,481
2-Oct-09	-	-	-	-	0	626,481
3-Oct-09	70	ALT70	65	104.48	6,791	633,272
4-Oct-09	71	ALT71	66	108.30	7,148	640,420
5-Oct-09	-	-	-	-	0	640,420
6-Oct-09	72	ALT72	110	105.50	11,605	652,025
7-Oct-09	73	ALT73	66	107.28	7,081	659,106
8-Oct-09	74	ALT74	85	105.80	8,993	668,098
9-Oct-09	75	ALT75	85	107.07	9,101	677,199
10-Oct-09	76	ALT76	71	106.73	7,578	684,777
11-Oct-09	77	ALT77	88	108.39	9,538	694,315
12-Oct-09	-	-	-	-	0	694,315
13-Oct-09	-	-	-	-	0	694,315
14-Oct-09	-	-	-	-	0	694,315
15-Oct-09	-	-	-	-	0	694,315
16-Oct-09	-	-	-	-	0	694,315
17-Oct-09	-	-	-	-	0	694,315
18-Oct-09	-	-	-	-	0	694,315
19-Oct-09	-	-	-	-	0	694,315
20-Oct-09	78	ALT78	71	91.68	6,509	700,825
21-Oct-09	79	ALT79	66	100.81	6,653	707,478
22-Oct-09	80	ALT80	84	97.90	8,224	715,701
23-Oct-09	-	-	-	-	0	715,701
24-Oct-09	-	-	-	-	0	715,701
25-Oct-09	81	ALT81	88	94.45	8,312	724,013
26-Oct-09	82	ALT82	88	97.73	8,600	732,613
27-Oct-09	83	ALT83	66	96.96	6,400	739,012
28-Oct-09	-	-	-	-	0	739,012
29-Oct-09	84	ALT84	106	99.41	10,537	749,550
30-Oct-09	-	-	-	-	0	749,550
31-Oct-09	-	-	-	-	0	749,550
1-Nov-09	85	ALT85	106	98.56	10,447	759,997
2-Nov-09	86	ALT86	96	102.28	9,819	769,816

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
3-Nov-09	87	ALT87	88	99.39	8,746	778,562
4-Nov-09	88	ALT88	88	98.41	8,660	787,222
5-Nov-09	89	ALT89	88	99.59	8,764	795,986
6-Nov-09	-	-	-	-	0	795,986
7-Nov-09	90	ALT90	88	101.00	8,888	804,873
8-Nov-09	91	ALT91	106	98.22	10,412	815,285
9-Nov-09	-	-	-	-	0	815,285
10-Nov-09	92	ALT92	91	106.31	9,674	824,959
11-Nov-09	93	ALT93	66	100.26	6,617	831,576
12-Nov-09	94	ALT94	88	102.42	9,013	840,589
13-Nov-09	95	ALT95	106	105.14	11,144	851,734
14-Nov-09	96	ALT96	106	100.81	10,686	862,420
15-Nov-09	97	ALT97	106	99.46	10,542	872,962
16-Nov-09	98	ALT98	106	99.56	10,554	883,515
17-Nov-09	99	ALT99	106	99.92	10,591	894,107
18-Nov-09	100	ALT01	108	101.19	10,929	905,036
19-Nov-09	101	ALT02	108	100.21	10,822	915,858
20-Nov-09	102	ALT03	107	105.59	11,298	927,156
21-Nov-09	-	-	-	-	0	927,156
22-Nov-09	103	ALT04	108	102.26	11,044	938,199
23-Nov-09	104	ALT05	108	101.14	10,923	949,122
24-Nov-09	105	ALT06	108	104.76	11,315	960,437
25-Nov-09	106	ALT07	108	103.49	11,177	971,614
26-Nov-09	-	-	-	-	0	971,614
27-Nov-09	-	-	-	-	0	971,614
28-Nov-09	-	-	-	-	0	971,614
29-Nov-09	-	-	-	-	0	971,614
30-Nov-09	-	-	-	-	0	971,614
1-Dec-09	-	-	-	-	0	971,614
2-Dec-09	107	ALT08	75	108.32	8,124	979,738
3-Dec-09	108	ALT09	88	107.82	9,488	989,227
4-Dec-09	109	ALT10	108	109.13	11,786	1,001,013
5-Dec-09	-	-	-	-	0	1,001,013
6-Dec-09	110	ALT11	108	107.75	11,637	1,012,650
7-Dec-09	111	ALT12	108	105.03	11,343	1,023,993
8-Dec-09	112	ALT13	92	107.25	9,867	1,033,860
9-Dec-09	-	-	-	-	0	1,033,860
10-Dec-09	113	ALT14	87	111.85	9,731	1,043,591
11-Dec-09	114	ALT15	93	102.98	9,577	1,053,167
12-Dec-09	115	ALT16	104	109.24	11,361	1,064,528
13-Dec-09	-	-	-	-	0	1,064,528
14-Dec-09	116	ALT17	108	109.10	11,783	1,076,311

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
15-Dec-09	117	ALT18	108	100.68	10,873	1,087,184
16-Dec-09	118	ALT19	108	107.40	11,600	1,098,784
17-Dec-09	119	ALT20	107	105.82	11,323	1,110,106
18-Dec-09	120	ALT21	95	100.04	9,504	1,119,611
19-Dec-09	121	ALT22	87	100.60	8,752	1,128,362
20-Dec-09	122	ALT23	108	104.28	11,262	1,139,625
21-Dec-09	123	ALT24	98	101.06	9,904	1,149,529
22-Dec-09	124	ALT25	108	101.50	10,962	1,160,491
23-Dec-09	125	ALT26	102	102.47	10,452	1,170,943
24-Dec-09	-	-	-	-	0	1,170,943
25-Dec-09	-	-	-	-	0	1,170,943
26-Dec-09	-	-	-	-	0	1,170,943
27-Dec-09	-	-	-	-	0	1,170,943
28-Dec-09	126	ALT27	108	103.73	11,203	1,182,145
29-Dec-09	127	ALT28	100	101.30	10,130	1,192,275
30-Dec-09	128	ALT29	108	101.80	10,994	1,203,269
31-Dec-09	-	-	-	-	0	1,203,269
1-Jan-10	-	-	-	-	0	1,203,269
2-Jan-10	-	-	-	-	0	1,203,269
3-Jan-10	-	-	-	-	0	1,203,269
4-Jan-10	129	ALT35	87	100.16	8,714	1,211,983
5-Jan-10	130	ALT36	85	103.98	8,838	1,220,821
6-Jan-10	-	-	-	-	0	1,220,821
7-Jan-10	131	ALT37	83	104.17	8,646	1,229,467
8-Jan-10	132	ALT38	85	100.44	8,538	1,238,005
9-Jan-10	133	ALT39	88	101.75	8,954	1,246,958
10-Jan-10	134	ALT40	88	105.07	9,246	1,256,205
11-Jan-10	135	ALT41	88	105.76	9,307	1,265,512
12-Jan-10	136	ALT42	87	103.99	9,048	1,274,559
13-Jan-10	-	-	-	-	0	1,274,559
14-Jan-10	137	ALT43	82	105.27	8,633	1,283,192
15-Jan-10	138	ALT44	68	101.82	6,924	1,290,115
16-Jan-10	139	ALT45	108	103.64	11,194	1,301,309
17-Jan-10	-	-	-	-	0	1,301,309
18-Jan-10	140	ALT46	108	108.24	11,690	1,312,999
19-Jan-10	141	ALT47	92	99.77	9,179	1,322,178
20-Jan-10	142	ALT48	100	102.59	10,259	1,332,437
21-Jan-10	-	-	-	-	0	1,332,437
22-Jan-10	-	-	-	-	0	1,332,437
23-Jan-10	143	ALT49	98	103.61	10,154	1,342,591
24-Jan-10	144	ALT50	87	103.07	8,967	1,351,558
25-Jan-10	-	-	-	-	0	1,351,558
26-Jan-10	-	-	-	-	0	1,351,558

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
27-Jan-10	145	ALT51	88	105.92	9,321	1,360,878
28-Jan-10	146	ALT52	85	102.30	8,695	1,369,574
29-Jan-10	147	ALT53	89	103.96	9,252	1,378,826
30-Jan-10	-	-	-	-	0	1,378,826
31-Jan-10	-	-	-	-	0	1,378,826
1-Feb-10	-	-	-	-	0	1,378,826
2-Feb-10	-	-	-	-	0	1,378,826
3-Feb-10	148	ALT54	88	103.19	9,081	1,387,906
4-Feb-10	149	ALT55	87	105.24	9,156	1,397,062
5-Feb-10	-	-	-	-	0	1,397,062
6-Feb-10	-	-	-	-	0	1,397,062
7-Feb-10	-	-	-	-	0	1,397,062
8-Feb-10	-	-	-	-	0	1,397,062
9-Feb-10	-	-	-	-	0	1,397,062
10-Feb-10	150	ALT56	89	105.68	9,405	1,406,467
11-Feb-10	151	ALT57	87	103.14	8,973	1,415,440
12-Feb-10	152	ALT58	107	103.18	11,040	1,426,480
13-Feb-10	153	ALT59	94	103.25	9,705	1,436,185
14-Feb-10	154	ALT60	86	104.10	8,953	1,445,138
15-Feb-10	-	-	-	-	0	1,445,138
16-Feb-10	155	ALT61	78	100.86	7,867	1,453,005
17-Feb-10	156	ALT62	82	101.91	8,357	1,461,362
18-Feb-10	157	ALT63	105	103.98	10,918	1,472,280
19-Feb-10	158	ALT64	82	98.44	8,072	1,480,352
20-Feb-10	159	ALT65	84	105.75	8,883	1,489,235
21-Feb-10	160	ALT66	104	103.39	10,752	1,499,987
22-Feb-10	161	ALT67	84	103.22	8,671	1,508,657
23-Feb-10	162	ALT68	83	95.25	7,906	1,516,563
24-Feb-10	163	ALT69	105	97.43	10,231	1,526,794
25-Feb-10	164	ALT70	99	102.26	10,124	1,536,918
26-Feb-10	-	-	-	-	0	1,536,918
27-Feb-10	165	ALT71	105	100.02	10,502	1,547,420
28-Feb-10	166	ALT72	106	102.36	10,850	1,558,271
1-Mar-10	167	ALT73	101	109.77	11,087	1,569,357
2-Mar-10	168	ALT74	83	90.07	7,476	1,576,833
3-Mar-10	169	ALT75	83	102.26	8,488	1,585,321
4-Mar-10	-	-	-	-	0	1,585,321
5-Mar-10	-	-	-	-	0	1,585,321
6-Mar-10	170	ALT76	105	100.59	10,562	1,595,883
7-Mar-10	171	ALT77	104	104.78	10,898	1,606,781
8-Mar-10	172	ALT78	108	104.54	11,290	1,618,071
9-Mar-10	173	ALT79	108	105.46	11,390	1,629,460

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
10-Mar-10	-	-	-	-	0	1,629,460
11-Mar-10	-	-	-	-	0	1,629,460
12-Mar-10	174	ALT80	100	104.24	10,424	1,639,885
13-Mar-10	175	ALT81	105	103.05	10,820	1,650,704
14-Mar-10	176	ALT82	81	105.90	8,578	1,659,282
15-Mar-10	177	ALT83	85	101.36	8,616	1,667,898
16-Mar-10	178	ALT84	97	101.40	9,836	1,677,734
17-Mar-10	179	ALT85	98	104.73	10,263	1,687,997
18-Mar-10	-	-	-	-	0	1,687,997
19-Mar-10	180	ALT86	84	103.53	8,697	1,696,693
20-Mar-10	181	ALT87	84	98.50	8,274	1,704,967
21-Mar-10	182	ALT88	101	98.86	9,985	1,714,952
22-Mar-10	183	ALT89	81	100.94	8,176	1,723,128
23-Mar-10	-	-	-	-	0	1,723,128
24-Mar-10	184	ALT90	103	99.30	10,228	1,733,356
25-Mar-10	185	ALT91	81	100.02	8,102	1,741,458
26-Mar-10	186	ALT92	81	98.57	7,984	1,749,442
27-Mar-10	187	ALT93	105	102.86	10,800	1,760,242
28-Mar-10	-	-	-	-	0	1,760,242
29-Mar-10	188	ALT94	104	99.45	10,343	1,770,585
30-Mar-10	189	ALT95	105	102.01	10,711	1,781,296
31-Mar-10	190	ALT96	104	100.45	10,447	1,791,742
1-Apr-10	191	ALT97	106	102.49	10,864	1,802,607
2-Apr-10	192	ALT98	101	102.97	10,400	1,813,007
3-Apr-10	193	ALT99	101	100.92	10,193	1,823,200
4-Apr-10	-	-	-	-	0	1,823,200
5-Apr-10	194	ALT01	103	104.55	10,768	1,833,968
6-Apr-10	195	ALT02	105	99.79	10,478	1,844,446
7-Apr-10	196	ALT03	83	101.61	8,433	1,852,879
8-Apr-10	197	ALT04	103	98.99	10,196	1,863,075
9-Apr-10	-	-	-	-	0	1,863,075
10-Apr-10	198	ALT05	104	103.23	10,736	1,873,810
11-Apr-10	199	ALT06	80	104.37	8,350	1,882,160
12-Apr-10	200	ALT07	86	101.50	8,729	1,890,889
13-Apr-10	201	ALT08	84	100.47	8,439	1,899,328
14-Apr-10	202	ALT09	84	101.77	8,548	1,907,877
15-Apr-10	203	ALT10	85	101.96	8,667	1,916,543
16-Apr-10	204	ALT11	106	99.55	10,552	1,927,095
17-Apr-10	205	ALT12	104	102.64	10,675	1,937,770
18-Apr-10	206	ALT13	84	102.14	8,580	1,946,350
19-Apr-10	207	ALT14	105	102.80	10,794	1,957,144
20-Apr-10	208	ALT15	105	103.12	10,828	1,967,972
21-Apr-10	209	ALT16	85	105.79	8,992	1,976,964

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
22-Apr-10	210	ALT17	106	103.67	10,989	1,987,953
23-Apr-10	211	ALT18	86	91.78	7,894	1,995,847
24-Apr-10	212	ALT19	104	103.80	10,796	2,006,642
25-Apr-10	-	-	-	-	0	2,006,642
26-Apr-10	213	ALT20	84	101.85	8,555	2,015,198
27-Apr-10	214	ALT21	86	101.54	8,732	2,023,930
28-Apr-10	215	ALT22	106	100.08	10,608	2,034,538
29-Apr-10	216	ALT23	104	99.43	10,341	2,044,879
30-Apr-10	217	ALT24	104	103.49	10,763	2,055,642
1-May-10	218	ALT25	104	102.02	10,610	2,066,252
2-May-10	219	ALT26	106	102.58	10,873	2,077,125
3-May-10	-	-	-	-	0	2,077,125
4-May-10	220	ALT27	101	103.65	10,469	2,087,594
5-May-10	221	ALT28	106	100.95	10,700	2,098,294
6-May-10	222	ALT29	84	99.99	8,400	2,106,694
6-May-10	223	ALT30	84	98.65	8,287	2,114,980
7-May-10	224	ALT31	106	103.48	10,969	2,125,949
8-May-10	225	ALT32	84	97.33	8,176	2,134,125
9-May-10	226	ALT33	106	100.48	10,651	2,144,775
10-May-10	227	ALT34	106	98.46	10,437	2,155,212
11-May-10	228	ALT35	106	99.47	10,544	2,165,756
12-May-10	229	ALT36	105	104.24	10,945	2,176,701
13-May-10	230	ALT37	104	100.53	10,455	2,187,156
14-May-10	231	ALT38	106	99.43	10,539	2,197,695
15-May-10	232	ALT39	105	104.70	10,993	2,208,689
16-May-10	233	ALT40	88	104.21	9,171	2,217,860
17-May-10	234	ALT41	104	101.27	10,532	2,228,391
18-May-10	235	ALT42	105	100.32	10,533	2,238,924
19-May-10	236	ALT43	104	103.54	10,768	2,249,693
20-May-10	237	ALT44	106	103.58	10,979	2,260,672
21-May-10	238	ALT45	104	101.00	10,504	2,271,176
22-May-10	239	ALT46	84	103.21	8,669	2,279,845
23-May-10	240	ALT47	106	102.86	10,903	2,290,749
24-May-10	241	ALT48	105	101.23	10,629	2,301,378
25-May-10	242	ALT49	106	100.53	10,656	2,312,034
26-May-10	243	ALT50	84	102.00	8,568	2,320,602
27-May-10	244	ALT51	104	102.37	10,646	2,331,248
28-May-10	245	ALT52	108	96.60	10,432	2,341,680
29-May-10	246	ALT53	104	99.78	10,377	2,352,057
30-May-10	-	-	-	-	0	2,352,057
31-May-10	-	-	-	-	0	2,352,057
1-Jun-10	247	ALT54	83	100.77	8,364	2,360,421

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
2-Jun-10	248	ALT55	106	101.58	10,768	2,371,189
3-Jun-10	249	ALT56	104	101.09	10,514	2,381,703
4-Jun-10	250	ALT57	106	101.47	10,756	2,392,459
5-Jun-10	251	ALT58	103	101.11	10,414	2,402,873
6-Jun-10	252	ALT59	106	99.27	10,522	2,413,396
7-Jun-10	253	ALT60	106	98.11	10,399	2,423,795
8-Jun-10	254	ALT61	100	101.69	10,169	2,433,964
9-Jun-10	255	ALT62	108	99.05	10,697	2,444,661
10-Jun-10	256	ALT63	102	99.19	10,118	2,454,779
11-Jun-10	257	ALT64	100	99.73	9,973	2,464,752
12-Jun-10	258	ALT65	105	99.15	10,411	2,475,163
13-Jun-10	259	ALT66	91	100.05	9,104	2,484,267
14-Jun-10	260	ALT67	105	101.19	10,625	2,494,892
15-Jun-10	261	ALT68	83	100.92	8,376	2,503,268
16-Jun-10	262	ALT69	104	99.81	10,381	2,513,649
17-Jun-10	263	ALT70	86	101.22	8,705	2,522,354
18-Jun-10	264	ALT71	105	99.65	10,463	2,532,817
19-Jun-10	265	ALT72	84	102.19	8,584	2,541,401
20-Jun-10	266	ALT73	103	99.75	10,274	2,551,675
21-Jun-10	267	ALT74	105	107.21	11,257	2,562,932
22-Jun-10	268	ALT75	105	102.05	10,716	2,573,648
23-Jun-10	269	ALT76	104	101.48	10,554	2,584,202
24-Jun-10	270	ALT77	106	101.00	10,706	2,594,908
25-Jun-10	271	ALT78	104	100.77	10,480	2,605,388
26-Jun-10	272	ALT79	81	100.39	8,131	2,613,519
27-Jun-10	273	ALT80	102	98.68	10,066	2,623,585
28-Jun-10	274	ALT81	104	101.00	10,504	2,634,088
29-Jun-10	275	ALT82	86	98.73	8,491	2,642,579
30-Jun-10	276	ALT83	106	101.39	10,748	2,653,327
1-Jul-10	277	ALT84	104	101.61	10,568	2,663,895
2-Jul-10	278	ALT85	100	98.70	9,870	2,673,765
3-Jul-10	-	-	-	-	0	2,673,765
4-Jul-10	-	-	-	-	0	2,673,765
5-Jul-10	-	-	-	-	0	2,673,765
6-Jul-10	279	ALT86	106	101.43	10,752	2,684,516
7-Jul-10	280	ALT87	104	101.32	10,538	2,695,054
8-Jul-10	281	ALT88	106	101.49	10,758	2,705,812
9-Jul-10	282	ALT89	106	102.37	10,851	2,716,663
10-Jul-10	283	ALT90	105	97.14	10,200	2,726,863
11-Jul-10	284	ALT91	83	100.57	8,347	2,735,211
12-Jul-10	285	ALT92	104	101.48	10,554	2,745,765
13-Jul-10	286	ALT93	106	99.03	10,498	2,756,262

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
14-Jul-10	287	ALT94	106	99.04	10,498	2,766,760
15-Jul-10	288	ALT95	104	102.04	10,613	2,777,373
16-Jul-10	289	ALT96	103	100.99	10,402	2,787,774
17-Jul-10	290	ALT97	93	99.37	9,242	2,797,016
18-Jul-10	291	ALT98	92	102.35	9,416	2,806,432
19-Jul-10	292	ALT99	106	101.81	10,792	2,817,224
20-Jul-10	293	ALT01	100	96.06	9,606	2,826,829
21-Jul-10	294	ALT02	106	102.48	10,863	2,837,692
22-Jul-10	295	ALT03	105	99.12	10,408	2,848,100
23-Jul-10	296	ALT04	84	101.46	8,522	2,856,622
24-Jul-10	297	ALT05	85	100.42	8,536	2,865,158
25-Jul-10	298	ALT06	104	96.53	10,039	2,875,198
26-Jul-10	299	ALT07	105	98.33	10,325	2,885,522
27-Jul-10	300	ALT08	102	95.73	9,764	2,895,287
28-Jul-10	301	ALT09	106	97.44	10,328	2,905,615
29-Jul-10	302	ALT10	104	98.84	10,280	2,915,895
30-Jul-10	303	ALT11	106	101.84	10,795	2,926,689
31-Jul-10	304	ALT12	104	99.53	10,351	2,937,041
1-Aug-10	305	ALT13	106	100.37	10,640	2,947,680
2-Aug-10	306	ALT14	104	97.27	10,117	2,957,797
3-Aug-10	307	ALT15	106	96.15	10,192	2,967,989
4-Aug-10	308	ALT16	104	98.86	10,281	2,978,270
5-Aug-10	309	ALT17	105	96.86	10,170	2,988,441
6-Aug-10	310	ALT18	102	97.00	9,894	2,998,335
7-Aug-10	311	ALT19	104	97.72	10,163	3,008,498
8-Aug-10	312	ALT20	85	96.30	8,186	3,016,683
9-Aug-10	313	ALT21	103	95.75	9,862	3,026,546
10-Aug-10	314	ALT22	84	101.61	8,536	3,035,081
11-Aug-10	315	ALT23	103	100.96	10,398	3,045,479
12-Aug-10	316	ALT24	106	100.36	10,639	3,056,118
13-Aug-10	317	ALT25	106	101.82	10,793	3,066,911
14-Aug-10	318	ALT26	106	101.92	10,804	3,077,714
15-Aug-10	319	ALT27	97	99.29	9,631	3,087,345
16-Aug-10	320	ALT28	106	99.94	10,593	3,097,938
17-Aug-10	321	ALT29	103	100.38	10,339	3,108,277
18-Aug-10	322	ALT30	84	101.79	8,550	3,116,828
19-Aug-10	323	ALT31	106	98.49	10,440	3,127,268
20-Aug-10	324	ALT32	104	101.48	10,554	3,137,822
21-Aug-10	325	ALT33	106	101.06	10,713	3,148,535
22-Aug-10	326	ALT34	104	99.97	10,396	3,158,931
23-Aug-10	327	ALT35	106	98.48	10,439	3,169,370

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
24-Aug-10	328	ALT36	102	96.61	9,854	3,179,224
25-Aug-10	329	ALT37	104	99.46	10,344	3,189,568
26-Aug-10	330	ALT38	106	100.51	10,654	3,200,221
27-Aug-10	331	ALT39	106	102.73	10,890	3,211,111
28-Aug-10	332	ALT40	106	98.02	10,391	3,221,502
29-Aug-10	333	ALT41	85	94.11	8,000	3,229,501
30-Aug-10	334	ALT42	106	100.53	10,656	3,240,158
31-Aug-10	335	ALT43	104	98.02	10,194	3,250,352
1-Sep-10	336	ALT44	106	98.64	10,456	3,260,808
2-Sep-10	337	ALT45	104	98.24	10,217	3,271,025
3-Sep-10	338	ALT46	105	96.68	10,152	3,281,177
4-Sep-10	339	ALT47	84	96.65	8,119	3,289,295
5-Sep-10	340	ALT48	83	98.59	8,183	3,297,478
6-Sep-10	-	-	-	-	0	3,297,478
7-Sep-10	341	ALT49	106	96.13	10,190	3,307,668
8-Sep-10	342	ALT50	106	95.38	10,111	3,317,779
9-Sep-10	343	ALT51	105	97.17	10,203	3,327,982
10-Sep-10	344	ALT52	104	101.58	10,564	3,338,546
11-Sep-10	-	-	-	-	0	3,338,546
12-Sep-10	345	ALT53	84	101.61	8,535	3,347,081
13-Sep-10	346	ALT54	106	100.55	10,659	3,357,740
14-Sep-10	347	ALT55	106	100.11	10,612	3,368,351
15-Sep-10	348	ALT56	104	97.65	10,156	3,378,507
16-Sep-10	349	ALT57	106	94.71	10,039	3,388,546
17-Sep-10	350	ALT58	106	97.61	10,347	3,398,893
18-Sep-10	351	ALT59	103	93.34	9,614	3,408,507
19-Sep-10	352	ALT60	84	95.08	7,987	3,416,494
20-Sep-10	353	ALT61	106	99.69	10,567	3,427,061
21-Sep-10	354	ALT62	104	112.37	11,686	3,438,747
22-Sep-10	355	ALT63	102	86.27	8,799	3,447,546
23-Sep-10	356	ALT64	106	99.07	10,501	3,458,048
24-Sep-10	357	ALT65	104	101.40	10,546	3,468,593
25-Sep-10	358	ALT66	104	98.06	10,199	3,478,792
26-Sep-10	-	-	-	-	0	3,478,792
27-Sep-10	359	ALT67	106	97.47	10,332	3,489,124
28-Sep-10	360	ALT68	104	98.19	10,211	3,499,335
29-Sep-10	361	ALT69	106	94.55	10,023	3,509,358
30-Sep-10	362	ALT70	106	93.95	9,959	3,519,316
1-Oct-10	363	ALT71	104	94.06	9,782	3,529,098
2-Oct-10	364	ALT72	106	95.80	10,155	3,539,253
3-Oct-10	-	-	-	-	0	3,539,253
4-Oct-10	365	ALT73	104	95.43	9,924	3,549,177
5-Oct-10	366	ALT74	103	91.46	9,420	3,558,597

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
6-Oct-10	367	ALT75	104	95.36	9,917	3,568,515
7-Oct-10	368	ALT76	104	94.44	9,822	3,578,336
8-Oct-10	369	ALT77	104	96.70	10,056	3,588,393
9-Oct-10	370	ALT78	102	94.77	9,666	3,598,059
10-Oct-10	371	ALT79	105	98.37	10,329	3,608,388
11-Oct-10	372	ALT80	106	96.67	10,247	3,618,635
12-Oct-10	373	ALT81	104	96.41	10,027	3,628,661
13-Oct-10	374	ALT82	100	97.81	9,781	3,638,443
14-Oct-10	375	ALT83	103	96.60	9,950	3,648,392
15-Oct-10	376	ALT84	104	100.85	10,488	3,658,880
16-Oct-10	377	ALT85	106	100.76	10,680	3,669,561
17-Oct-10	-	-	-	-	0	3,669,561
18-Oct-10	378	ALT86	104	93.80	9,755	3,679,316
19-Oct-10	379	ALT87	104	100.33	10,434	3,689,750
20-Oct-10	380	ALT88	106	98.80	10,473	3,700,223
21-Oct-10	381	ALT89	103	86.76	8,936	3,709,159
22-Oct-10	382	ALT90	106	97.54	10,339	3,719,498
23-Oct-10	-	-	-	-	0	3,719,498
24-Oct-10	383	ALT91	106	99.71	10,569	3,730,067
25-Oct-10	384	ALT92	84	98.14	8,243	3,738,311
26-Oct-10	385	ALT93	106	85.52	9,065	3,747,375
27-Oct-10	386	ALT94	84	104.04	8,740	3,756,115
28-Oct-10	387	ALT95	84	105.07	8,826	3,764,941
29-Oct-10	388	ALT96	90	96.47	8,683	3,773,624
30-Oct-10	389	ALT97	90	95.97	8,637	3,782,261
31-Oct-10	-	-	-	-	0	3,782,261
1-Nov-10	390	ALT98	90	98.78	8,890	3,791,151
2-Nov-10	391	ALT99	90	102.35	9,212	3,800,363
3-Nov-10	-	-	-	-	0	3,800,363
4-Nov-10	392	ALT01	90	94.58	8,512	3,808,875
5-Nov-10	393	ALT02	90	93.63	8,426	3,817,302
6-Nov-10	394	ALT03	90	97.45	8,770	3,826,072
7-Nov-10	395	ALT04	90	93.60	8,424	3,834,496
8-Nov-10	396	ALT05	90	97.61	8,785	3,843,281
9-Nov-10	397	ALT06	106	98.49	10,440	3,853,721
10-Nov-10	398	ALT07	106	99.43	10,540	3,864,261
11-Nov-10	399	ALT08	106	97.19	10,302	3,874,563
12-Nov-10	400	ALT09	105	105.67	11,095	3,885,658
13-Nov-10	401	ALT10	106	100.22	10,624	3,896,282
14-Nov-10	-	-	-	-	0	3,896,282
15-Nov-10	402	ALT11	106	98.62	10,454	3,906,736
16-Nov-10	403	ALT12	106	97.07	10,290	3,917,026
17-Nov-10	404	ALT13	102	99.72	10,171	3,927,197

TABLE F-2 DAILY TRANSPORTED QUANTITIES

Ship Date	Train Number	Waybill Train Number	Number of Railcars Shipped	Net Weight per Railcar (Tons)	Net Weight of Material on Train[a] (Tons)	Cumulative Net Weight (Tons)
18-Nov-10	405	ALT14	106	96.84	10,265	3,937,462
19-Nov-10	406	ALT15	84	98.38	8,264	3,945,726
20-Nov-10	407	ALT16	84	97.57	8,196	3,953,922
21-Nov-10	-	-	-	-	0	3,953,922
22-Nov-10	408	ALT17	106	97.81	10,368	3,964,290
23-Nov-10	409	ALT18	106	99.17	10,512	3,974,802
24-Nov-10	410	ALT19	82	101.56	8,328	3,983,130
25-Nov-10	-	-	-	-	0	3,983,130
26-Nov-10	-	-	-	-	0	3,983,130
27-Nov-10	411	ALT20	84	97.28	8,172	3,991,302
28-Nov-10	412	ALT21	84	97.94	8,227	3,999,528
29-Nov-10	413	ALT22	101	116.05	11,721	4,011,250
30-Nov-10	-	-	-	-	0	4,011,250
1-Dec-10	414	ALT23	106	100.80	10,685	4,021,935
7-Jan-11	999[b]	N/A	-	-	3,133	4,025,068
TOTAL	**414**		**39,712**	**-**	**4,025,068**	**4,025,068**
AVERAGE	**-**		**96**	**101.36**	**-**	**-**

[a] As measured on calibrated scales at Uniontown Landfill

[b] Final railyard cleanup quantity

Appendix G
Daily Unloaded Quantities

FIGURE G-1 DAILY UNLOADED QUANTITIES

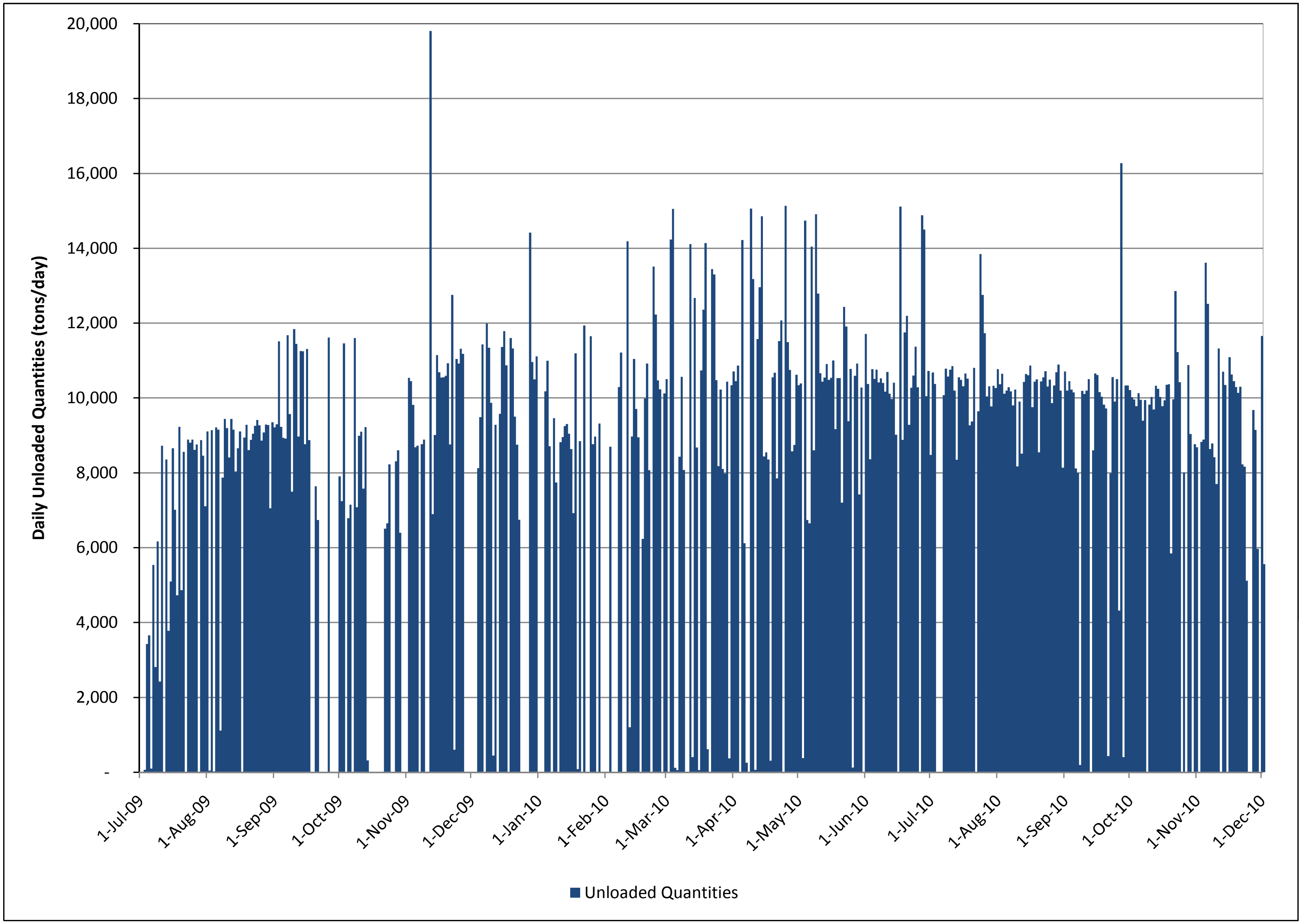

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TABLE G-1 UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA BY TRAIN

Completed Train No.	No. of Railcars	No. of Loads to Date	Tonnage	Tons/Load	Arrival Date	Completion Date	Comments
01-ALT01	80	191	7,153.05	37.45	3-Jul-09	6-Jul-09	
02-ALT02	85	194	8,447.52	43.54	6-Jul-09	8-Jul-09	
03-ALT03	85	229	8,589.68	37.51	8-Jul-09	10-Jul-09	
04-ALT04	85	229	8,746.76	38.20	10-Jul-09	11-Jul-09	
05-ALT05	85	223	8,421.61	37.77	12-Jul-09	14-Jul-09	
06-ALT06	85	244	8,789.95	36.02	13-Jul-09	15-Jul-09	
07-ALT07	85	223	8,754.07	39.26	16-Jul-09	16-Jul-09	
08-ALT08	85	227	8,809.48	38.81	17-Jul-09	18-Jul-09	
09-ALT09	80	207	8,095.96	39.11	18-Jul-09	19-Jul-09	
10-ALT10	84	213	8,827.27	41.44	19-Jul-09	20-Jul-09	
11-ALT11	83	213	8,563.33	40.20	20-Jul-09	21-Jul-09	
12-ALT12	85	226	8,887.23	39.32	22-Jul-09	23-Jul-09	
13-ALT13	85	222	8,805.39	39.66	23-Jul-09	24-Jul-09	
14-ALT14	85	219	8,885.78	40.57	25-Jul-09	25-Jul-09	
15-ALT15	85	216	8,615.89	39.89	26-Jul-09	26-Jul-09	
16-ALT16	85	209	8,757.12	41.90	27-Jul-09	27-Jul-09	
17-ALT17	85	208	8,876.05	42.67	29-Jul-09	29-Jul-09	
18-ALT18	85	191	8,461.39	44.30	30-Jul-09	30-Jul-09	
19-ALT19	66	156	7,107.97	45.56	31-Jul-09	31-Jul-09	
20-ALT20	85	194	9,155.19	47.19	1-Aug-09	2-Aug-09	
21-ALT21	84	215	9,164.11	42.62	2-Aug-09	4-Aug-09	
22-ALT22	86	215	9,331.26	43.40	5-Aug-09	6-Aug-09	
23-ALT23	85	209	9,040.81	43.26	6-Aug-09	6-Aug-09	
24-ALT24	85	218	8,985.96	**41.22**	7-Aug-09	8-Aug-09	Tonnage adjusted to reflect 41.22 tons/load average
25-ALT25	85	230	9,480.60	**41.22**	9-Aug-09	10-Aug-09	One cleanup load on 8/10/09; Tonnage adjusted to reflect 41.22 tons/load average
26-ALT26	85	222	9,150.84	**41.22**	10-Aug-09	10-Aug-09	Tonnage adjusted to reflect 41.22 tons/load average
27-ALT27	85	229	9,439.38	**41.22**	12-Aug-09	12-Aug-09	Tonnage adjusted to reflect 41.22 tons/load average
28-ALT28	85	204	8,408.88	**41.22**	11-Aug-09	11-Aug-09	Tonnage adjusted to reflect 41.22 tons/load average
29-ALT29	85	222	9,150.84	**41.22**	13-Aug-09	13-Aug-09	Tonnage adjusted to reflect 41.22 tons/load average
30-ALT30	85	195	8,037.90	**41.22**	14-Aug-09	14-Aug-09	Tonnage adjusted to reflect 41.22 tons/load average
31-ALT31	85	212	8,738.64	**41.22**	15-Aug-09	15-Aug-09	Tonnage adjusted to reflect 41.22 tons/load average
32-ALT32	85	219	9,027.18	**41.22**	16-Aug-09	16-Aug-09	Tonnage adjusted to reflect 41.22 tons/load average
33-ALT33	85	217	8,944.74	**41.22**	17-Aug-09	18-Aug-09	Tonnage adjusted to reflect 41.22 tons/load average
34-ALT34	85	224	9,290.76	41.48	19-Aug-09	19-Aug-09	
35-ALT35	85	205	8,600.66	41.95	20-Aug-09	20-Aug-09	
36-ALT36	85	208	8,878.78	42.69	21-Aug-09	21-Aug-09	
37-ALT37	85	201	9,044.01	45.00	22-Aug-09	22-Aug-09	
38-ALT38	85	203	9,256.51	45.60	23-Aug-09	23-Aug-09	
39-ALT39	85	204	9,415.43	46.15	24-Aug-09	24-Aug-09	
40-ALT40	85	197	9,269.79	47.05	25-Aug-09	25-Aug-09	
41-ALT41	85	198	8,864.03	44.77	26-Aug-09	26-Aug-09	
42-ALT42	85	196	9,079.35	46.32	27-Aug-09	27-Aug-09	

TABLE G-1 UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA BY TRAIN

Completed Train No.	No. of Railcars	No. of Loads to Date	Tonnage	Tons/Load	Arrival Date	Completion Date	Comments
43-ALT43	85	216	9,293.39	43.02	28-Aug-09	28-Aug-09	
44-ALT44	85	210	9,277.42	44.18	29-Aug-09	29-Aug-09	
45-ALT45	66	160	7,050.69	44.07	30-Aug-09	30-Aug-09	
46-ALT46	85	205	9,353.03	45.62	31-Aug-09	31-Aug-09	
47-ALT47	85	206	9,216.02	44.74	1-Sep-09	1-Sep-09	
48-ALT48	85	199	9,294.25	46.70	2-Sep-09	2-Sep-09	
49-ALT49	110	252	11,512.55	45.68	3-Sep-09	4-Sep-09	
50-ALT50	85	205	9,226.25	45.01	4-Sep-09	4-Sep-09	
51-ALT51	85	201	8,938.48	44.47	5-Sep-09	5-Sep-09	
52-ALT52	110	203	8,922.03	43.95	6-Sep-09	6-Sep-09	
53-ALT53	85	277	11,694.52	42.22	7-Sep-09	7-Sep-09	
54-ALT54	85	223	9,553.13	42.84	8-Sep-09	8-Sep-09	
55-ALT55	70	173	7,496.81	43.33	9-Sep-09	9-Sep-09	
56-ALT56	110	270	11,842.17	43.86	10-Sep-09	10-Sep-09	
57-ALT57	110	280	11,446.00	40.88	11-Sep-09	11-Sep-09	Tonnage adjusted to reflect MACTEC's totals
58-ALT58	85	210	8,969.00	42.71	12-Sep-09	12-Sep-09	Tonnage adjusted to reflect MACTEC's totals
59-ALT59	110	273	11,252.00	41.22	13-Sep-09	13-Sep-09	Tonnage adjusted to reflect MACTEC's totals
60-ALT60	110	272	11,246.00	41.35	14-Sep-09	15-Sep-09	Tonnage adjusted to reflect MACTEC's totals
61-ALT61	85	182	8,762.00	48.14	15-Sep-09	15-Sep-09	Tonnage adjusted to reflect MACTEC's totals
62-ALT62	110	289	11,311.00	39.14	16-Sep-09	16-Sep-09	Tonnage adjusted to reflect MACTEC's totals
63-ALT63	85	212	8,874.00	41.86	17-Sep-09	17-Sep-09	Tonnage adjusted to reflect MACTEC's totals
64-ALT64	73	165	7,638.00	46.29	20-Sep-09	20-Sep-09	Tonnage adjusted to reflect MACTEC's totals
65-ALT65	64	167	6,738.00	40.35	21-Sep-09	21-Sep-09	Tonnage adjusted to reflect MACTEC's totals
66-ALT66	100	225	11,614.00	51.62	26-Sep-09	26-Sep-09	Tonnage adjusted to reflect MACTEC's totals
67-ALT67	85	210	7,907.00	37.65	1-Oct-09	1-Oct-09	Tonnage adjusted to reflect MACTEC's totals
68-ALT68	69	190	7,245.00	38.13	1-Oct-09	2-Oct-09	Tonnage adjusted to reflect MACTEC's totals
69-ALT69	110	293	11,457.00	39.10	2-Oct-09	3-Oct-09	Tonnage adjusted to reflect MACTEC's totals
70-ALT70	65	174	6,791.00	39.03	4-Oct-09	5-Oct-09	Tonnage adjusted to reflect MACTEC's totals
71-ALT71	66	183	7,147.80	39.06	5-Oct-09	6-Oct-09	
72-ALT72	110	274	11,605.29	42.36	8-Oct-09	8-Oct-09	
73-ALT73	66	165	7,080.59	42.91	9-Oct-09	9-Oct-09	
74-ALT74	85	213	8,992.59	42.22	9-Oct-09	10-Oct-09	
75-ALT75	85	222	9,101.14	41.00	11-Oct-09	11-Oct-09	
76-ALT76	71	187	7,578.00	40.52	12-Oct-09	12-Oct-09	Tonnage adjusted to 7,578 per TVA
77-ALT77	88	241	9,538.00	39.58	13-Oct-09	13-Oct-09	Tonnage adjusted to 9,538 per TVA
78-ALT78	71	177	6,509.20	36.78	22-Oct-09	22-Oct-09	
79-ALT79	66	171	6,653.33	38.91	23-Oct-09	23-Oct-09	
80-ALT80	84	212	8,223.50	38.79	24-Oct-09	24-Oct-09	
81-ALT81	88	225	8,311.57	36.94	27-Oct-09	27-Oct-09	
82-ALT82	88	236	8,599.91	36.44	28-Oct-09	28-Oct-09	
83-ALT83	66	169	6,399.59	37.87	29-Oct-09	29-Oct-09	
84-ALT84	106	278	10,537.40	37.90	2-Nov-09	2-Nov-09	

TABLE G-1 UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA BY TRAIN

Completed Train No.	No. of Railcars	No. of Loads to Date	Tonnage	Tons/Load	Arrival Date	Completion Date	Comments
85-ALT85	106	269	10,447.08	38.84	3-Nov-09	3-Nov-09	
86-ALT86	96	255	9,818.78	38.51	4-Nov-09	4-Nov-09	
87-ALT87	88	233	8,746.09	37.54	5-Nov-09	5-Nov-09	
88-ALT88	88	226	8,659.93	38.32	6-Nov-09	6-Nov-09	
89-ALT89	88	229	8,763.94	38.27	7-Nov-09	8-Nov-09	
90-ALT90	88	229	8,887.80	38.81	9-Nov-09	9-Nov-09	
91-ALT91	106	269	10,411.70	38.71	12-Nov-09	12-Nov-09	
92-ALT92	91	263	9,674.32	36.78	12-Nov-09	13-Nov-09	
93-ALT93	66	178	6,617.03	37.17	13-Nov-09	13-Nov-09	
94-ALT94	88	248	9,012.70	36.34	14-Nov-09	14-Nov-09	
95-ALT95	106	287	11,144.39	38.83	15-Nov-09	15-Nov-09	
96-ALT96	106	286	10,685.97	37.36	16-Nov-09	16-Nov-09	
97-ALT97	106	278	10,542.39	37.92	17-Nov-09	17-Nov-09	
98-ALT98	106	279	10,553.54	37.83	18-Nov-09	18-Nov-09	
99-ALT99	106	273	10,591.29	38.80	19-Nov-09	19-Nov-09	
100-ALT01	108	279	10,928.93	39.17	20-Nov-09	20-Nov-09	
101-ALT02	108	275	10,822.21	39.35	21-Nov-09	21-Nov-09	
102-ALT03	107	281	11,297.64	40.21	22-Nov-09	22-Nov-09	
103-ALT04	108	273	11,043.70	40.45	24-Nov-09	24-Nov-09	
104-ALT05	108	276	10,923.13	39.58	25-Nov-09	25-Nov-09	
105-ALT06	108	298	11,314.60	37.97	26-Nov-09	26-Nov-09	
106-ALT07	108	282	11,177.17	39.64	27-Nov-09	27-Nov-09	
107-ALT08	75	185	8,124.33	43.92	4-Dec-09	4-Dec-09	
108-ALT09	88	224	9,488.07	42.36	5-Dec-09	5-Dec-09	
109-ALT10	108	282	11,786.46	41.80	6-Dec-09	6-Dec-09	
110-ALT11	108	281	11,636.52	41.41	8-Dec-09	8-Dec-09	
111-ALT12	108	265	11,343.03	42.80	9-Dec-09	9-Dec-09	
112-ALT13	92	223	9,867.00	44.25	10-Dec-09	10-Dec-09	
113-ALT14	87	234	9,731.08	41.59	11-Dec-09	12-Dec-09	
114-ALT15	93	237	9,576.86	40.41	14-Dec-09	14-Dec-09	
115-ALT16	104	264	11,360.63	43.03	15-Dec-09	15-Dec-09	
116-ALT17	108	271	11,782.99	43.48	16-Dec-09	16-Dec-09	
117-ALT18	108	255	10,873.08	42.64	17-Dec-09	17-Dec-09	
118-ALT19	108	268	11,599.71	43.28	19-Dec-09	19-Dec-09	
119-ALT20	107	275	11,322.50	41.17	20-Dec-09	20-Dec-09	
120-ALT21	95	228	9,504.21	41.69	21-Dec-09	21-Dec-09	
121-ALT22	87	203	8,751.85	43.11	22-Dec-09	22-Dec-09	
122-ALT23	108	263	11,262.31	42.82	23-Dec-09	28-Dec-09	
123-ALT24	98	227	9,904.33	43.63	28-Dec-09	28-Dec-09	
124-ALT25	108	246	10,961.51	44.56	29-Dec-09	29-Dec-09	
125-ALT26	102	242	10,452.18	43.19	30-Dec-09	30-Dec-09	
126-ALT27	108	276	11,202.54	40.59	31-Dec-09	31-Dec-09	

TABLE G-1 UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA BY TRAIN

Completed Train No.	No. of Railcars	No. of Loads to Date	Tonnage	Tons/Load	Arrival Date	Completion Date	Comments
127-ALT28	100	242	10,129.61	41.86	4-Jan-10	4-Jan-10	
128-ALT29	108	282	10,994.15	38.99	5-Jan-10	5-Jan-10	
129-ALT35	87	220	8,713.78	39.61	6-Jan-10	6-Jan-10	
130-ALT36	85	223	8,838.00	39.63	8-Jan-10	8-Jan-10	Tonnage adjusted to 8,838 per TVA
131-ALT37	83	278	8,646.00	31.10	8-Jan-10	11-Jan-10	Tonnage adjusted to 8,646 per TVA
132-ALT38	85	247	8,537.65	34.57	11-Jan-10	11-Jan-10	
133-ALT39	88	241	8,953.76	37.15	12-Jan-10	12-Jan-10	
134-ALT40	88	243	9,246.34	38.05	13-Jan-10	13-Jan-10	
135-ALT41	88	237	9,307.07	39.27	14-Jan-10	14-Jan-10	
136-ALT42	87	228	9,047.52	39.68	15-Jan-10	15-Jan-10	
137-ALT43	82	215	8,632.50	40.15	16-Jan-10	16-Jan-10	
138-ALT44	68	165	6,923.52	41.96	17-Jan-10	17-Jan-10	
139-ALT45	108	281	11,193.61	39.83	18-Jan-10	18-Jan-10	
140-ALT46	108	281	11,690.07	41.60	20-Jan-10	22-Jan-10	
141-ALT47	92	216	9,178.96	42.50	22-Jan-10	22-Jan-10	
142-ALT48	100	244	10,259.06	42.05	25-Jan-10	25-Jan-10	
143-ALT49	98	256	10,154.00	39.66	25-Jan-10	26-Jan-10	Tonnage adjusted to 10,154 per TVA
144-ALT50	87	225	8,967.00	39.85	27-Jan-10	27-Jan-10	Tonnage adjusted to 8,967 per TVA
145-ALT51	88	255	9,320.57	36.55	29-Jan-10	29-Jan-10	
146-ALT52	85	224	8,695.40	38.82	3-Feb-10	3-Feb-10	
147-ALT53	89	229	9,252.02	40.40	7-Feb-10	7-Feb-10	
148-ALT54	88	223	9,080.56	40.72	7-Feb-10	8-Feb-10	
149-ALT55	87	221	9,155.61	41.43	8-Feb-10	11-Feb-10	
150-ALT56	89	235	9,405.09	40.02	11-Feb-10	12-Feb-10	
151-ALT57	87	219	8,972.94	40.97	13-Feb-10	13-Feb-10	
152-ALT58	107	272	11,040.09	40.59	14-Feb-10	14-Feb-10	
153-ALT59	94	224	9,705.20	43.33	15-Feb-10	15-Feb-10	
154-ALT60	86	200	8,952.77	44.76	16-Feb-10	16-Feb-10	
155-ALT61	78	183	7,866.80	42.99	18-Feb-10	19-Feb-10	
156-ALT62	82	189	8,356.97	44.22	19-Feb-10	19-Feb-10	
157-ALT63	105	249	10,917.98	43.85	20-Feb-10	20-Feb-10	
158-ALT64	82	187	8,071.90	43.17	21-Feb-10	21-Feb-10	
159-ALT65	84	237	8,882.68	37.48	22-Feb-10	23-Feb-10	
160-ALT66	104	260	10,752.14	41.35	23-Feb-10	24-Feb-10	
161-ALT67	84	202	8,670.74	42.92	24-Feb-10	25-Feb-10	
162-ALT68	83	191	7,905.93	41.39	25-Feb-10	25-Feb-10	
163-ALT69	105	279	10,230.60	36.67	26-Feb-10	26-Feb-10	
164-ALT70	99	259	10,124.21	39.09	28-Feb-10	28-Feb-10	
165-ALT71	105	253	10,502.32	41.51	1-Mar-10	1-Mar-10	
166-ALT72	106	244	10,850.23	44.47	2-Mar-10	3-Mar-10	
167-ALT73	101	258	11,086.53	42.97	3-Mar-10	4-Mar-10	
168-ALT74	83	186	7,475.89	40.19	4-Mar-10	6-Mar-10	

TABLE G-1 UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA BY TRAIN

Completed Train No.	No. of Railcars	No. of Loads to Date	Tonnage	Tons/Load	Arrival Date	Completion Date	Comments
169-ALT75	83	218	8,487.68	38.93	7-Mar-10	7-Mar-10	
170-ALT76	105	254	10,562.30	41.58	8-Mar-10	8-Mar-10	
171-ALT77	104	259	10,897.61	42.08	9-Mar-10	12-Mar-10	Tonnage adjusted to 10,897.60 per TVA
172-ALT78	108	265	11,289.90	42.60	12-Mar-10	12-Mar-10	Tonnage adjusted to 11,289.90 per TVA
173-ALT79	108	252	11,389.69	45.20	13-Mar-10	14-Mar-10	Tonnage adjusted to 11,389.70 per TVA
174-ALT80	100	246	10,424.29	42.38	14-Mar-10	15-Mar-10	
175-ALT81	105	239	10,819.88	45.27	16-Mar-10	17-Mar-10	
176-ALT82	81	186	8,577.54	46.12	17-Mar-10	18-Mar-10	
177-ALT83	85	200	8,615.63	43.08	17-Mar-10	19-Mar-10	
178-ALT84	97	207	9,836.00	47.52	18-Mar-10	19-Mar-10	
179-ALT85	98	235	10,263.08	43.67	21-Mar-10	22-Mar-10	
180-ALT86	84	196	8,696.53	44.37	22-Mar-10	23-Mar-10	
181-ALT87	84	195	8,274.03	42.43	23-Mar-10	24-Mar-10	
182-ALT88	101	234	9,984.56	42.67	24-Mar-10	24-Mar-10	
183-ALT89	81	187	8,176.04	43.72	25-Mar-10	25-Mar-10	
184-ALT90	103	229	10,227.80	44.66	26-Mar-10	26-Mar-10	
185-ALT91	81	179	8,102.02	45.26	27-Mar-10	27-Mar-10	
186-ALT92	81	175	7,984.24	45.62	28-Mar-10	28-Mar-10	
187-ALT93	105	246	10,800.17	43.90	29-Mar-10	29-Mar-10	
188-ALT94	104	225	10,342.90	45.97	31-Mar-10	31-Mar-10	
189-ALT95	105	237	10,710.70	45.19	1-Apr-10	1-Apr-10	
190-ALT96	104	229	10,446.81	45.62	2-Apr-10	2-Apr-10	
191-ALT97	106	234	10,864.26	46.43	3-Apr-10	3-Apr-10	
192-ALT98	101	230	10,399.86	45.22	5-Apr-10	5-Apr-10	
193-ALT99	101	239	10,192.94	42.65	5-Apr-10	6-Apr-10	
194-ALT01	103	239	10,768.30	45.06	6-Apr-10	9-Apr-10	
195-ALT02	105	242	10,477.85	43.30	7-Apr-10	10-Apr-10	
196-ALT03	83	197	8,433.25	42.81	10-Apr-10	11-Apr-10	
197-ALT04	103	202	10,195.71	50.47	11-Apr-10	12-Apr-10	Tonnage adjusted to 10,195.70 per TVA
198-ALT05	104	234	10,735.58	45.88	12-Apr-10	13-Apr-10	
199-ALT06	80	180	8,349.64	46.39	13-Apr-10	14-Apr-10	
200-ALT07	86	171	8,729.00	51.05	14-Apr-10	14-Apr-10	Tonnage adjusted to 8,729.00 per TVA
201-ALT08	84	195	8,439.34	43.28	15-Apr-10	15-Apr-10	
202-ALT09	84	192	8,548.48	44.52	16-Apr-10	16-Apr-10	
203-ALT10	85	196	8,666.63	44.22	17-Apr-10	18-Apr-10	
204-ALT11	106	238	10,551.95	44.34	19-Apr-10	19-Apr-10	
205-ALT12	104	270	10,674.53	39.54	20-Apr-10	20-Apr-10	
206-ALT13	84	245	8,579.95	35.02	21-Apr-10	22-Apr-10	
207-ALT14	105	260	10,794.44	41.52	22-Apr-10	22-Apr-10	
208-ALT15	105	272	10,828.01	39.81	23-Apr-10	23-Apr-10	
209-ALT16	85	233	8,992.07	38.59	23-Apr-10	25-Apr-10	
210-ALT17	106	276	10,989.19	39.82	25-Apr-10	26-Apr-10	

TABLE G-1 UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA BY TRAIN

Completed Train No.	No. of Railcars	No. of Loads to Date	Tonnage	Tons/Load	Arrival Date	Completion Date	Comments
211-ALT18	86	204	7,893.50	38.69	26-Apr-10	26-Apr-10	
212-ALT19	104	305	10,795.50	35.40	27-Apr-10	27-Apr-10	
213-ALT20	84	241	8,555.01	35.50	28-Apr-10	28-Apr-10	
214-ALT21	86	229	8,732.49	38.13	29-Apr-10	29-Apr-10	
215-ALT22	106	278	10,608.08	38.16	30-Apr-10	30-Apr-10	
216-ALT23	104	282	10,340.85	36.67	1-May-10	1-May-10	
217-ALT24	104	291	10,763.35	36.99	2-May-10	3-May-10	
218-ALT25	104	274	10,609.91	38.72	3-May-10	4-May-10	
219-ALT26	106	292	10,872.98	37.24	5-May-10	5-May-10	
220-ALT27	101	279	10,468.61	37.52	6-May-10	7-May-10	
221-ALT28	106	291	10,700.41	36.77	7-May-10	7-May-10	
222-ALT29	84	233	8,399.55	36.05	8-May-10	8-May-10	
223-ALT30	84	220	8,286.67	37.67	9-May-10	9-May-10	
224-ALT31	106	293	10,968.64	37.44	9-May-10	10-May-10	
225-ALT32	84	223	8,175.55	36.66	10-May-10	10-May-10	
226-ALT33	106	287	10,650.87	37.11	11-May-10	11-May-10	
227-ALT34	106	284	10,436.78	36.75	12-May-10	12-May-10	
228-ALT35	106	293	10,543.55	35.98	13-May-10	13-May-10	
229-ALT36	105	289	10,944.91	37.87	14-May-10	14-May-10	
230-ALT37	104	268	10,455.22	39.01	15-May-10	15-May-10	
231-ALT38	106	264	10,539.42	39.92	16-May-10	16-May-10	
232-ALT39	105	282	10,993.35	38.98	17-May-10	17-May-10	
233-ALT40	88	240	9,170.88	38.21	18-May-10	18-May-10	
234-ALT41	104	273	10,531.67	38.58	19-May-10	19-May-10	
235-ALT42	105	278	10,533.17	37.89	20-May-10	20-May-10	
236-ALT43	104	277	10,768.19	38.87	21-May-10	22-May-10	
237-ALT44	106	287	10,979.08	38.25	22-May-10	23-May-10	
238-ALT45	104	266	10,504.35	39.49	23-May-10	24-May-10	
239-ALT46	84	192	8,669.30	45.15	24-May-10	24-May-10	Tonnage adjusted to 8,669.30 per TVA
240-ALT47	106	281	10,903.17	38.80	25-May-10	26-May-10	
241-ALT48	105	280	10,629.39	37.96	27-May-10	28-May-10	
242-ALT49	106	266	10,655.91	40.06	28-May-10	28-May-10	
243-ALT50	84	213	8,568.30	40.23	28-May-10	30-May-10	
244-ALT51	104	261	10,645.98	40.79	30-May-10	1-Jun-10	
245-ALT52	108	251	10,432.34	41.56	1-Jun-10	1-Jun-10	
246-ALT53	104	247	10,376.93	42.01	2-Jun-10	2-Jun-10	
247-ALT54	83	203	8,363.97	41.20	3-Jun-10	3-Jun-10	
248-ALT55	106	260	10,768.00	41.42	4-Jun-10	4-Jun-10	Tonnage adjusted to 10,768.00 per TVA
249-ALT56	104	253	10,513.70	41.56	5-Jun-10	5-Jun-10	Tonnage adjusted to 10,513.70 per TVA
250-ALT57	106	259	10,756.20	41.53	6-Jun-10	6-Jun-10	Tonnage adjusted to 10,756.20 per TVA
251-ALT58	103	252	10,414.10	41.33	7-Jun-10	7-Jun-10	Tonnage adjusted to 10,414.10 per TVA
252-ALT59	106	272	10,522.46	38.69	8-Jun-10	8-Jun-10	

TABLE G-1 UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA BY TRAIN

Completed Train No.	No. of Railcars	No. of Loads to Date	Tonnage	Tons/Load	Arrival Date	Completion Date	Comments
253-ALT60	106	273	10,399.19	38.09	9-Jun-10	9-Jun-10	
254-ALT61	100	271	10,169.25	37.52	10-Jun-10	10-Jun-10	Tonnage adjusted to 10,169.25 per TVA
255-ALT62	108	274	10,696.94	39.04	11-Jun-10	11-Jun-10	
256-ALT63	102	235	10,117.76	43.05	12-Jun-10	12-Jun-10	
257-ALT64	100	245	9,973.18	40.71	13-Jun-10	13-Jun-10	
258-ALT65	105	260	10,410.73	40.04	14-Jun-10	14-Jun-10	
259-ALT66	91	235	9,104.33	38.74	15-Jun-10	17-Jun-10	
260-ALT67	105	262	10,625.10	40.55	17-Jun-10	17-Jun-10	
261-ALT68	83	203	8,376.14	41.26	17-Jun-10	18-Jun-10	
262-ALT69	104	237	10,380.62	43.80	18-Jun-10	19-Jun-10	Tonnage adjusted to 10,380.62 per TVA
263-ALT70	86	214	8,704.83	40.68	19-Jun-10	20-Jun-10	
264-ALT71	105	255	10,463.17	41.03	20-Jun-10	21-Jun-10	
265-ALT72	84	188	8,583.77	45.66	21-Jun-10	21-Jun-10	Tonnage adjusted to 8,583.77 per TVA
266-ALT73	103	244	10,274.31	42.11	22-Jun-10	22-Jun-10	
267-ALT74	105	282	11,257.34	39.92	23-Jun-10	24-Jun-10	
268-ALT75	105	242	10,715.71	44.28	24-Jun-10	24-Jun-10	Tonnage adjusted to 10,715.71 per TVA
269-ALT76	104	263	10,554.10	40.13	25-Jun-10	27-Jun-10	
270-ALT77	106	259	10,705.80	41.34	27-Jun-10	27-Jun-10	
271-ALT78	104	295	10,479.59	35.52	27-Jun-10	28-Jun-10	
272-ALT79	81	202	8,131.49	40.25	28-Jun-10	29-Jun-10	Tonnage adjusted to 8,131.49 per TVA
273-ALT80	102	267	10,065.65	37.70	29-Jun-10	30-Jun-10	
274-ALT81	104	254	10,503.61	41.35	1-Jul-10	1-Jul-10	Tonnage adjusted to 10,503.62 per TVA
275-ALT82	86	222	8,490.98	38.25	2-Jul-10	2-Jul-10	
276-ALT83	106	269	10,747.81	39.95	2-Jul-10	3-Jul-10	Tonnage adjusted to 10,747.81 per TVA
277-ALT84	104	271	10,567.62	38.99	3-Jul-10	7-Jul-10	Tonnage adjusted to 10,567.62 per TVA
278-ALT85	100	259	9,869.88	38.11	7-Jul-10	8-Jul-10	
279-ALT86	106	293	10,751.81	36.70	8-Jul-10	9-Jul-10	Tonnage adjusted to 10,751.81 per TVA
280-ALT87	104	277	10,537.62	38.04	9-Jul-10	9-Jul-10	Tonnage adjusted to 10,537.62 per TVA
281-ALT88	106	286	10,757.71	37.61	10-Jul-10	10-Jul-10	Tonnage adjusted to 10,757.71 per TVA
282-ALT89	106	275	10,851.51	39.46	11-Jul-10	11-Jul-10	Tonnage adjusted to 10,851.51 per TVA
283-ALT90	105	262	10,200.03	38.93	12-Jul-10	12-Jul-10	
284-ALT91	83	246	8,347.50	33.93	13-Jul-10	13-Jul-10	
285-ALT92	104	267	10,553.68	39.53	14-Jul-10	14-Jul-10	Tonnage adjusted to 10,553.67 per TVA
286-ALT93	106	269	10,497.62	39.02	15-Jul-10	16-Jul-10	
287-ALT94	106	285	10,498.00	36.84	16-Jul-10	17-Jul-10	
288-ALT95	104	269	10,612.51	39.45	17-Jul-10	18-Jul-10	Tonnage adjusted to 10,612.52 per TVA
289-ALT96	103	273	10,401.84	38.10	18-Jul-10	19-Jul-10	
290-ALT97	93	246	9,241.69	37.57	19-Jul-10	20-Jul-10	
291-ALT98	92	255	9,415.90	36.93	20-Jul-10	21-Jul-10	
292-ALT99	106	275	10,791.53	39.24	21-Jul-10	23-Jul-10	
293-ALT01	100	286	9,605.86	33.59	23-Jul-10	23-Jul-10	
294-ALT02	106	294	10,862.80	36.95	24-Jul-10	24-Jul-10	Tonnage adjusted to 10,862.81 per TVA

TABLE G-1 UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA BY TRAIN

Completed Train No.	No. of Railcars	No. of Loads to Date	Tonnage	Tons/Load	Arrival Date	Completion Date	Comments
295-ALT03	105	322	10,407.66	32.32	24-Jul-10	25-Jul-10	
296-ALT04	84	208	8,522.41	40.97	25-Jul-10	26-Jul-10	
297-ALT05	85	219	8,535.85	38.98	26-Jul-10	26-Jul-10	Tonnage adjusted to 8,535.86 per TVA
298-ALT06	104	296	10,039.46	33.92	27-Jul-10	27-Jul-10	
299-ALT07	105	342	10,324.81	30.19	28-Jul-10	29-Jul-10	
300-ALT08	102	319	9,764.14	30.61	29-Jul-10	29-Jul-10	
301-ALT09	106	320	10,328.37	32.28	30-Jul-10	30-Jul-10	
302-ALT10	104	310	10,279.63	33.16	1-Aug-10	1-Aug-10	
303-ALT11	106	315	10,794.90	34.27	1-Aug-10	2-Aug-10	
304-ALT12	104	305	10,351.26	33.94	2-Aug-10	3-Aug-10	
305-ALT13	106	321	10,639.56	33.15	3-Aug-10	4-Aug-10	
306-ALT14	104	313	10,116.52	32.32	4-Aug-10	5-Aug-10	
307-ALT15	106	325	10,192.28	31.36	5-Aug-10	6-Aug-10	
308-ALT16	104	336	10,281.22	30.60	6-Aug-10	7-Aug-10	
309-ALT17	105	345	10,170.41	29.48	7-Aug-10	7-Aug-10	
310-ALT18	102	335	9,893.89	29.53	8-Aug-10	9-Aug-10	
311-ALT19	104	358	10,163.02	28.39	9-Aug-10	10-Aug-10	
312-ALT20	85	294	8,185.74	27.84	10-Aug-10	8/11/1010	
313-ALT21	103	329	9,862.15	29.98	11-Aug-10	12-Aug-10	
314-ALT22	84	284	8,535.56	30.05	12-Aug-10	13-Aug-10	Tonnage adjusted to 8,535.57 per TVA
315-ALT23	103	323	10,398.37	32.19	13-Aug-10	13-Aug-10	Tonnage adjusted to 10,398.38 per TVA
316-ALT24	106	345	10,638.52	30.84	14-Aug-10	14-Aug-10	Tonnage adjusted to 10,638.51 per TVA
317-ALT25	106	343	10,792.50	31.47	15-Aug-10	16-Aug-10	Tonnage adjusted to 10,792.51 per TVA
318-ALT26	106	348	10,803.52	31.04	16-Aug-10	17-Aug-10	Tonnage adjusted to 10,803.51 per TVA
319-ALT27	97	313	9,630.78	30.77	17-Aug-10	17-Aug-10	
320-ALT28	106	362	10,593.42	29.26	18-Aug-10	19-Aug-10	
321-ALT29	103	333	10,339.09	31.05	19-Aug-10	19-Aug-10	
322-ALT30	84	285	8,550.44	30.00	20-Aug-10	20-Aug-10	
323-ALT31	106	336	10,440.24	31.07	21-Aug-10	21-Aug-10	
324-ALT32	104	320	10,554.43	32.98	22-Aug-10	22-Aug-10	Tonnage adjusted to 10,554.42 per TVA
325-ALT33	106	341	10,712.52	31.42	23-Aug-10	23-Aug-10	Tonnage adjusted to 10,712.51 per TVA
326-ALT34	104	342	10,396.43	30.40	24-Aug-10	25-Aug-10	
327-ALT35	106	367	10,438.79	28.44	25-Aug-10	26-Aug-10	
328-ALT36	102	366	9,854.00	26.92	26-Aug-10	27-Aug-10	
329-ALT37	104	352	10,343.50	29.38	27-Aug-10	28-Aug-10	
330-ALT38	106	352	10,653.66	30.27	28-Aug-10	28-Aug-10	
331-ALT39	106	360	10,889.83	30.25	29-Aug-10	29-Aug-10	
332-ALT40	106	382	10,390.51	27.20	30-Aug-10	31-Aug-10	Tonnage adjusted to 10,390.51 per TVA
333-ALT41	85	304	7,999.61	26.31	31-Aug-10	1-Sep-10	Tonnage adjusted to 7,999.61 per TVA
334-ALT42	106	377	10,656.24	28.27	1-Sep-10	1-Sep-10	
335-ALT43	104	349	10,194.24	29.21	2-Sep-10	2-Sep-10	
336-ALT44	106	357	10,455.97	29.29	3-Sep-10	4-Sep-10	

TABLE G-1 UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA BY TRAIN

Completed Train No.	No. of Railcars	No. of Loads to Date	Tonnage	Tons/Load	Arrival Date	Completion Date	Comments
337-ALT45	104	339	10,217.43	30.14	4-Sep-10	4-Sep-10	
338-ALT46	105	358	10,151.65	28.36	5-Sep-10	5-Sep-10	
339-ALT47	84	276	8,118.69	29.42	6-Sep-10	6-Sep-10	
340-ALT48	83	279	8,182.92	29.33	7-Sep-10	8-Sep-10	
341-ALT49	106	352	10,189.73	28.95	9-Sep-10	9-Sep-10	
342-ALT50	106	343	10,110.74	29.48	10-Sep-10	10-Sep-10	
343-ALT51	105	331	10,202.99	30.82	11-Sep-10	12-Sep-10	
344-ALT52	104	353	10,564.25	29.93	12-Sep-10	14-Sep-10	
345-ALT53	84	268	8,534.85	31.85	14-Sep-10	14-Sep-10	
346-ALT54	106	336	10,658.59	31.72	15-Sep-10	16-Sep-10	
347-ALT55	106	344	10,611.63	30.85	16-Sep-10	16-Sep-10	
348-ALT56	104	336	10,155.91	30.23	17-Sep-10	18-Sep-10	
349-ALT57	106	335	10,039.24	29.97	18-Sep-10	19-Sep-10	
350-ALT58	106	330	10,346.88	31.35	19-Sep-10	20-Sep-10	
351-ALT59	103	310	9,613.84	31.01	20-Sep-10	21-Sep-10	
352-ALT60	84	249	7,986.83	32.08	22-Sep-10	22-Sep-10	
353-ALT61	106	334	10,566.91	31.64	23-Sep-10	24-Sep-10	
354-ALT62	104	362	11,686.27	32.28	24-Sep-10	27-Sep-10	
355-ALT63	102	287	8,799.13	30.66	24-Sep-10	24-Sep-10	
356-ALT64	106	337	10,501.33	31.16	25-Sep-10	25-Sep-10	
357-ALT65	104	334	10,545.78	31.57	27-Sep-10	29-Sep-10	
358-ALT66	104	306	10,198.65	33.33	29-Sep-10	29-Sep-10	
359-ALT67	106	349	10,331.64	29.60	30-Sep-10	30-Sep-10	
360-ALT68	104	315	10,211.45	32.42	1-Oct-10	1-Oct-10	
361-ALT69	106	321	10,022.77	31.22	2-Oct-10	2-Oct-10	
362-ALT70	106	325	9,958.50	30.64	3-Oct-10	3-Oct-10	
363-ALT71	104	315	9,781.97	31.05	4-Oct-10	4-Oct-10	
364-ALT72	106	341	10,154.68	29.78	5-Oct-10	6-Oct-10	
365-ALT73	104	327	9,924.21	30.35	6-Oct-10	6-Oct-10	
366-ALT74	103	328	9,420.21	28.72	7-Oct-10	8-Oct-10	
367-ALT75	104	324	9,917.26	30.61	8-Oct-10	8-Oct-10	
368-ALT76	104	312	9,821.54	31.48	10-Oct-10	10-Oct-10	
369-ALT77	104	333	10,056.31	30.20	11-Oct-10	12-Oct-10	
370-ALT78	102	295	9,666.35	32.77	12-Oct-10	12-Oct-10	
371-ALT79	105	312	10,329.18	33.11	13-Oct-10	13-Oct-10	
372-ALT80	106	306	10,246.83	33.49	14-Oct-10	14-Oct-10	
373-ALT81	104	296	10,026.58	33.87	15-Oct-10	15-Oct-10	
374-ALT82	100	294	9,781.42	33.27	16-Oct-10	16-Oct-10	
375-ALT83	103	298	9,949.60	33.39	17-Oct-10	18-Oct-10	
376-ALT84	104	321	10,488.02	32.67	18-Oct-10	19-Oct-10	
377-ALT85	106	325	10,680.39	32.86	19-Oct-10	20-Oct-10	
378-ALT86	104	319	9,755.14	30.58	20-Oct-10	21-Oct-10	

TABLE G-1 UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA BY TRAIN

Completed Train No.	No. of Railcars	No. of Loads to Date	Tonnage	Tons/Load	Arrival Date	Completion Date	Comments
379-ALT87	104	341	10,434.16	30.60	21-Oct-10	22-Oct-10	
380-ALT88	106	338	10,472.86	30.98	22-Oct-10	23-Oct-10	
381-ALT89	103	282	8,936.24	31.69	23-Oct-10	24-Oct-10	
382-ALT90	106	331	10,338.76	31.23	24-Oct-10	26-Oct-10	
383-ALT91	106	323	10,569.13	32.72	26-Oct-10	28-Oct-10	
384-ALT92	84	238	8,243.42	34.64	28-Oct-10	28-Oct-10	
385-ALT93	106	280	9,064.90	32.37	29-Oct-10	31-Oct-10	
386-ALT94	84	275	8,739.65	31.78	31-Oct-10	31-Oct-10	
387-ALT95	84	264	8,826.01	33.43	3-Nov-10	3-Nov-10	
388-ALT96	90	272	8,682.58	31.92	1-Nov-10	1-Nov-10	
389-ALT97	90	275	8,637.49	31.41	5-Nov-10	5-Nov-10	
390-ALT98	90	287	8,890.12	30.98	4-Nov-10	4-Nov-10	
391-ALT99	90	295	9,211.58	31.23	5-Nov-10	6-Nov-10	
392-ALT01	90	276	8,512.46	30.84	6-Nov-10	7-Nov-10	
393-ALT02	90	278	8,426.28	30.31	7-Nov-10	8-Nov-10	
394-ALT03	90	295	8,770.05	29.73	8-Nov-10	8-Nov-10	
395-ALT04	90	278	8,423.91	30.30	9-Nov-10	10-Nov-10	
396-ALT05	90	284	8,784.98	30.93	10-Nov-10	11-Nov-10	
397-ALT06	106	337	10,440.45	30.98	11-Nov-10	13-Nov-10	
398-ALT07	106	318	10,539.61	33.14	13-Nov-10	14-Nov-10	
399-ALT08	106	309	10,302.19	33.34	14-Nov-10	14-Nov-10	
400-ALT09	105	327	11,095.31	33.93	16-Nov-10	17-Nov-10	
401-ALT10	106	328	10,623.83	32.39	17-Nov-10	18-Nov-10	
402-ALT11	106	322	10,454.04	32.47	18-Nov-10	19-Nov-10	
403-ALT12	106	301	10,289.62	34.18	19-Nov-00	20-Nov-10	
404-ALT13	102	307	10,171.01	33.13	20-Nov-10	21-Nov-10	
405-ALT14	106	300	10,265.22	34.22	21-Nov-10	22-Nov-10	
406-ALT15	84	245	8,263.98	33.73	22-Nov-10	23-Nov-10	
407-ALT16	84	256	8,195.78	32.01	23-Nov-10	24-Nov-10	
408-ALT17	106	324	10,368.32	32.00	24-Nov-10	27-Nov-10	
409-ALT18	106	330	10,512.29	31.86	27-Nov-10	28-Nov-10	
410-ALT19	82	251	8,327.99	33.18	28-Nov-10	29-Nov-10	
411-ALT20	84	233	8,171.55	35.07	29-Nov-10	1-Dec-10	
412-ALT21	84	243	8,226.65	33.85	1-Dec-10	2-Dec-10	
413-ALT22	101	336	11,721.43	34.89	2-Dec-10	4-Dec-10	
414-ALT23	106	298	10,684.87	35.86	4-Dec-10	4-Dec-10	
999	-	107.00	3,133.36	29.28	N/A	7-Jan-11	
TOTAL	**39,712.00**	**107,672**	**4,025,068.09**	**37.38**			

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
1-Jul-09	-	-	-	-	-	
2-Jul-09	-	-	-	-	-	
3-Jul-09	1	80	1	3	67	67
4-Jul-09	-	-	42	93	3,425	3,492
5-Jul-09	-	-	37	94	3,658	7,150
6-Jul-09	2	85	-	4	97	7,246
7-Jul-09	-	-	53	122	5,540	12,787
8-Jul-09	3	85	32	69	2,814	15,601
9-Jul-09	-	-	61	156	6,168	21,768
10-Jul-09	4	85	24	73	2,422	24,190
11-Jul-09	-	-	85	228	8,724	32,914
12-Jul-09	5	85	-	-	-	32,914
13-Jul-09	6	85	85	219	8,358	41,272
14-Jul-09	-	-	40	100	3,781	45,053
15-Jul-09	7	85	45	149	5,096	50,149
16-Jul-09	8	85	85	221	8,653	58,802
17-Jul-09	-	-	69	181	7,014	65,816
18-Jul-09	9	80	46	119	4,726	70,542
19-Jul-09	10	84	89	228	9,226	79,768
20-Jul-09	11	83	45	121	4,867	84,635
21-Jul-09	-	-	83	213	8,563	93,199
22-Jul-09	12	85	-	-	-	93,199
23-Jul-09	13	85	85	226	8,887	102,086
24-Jul-09	-	-	85	222	8,805	110,891
25-Jul-09	14	85	85	219	8,886	119,777
26-Jul-09	15	85	85	216	8,616	128,393
27-Jul-09	16	85	85	209	8,757	137,150
28-Jul-09	-	-	-	-	-	137,150
29-Jul-09	17	85	85	208	8,876	146,026
30-Jul-09	18	85	85	191	8,461	154,488
31-Jul-09	19	66	66	156	7,108	161,596
1-Aug-09	20	85	85	192	9,109	170,704
2-Aug-09	21	84	-	2	47	170,751
3-Aug-09	-	-	84	212	9,142	179,893
4-Aug-09	-	-	-	3	22	179,915
5-Aug-09	22	86	86	212	9,217	189,132
6-Aug-09	23	85	85	212	9,155	198,287
7-Aug-09	24	85	10	27	1,113	199,400
8-Aug-09	-	-	75	191	7,873	207,273
9-Aug-09	25	85	85	229	9,439	216,712
10-Aug-09	26	85	85	223	9,192	225,904

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
11-Aug-09	27	85	85	204	8,409	234,313
12-Aug-09	28	85	85	229	9,439	243,753
13-Aug-09	29	85	85	222	9,151	252,903
14-Aug-09	30	85	85	195	8,038	260,941
15-Aug-09	31	85	85	210	8,656	269,597
16-Aug-09	32	85	85	221	9,110	278,707
17-Aug-09	33	85	-	0	-	278,707
18-Aug-09	-	-	85	217	8,945	287,652
19-Aug-09	34	85	85	223	9,281	296,933
20-Aug-09	35	85	85	206	8,610	305,543
21-Aug-09	36	85	85	208	8,879	314,422
22-Aug-09	37	85	85	201	9,044	323,466
23-Aug-09	38	85	85	203	9,257	332,723
24-Aug-09	39	85	85	204	9,415	342,138
25-Aug-09	40	85	85	197	9,270	351,408
26-Aug-09	41	85	85	198	8,864	360,272
27-Aug-09	42	85	85	196	9,079	369,351
28-Aug-09	43	85	85	216	9,293	378,645
29-Aug-09	44	85	85	210	9,277	387,922
30-Aug-09	45	66	66	160	7,051	394,973
31-Aug-09	46	85	85	205	9,353	404,326
1-Sep-09	47	85	85	206	9,216	413,542
2-Sep-09	48	85	85	199	9,294	422,836
3-Sep-09	49	110	108	252	11,513	434,349
4-Sep-09	50	85	87	205	9,226	443,575
5-Sep-09	51	85	85	201	8,938	452,513
6-Sep-09	52	110	84	202	8,918	461,431
7-Sep-09	53	85	111	276	11,679	473,110
8-Sep-09	54	85	85	225	9,573	482,683
9-Sep-09	55	70	70	173	7,497	490,180
10-Sep-09	56	110	110	270	11,842	502,022
11-Sep-09	57	110	110	280	11,446	513,468
12-Sep-09	58	85	85	210	8,969	522,437
13-Sep-09	59	110	110	273	11,252	533,689
14-Sep-09	60	110	95	218	11,246	544,935
15-Sep-09	61	85	100	236	8,762	553,697
16-Sep-09	62	110	110	289	11,311	565,008
17-Sep-09	63	85	85	212	8,874	573,882
18-Sep-09	-	-	-	-	-	573,882
19-Sep-09	-	-	-	-	-	573,882
20-Sep-09	64	73	73	165	7,638	581,520

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
21-Sep-09	65	64	64	167	6,738	588,258
22-Sep-09	-	-	-	-	-	588,258
23-Sep-09	-	-	-	-	-	588,258
24-Sep-09	-	-	-	-	-	588,258
25-Sep-09	-	-	-	-	-	588,258
26-Sep-09	66	100	100	225	11,614	599,872
27-Sep-09	-	-	-	-	-	599,872
28-Sep-09	-	-	-	-	-	599,872
29-Sep-09	-	-	-	-	-	599,872
30-Sep-09	-	-	-	-	-	599,872
1-Oct-09	67	85	85	210	7,907	607,779
2-Oct-09	68	69	69	190	7,245	615,024
3-Oct-09	69	110	110	293	11,457	626,481
4-Oct-09	-	-	-	0	-	626,481
5-Oct-09	70	65	65	174	6,791	633,272
6-Oct-09	71	66	66	183	7,148	640,420
7-Oct-09	-	-	-	-	-	640,420
8-Oct-09	72	110	110	274	11,605	652,025
9-Oct-09	73	66	66	165	7,081	659,106
10-Oct-09	74	85	85	213	8,993	668,098
11-Oct-09	75	85	85	222	9,101	677,199
12-Oct-09	76	71	71	187	7,578	684,777
13-Oct-09	77	88	88	233	9,221	693,999
14-Oct-09	-	-	-	8	317	694,315
15-Oct-09	-	-	-	-	-	694,315
16-Oct-09	-	-	-	-	-	694,315
17-Oct-09	-	-	-	-	-	694,315
18-Oct-09	-	-	-	-	-	694,315
19-Oct-09	-	-	-	-	-	694,315
20-Oct-09	-	-	-	-	-	694,315
21-Oct-09	-	-	-	-	-	694,315
22-Oct-09	78	71	71	177	6,509	700,825
23-Oct-09	79	66	66	171	6,653	707,478
24-Oct-09	80	84	84	212	8,224	715,701
25-Oct-09	-	-	-	-	-	715,701
26-Oct-09	-	-	-	-	-	715,701
27-Oct-09	81	88	88	225	8,312	724,013
28-Oct-09	82	88	88	236	8,600	732,613
29-Oct-09	83	66	66	169	6,400	739,012
30-Oct-09	-	-	-	-	-	739,012
31-Oct-09	-	-	-	-	-	739,012

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
1-Nov-09	-	-	-	-	-	739,012
2-Nov-09	84	106	106	278	10,537	749,550
3-Nov-09	85	106	106	269	10,447	759,997
4-Nov-09	86	96	96	255	9,819	769,816
5-Nov-09	87	88	88	231	8,684	778,500
6-Nov-09	88	88	88	228	8,722	787,222
7-Nov-09	89	88	-	-	-	787,222
8-Nov-09	-	-	88	229	8,764	795,986
9-Nov-09	90	88	88	229	8,888	804,873
10-Nov-09	-	-	-	-	-	804,873
11-Nov-09	-	-	-	-	-	804,873
12-Nov-09	91 , 92	197	197	521	19,804	824,677
13-Nov-09	93	66	66	189	6,900	831,576
14-Nov-09	94	88	88	248	9,013	840,589
15-Nov-09	95	106	106	287	11,144	851,734
16-Nov-09	96	106	106	286	10,686	862,420
17-Nov-09	97	106	106	278	10,542	872,962
18-Nov-09	98	106	106	279	10,554	883,515
19-Nov-09	99	106	106	273	10,591	894,107
20-Nov-09	100	108	108	279	10,929	905,036
21-Nov-09	101	108	108	222	8,761	913,797
22-Nov-09	102	107	107	317	12,753	926,550
23-Nov-09	-	-	-	17	606	927,156
24-Nov-09	103	108	108	273	11,044	938,199
25-Nov-09	104	108	108	276	10,923	949,122
26-Nov-09	105	108	108	298	11,315	960,437
27-Nov-09	106	108	108	282	11,177	971,614
28-Nov-09	-	-	-	-	-	971,614
29-Nov-09	-	-	-	-	-	971,614
30-Nov-09	-	-	-	-	-	971,614
1-Dec-09	-	-	-	-	-	971,614
2-Dec-09	-	-	-	-	-	971,614
3-Dec-09	-	-	-	-	-	971,614
4-Dec-09	107	75	75	185	8,124	979,738
5-Dec-09	108	88	88	224	9,488	989,227
6-Dec-09	109	108	108	269	11,430	1,000,657
7-Dec-09	-	-	-	-	-	1,000,657
8-Dec-09	110	108	108	294	11,993	1,012,650
9-Dec-09	111	108	108	265	11,343	1,023,993
10-Dec-09	112	92	92	223	9,867	1,033,860
11-Dec-09	113	87	-	15	448	1,034,307

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
12-Dec-09	-	-	87	219	9,283	1,043,591
13-Dec-09	-	-	-	-	-	1,043,591
14-Dec-09	114	93	93	237	9,577	1,053,167
15-Dec-09	115	104	104	264	11,361	1,064,528
16-Dec-09	116	108	108	271	11,783	1,076,311
17-Dec-09	117	108	108	255	10,873	1,087,184
18-Dec-09	-	-	-	-	-	1,087,184
19-Dec-09	118	108	108	268	11,600	1,098,784
20-Dec-09	119	107	107	275	11,323	1,110,106
21-Dec-09	120	95	95	228	9,504	1,119,611
22-Dec-09	121	87	87	203	8,752	1,128,362
23-Dec-09	122	108	66	162	6,748	1,135,110
24-Dec-09	-	-	-	-	-	1,135,110
25-Dec-09	-	-	-	-	-	1,135,110
26-Dec-09	-	-	-	-	-	1,135,110
27-Dec-09	-	-	-	-	-	1,135,110
28-Dec-09	123	98	140	328	14,419	1,149,529
29-Dec-09	124	108	108	246	10,962	1,160,491
30-Dec-09	125	102	102	243	10,496	1,170,987
31-Dec-09	126	108	108	269	11,112	1,182,099
1-Jan-10	-	-	-	-	-	1,182,099
2-Jan-10	-	-	-	-	-	1,182,099
3-Jan-10	-	-	-	-	-	1,182,099
4-Jan-10	127	100	100	248	10,176	1,192,275
5-Jan-10	128	108	108	282	10,994	1,203,269
6-Jan-10	129	87	87	220	8,714	1,211,983
7-Jan-10	-	-	-	-	-	1,211,983
8-Jan-10	130	85	85	243	9,460	1,221,443
9-Jan-10	131	83	83	249	7,744	1,229,187
10-Jan-10	-	-	-	-	-	1,229,187
11-Jan-10	132	85	85	256	8,818	1,238,005
12-Jan-10	133	88	88	241	8,954	1,246,958
13-Jan-10	134	88	88	243	9,246	1,256,205
14-Jan-10	135	88	88	237	9,307	1,265,512
15-Jan-10	136	87	87	228	9,048	1,274,559
16-Jan-10	137	82	82	215	8,633	1,283,192
17-Jan-10	138	68	68	165	6,924	1,290,115
18-Jan-10	139	108	108	281	11,194	1,301,309
19-Jan-10	-	-	-	7	86	1,301,395
20-Jan-10	140	108	85	206	8,846	1,310,241
21-Jan-10	-	-	-	-	-	1,310,241

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
22-Jan-10	141	92	115	284	11,936	1,322,178
23-Jan-10	-	-	-	-	-	1,322,178
24-Jan-10	-	-	-	-	-	1,322,178
25-Jan-10	142 , 143	198	114	279	11,647	1,333,825
26-Jan-10	-	-	84	221	8,766	1,342,591
27-Jan-10	144	87	87	225	8,967	1,351,558
28-Jan-10	-	-	-	-	-	1,351,558
29-Jan-10	145	88	88	255	9,321	1,360,879
30-Jan-10	-	-	-	-	-	1,360,879
31-Jan-10	-	-	-	-	-	1,360,879
1-Feb-10	-	-	-	-	-	1,360,879
2-Feb-10	-	-	-	-	-	1,360,879
3-Feb-10	146	85	85	224	8,695	1,369,574
4-Feb-10	147	89	-	-	-	1,369,574
5-Feb-10	148	88	-	-	-	1,369,574
6-Feb-10	-	-	-	-	-	1,369,574
7-Feb-10	149	87	100	258	10,292	1,379,866
8-Feb-10	-	-	110	278	11,215	1,391,080
9-Feb-10	-	-	-	-	-	1,391,080
10-Feb-10	-	-	-	-	-	1,391,080
11-Feb-10	150	89	133	337	14,187	1,405,268
12-Feb-10	-	-	10	35	1,200	1,406,467
13-Feb-10	151	87	87	219	8,973	1,415,440
14-Feb-10	152	107	107	272	11,040	1,426,480
15-Feb-10	153	94	94	224	9,705	1,436,185
16-Feb-10	154	86	86	200	8,953	1,445,138
17-Feb-10	-	-	-	-	-	1,445,138
18-Feb-10	155	78	66	146	6,235	1,451,373
19-Feb-10	156	82	94	226	9,989	1,461,362
20-Feb-10	157	105	105	249	10,918	1,472,280
21-Feb-10	158	82	82	187	8,072	1,480,352
22-Feb-10	159	84	-	-	-	1,480,352
23-Feb-10	160	104	130	355	13,508	1,493,860
24-Feb-10	161	84	120	287	12,231	1,506,091
25-Feb-10	162	83	105	248	10,473	1,516,563
26-Feb-10	163	105	105	279	10,231	1,526,794
27-Feb-10	164	99	-	-	-	1,526,794
28-Feb-10	-	-	99	259	10,124	1,536,918
1-Mar-10	165	105	105	253	10,502	1,547,420
2-Mar-10	166	106	-	-	-	1,547,420
3-Mar-10	167	101	140	321	14,238	1,561,658

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
4-Mar-10	168	83	150	362	15,055	1,576,713
5-Mar-10	-	-	-	5	120	1,576,833
6-Mar-10	-	-	-	11	59	1,576,892
7-Mar-10	169	83	83	207	8,429	1,585,321
8-Mar-10	170	105	105	254	10,562	1,595,883
9-Mar-10	171	104	77	192	8,079	1,603,962
10-Mar-10	-	-	-	-	-	1,603,962
11-Mar-10	-	-	-	-	-	1,603,962
12-Mar-10	172	108	135	332	14,109	1,618,071
13-Mar-10	173	108	-	9	407	1,618,477
14-Mar-10	174	100	124	282	12,674	1,631,152
15-Mar-10	-	-	84	203	8,677	1,639,829
16-Mar-10	175	105	-	4	56	1,639,885
17-Mar-10	176	81	105	237	10,738	1,650,623
18-Mar-10	177	85	122	281	12,357	1,662,979
19-Mar-10	178	97	141	301	14,137	1,677,116
20-Mar-10	-	-	-	13	618	1,677,734
21-Mar-10	179	98	-	-	-	1,677,734
22-Mar-10	180	84	132	307	13,441	1,691,175
23-Mar-10	181	84	134	308	13,300	1,704,475
24-Mar-10	182	101	101	245	10,477	1,714,952
25-Mar-10	183	81	81	187	8,176	1,723,128
26-Mar-10	184	103	103	229	10,228	1,733,356
27-Mar-10	185	81	81	179	8,102	1,741,458
28-Mar-10	186	81	81	175	7,984	1,749,442
29-Mar-10	187	105	105	233	10,433	1,759,875
30-Mar-10	-	-	-	13	367	1,760,242
31-Mar-10	188	104	104	225	10,343	1,770,585
1-Apr-10	189	105	105	237	10,711	1,781,296
2-Apr-10	190	104	104	229	10,447	1,791,742
3-Apr-10	191	106	106	234	10,864	1,802,607
4-Apr-10	-	-	-	-	-	1,802,607
5-Apr-10	192 , 193	202	144	316	14,222	1,816,829
6-Apr-10	194	103	58	143	6,118	1,822,946
7-Apr-10	195	105	3	10	253	1,823,200
8-Apr-10	-	-	-	-	-	1,823,200
9-Apr-10	-	-	150	337	15,058	1,838,258
10-Apr-10	196	83	137	307	13,179	1,851,437
11-Apr-10	-	-	1	3	65	1,851,501
12-Apr-10	197	103	103	233	11,573	1,863,075
13-Apr-10	198 , 199	184	132	284	12,962	1,876,037

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
14-Apr-10	200	86	138	301	14,852	1,890,889
15-Apr-10	201	84	84	195	8,439	1,899,328
16-Apr-10	202	84	84	192	8,548	1,907,877
17-Apr-10	203	85	85	186	8,358	1,916,235
18-Apr-10	-	-	-	10	308	1,916,543
19-Apr-10	204	106	106	238	10,552	1,927,095
20-Apr-10	205	104	104	270	10,675	1,937,770
21-Apr-10	206	84	76	228	7,852	1,945,621
22-Apr-10	207	105	113	277	11,523	1,957,144
23-Apr-10	208 , 209	190	110	305	12,071	1,969,215
24-Apr-10	210	106	-	-	-	1,969,215
25-Apr-10	211 , 212	190	153	386	15,136	1,984,351
26-Apr-10	-	-	119	294	11,496	1,995,847
27-Apr-10	-	-	104	302	10,752	2,006,599
28-Apr-10	213	84	84	242	8,576	2,015,175
29-Apr-10	214	86	86	230	8,744	2,023,919
30-Apr-10	215	106	106	279	10,620	2,034,538
1-May-10	216	104	104	282	10,341	2,044,879
2-May-10	217	104	103	279	10,386	2,055,265
3-May-10	218	104	1	12	378	2,055,642
4-May-10	219	106	146	382	14,741	2,070,383
5-May-10	-	-	64	184	6,742	2,077,125
6-May-10	220	101	66	183	6,650	2,083,775
7-May-10	221	106	141	369	14,045	2,097,820
8-May-10	222	84	84	244	8,603	2,106,423
9-May-10	223 , 224	190	148	402	14,907	2,121,330
10-May-10	225	84	126	340	12,787	2,134,117
11-May-10	226	106	106	288	10,659	2,144,775
12-May-10	227	106	106	284	10,437	2,155,212
13-May-10	228	106	106	293	10,544	2,165,756
14-May-10	229	105	105	287	10,905	2,176,661
15-May-10	230	104	104	268	10,487	2,187,148
16-May-10	231	106	106	264	10,539	2,197,687
17-May-10	232	105	105	284	11,002	2,208,689
18-May-10	233	88	88	240	9,171	2,217,860
19-May-10	234	104	104	273	10,532	2,228,391
20-May-10	235	105	105	278	10,533	2,238,924
21-May-10	236	104	73	183	7,202	2,246,126
22-May-10	237	106	117	327	12,431	2,258,558
23-May-10	238	104	124	301	11,912	2,270,470
24-May-10	239	84	84	211	9,376	2,279,845

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
25-May-10	240	106	106	271	10,779	2,290,624
26-May-10	-	-	-	10	124	2,290,749
27-May-10	241	105	105	275	10,594	2,301,343
28-May-10	242	106	106	277	10,923	2,312,266
29-May-10	243	84	84	183	7,425	2,319,691
30-May-10	244	104	104	254	10,279	2,329,969
31-May-10	-	-	-	-	-	2,329,969
1-Jun-10	245	108	108	282	11,711	2,341,680
2-Jun-10	246	104	104	247	10,377	2,352,057
3-Jun-10	247	83	83	203	8,364	2,360,421
4-Jun-10	248	106	106	260	10,768	2,371,189
5-Jun-10	249	104	104	253	10,514	2,381,703
6-Jun-10	250	106	106	259	10,756	2,392,459
7-Jun-10	251	103	103	252	10,414	2,402,873
8-Jun-10	252	106	106	272	10,522	2,413,396
9-Jun-10	253	106	106	273	10,399	2,423,795
10-Jun-10	254	100	100	271	10,169	2,433,964
11-Jun-10	255	108	108	274	10,697	2,444,661
12-Jun-10	256	102	102	235	10,118	2,454,779
13-Jun-10	257	100	100	245	9,973	2,464,752
14-Jun-10	258	105	105	260	10,411	2,475,163
15-Jun-10	259	91	91	229	9,016	2,484,179
16-Jun-10	260	105	-	-	-	2,484,179
17-Jun-10	261	83	150	374	15,117	2,499,296
18-Jun-10	262	104	89	209	8,878	2,508,174
19-Jun-10	263	86	127	278	11,749	2,519,923
20-Jun-10	264	105	117	297	12,195	2,532,118
21-Jun-10	265	84	84	207	9,283	2,541,401
22-Jun-10	266	103	103	244	10,274	2,551,675
23-Jun-10	267	105	105	260	10,600	2,562,275
24-Jun-10	268	105	105	264	11,373	2,573,648
25-Jun-10	269	104	104	250	10,287	2,583,935
26-Jun-10	-	-	-	-	-	2,583,935
27-Jun-10	270 , 271	210	150	376	14,881	2,598,816
28-Jun-10	272	81	141	388	14,501	2,613,318
29-Jun-10	273	102	102	263	10,049	2,623,367
30-Jun-10	274	104	104	263	10,721	2,634,088
1-Jul-10	275	86	86	220	8,479	2,642,568
2-Jul-10	276	106	106	269	10,679	2,653,247
3-Jul-10	277	104	104	266	10,375	2,663,622
4-Jul-10	-	-	-	-	-	2,663,622

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
5-Jul-10	-	-	-	-	-	2,663,622
6-Jul-10	-	-	-	-	-	2,663,622
7-Jul-10	278	100	100	264	10,073	2,673,695
8-Jul-10	279	106	106	294	10,785	2,684,480
9-Jul-10	280	104	104	278	10,574	2,695,054
10-Jul-10	281	106	106	286	10,758	2,705,812
11-Jul-10	282	106	106	275	10,852	2,716,663
12-Jul-10	283	105	105	262	10,200	2,726,863
13-Jul-10	284	83	83	246	8,348	2,735,211
14-Jul-10	285	104	104	267	10,554	2,745,765
15-Jul-10	286	106	106	267	10,482	2,756,247
16-Jul-10	287	106	106	280	10,316	2,766,563
17-Jul-10	288	104	104	272	10,652	2,777,215
18-Jul-10	289	103	103	273	10,520	2,787,735
19-Jul-10	290	93	93	248	9,273	2,797,008
20-Jul-10	291	92	92	251	9,370	2,806,377
21-Jul-10	292	106	106	279	10,807	2,817,184
22-Jul-10	-	-	-	-	-	2,817,184
23-Jul-10	293	100	100	288	9,645	2,826,829
24-Jul-10	294 , 295	211	133	383	13,846	2,840,676
25-Jul-10	296	84	122	352	12,752	2,853,428
26-Jul-10	297	85	125	308	11,730	2,865,158
27-Jul-10	298	104	104	296	10,039	2,875,198
28-Jul-10	299	105	105	341	10,312	2,885,509
29-Jul-10	300	102	102	320	9,777	2,895,287
30-Jul-10	301	106	106	320	10,328	2,905,615
31-Jul-10	302	104	104	309	10,268	2,915,883
1-Aug-10	303	106	106	313	10,773	2,926,656
2-Aug-10	304	104	104	306	10,369	2,937,025
3-Aug-10	305	106	106	321	10,649	2,947,674
4-Aug-10	306	104	104	313	10,113	2,957,787
5-Aug-10	307	106	106	326	10,194	2,967,981
6-Aug-10	308	104	104	335	10,285	2,978,266
7-Aug-10	309	105	105	347	10,175	2,988,441
8-Aug-10	310	102	102	331	9,805	2,998,245
9-Aug-10	311	104	104	359	10,222	3,008,467
10-Aug-10	312	85	85	293	8,171	3,016,638
11-Aug-10	313	103	103	332	9,903	3,026,541
12-Aug-10	314	84	84	284	8,510	3,035,051
13-Aug-10	315	103	103	324	10,428	3,045,479
14-Aug-10	316	106	106	345	10,639	3,056,118

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
15-Aug-10	317	106	106	337	10,604	3,066,722
16-Aug-10	318	106	106	350	10,868	3,077,590
17-Aug-10	319	97	97	317	9,755	3,087,345
18-Aug-10	320	106	106	355	10,437	3,097,782
19-Aug-10	321	103	103	340	10,496	3,108,277
20-Aug-10	322	84	84	285	8,550	3,116,828
21-Aug-10	323	106	106	336	10,440	3,127,268
22-Aug-10	324	104	104	320	10,554	3,137,822
23-Aug-10	325	106	106	341	10,713	3,148,535
24-Aug-10	326	104	104	336	10,310	3,158,844
25-Aug-10	327	106	106	369	10,491	3,169,336
26-Aug-10	328	102	102	366	9,866	3,179,202
27-Aug-10	329	104	104	354	10,333	3,189,535
28-Aug-10	330	106	106	354	10,686	3,200,221
29-Aug-10	331	106	106	360	10,890	3,211,111
30-Aug-10	332	106	106	375	10,200	3,221,311
31-Aug-10	333	85	85	309	8,137	3,229,449
1-Sep-10	334	106	106	379	10,709	3,240,158
2-Sep-10	335	104	104	349	10,194	3,250,352
3-Sep-10	336	106	106	356	10,450	3,260,802
4-Sep-10	337	104	104	340	10,224	3,271,025
5-Sep-10	338	105	105	358	10,152	3,281,177
6-Sep-10	339	84	84	276	8,119	3,289,295
7-Sep-10	340	83	83	268	7,992	3,297,287
8-Sep-10	-	-	-	11	191	3,297,478
9-Sep-10	341	106	106	352	10,190	3,307,668
10-Sep-10	342	106	106	343	10,111	3,317,779
11-Sep-10	343	105	105	330	10,197	3,327,976
12-Sep-10	344	104	104	350	10,504	3,338,480
13-Sep-10	-	-	-	-	-	3,338,480
14-Sep-10	345	84	84	272	8,601	3,347,081
15-Sep-10	346	106	106	335	10,651	3,357,732
16-Sep-10	347	106	106	344	10,615	3,368,347
17-Sep-10	348	104	104	336	10,157	3,378,504
18-Sep-10	349	106	106	333	10,035	3,388,539
19-Sep-10	350	106	106	315	9,820	3,398,359
20-Sep-10	351	103	103	308	9,718	3,408,077
21-Sep-10	-	-	-	20	430	3,408,507
22-Sep-10	352	84	84	249	7,987	3,416,494
23-Sep-10	353	106	106	333	10,562	3,427,056
24-Sep-10	354	104	102	321	9,904	3,436,960

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
25-Sep-10	355	102	104	337	10,501	3,447,461
26-Sep-10	356	106	41	136	4,319	3,451,780
27-Sep-10	357	104	166	504	16,273	3,468,054
28-Sep-10	-	-	2	19	405	3,468,458
29-Sep-10	358	104	105	310	10,334	3,478,792
30-Sep-10	359	106	106	349	10,332	3,489,124
1-Oct-10	360	104	104	315	10,211	3,499,335
2-Oct-10	361	106	106	321	10,023	3,509,358
3-Oct-10	362	106	106	325	9,959	3,519,316
4-Oct-10	363	104	104	315	9,782	3,529,098
5-Oct-10	364	106	106	339	10,128	3,539,226
6-Oct-10	365	104	104	329	9,951	3,549,177
7-Oct-10	366	103	103	325	9,394	3,558,571
8-Oct-10	367	104	104	327	9,943	3,568,515
9-Oct-10	-	-	-	-	-	3,568,515
10-Oct-10	368	104	104	312	9,822	3,578,336
11-Oct-10	369	104	104	331	10,027	3,588,363
12-Oct-10	370	102	102	297	9,695	3,598,059
13-Oct-10	371	105	105	312	10,329	3,608,388
14-Oct-10	372	106	106	306	10,247	3,618,635
15-Oct-10	373	104	104	296	10,027	3,628,661
16-Oct-10	374	100	100	294	9,781	3,638,443
17-Oct-10	375	103	103	297	9,939	3,648,382
18-Oct-10	376	104	104	316	10,356	3,658,737
19-Oct-10	377	106	106	314	10,371	3,669,108
20-Oct-10	378	104	63	195	5,846	3,674,955
21-Oct-10	379	104	102	325	9,965	3,684,920
22-Oct-10	380	106	137	422	12,857	3,697,777
23-Oct-10	381	103	115	350	11,230	3,709,007
24-Oct-10	382	106	106	330	10,421	3,719,428
25-Oct-10	-	-	-	-	-	3,719,428
26-Oct-10	383	106	85	254	8,005	3,727,433
27-Oct-10	-	-	-	-	-	3,727,433
28-Oct-10	384	84	105	313	10,878	3,738,311
29-Oct-10	385	106	100	279	9,039	3,747,350
30-Oct-10	-	-	-	-	-	3,747,350
31-Oct-10	386	84	90	276	8,765	3,756,115
1-Nov-10	388	90	90	272	8,683	3,764,798
2-Nov-10	-	-	-	-	-	3,764,798
3-Nov-10	387	84	84	264	8,826	3,773,624
4-Nov-10	390	90	90	287	8,890	3,782,514

TABLE G-2 DAILY UNLOADED QUANTITIES AT PERRY CO. LANDFILL, ALABAMA

Date	Train No.	Number of Rail Cars Received	Number of Railcars Unloaded	Number of Truck Loads	Net Weight of Material (Tons)	Cumulative Net Weight (Tons)
5-Nov-10	389 , 391	180	142	434	13,617	3,796,131
6-Nov-10	392	90	128	404	12,518	3,808,649
7-Nov-10	393	90	90	284	8,638	3,817,286
8-Nov-10	394	90	90	297	8,785	3,826,072
9-Nov-10	395	90	90	277	8,420	3,834,492
10-Nov-10	396	90	79	247	7,703	3,842,196
11-Nov-10	397	106	117	362	11,321	3,853,517
12-Nov-10	-	-	-	-	-	3,853,517
13-Nov-10	398	106	106	329	10,702	3,864,218
14-Nov-10	399	106	106	311	10,345	3,874,563
15-Nov-10	-	-	-	-	-	3,874,563
16-Nov-10	400	105	105	326	11,088	3,885,651
17-Nov-10	401	106	106	328	10,627	3,896,278
18-Nov-10	402	106	106	322	10,452	3,906,730
19-Nov-10	403	106	106	301	10,290	3,917,020
20-Nov-10	404	102	102	306	10,137	3,927,157
21-Nov-10	405	106	106	301	10,301	3,937,458
22-Nov-10	406	84	84	243	8,223	3,945,681
23-Nov-10	407	84	84	253	8,164	3,953,845
24-Nov-10	408	106	49	170	5,117	3,958,962
25-Nov-10	-	-	-	-	-	3,958,962
26-Nov-10	-	-	-	-	-	3,958,962
27-Nov-10	409	106	98	289	9,680	3,968,642
28-Nov-10	410	82	94	294	9,145	3,977,787
29-Nov-10	411	84	63	177	5,969	3,983,756
30-Nov-10	-	-	-	-	-	3,983,756
1-Dec-10	412	84	112	335	11,657	3,995,413
2-Dec-10	413	101	53	164	5,557	4,000,970
3-Dec-10	414	106	94	293	10,275	4,011,245
4-Dec-10	-	-	106	299	10,690	4,021,935
7-Jan-11	999a	-	-	107	3,133	4,025,068
TOTAL	**414**	**39,712**	**39,712**	**107,672**	**4,025,068**	**4,025,068**

Appendix H
Analytical Data

TABLE H-1 SUMMARY STATISTICS FOR TVA, TDEC, AND EPA ASH DATA

		Summary Statistics for TVA Ash Data				Summary Statistics for TDEC Ash Data				Summary Statistics for EPA Ash Data			
Analyte	Unit	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Number of Detections / Samples	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Number of Detections / Samples	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Number of Detections / Samples
Metals													
Aluminum	mg/kg	8,710	25,193	45,200	52 / 52	1,000	14,200	22,000	11 / 11	10,500	17,543	28,900	7 / 7
Antimony	mg/kg	ND	ND	ND	0 / 52	2.4	2.4	2.4	1 / 12	0.916	1.21	1.63	7 / 7
Arsenic	mg/kg	2.78	65	166	52 / 52	26	73	100	12 / 12	44.8	61.1	81.3	7 / 7
Barium	mg/kg	69.7	710	1,410	52 / 52	180	358	1,100	12 / 12	188	395	864	7 / 7
Beryllium	mg/kg	1.66	5.8	9.6	47 / 52	1.5	3.2	7.9	12 / 12	0.122	1.59	6.25	7 / 7
Boron	mg/kg	14.8	99	212	48 / 52	--	--	--	--	--	--	--	--
Cadmium	mg/kg	ND	ND	ND	0 / 52	0.2	0.2	0.2	2 / 12	0.577	0.86	1.23	7 / 7
Calcium	mg/kg	1,460	12,081	30,900	52 / 52	2,000	5,325	27,000	12 / 12	2,190	8,156	19,500	7 / 7
Chromium	mg/kg	9.64	42	66	52 / 52	16	25	43	12 / 12	18.2	28.2	41.3	7 / 7
Cobalt	mg/kg	13.1	20.8	29.7	42 / 52	6.7	13	29	12 / 12	7.91	12.1	18.7	7 / 7
Copper	mg/kg	8.49	64	102	52 / 52	25	47	76	12 / 12	29.9	47.8	69.4	7 / 7
Iron	mg/kg	9,840	19,814	39,700	52 / 52	10,000	12,417	15,000	12 / 12	9,590	13,699	19,300	7 / 7
Lead	mg/kg	10.7	27	46	52 / 52	9.8	19	29	12 / 12	15.3	25.6	56.9	7 / 7
Lithium	mg/kg	--	--	--	--	16	25	36	10 / 10	--	--	--	--
Magnesium	mg/kg	662	2,875	6,230	52 / 52	730	1,616	6,400	12 / 12	713	1,946	4,300	7 / 7
Manganese	mg/kg	45.6	139	698	52 / 52	56	99	260	12 / 12	45.7	138	447	7 / 7
Mercury	mg/kg	0.136	0.17	0.209	4 / 12	--	--	--	0 / 11	0.0563	0.087	0.116	7 / 7
Molybdenum	mg/kg	ND	ND	ND	0 / 52	1.6	3.3	5.3	7 / 10	--	--	--	--
Nickel	mg/kg	7.37	38.6	64.4	52 / 52	13	23	37	12 / 12	17.1	24.1	32.3	7 / 7
Potassium	mg/kg	642	3,581	7,040	52 / 52	--	--	--	--	1,340	2,340	3,280	7 / 7
Selenium	mg/kg	2.64	6.7	17.8	45 / 52	2.2	2.2	2.2	1 / 12	3.13	5.88	7.15	7 / 7
Silica	mg/kg	--	--	--	--	--	--	--	--	40.1	527	1,060	6 / 6
Silver	mg/kg	ND	ND	ND	0 / 52	ND	ND	ND	0 / 12	--	--	--	--
Sodium	mg/kg	283	843	1,790	46 / 52	--	--	--	--	147	344	725	7 / 7
Strontium	mg/kg	--	--	--	--	130	202	260	10 / 10	--	--	--	--
Thallium	mg/kg	2.65	3.1	3.8	4 / 52	1.8	1.8	1.8	1 / 12	4.36	4.36	4.36	1 / 7
Uranium	mg/kg	--	--	--	--	2.3	3.1	4	10 / 10	--	--	--	--
Vanadium	mg/kg	15.6	104	163	52 / 52	42	77	150	12 / 12	44.6	73	121	7 / 7
Zinc	mg/kg	23.5	57.4	94.7	52 / 52	25	40	67	12 / 12	24.3	39.7	55.6	7 / 7

TABLE H-1 SUMMARY STATISTICS FOR TVA, TDEC, AND EPA ASH DATA

Radionuclides													
Gross Alpha	pCi/g	--	--	--	--	4.6	8.99	25	12 / 12	--	--	--	--
Gross Beta	pCi/g	--	--	--	--	1.88	4.76	10	12 / 12	--	--	--	--
Actinium-228	pCi/g	3.63	4.24	5.28	11 / 11	2.47	3.06	3.76	12 / 12	--	--	--	--
Bismuth-212	pCi/g	--	--	--	--	1.73	2.24	3.08	12 / 12	--	--	--	--
Bismuth-214	pCi/g	4.51	5.56	6.62	11 / 11	2.89	3.99	5.96	12 / 12	--	--	--	--
Lead-212	pCi/g	3.7	4.38	4.98	11 / 11	2.368	2.99	3.84	12 / 12	--	--	--	--
Lead-214	pCi/g	4.85	5.83	7.1	11 / 11	3.37	4.43	6.52	12 / 12	--	--	--	--
Potassium-40	pCi/g	20.8	27.2	32.4	11 / 11	14.62	18.85	25.76	12 / 12	--	--	--	--
Radium-226	pCi/g	4.6	5.85	8.79	11 / 11	--	--	--	--	--	--	--	--
Radium-228	pCi/g	3.63	4.24	5.28	11 / 11	--	--	--	--	--	--	--	--
Thallium-208	pCi/g	3.11	3.4	4.43	10 / 11	0.836	1.01	1.24	12 / 12	--	--	--	--
Thorium-228	pCi/g	0.41	0.779	1.46	11 / 11	--	--	--	--	--	--	--	--
Thorium-230	pCi/g	0.941	2.21	3.99	11 / 11	--	--	--	--	--	--	--	--
Thorium-232	pCi/g	0.321	1	1.82	11 / 11	--	--	--	--	--	--	--	--
Thorium-234	pCi/g	5.97	7.49	11.3	10 / 11	--	--	--	--	--	--	--	--
Uranium-234	pCi/g	0.816	1.78	2.51	11 / 11	--	--	--	--	--	--	--	--
Uranium-235	pCi/g	0.0401	0.118	0.182	11 / 11	--	--	--	--	--	--	--	--
Uranium-238	pCi/g	0.865	1.76	2.33	11 / 11	--	--	--	--	--	--	--	--

Notes:

ND = not detected

mg/kg = milligram per kilogram

pCi/g = picocurie per gram

Results are reported on a dry-weight basis.

TABLE H-2 RANGE OF CONCENTRATIONS[1] OF ORGANIC CONSTITUENTS AND RADIOTOPES REPORTED IN TENNESSEE SOIL

Analyte	TVA[2]			TDEC[2]			EPA[2]			DOE (1993)[3]			USGS (TDEC 2001)[4]			Maximum Concentration Detected in Ash
	Minimum Detected Result	Maximum Detected Result	Frequency of Detection	Minimum Detected Result	Maximum Detected Result	Frequency of Detection	Minimum Detected Result	Maximum Detected Result	Frequency of Detection	Minimum Detected Result	Maximum Detected Result	Frequency of Detection	Minimum	Maximum	Number of Samples	
Aluminum	6,440	34,600	25/25	1,600	15,000	15/15	2,170	14,400	9/9	7,560	46,700	108/108	--	--	--	45,200
Antimony	--	--	--	--	--	--	0.425	1.24	8/9	0.095	1.5	20/108	<1	2	8	ND
Arsenic	1.86	102	25/25	2	6.4	9/15	1.06	27.9	9/9	0.23	655	103/108	3.1	73	16	166
Barium	11.3	270	25/25	21	180	15/15	24.5	118	9/9	9.1	196	108/108	100	700	19	1,410
Beryllium	1.79	2.36	2/25	0.1	1.1	13/15	0.0646	0.685	8/9	0.24	1.65	99/108	1.2	2	5	9.6
Boron	14.2	14.2	1/25	--	--	--	--	--	--	2.4	53	23/90	20	100	19	212
Cadmium	--	--	--	0.1	0.7	4/15	0.0404	0.355	6/9	0.0095	0.155	1/108	--	--	--	ND
Calcium	238	43,900	25/25	210	3,700	15/15	348	2,140	9/9	80	2,110	90/108	--	--	--	30,900
Chromium	5.44	48.6	25/25	8	33	15/15	4.19	54.4	9/9	0.23	80.1	106/108	30	200	19	66
Cobalt	2.87	99.6	18/25	0.9	29	15/15	3.23	33.7	9/9	0.55	51.3	92/108	5	50	18	29.7
Copper	6.21	147	25/25	1.1	120	13/15	4.26	23.2	9/9	1.35	54.2	101/108	10	50	19	102
Iron	11,000	69,100	25/25	8,800	41,000	15/15	4,880	36,700	9/9	9,365	53,900	108/108	--	--	--	39,700
Lead	11.9	282	25/25	4.4	33	15/15	6.57	71.8	9/9	0.115	165	105/107	15	70	18	46
Lithium	--	--	--	2.8	20	15/15	--	--	--	1.25	33	85/95	15	93	16	--
Magnesium	323	27,000	25/25	300	19,000	15/15	240	2,530	9/9	276	5,410	108/108	--	--	--	6,230
Manganese	97.6	8,940	25/25	52	2,900	15/15	61.1	1,410	9/9	41.7	3,470	108/108	50	7,000	19	698
Mercury	0.175	0.225	4/25	--	--	--	0.028	0.127	3/9	0.017	0.34	69/108	0.05	0.12	16	0.209
Molybdenum	4.06	5.29	4/25	0.6	1.1	4/15	--	--	--	0.7	6.4	23/96	--	15	1	ND
Nickel	5.42	145	25/25	1	19	13/15	6.66	23.5	8/9	2.45	50.8	91/108	5	70	19	64.4
Potassium	342	3,850	25/25	--	--	--	213	2,260	9/9	133.5	5,890	98/104	--	--	--	7,040
Selenium	2.45	4.3	6/25	2	5.3	4/15	1.04	3.37	9/9	0.105	3.6	70/100	<1	1.1	16	17.8
Silicon	--	--	--	--	--	--	--	--	--	185	721	81/81	--	--	--	
Silica	--	--	--	--	--	--	192	320	9/9	--	--	--	--	--	--	
Silver	--	--	--	--	--	--	--	--	--	0.029	1.4	0/108	--	--	--	ND
Sodium	266	296	2/25	--	--	--	--	--	--	9	463	51/63	--	--	--	1,790
Strontium	--	--	--	2.3	18	15/15	--	--	--	0.105	11.7	82/95	--	--	--	
Thallium	--	--	--	--	--	--	--	--	--	0.1	1.4725	16/100	--	--	--	3.8
Vanadium	22.4	85.8	25/25	15	28	15/15	5.01	81.5	9/9	4.8	101	108/108	30	100	19	163
Zinc	25.5	544	25/25	9.7	54	15/15	17.7	68.5	9/9	14	438	107/108	16	25	80	94.7
Potassium-40	--	--	--	4.06	42.3	14/15	--	--	--	1.11689	35.67	222/230	--	--	--	32.4
Radium-226	--	--	--	--	--	--	--	--	--	0.329	6.55	123/127	--	--	--	8.79
Thorium-228	--	--	--	--	--	--	--	--	--	0.17	3.40	125/127	--	--	--	1.46
Thorium-230	--	--	--	--	--	--	--	--	--	0.19	2.55	127/127	--	--	--	3.99
Thorium-232	--	--	--	--	--	--	--	--	--	0.18	3.20	241/241	--	--	--	1.82
Thorium-234	--	--	--	--	--	--	--	--	--	0.78	3.68	73/124	--	--	--	11.3
Total Uranium	--	--	--	--	--	--	--	--	--	0.069	6.50	54/55	--	--	--	--
Uranium-233/234	--	--	--	--	--	--	--	--	--	0.39	3.21	129/141	--	--	--	2.51
Uranium-235	--	--	--	--	--	--	--	--	--	0.0175	7.72	251/350	--	--	--	0.182
Uranium-238	--	--	--	--	--	--	--	--	--	0.44	5.74	242/316	--	--	--	2.33
Uranium-235/236	--	--	--	--	--	--	--	--	--	0.0384	0.141	23/24	--	--	--	--
Bi-214	--	--	--	0.698	1.434	15/15	--	--	--	--	--	--	--	--	--	6.62
Ac-228	--	--	--	0.704	2.45	15/15	--	--	--	--	--	--	--	--	--	5.276
Bi-212	--	--	--	0.68	1.36	7/15	--	--	--	--	--	--	--	--	--	--

Notes:

ND = not detected

1 Units are mg/kg and pCi/g.

2 Concentrations from TVA, TDEC, and EPA are from samples collected in December 2008 - January 2009 from properties adjacent to the KIF in areas not impacted by the ash release and locations away from KII

3 DOE 1993. Final Report on the Background Soil Characterization Project at the Oak Ridge Reservation, Oak Ridge, Tennessee, Prepared by Environmental Sciences Division, Oak Ridge National Laboratory for U.S. Department of Energy (DOE/OR/0 1175/V1) October 1993.

4 TDEC 2001. Hazardous Trace Elements in Tennessee Soils and Other Regolith. Tennessee Department of Environment and Conservation, Division of Geology, Report of Investigations No. 49

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TABLE H-3. SUMMARY STATISTICS FOR RELEASED ASH AND SEDIMENT IN RIVER

Analyte	Units	Regulatory Values	Samples Collected Between 05-Feb-09 and 30-Jun-10							
			Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Total Metals										
Aluminum	mg/kg	--	--	1730	13621	28600	ERM6.9	02/13/2009	97 / 97	--
Antimony	mg/kg	--	8.5 / 97.1	ND	--	ND	--	--	0 / 97	--
Arsenic	mg/kg	--	1.2 / 9.71	1.84	56.37	110	ERM2.1GRID34	02/06/2009	67 / 97	--
Barium	mg/kg	--	--	18.3	256.4	609	ERM.VB.4_K.D.04	12/02/2009	97 / 97	--
Beryllium	mg/kg	--	1.2 / 9.71	1.36	3.55	5.4	ERM.VB.4_K.D.04	12/02/2009	48 / 97	--
Boron	mg/kg	--	12 / 97.1	13	53.8	69.8	ERM.VB.4_K.D.04	12/02/2009	44 / 97	--
Cadmium	mg/kg	--	0.71 / 9.71	ND	--	ND	--	--	0 / 97	--
Calcium	mg/kg	--	12.1 / 763	292	4246	12800	ERM9.7	02/07/2009	90 / 97	--
Chromium	mg/kg	--	0.5 / 9.71	3.19	21.61	49	ERM2.1GRID34	02/06/2009	134 / 136	--
Cobalt	mg/kg	--	1.21 / 97.1	7.16	13.19	30.6	ERM6.9	02/13/2009	54 / 97	--
Copper	mg/kg	--	2.41 / 19.4	3.24	33.56	74.4	ERM2.1GRID34	02/06/2009	88 / 97	--
Hexavalent Chromium	mg/kg	--	2.54 / 6.94	ND	--	ND	--	--	0 / 39	--
Iron	mg/kg	--	--	3650	15690	30000	ERM6.9	02/13/2009	97 / 97	--
Lead	mg/kg	--	--	2.12	17.96	178	ERM9.8	02/07/2009	97 / 97	--
Magnesium	mg/kg	--	12.1 / 2090	274	1382	2410	ERM6.9	02/13/2009	85 / 97	--
Manganese	mg/kg	--	--	38.8	253.6	2090	ERM6.9	02/13/2009	97 / 97	--
Mercury	mg/kg	--	0.0031 / 0.217	0.028	0.4829	4.4	ERM0.0GRID10	12/16/2009	67 / 138	--
Molybdenum	mg/kg	--	3.63 / 97.1	ND	--	ND	--	--	0 / 97	--
Nickel	mg/kg	--	1.2 / 1.41	4.39	22.95	46.8	ERM6.9	02/13/2009	96 / 97	--
Potassium	mg/kg	--	121 / 1940	291	1865	5160	ERM2.1GRID36	02/06/2009	70 / 77	--
Selenium	mg/kg	--	2.1 / 19.4	2.45	4.936	7.5	ERM.VB.2	03/17/2009	48 / 97	--
Silicon	mg/kg	--	141 / 419	172	265.7	406	ERM9.6	02/07/2009	9 / 12	--
Silver	mg/kg	--	1.2 / 12.6	ND	--	ND	--	--	0 / 97	--
Sodium	mg/kg	--	241 / 1940	251	498.6	1280	ASH01	03/30/2009	10 / 77	--
Thallium	mg/kg	--	2.41 / 19.4	ND	--	ND	--	--	0 / 97	--
Tin	mg/kg	--	14.1 / 41.9	ND	--	ND	--	--	0 / 20	--
Titanium	mg/kg	--	--	21.8	210.7	565	ERM2.1GRID36	02/06/2009	20 / 20	--
Vanadium	mg/kg	--	3.5 / 97.1	6.7	64.63	117	ERM.VB.4_K.D.04	12/02/2009	71 / 97	--
Zinc	mg/kg	--	8.5 / 97.1	15	49.55	169	ERM6.9	02/13/2009	96 / 97	--

TABLE H-3. SUMMARY STATISTICS FOR RELEASED ASH AND SEDIMENT IN RIVER

Radionuclides (gamma)										
Actinium-228	pCi/g	--	--	2.266	3.131	4.776	ERM0.0GRID78	03/18/2010	3 / 3	--
Bismuth-214	pCi/g	--	--	0.9315	3.302	7.207	ERM0.0GRID78	03/18/2010	3 / 3	--
Cesium-137	pCi/g	--	0.05556 / 2.376	0.08991	1.575	17.57	ERM0.0GRID01	01/07/2010	114 / 215	--
Cobalt-60	pCi/g	--	0.1863 / 0.3098	ND	--	ND	--	--	0 / 8	--
Lead-212	pCi/g	--	--	1.942	3.34	6.009	ERM0.0GRID78	03/18/2010	3 / 3	--
Lead-214	pCi/g	--	--	0.78	3.403	7.687	ERM0.0GRID78	03/18/2010	3 / 3	--
Potassium-40	pCi/g	--	--	19.2	31.56	42.47	ERM0.0GRID77	03/18/2010	3 / 3	--
Thallium-208	pCi/g	--	--	1.443	2.681	4.733	ERM0.0GRID78	03/18/2010	3 / 3	--
Pesticides / PCBs										
alpha-Chlordane	ug/kg	--	1.7 / 3.6	ND	--	ND	--	--	0 / 9	--
gamma-Chlordane	ug/kg	--	1.7 / 3.6	ND	--	ND	--	--	0 / 9	--
PCB 1016	ug/kg	--	0.0413 / 69	ND	--	ND	--	--	0 / 59	--
PCB 1221	ug/kg	--	0.0413 / 69	ND	--	ND	--	--	0 / 59	--
PCB 1232	ug/kg	--	0.0413 / 69	ND	--	ND	--	--	0 / 59	--
PCB 1242	ug/kg	--	0.0413 / 0.291	ND	--	ND	--	--	0 / 39	--
PCB 1248	ug/kg	--	0.0413 / 69	ND	--	ND	--	--	0 / 59	--
PCB 1254	ug/kg	--	0.0413 / 69	65.6	65.6	65.6	ERM0.0GRID01	01/07/2010	1 / 59	--
PCB 1260	ug/kg	--	0.0413 / 69	ND	--	ND	--	--	0 / 59	--

ND = not detected

mg/kg = milligram per kilogram

pCi/g = picoCurie per gram

PCB = polychlorinated biphenyl

ug/kg = microgram per kilogram

TABLE H-4 SUMMARY STATISTICS FOR ASH WASTE CHARACTERIZATION

			Samples Collected Between 12-Mar-09 and 17-Nov-10							
Analyte	Units	Regulatory Values	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
TCLP Metals		**TCLP Limit**								
Arsenic	mg/L	5	0.1 / 0.1	0.156	0.2188	0.27	WGRAB212	11/17/2010	4 / 109	--
Barium	mg/L	100	--	0.725	2.277	4.28	WGRAB156	12/17/2009	109 / 109	--
Cadmium	mg/L	1	0.01 / 0.01	0.013	0.056	0.152	WCOMP16	06/22/2009	8 / 108	--
Chromium	mg/L	5	0.05 / 0.05	0.069	0.069	0.069	WGRAB148	10/22/2009	1 / 109	--
Copper	mg/L	--	0.1 / 0.1	0.149	0.149	0.149	WCOMP1	04/24/2009	1 / 109	--
Lead	mg/L	5	0.05 / 0.05	0.056	0.07996	0.116	WGRAB157	12/17/2009	7 / 109	--
Mercury	mg/L	0.2	0.01 / 0.01	ND	--	ND	--	--	0 / 109	--
Nickel	mg/L	--	0.1 / 0.1	0.105	0.1197	0.128	WGRAB179	04/14/2010	3 / 109	--
Selenium	mg/L	1	0.1 / 0.1	0.101	0.11	0.141	WGRAB147	10/22/2009	7 / 109	--
Silver	mg/L	5	0.05 / 0.05	ND	--	ND	--	--	0 / 109	--
Zinc	mg/L	--	0.5 / 0.5	0.514	1.348	3.22	WGRAB166	02/18/2010	5 / 109	--
Total Metals										
Arsenic	mg/kg	--	--	43.7	57.3	63	WCOMP1	04/24/2009	2 / 2	--
Barium	mg/kg	--	--	329	393.5	411	WCOMP1	04/24/2009	2 / 2	--
Cadmium	mg/kg	--	1.2 / 1.25	ND	--	ND	--	--	0 / 2	--
Chromium	mg/kg	--	--	25.2	35.05	39.3	WCOMP1	04/24/2009	2 / 2	--
Copper	mg/kg	--	--	32.5	42.65	46.6	WCOMP1	04/24/2009	2 / 2	--
Lead	mg/kg	--	--	11.7	16.6	18.5	WCOMP1	04/24/2009	2 / 2	--
Mercury	mg/kg	--	0.119 / 0.124	ND	--	ND	--	--	0 / 2	--
Nickel	mg/kg	--	--	22.5	31.85	35.8	WCOMP1	04/24/2009	2 / 2	--
Selenium	mg/kg	--	--	3.6	5.595	6.57	WCOMP1	04/24/2009	2 / 2	--
Silver	mg/kg	--	1.2 / 1.25	ND	--	ND	--	--	0 / 2	--
Zinc	mg/kg	--	--	30.5	38.15	41.8	WCOMP1	04/24/2009	2 / 2	--
Radionuclides		**TENORM**								
Actinium-228 (Gamma)	pCi/g	--	0.181 / 5.316	1.684	2.976	5.987	RADGRAB	06/23/2010	179 / 192	--
Americium-241 (Gamma)	pCi/g	--	0.185 / 0.464	ND	--	ND	--	--	0 / 15	--
Bismuth-214 (Gamma)	pCi/g	--	0.102 / 5.062	1.977	4.021	6.389	RADGRAB	06/03/2010	173 / 181	--
Cesium-137 (Gamma)	pCi/g	--	0.058 / 0.5101	ND	--	ND	--	--	0 / 193	--
Cobalt-60 (Gamma)	pCi/g	--	0.1344 / 0.457	ND	--	ND	--	--	0 / 5	--
Lead-212 (Gamma)	pCi/g	--	0.0915 / 2.125	0.6904	3.173	4.839	WCOMP15	06/22/2009	189 / 192	--
Lead-214 (Gamma)	pCi/g	--	0.116 / 2.822	2.232	4.214	6.393	WCOMP15	06/22/2009	191 / 192	--
Potassium-40 (Gamma)	pCi/g	--	0.471 / 25.98	10.21	19.11	30.11	WCOMP15	06/22/2009	172 / 176	--
Protactinium-234M (Gamma)	pCi/g	--	8.782 / 30.01	12.15	14.04	15.93	RADGRAB	04/20/2010	2 / 21	--
Radium-226 (Alpha)	pCi/g	10[a]	--	2.292	3.896	5.72	WGRAB139	08/27/2009	90 / 90	--
Radium-226 (Gamma)	pCi/g	10[a]	--	2.17	4.032	6.914	WGRAB192	07/14/2010	107 / 107	--
Radium-228 (Gamma)	pCi/g	10[a]	0.181 / 5.316	1.606	2.95	5.987	RADGRAB	06/23/2010	175 / 186	--
Radium-226/228 (Gamma)	pCi/g	10[a]	--	4.097	6.827	9.867	WGRAB149	10/22/2009	107 / 107	--
Thallium-208 (Gamma)	pCi/g	--	0.0508 / 3.645	0.697	2.407	4.02	RADGRAB	03/16/2010	169 / 192	--
Thorium-228 (Alpha)	pCi/g	--	--	0.8841	0.8841	0.8841	WCOMP31	07/21/2009	1 / 1	--
Thorium-230 (Alpha)	pCi/g	--	--	1.252	1.252	1.252	WCOMP31	07/21/2009	1 / 1	--
Thorium-232 (Alpha)	pCi/g	--	--	0.5514	0.5514	0.5514	WCOMP31	07/21/2009	1 / 1	--
Thorium-234 (Gamma)	pCi/g	--	1.175 / 10.59	1.778	5.617	14.95	WCOMP26	06/22/2009	125 / 187	--

TABLE H-4 SUMMARY STATISTICS FOR ASH WASTE CHARACTERIZATION

Analyte	Units	Regulatory Values	Samples Collected Between 12-Mar-09 and 17-Nov-10							
			Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Uranium-234 (Alpha)	pCi/g	--	--	4.056	4.056	4.056	WCOMP31	07/21/2009	1 / 1	--
Uranium-235 (Alpha)	pCi/g	--	--	0.1757	0.1757	0.1757	WCOMP31	07/21/2009	1 / 1	--
Uranium-238 (Alpha)	pCi/g	--	--	3.939	3.939	3.939	WCOMP31	07/21/2009	1 / 1	--
Paint Filter Test										
Paint Filter Test	NA	Pass / Fail	N/A	N/A	N/A	Fail[b]	WGRAB208	10/27/2010	1/250	1[b]

[a] Allowable threshold for the Arrowhead Landfill for combined radium-226/228 per Alabama Department of Environmental Management

[b] Sample passed the paint filter test upon resampling and retesting of this railcar.

mg/kg = milligram per kilogram

mg/L = milligram per liter

pCi/g = picoCurie per gram

ND = not detected

TCLP = Toxicity Characteristic Leaching Procedure

TENORM = Technologically Enhanced Naturally Occurring Radioactive Material

TABLE H-5 SUMMARY STATISTICS FOR SURFACE WATER
EMORY RIVER MILE 12.2 - NON-STORM EVENT SAMPLING

Analyte	Unit	Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
		F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	10 / 20	10	10.87	12.2	ERM12.2	29-Apr-09	15 / 27	--	10 / 35.7	10	22.42	78.6	ERM12.2	19-Jul-10	96 / 112	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.5	ND	--	ND			0 / 31	--	0.025 / 0.1	0.0253	0.0389	0.106	ERM12.2	3-Aug-09	25 / 112	--
Aluminum, Total	mg/L	--	--	--	0.1 / 0.5	0.108	0.1983	0.347	ERM12.2	28-Feb-09	8 / 31	--	0.025 / 0.185	0.0523	0.1861	2.41	ERM12.2	17-Jul-09	84 / 112	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.244	0.101	0.1366	0.218	ERM12.2	19-Aug-09	7 / 48	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.001 / 0.002	0.00222	0.002705	0.00318	ERM12.2	28-Feb-09	4 / 31	--	0.00033 / 0.002	0.00033	0.00049	0.00065	ERM12.2	2-Apr-10	2 / 112	--
Antimony, Total	mg/L	--	0.006	0.0056	0.001 / 0.002	0.00599	0.00599	0.00599	ERM12.2	6-Mar-09	1 / 31	1>TWQC	0.00033 / 0.002	0.00315	0.00315	0.00315	ERM12.2	4-Sep-09	1 / 112	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.001 / 0.002	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	0.00033	0.0003879	0.00054	ERM12.2	11-Sep-09	14 / 112	--
Arsenic, Total	mg/L	--	0.01	0.01	0.001 / 0.002	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	0.00033	0.0004277	0.00068	ERM12.2	30-Nov-09	26 / 112	--
Barium, Dissolved	mg/L	--	2	--	0.005 / 0.0177	0.021	0.02468	0.0285	ERM12.2	28-Jan-09	29 / 30	--	--	0.0154	0.02785	0.0389	ERM12.2	16-Aug-10	112 / 112	--
Barium, Total	mg/L	--	2	--	0.005 / 0.0195	0.023	0.02599	0.0298	ERM12.2	16-Feb-09	29 / 30	--	--	0.0208	0.02982	0.0541	ERM12.2	17-Jul-09	112 / 112	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 112	--
Beryllium, Total	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 112	--
Boron, Dissolved	mg/L	--	--	--	0.05 / 0.1	ND	--	ND	--	--	0 / 31	--	0.0125 / 0.05	0.0129	0.01568	0.021	ERM12.2	6-Aug-10	24 / 112	--
Boron, Total	mg/L	--	--	--	0.05 / 0.1	ND	--	ND	--	--	0 / 31	--	0.0125 / 0.05	0.0125	0.01558	0.0213	ERM12.2	6-Aug-10	25 / 112	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 112	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 112	--
Calcium, Dissolved	mg/L	--	--	--	--	4.82	6.172	8.54	ERM12.2	28-Jan-09	21 / 21	--	--	3.74	7.817	13.2	ERM12.2	26-Jul-10	112 / 112	--
Calcium, Total	mg/L	--	--	--	--	5.21	6.011	8.1	ERM12.2	28-Jan-09	29 / 29	--	--	5.01	7.945	12.9	ERM12.2	16-Aug-10	112 / 112	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	1.91	3.542	6.1	ERM12.2	15-Mar-10	48 / 48	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.001 / 0.002	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	0.00034	0.0004125	0.00056	ERM12.2	18-Dec-09	4 / 112	--
Chromium, Total	mg/L	--	0.1	--	0.001 / 0.002	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	0.00034	0.0008471	0.00279	ERM12.2	17-Jul-09	17 / 112	--
Cobalt, Dissolved	mg/L	--	--	--	0.001 / 0.02	0.00386	0.00386	0.00386	ERM12.2	23-Mar-09	1 / 31	--	0.00033 / 0.002	0.00033	0.00033	0.00033	ERM12.2	19-Feb-10	1 / 112	--
Cobalt, Total	mg/L	--	--	--	0.001 / 0.02	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	0.00033	0.0004673	0.00151	ERM12.2	30-Nov-09	15 / 112	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.001 / 0.005	0.0014	0.0061	0.0108	ERM12.2	2-Mar-09	2 / 31	1>F&AL	0.00033 / 0.0093	0.00033	0.0004673	0.00149	ERM12.2	16-Aug-10	26 / 111	--
Copper, Total	mg/L	--	1.3	--	0.001 / 0.005	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.005	0.00033	0.0005316	0.00252	ERM12.2	30-Nov-09	44 / 111	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.126	0.105	0.1225	0.156	ERM12.2	16-Aug-10	24 / 48	--
Hardness (As CaCO3)	mg/L	--	--	--	--	18.7	20.65	23.4	ERM12.2	13-Mar-09	21 / 21	--	--	18	28.4	47.3	ERM12.2	16-Aug-10	111 / 111	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.1	0.0539	0.06685	0.0949	ERM12.2	23-Mar-09	4 / 31	--	0.0125 / 0.065	0.0255	0.06685	0.154	ERM12.2	20-Jul-09	92 / 112	--
Iron, Total	mg/L	--	--	--	--	0.083	0.1576	0.455	ERM12.2	28-Feb-09	30 / 30	--	--	0.0742	0.2758	4.77	ERM12.2	17-Jul-09	112 / 112	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 15	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 112	--
Lead, Total	mg/L	--	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 15	--	0.00033 / 0.002	0.00039	0.001188	0.00285	ERM12.2	17-Jul-09	5 / 112	--
Magnesium, Dissolved	mg/L	--	--	--	--	1.32	1.692	2.59	ERM12.2	28-Jan-09	31 / 31	--	--	0.97	2.033	3.86	ERM12.2	26-Jul-10	112 / 112	--
Magnesium, Total	mg/L	--	--	--	--	1.34	1.635	2.43	ERM12.2	28-Jan-09	30 / 30	--	--	1.22	2.073	3.75	ERM12.2	26-Jul-10	112 / 112	--
Manganese, Dissolved	mg/L	--	--	--	0.001 / 0.005	0.0184	0.03029	0.0467	ERM12.2	25-Mar-09	22 / 31	--	0.00033 / 0.005	0.00049	0.02676	0.0765	ERM12.2	14-May-10	99 / 112	--
Manganese, Total	mg/L	--	--	--	--	0.0219	0.03604	0.0594	ERM12.2	28-Jan-09	30 / 30	--	--	0.0195	0.0469	0.119	ERM12.2	30-Nov-09	112 / 112	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 27	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 112	--
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 27	--	0.0001 / 0.0002	0.00011	0.000125	0.00014	ERM12.2	30-Nov-09	2 / 112	2>TWQC
Molybdenum, Dissolved	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.005	0.00033	0.00033	0.00033	ERM12.2	16-Aug-10	1 / 112	--
Molybdenum, Total	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.005	0.00034	0.00034	0.00034	ERM12.2	16-Aug-10	1 / 112	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.001 / 0.01	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.005	0.0004	0.0008261	0.00126	ERM12.2	20-Aug-10	71 / 112	--
Nickel, Total	mg/L	--	0.1	0.61	0.001 / 0.01	0.0012	0.0012	0.0012	ERM12.2	8-Apr-09	1 / 31	--	0.00033 / 0.005	0.00054	0.001042	0.005	ERM12.2	17-Jul-09	74 / 112	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.246	0.107	0.1629	0.22	ERM12.2	15-Mar-10	16 / 48	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 47	--
pH	pH	--	--	--	--	6.6	7.183	7.9	ERM12.2	13-Apr-09	12 / 12	--	--	6	7.15	8	ERM12.2	19-Aug-09	112 / 112	--
Potassium, Dissolved	mg/L	--	--	--	0.2 / 1	0.92	0.97	1.02	ERM12.2	28-Jan-09	2 / 21	--	0.25 / 1.3	0.411	1.072	1.83	ERM12.2	26-Jul-10	101 / 112	--
Potassium, Total	mg/L	--	--	--	0.2 / 1	0.94	0.94	0.94	ERM12.2	8-Apr-09	1 / 22	--	0.25 / 1.73	0.38	1.096	1.9	ERM12.2	17-Jul-09	103 / 112	--
Selenium, Dissolved	mg/L	--	0.05	--	0.001 / 0.002	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	0.00033	0.00033	0.00033	ERM12.2	29-Jan-10	1 / 112	--
Selenium, Total	mg/L	0.005	0.05	--	0.001 / 0.002	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 112	--
Silica, Dissolved	mg/L	--	--	--	1 / 1	1.08	2.816	3.72	ERM12.2	9-Mar-09	7 / 9	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.0005 / 0.002	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	0.00037	0.00037	0.00037	ERM12.2	2-Apr-10	1 / 112	--
Silver, Total	mg/L	--	--	--	0.0005 / 0.002	ND	--	ND	--	--	0 / 31	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 112	--
Sodium, Dissolved	mg/L	--	--	--	--	1.52	2.087	3.45	ERM12.2	28-Jan-09	21 / 21	--	--	0.872	2.603	6.98	ERM12.2	16-Aug-10	112 / 112	--
Sodium, Total	mg/L	--	--	--	--	1.54	2.109	2.98	ERM12.2	28-Jan-09	22 / 22	--	--	1.28	2.639	7	ERM12.2	16-Aug-10	112 / 112	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0249	0.03988	0.0587	ERM12.2	16-Aug-10	30 / 30	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0253	0.03987	0.0587	ERM12.2	16-Aug-10	30 / 30	--

TABLE H-5 SUMMARY STATISTICS FOR SURFACE WATER
EMORY RIVER MILE 12.2 - NON-STORM EVENT SAMPLING

Analyte	Unit	Regulatory Values: F&AL	Regulatory Values: TDWS	Regulatory Values: TWQC	22-Dec-08 to 30-Apr-09: Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	1-May-09 to 27-Aug-10: Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	7.6	12.83	21.3	ERM12.2	26-Jul-10	48 / 48	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 31	--	0.00025 / 0.002	0.00026	0.000275	0.00029	ERM12.2	1-Mar-10	2 / 112	2>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 31	--	0.00025 / 0.002	0.00026	0.0003825	0.00054	ERM12.2	21-Jun-10	4 / 112	4>TWQC
Tin, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--	--	--	--	--	--	--	--	--
Tin, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	19	31.75	49	ERM12.2	25-Mar-09	12 / 12	--	10 / 10	23	49.35	81	ERM12.2	19-Jun-09	110 / 111	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.489	0.104	0.2297	0.556	ERM12.2	1-Jun-10	17 / 46	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.186	0.111	0.1235	0.136	ERM12.2	22-Feb-10	2 / 47	--
Total Suspended Solids	mg/L	--	--	--	1 / 1	1	3.396	12	ERM12.2	16-Feb-09	24 / 27	--	1 / 3.5	1.2	5.247	108	ERM12.2	17-Jul-09	103 / 111	--
Vanadium, Dissolved	mg/L	--	--	--	0.001 / 0.004	ND	--	ND	--	--	0 / 22	--	0.00033 / 0.004	0.00033	0.0004829	0.00102	ERM12.2	4-Jun-10	7 / 112	--
Vanadium, Total	mg/L	--	--	--	0.001 / 0.004	ND	--	ND	--	--	0 / 22	--	0.00033 / 0.004	0.00038	0.001179	0.00523	ERM12.2	17-Jul-09	12 / 112	--
Zinc, Dissolved	mg/L	0.12	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 31	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 112	--
Zinc, Total	mg/L	--	--	--	0.005 / 0.0	ND	--	ND	--	--	0 / 31	--	0.0083 / 0.0	0.0144	0.0144	0.0144	ERM12.2	22-Mar-10	1 / 112	--

Notes:

ERM = Emory River Mile

F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life

ND = not detected

TDWS = Tennessee Domestic Water Supply Standard

TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-6 SUMMARY STATISTICS FOR SURFACE WATER
EMORY RIVER (DOWNSTREAM) - NON-STORM EVENT SAMPLING

Analyte	Unit	Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
		F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	10 / 20	10	40.84	168	ERM0.1	25-Mar-09	82 / 98	--	10 / 44	10.7	65.66	150	ERM1.75	19-Jul-10	451 / 474	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.5	0.125	0.3717	0.702	ERM4.0	28-Jan-09	3 / 153	--	0.025 / 0.1	0.0252	0.03868	0.118	ERM1.75	26-Mar-10	96 / 474	--
Aluminum, Total	mg/L	--	--	--	0.1 / 0.392	0.101	0.6626	22.5	ERM1.75	22-Dec-08	123 / 155	--	0.025 / 0.173	0.0812	0.4703	5.64	ERM1.75	19-Mar-10	455 / 474	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.591	0.1	0.1635	0.861	ERM1.75	1-Mar-10	49 / 198	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.001 / 0.002	ND	--	ND	--	--	0 / 153	--	0.00033 / 0.002	0.00033	0.0004341	0.00075	ERM2.1	2-Oct-09	17 / 474	--
Antimony, Total	mg/L	--	0.006	0.0056	0.001 / 0.002	0.00225	0.002305	0.00236	ERM1.75	22-Dec-08	2 / 155	--	0.00033 / 0.002	0.00033	0.0004479	0.00099	ERM1.75	19-Mar-10	57 / 474	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.001 / 0.002	0.00224	0.01002	0.0151	ERM1.75	22-Dec-08	5 / 153	3>TDWS; 3>TWQ	0.00033 / 0.00333	0.00033	0.001826	0.0102	ERM2.1	21-May-10	309 / 474	1>TDWS; 1>TWQC
Arsenic, Total	mg/L	--	0.01	0.01	0.001 / 0.002	0.00277	0.02024	0.0589	ERM1.75	22-Dec-08	7 / 155	4>TDWS; 4>TWQ	0.00033 / 0.002	0.00033	0.002953	0.0185	ERM2.1	21-May-10	354 / 474	4>TDWS; 4>TWQC
Barium, Dissolved	mg/L	--	2	--	0.005 / 0.01	0.0128	0.02696	0.0542	ERM1.0	22-Dec-08	151 / 153	--	--	0.0107	0.0343	0.0633	ERM2.1	21-May-10	474 / 474	--
Barium, Total	mg/L	--	2	--	--	0.0215	0.03536	0.339	ERM1.75	22-Dec-08	155 / 155	--	--	0.0219	0.04218	0.143	ERM1.75	19-Mar-10	474 / 474	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 153	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 474	--
Beryllium, Total	mg/L	--	0.004	--	0.001 / 0.004	0.00208	0.00232	0.00256	ERM1.75	22-Dec-08	2 / 155	--	0.00033 / 0.002	0.00033	0.0004939	0.00116	ERM1.75	19-Mar-10	23 / 474	--
Boron, Dissolved	mg/L	--	--	--	0.05 / 0.1	0.0655	0.0893	0.113	ERM1.0	22-Dec-08	4 / 153	--	0.0125 / 0.05	0.0125	0.01967	0.0393	ERM0.1	2-Jul-10	208 / 474	--
Boron, Total	mg/L	--	--	--	0.05 / 0.1	0.061	0.1027	0.134	ERM1.0	22-Dec-08	4 / 155	--	0.0125 / 0.05	0.0125	0.02035	0.0435	ERM2.1	21-May-10	232 / 474	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 153	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 474	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.005	ND	--	ND	--	--	0 / 155	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 474	--
Calcium, Dissolved	mg/L	--	--	--	--	4.86	13.64	40.7	ERM0.1	23-Jan-09	118 / 118	--	--	2.51	19.07	39.7	ERM0.1	29-Jun-09	474 / 474	--
Calcium, Total	mg/L	--	--	--	--	5.29	15.03	38.7	ERM1.75	13-Feb-09	151 / 151	--	--	5.29	19.29	38.5	ERM1.75	16-Aug-10	474 / 474	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	1.68	4.275	7.48	ERM0.1	14-Sep-09	198 / 198	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.001 / 0.002	ND	--	ND	--	--	0 / 153	--	0.00033 / 0.002	0.00033	0.0005817	0.00323	ERM2.1	15-Jan-10	35 / 474	--
Chromium, Total	mg/L	--	0.1	--	0.001 / 0.002	0.00268	0.008072	0.0164	ERM1.75	22-Dec-08	5 / 155	--	0.00033 / 0.002	0.00033	0.0008872	0.00544	ERM1.75	19-Mar-10	221 / 474	--
Cobalt, Dissolved	mg/L	--	--	--	0.001 / 0.02	ND	--	ND	--	--	0 / 152	--	0.00033 / 0.002	0.00034	0.00034	0.00034	ERM1.75	19-Oct-09	3 / 474	--
Cobalt, Total	mg/L	--	--	--	0.001 / 0.02	0.00316	0.007367	0.0112	ERM1.75	22-Dec-08	3 / 155	--	0.00033 / 0.002	0.00033	0.0007298	0.00393	ERM1.75	19-Mar-10	183 / 474	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.001 / 0.005	0.00629	0.011	0.0157	ERM0.1	23-Feb-09	2 / 153	1>F&AL	0.00033 / 0.005	0.00033	0.0007922	0.013	ERM1.75	1-May-09	192 / 473	1>F&AL
Copper, Total	mg/L	--	1.3	--	0.001 / 0.005	0.00637	0.01867	0.0379	ERM1.75	22-Dec-08	5 / 155	--	0.00033 / 0.00583	0.00034	0.00201	0.0471	ERM1.75	24-May-10	280 / 473	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.152	0.1	0.1339	0.6	ERM0.1	10-Jun-09	109 / 198	--
Hardness (As CaCO3)	mg/L	--	--	--	--	19.1	44.37	145	ERM0.1	13-Mar-09	74 / 74	--	--	19.3	70.44	144	ERM1.75	16-Aug-10	474 / 474	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.1	0.0523	0.09112	0.287	ERM4.0	28-Jan-09	14 / 153	--	0.0125 / 0.05	0.0201	0.05904	0.112	ERM4.0	24-Aug-09	176 / 474	--
Iron, Total	mg/L	--	--	--	--	0.0905	0.3573	8.61	ERM1.75	22-Dec-08	155 / 155	--	0.0125 / 0.0275	0.033	0.3414	2.37	ERM1.75	19-Mar-10	473 / 474	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.001 / 0.002	ND	--	ND	--	--	0 / 138	--	0.00033 / 0.002	0.00034	0.00034	0.00034	ERM1.75	19-Oct-09	1 / 474	--
Lead, Total	mg/L	--	0.005	--	0.001 / 0.002	0.00323	0.01204	0.0242	ERM1.75	22-Dec-08	5 / 135	3>TDWS	0.00033 / 0.002	0.00033	0.001086	0.00733	ERM1.75	19-Mar-10	203 / 474	2>TDWS
Magnesium, Dissolved	mg/L	--	--	--	--	1.36	4.639	13.6	ERM1.75	28-Jan-09	153 / 153	--	--	0.717	5.314	11.4	ERM0.1	30-Nov-09	474 / 474	--
Magnesium, Total	mg/L	--	--	--	--	1.39	4.614	12.9	ERM1.75	13-Feb-09	155 / 155	--	--	1.3	5.404	11.8	ERM0.1	30-Nov-09	474 / 474	--
Manganese, Dissolved	mg/L	--	--	--	0.001 / 0.015	0.00517	0.03069	0.0543	ERM4.0	16-Feb-09	64 / 153	--	0.00033 / 0.005	0.00036	0.03581	0.624	ERM4.0	19-Jul-10	357 / 474	--
Manganese, Total	mg/L	--	--	--	--	0.0213	0.04488	0.284	ERM0.1	23-Dec-08	155 / 155	--	0.00033 / 0.0275	0.0186	0.07384	0.67	ERM4.0	19-Jul-10	471 / 474	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 98	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 474	--
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	0.00025	0.0002575	0.00027	ERM2.1	2-Mar-09	2 / 98	2>TWQC	0.0001 / 0.0002	ND	--	ND	--	--	0 / 474	--
Molybdenum, Dissolved	mg/L	--	--	--	0.001 / 0.05	0.00515	0.00532	0.00549	ERM1.0	22-Dec-08	2 / 153	--	0.00033 / 0.005	0.00033	0.0009036	0.00245	ERM0.1	7-Jun-10	157 / 474	--
Molybdenum, Total	mg/L	--	--	--	0.001 / 0.05	0.00585	0.00585	0.00585	ERM1.0	22-Dec-08	1 / 155	--	0.00033 / 0.005	0.00033	0.0008843	0.00237	ERM0.1	7-Jun-10	174 / 474	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.001 / 0.01	ND	--	ND	--	--	0 / 153	--	0.00033 / 0.005	0.00033	0.000719	0.00182	ERM1.75	2-Aug-10	272 / 474	--
Nickel, Total	mg/L	--	0.1	0.61	0.001 / 0.025	0.0015	0.00901	0.0181	ERM1.0	22-Dec-08	3 / 155	--	0.00033 / 0.005	0.00036	0.001382	0.00823	ERM1.75	19-Mar-10	312 / 474	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.238	0.1	0.278	0.595	ERM0.1	23-Aug-10	144 / 198	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	0.176	1.761	9	ERM0.1	2-Aug-10	6 / 196	--
pH	pH	--	--	--	--	6.2	7.415	8.2	ERM0.1	29-Apr-09	39 / 39	--	--	5.8	7.311	8.4	ERM2.1	17-Aug-09	474 / 474	--
Potassium, Dissolved	mg/L	--	--	--	0.2 / 1	1	1.513	2.11	ERM0.1	23-Jan-09	61 / 118	--	0.25 / 1	0.269	1.226	1.95	ERM0.1	29-Jun-09	451 / 473	--
Potassium, Total	mg/L	--	--	--	0.2 / 1	1	1.689	5.08	ERM1.75	22-Dec-08	60 / 120	--	0.25 / 2.53	0.427	1.299	2.02	ERM0.1	19-Jun-09	450 / 473	--
Selenium, Dissolved	mg/L	--	0.05	--	0.001 / 0.002	ND	--	ND	--	--	0 / 153	--	0.00033 / 0.002	0.00033	0.00046	0.00096	ERM1.75	9-Jul-10	56 / 474	--
Selenium, Total	mg/L	0.005	0.05	--	0.001 / 0.01	ND	--	ND	--	--	0 / 155	--	0.00033 / 0.002	0.00033	0.0004551	0.00082	ERM1.75	30-Jul-10	83 / 474	--
Silica, Dissolved	mg/L	--	--	--	1 / 1	1.01	2.833	4.77	ERM2.1	11-Mar-09	29 / 35	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.0005 / 0.002	ND	--	ND	--	--	0 / 153	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 474	--
Silver, Total	mg/L	--	--	--	0.0005 / 0.01	ND	--	ND	--	--	0 / 155	--	0.00033 / 0.002	0.00038	0.00038	0.00038	ERM1.75	27-Aug-10	1 / 474	--
Sodium, Dissolved	mg/L	--	--	--	1 / 3.26	1.47	4.092	10.7	ERM1.75	28-Jan-09	114 / 118	--	--	0.406	3.847	7.53	ERM0.1	17-Jun-09	474 / 474	--
Sodium, Total	mg/L	--	--	--	1 / 3.13	1.48	4.073	10.1	ERM0.1	28-Jan-09	118 / 120	--	--	1.14	3.905	7.88	ERM1.75	14-Aug-09	474 / 474	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0235	0.08115	0.117	ERM0.1	2-Jul-10	136 / 136	--

TABLE H-6 SUMMARY STATISTICS FOR SURFACE WATER
EMORY RIVER (DOWNSTREAM) - NON-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.024	0.08328	0.121	ERM0.1	2-Jul-10	136 / 136	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	6.69	17.51	36	ERM0.1	10-Jun-09	198 / 198	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 153	--	0.00025 / 0.002	0.00025	0.0005056	0.00078	ERM1.75	2-Oct-09	41 / 474	41>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 155	--	0.00025 / 0.002	0.00025	0.0005269	0.00097	ERM1.75	2-Oct-09	51 / 474	51>TWQC
Tin, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 35	--	--	--	--	--	--	--	--	--
Tin, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 35	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 35	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 35	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	--	--	--	--	--	--	--		11	94.92	198	ERM0.1	14-Sep-09	474 / 474	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 1.31	0.102	0.266	0.825	ERM0.1	26-Jul-10	69 / 195	--
Total Phosphorus	mg/L	--	--	--	--	11	49.56	183	ERM0.1	25-Mar-09	39 / 39	--	0.1 / 5.4	0.111	0.2249	0.702	ERM0.1	9-Aug-10	7 / 197	--
Total Suspended Solids	mg/L	--	--	--	--	1.4	5.578	20.6	ERM1.75	13-Apr-09	98 / 98	--	--	1	10.66	100	ERM1.75	19-Mar-10	474 / 474	--
Vanadium, Dissolved	mg/L	--	--	--	0.001 / 0.004	0.00604	0.008293	0.00989	ERM1.75	22-Dec-08	3 / 118	--	0.00033 / 0.00424	0.00035	0.001665	0.00757	ERM2.1	21-May-10	127 / 474	--
Vanadium, Total	mg/L	--	--	--	0.001 / 0.004	0.0012	0.02561	0.0616	ERM1.75	22-Dec-08	6 / 120	--	0.00033 / 0.00549	0.00038	0.003191	0.0215	ERM1.75	19-Mar-10	241 / 474	--
Zinc, Dissolved	mg/L	0.12	--	--	0.005 / 0.05	0.151	0.151	0.151	ERM2.1	20-Mar-09	1 / 153	1>F&AL	0.0083 / 0.05	0.00881	0.01131	0.0138	ERM0.1	30-Jul-10	2 / 474	--
Zinc, Total	mg/L	--	--	--	0.005 / 0.2	0.0527	0.0527	0.0527	ERM1.0	22-Dec-08	1 / 155	--	0.0083 / 0.0	0.0083	0.0107	0.018	ERM1.75	19-Mar-10	10 / 474	--

Notes:

ERM = Emory River Mile

F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life

ND = not detected

TDWS = Tennessee Domestic Water Supply Standard

TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-7 SUMMARY STATISTICS FOR SURFACE WATER
CLINCH RIVER MILE 5.5 - NON-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	--	104	112.3	122	CRM5.5	29-Apr-09	26 / 26	--	--	87	120.8	147	CRM5.5	30-Jul-10	114 / 114	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.5	ND	--	ND	--	--	0 / 43	--	0.025 / 0.122	0.025	0.02923	0.0349	CRM5.5	15-Jan-10	10 / 114	--
Aluminum, Total	mg/L	--	--	--	0.1 / 0.5	0.1	0.1968	0.689	CRM5.5	22-Dec-08	30 / 43	--	0.025 / 0.177	0.0527	0.1918	1.06	CRM5.5	29-Jan-10	104 / 114	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.276	0.103	0.1704	0.303	CRM5.5	16-Aug-10	7 / 50	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.001 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	0.00033	0.00051	0.00069	CRM5.5	2-Oct-09	2 / 114	--
Antimony, Total	mg/L	--	0.006	0.0056	0.001 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	0.00033	0.00033	0.00033	CRM5.5	12-Oct-09	1 / 114	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.001 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	0.00033	0.0006072	0.00257	CRM5.5	5-Jun-09	69 / 114	--
Arsenic, Total	mg/L	--	0.01	0.01	0.001 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	0.00034	0.0007121	0.00278	CRM5.5	5-Jun-09	76 / 114	--
Barium, Dissolved	mg/L	--	2	--	0.005 / 0.01	0.016	0.03212	0.0386	CRM5.5	13-Feb-09	40 / 43	--	--	0.027	0.03391	0.0453	CRM5.5	2-Aug-10	114 / 114	--
Barium, Total	mg/L	--	2	--	--	0.0319	0.03664	0.0395	CRM5.5	6-Jan-09	43 / 43	--	--	0.0297	0.03624	0.0493	CRM5.5	5-Jun-09	114 / 114	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 114	--
Beryllium, Total	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 114	--
Boron, Dissolved	mg/L	--	--	--	0.05 / 0.1	ND	--	ND	--	--	0 / 43	--	0.0125 / 0.05	0.0126	0.01753	0.0307	CRM5.5	2-Aug-10	66 / 114	--
Boron, Total	mg/L	--	--	--	0.05 / 0.1	ND	--	ND	--	--	0 / 43	--	0.0125 / 0.05	0.0127	0.01738	0.0325	CRM5.5	2-Aug-10	71 / 114	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 114	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 114	--
Calcium, Dissolved	mg/L	--	--	--	--	13.4	32.37	40.6	CRM5.5	13-Feb-09	34 / 34	--	--	27	34.74	46.6	CRM5.5	13-Nov-09	114 / 114	--
Calcium, Total	mg/L	--	--	--	--	31.9	35.92	39.1	CRM5.5	13-Feb-09	42 / 42	--	--	26.4	35.02	41.8	CRM5.5	13-Nov-09	114 / 114	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	4.44	5.728	7.3	CRM5.5	12-Jul-10	50 / 50	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.001 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	0.00033	0.0008617	0.00131	CRM5.5	2-Aug-10	6 / 113	--
Chromium, Total	mg/L	--	0.1	--	0.001 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	0.00033	0.0005169	0.00247	CRM5.5	5-Mar-10	36 / 113	--
Cobalt, Dissolved	mg/L	--	--	--	0.001 / 0.02	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 114	--
Cobalt, Total	mg/L	--	--	--	0.001 / 0.02	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	0.00044	0.0006	0.00076	CRM5.5	29-Jan-10	2 / 114	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.001 / 0.005	0.0011	0.0011	0.0011	CRM5.5	8-Apr-09	1 / 43	--	0.00033 / 0.00756	0.00033	0.0005321	0.00091	CRM5.5	16-Apr-10	63 / 114	--
Copper, Total	mg/L	--	1.3	--	0.001 / 0.005	0.001	0.00516	0.00932	CRM5.5	19-Jan-09	2 / 43	--	0.00033 / 0.005	0.00039	0.001368	0.0391	CRM5.5	24-May-10	71 / 114	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.14	0.116	0.1422	0.19	CRM5.5	23-Nov-09	31 / 50	--
Hardness (As CaCO3)	mg/L	--	--	--	--	118	134.1	144	CRM5.5	25-Feb-09	21 / 21	--	--	98	129.6	156	CRM5.5	13-Nov-09	114 / 114	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.1	ND	0	ND			0 / 43	--	0.0125 / 0.0765	0.0314	0.05467	0.0651	CRM5.5	29-Jan-10	3 / 114	--
Iron, Total	mg/L	--	--	--	--	0.0922	0.2184	0.878	CRM5.5	22-Dec-08	43 / 43	--	--	0.0742	0.2217	1.64	CRM5.5	29-Jan-10	114 / 114	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.001 / 0.002	ND	--	ND	--	--	0 / 39	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 114	--
Lead, Total	mg/L	--	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 34	--	0.00033 / 0.002	0.00033	0.0004647	0.00139	CRM5.5	29-Jan-10	19 / 114	--
Magnesium, Dissolved	mg/L	--	--	--	--	9.1	11.43	13.5	CRM5.5	28-Jan-09	43 / 43	--	--	7.46	10.1	12.9	CRM5.5	13-Nov-09	114 / 114	--
Magnesium, Total	mg/L	--	--	--	--	8.65	11.26	13	CRM5.5	13-Feb-09	43 / 43	--	--	7.76	10.23	12.5	CRM5.5	13-Nov-09	114 / 114	--
Manganese, Dissolved	mg/L	--	--	--	0.001 / 0.015	0.0014	0.00366	0.00592	CRM5.5	16-Feb-09	2 / 43	--	0.00033 / 0.0126	0.0004	0.003939	0.0112	CRM5.5	8-Mar-10	72 / 114	--
Manganese, Total	mg/L	--	--	--	0.001 / 0.005	0.0273	0.03647	0.0488	CRM5.5	28-Jan-09	42 / 43	--	0.00033 / 0.0346	0.0201	0.03996	0.12	CRM5.5	23-Nov-09	112 / 114	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 26	--	0.0001 / 0.0002	0.00011	0.000123	0.00015	CRM5.5	30-Nov-09	3 / 114	3>TWQC
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 26	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 114	--
Molybdenum, Dissolved	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.005	0.00036	0.0006698	0.00148	CRM5.5	2-Aug-10	54 / 114	--
Molybdenum, Total	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.005	0.00037	0.0006674	0.00147	CRM5.5	2-Aug-10	57 / 114	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.001 / 0.01	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.005	0.00033	0.0004211	0.00068	CRM5.5	25-Sep-09	57 / 114	--
Nickel, Total	mg/L	--	0.1	0.61	0.001 / 0.01	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.005	0.00034	0.0005674	0.00157	CRM5.5	29-Jan-10	73 / 114	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.529	0.2	0.428	0.624	CRM5.5	23-Aug-10	49 / 50	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 49	--
pH	pH	--	--	--	--	7.5	7.858	8.1	CRM5.5	8-Apr-09	12 / 12	--	--	6.8	7.591	8.3	CRM5.5	1-May-09	114 / 114	--
Potassium, Dissolved	mg/L	--	--	--	--	1.42	1.824	2.09	CRM5.5	5-Jan-09	34 / 34	--	--	1.24	1.584	1.99	CRM5.5	4-Dec-09	114 / 114	--
Potassium, Total	mg/L	--	--	--	--	1.51	1.839	2.2	CRM5.5	23-Dec-08	34 / 34	--	0.25 / 1.89	1.24	1.621	1.99	CRM5.5	4-Dec-09	113 / 114	--
Selenium, Dissolved	mg/L	--	0.05	--	0.001 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	0.00033	0.0004017	0.00052	CRM5.5	2-Aug-10	6 / 114	--
Selenium, Total	mg/L	0.005	0.05	--	0.001 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	0.00033	0.0004017	0.00062	CRM5.5	2-Aug-10	6 / 114	--
Silica, Dissolved	mg/L	--	--	--	1 / 1	1.18	2.634	3.63	CRM5.5	11-Mar-09	7 / 9	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.0005 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 114	--
Silver, Total	mg/L	--	--	--	0.0005 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 114	--
Sodium, Dissolved	mg/L	--	--	--	--	5.58	8.4	10.6	CRM5.5	28-Jan-09	34 / 34	--	--	3.8	6.117	7.95	CRM5.5	20-May-09	114 / 114	--
Sodium, Total	mg/L	--	--	--	--	5.77	8.281	10.2	CRM5.5	13-Feb-09	34 / 34	--	--	3.68	6.195	7.94	CRM5.5	24-Aug-09	114 / 114	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0745	0.09738	0.11	CRM5.5	30-Jul-10	31 / 31	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0749	0.09814	0.113	CRM5.5	30-Jul-10	31 / 31	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	14.2	26.4	34.8	CRM5.5	10-Jun-09	50 / 50	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00025 / 0.002	0.0003	0.000395	0.00049	CRM5.5	19-Feb-10	2 / 114	2>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 43	--	0.00025 / 0.002	0.00026	0.00042	0.00058	CRM5.5	19-Feb-10	2 / 114	2>TWQC
Tin, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--	--	--	--	--	--	--	--	--

TABLE H-7 SUMMARY STATISTICS FOR SURFACE WATER
CLINCH RIVER MILE 5.5 - NON-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Tin, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	131	158	200	CRM5.5	25-Mar-09	12 / 12	--	--	116	161.7	192	CRM5.5	11-Sep-09	114 / 114	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.937	0.123	1.262	16.3	CRM5.5	1-Feb-10	18 / 50	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.884	0.133	0.2255	0.318	CRM5.5	3-Jun-09	2 / 49	--
Total Suspended Solids	mg/L	--	--	--	--	4.1	7.073	10	CRM5.5	20-Mar-09	26 / 26	--	--	1.1	7.281	32.8	CRM5.5	29-Jan-10	114 / 114	--
Vanadium, Dissolved	mg/L	--	--	--	0.001 / 0.004	ND	--	ND	--	--	0 / 34	--	0.00033 / 0.004	0.00052	0.001007	0.00217	CRM5.5	2-Aug-10	21 / 114	--
Vanadium, Total	mg/L	--	--	--	0.001 / 0.004	ND	--	ND	--	--	0 / 34	--	0.00033 / 0.004	0.00074	0.001241	0.00241	CRM5.5	2-Aug-10	28 / 114	--
Zinc, Dissolved	mg/L	0.12	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 43	--	0.0083 / 0.05	0.0171	0.0171	0.0171	CRM5.5	16-Aug-10	1 / 114	--
Zinc, Total	mg/L	--	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 43	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 114	--

Notes:
CRM = Clinch River Mile
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-8 SUMMARY STATISTICS FOR SURFACE WATER
CLINCH RIVER (DOWNSTREAM) - NON-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	10 / 20	25.7	84.64	114	CRM4.0	9-Mar-09	79 / 80	--	10 / 53.9	28.8	98.2	144	CRM4.0	19-Jul-10	374 / 376	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.5	0.155	0.155	0.155	CRM2.0	2-Mar-09	1 / 123	--	0.025 / 0.1	0.0253	0.03315	0.056	CRM2.0	26-Mar-10	37 / 377	--
Aluminum, Total	mg/L	--	--	--	0.1 / 0.398	0.118	0.263	0.996	CRM0.0	23-Dec-08	106 / 124	--	0.025 / 0.212	0.0619	0.2604	1.18	CRM2.0	29-Jan-10	363 / 377	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.501	0.1	0.1515	0.433	CRM2.0	7-Dec-09	34 / 165	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.001 / 0.002	ND	--	ND	--	--	0 / 122	--	0.00033 / 0.002	0.00033	0.000471	0.00071	CRM2.0	5-Oct-09	10 / 377	--
Antimony, Total	mg/L	--	0.006	0.0056	0.001 / 0.002	ND	--	ND	--	--	0 / 123	--	0.00033 / 0.002	0.00033	0.00094	0.00416	CRM2.0	4-Sep-09	13 / 377	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.001 / 0.002	0.00468	0.00468	0.00468	CRM0.0	23-Dec-08	1 / 123	--	0.00033 / 0.00251	0.00034	0.001228	0.00573	CRM2.0	17-Jul-09	258 / 377	--
Arsenic, Total	mg/L	--	0.01	0.01	0.001 / 0.002	0.0013	0.003128	0.00536	CRM0.0	23-Dec-08	4 / 124	--	0.00033 / 0.002	0.00039	0.001599	0.00692	CRM2.0	17-Jul-09	277 / 377	--
Barium, Dissolved	mg/L	--	2	--	0.005 / 0.0146	0.0101	0.03047	0.039	CRM2.0	13-Feb-09	119 / 123	--	--	0.0191	0.03289	0.0548	CRM2.0	28-Jun-10	377 / 377	--
Barium, Total	mg/L	--	2	--	--	0.0189	0.03618	0.0478	CRM0.0	23-Dec-08	124 / 124	--	--	0.0218	0.03663	0.0625	CRM2.0	25-Jun-10	377 / 377	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 123	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 377	--
Beryllium, Total	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 124	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 377	--
Boron, Dissolved	mg/L	--	--	--	0.05 / 0.1	ND	--	ND	--	--	0 / 123	--	0.0125 / 0.05	0.0125	0.01881	0.0433	CRM4.0	14-Sep-09	201 / 377	--
Boron, Total	mg/L	--	--	--	0.05 / 0.1	ND	--	ND	--	--	0 / 124	--	0.0125 / 0.05	0.0126	0.0189	0.046	CRM4.0	14-Sep-09	220 / 377	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 123	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 377	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 124	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 377	--
Calcium, Dissolved	mg/L	--	--	--	--	9.18	26.11	40.4	CRM4.0	13-Feb-09	96 / 96	--	--	8.1	28.1	45.3	CRM4.0	13-Nov-09	377 / 377	--
Calcium, Total	mg/L	--	--	--	--	9.69	29.04	38.6	CRM4.0	9-Feb-09	121 / 121	--	--	8.28	28.42	41.6	CRM4.0	29-Jul-09	377 / 377	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	1 / 1	2.47	5.772	9.91	CRM0.0	31-Aug-09	164 / 165	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.001 / 0.002	ND	--	ND	--	--	0 / 123	--	0.00033 / 0.002	0.00033	0.0007523	0.00195	CRM0.0	14-Jun-10	26 / 376	--
Chromium, Total	mg/L	--	0.1	--	0.001 / 0.002	0.001	0.003235	0.00547	CRM4.0	6-Apr-09	2 / 124	--	0.00033 / 0.002	0.00033	0.0005211	0.00158	CRM2.0	29-Jan-10	179 / 376	--
Cobalt, Dissolved	mg/L	--	--	--	0.001 / 0.02	ND	--	ND	--	--	0 / 123	--	0.00033 / 0.002	0.00035	0.00035	0.00035	CRM0.0	23-Oct-09	1 / 377	--
Cobalt, Total	mg/L	--	--	--	0.001 / 0.02	ND	--	ND	--	--	0 / 124	--	0.00033 / 0.002	0.00033	0.0004433	0.00089	CRM2.0	29-Jan-10	43 / 377	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.001 / 0.005	0.0015	0.006702	0.00913	CRM2.0	28-Feb-09	5 / 122	1>F&AL	0.00033 / 0.00918	0.00033	0.0008215	0.00737	CRM0.0	20-Aug-10	212 / 377	--
Copper, Total	mg/L	--	1.3	--	0.001 / 0.005	0.0011	0.0014	0.0017	CRM0.0	8-Apr-09	2 / 123	--	0.00033 / 0.005	0.00048	0.00134	0.00665	CRM2.0	25-Jun-10	230 / 377	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.2	0.11	0.1393	0.19	CRM2.0	30-Nov-09	97 / 165	--
Hardness (As CaCO3)	mg/L	--	--	--	--	34.3	98.46	144	CRM4.0	13-Mar-09	62 / 62	--	--	29.9	103.9	155	CRM4.0	13-Nov-09	377 / 377	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.1	0.138	0.244	0.35	CRM0.0	4-Feb-09	2 / 123	--	0.0125 / 0.05	0.0164	0.04697	0.182	CRM0.0	1-May-09	24 / 376	--
Iron, Total	mg/L	--	--	--	0.05 / 0.05	0.0882	0.2328	0.509	CRM2.0	26-Dec-08	123 / 124	--	--	0.0707	0.2407	1.75	CRM2.0	29-Jan-10	377 / 377	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.001 / 0.002	ND	0	ND			0 / 104	--	0.00033 / 0.002	0.00033	0.00033	0.00033	CRM0.0	30-Jul-10	1 / 377	--
Lead, Total	mg/L	--	0.005	--	0.002 / 0.002	ND	0	ND			0 / 90	--	0.00033 / 0.002	0.00033	0.0005752	0.0101	CRM4.0	11-Sep-09	129 / 377	1>TDWS
Magnesium, Dissolved	mg/L	--	--	--	--	2.35	9.113	13.5	CRM2.0	28-Jan-09	123 / 123	--	--	2.16	7.88	12.6	CRM4.0	13-Nov-09	377 / 377	--
Magnesium, Total	mg/L	--	--	--	--	2.44	9.043	12.6	CRM4.0	21-Jan-09	124 / 124	--	--	2.24	8.001	12.5	CRM4.0	13-Nov-09	377 / 377	--
Manganese, Dissolved	mg/L	--	--	--	0.001 / 0.015	0.00578	0.01205	0.026	CRM4.0	6-Apr-09	24 / 123	--	0.00033 / 0.0119	0.00033	0.007121	0.0405	CRM4.0	7-May-10	240 / 377	--
Manganese, Total	mg/L	--	--	--	0.001 / 0.005	0.00956	0.03655	0.0539	CRM0.0	29-Dec-08	123 / 124	--	0.00033 / 0.0288	0.0191	0.04633	0.117	CRM0.0	13-Nov-09	374 / 377	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 80	--	0.0001 / 0.0002	0.0001	0.000111	0.00012	CRM0.0	20-Nov-09	2 / 377	2>TWQC
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 80	--	0.0001 / 0.0002	0.0001	0.000104	0.0001	CRM0.0	30-Nov-09	1 / 377	1>TWQC
Molybdenum, Dissolved	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 123	--	0.00033 / 0.005	0.00033	0.0007871	0.00278	CRM2.0	25-Jun-10	168 / 377	--
Molybdenum, Total	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 124	--	0.00033 / 0.005	0.00033	0.0007704	0.00259	CRM2.0	25-Jun-10	179 / 377	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.001 / 0.01	ND	--	ND	--	--	0 / 123	--	0.00033 / 0.005	0.00033	0.0004622	0.0013	CRM0.0	5-Mar-10	166 / 376	--
Nickel, Total	mg/L	--	0.1	0.61	0.001 / 0.01	0.0014	0.0014	0.0014	CRM0.0	8-Apr-09	2 / 124	--	0.00033 / 0.005	0.00033	0.000706	0.00241	CRM4.0	23-Nov-09	237 / 376	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.513	0.103	0.3376	0.618	CRM4.0	23-Aug-10	156 / 165	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 162	--
pH	pH	--	--	--		7	7.617	8.1	CRM4.0	29-Apr-09	35 / 35	--	--	6.2	7.47	8.3	CRM0.0	1-May-09	377 / 377	--
Potassium, Dissolved	mg/L	--	--	--	0.2 / 1	1.07	1.671	2.1	CRM0.0	9-Feb-09	92 / 96	--	0.25 / 1.5	0.783	1.469	1.93	CRM4.0	29-Jun-09	373 / 377	--
Potassium, Total	mg/L	--	--	--	0.2 / 1	1.07	1.677	2.1	CRM4.0	5-Jan-09	94 / 97	--	0.25 / 1.95	0.829	1.519	1.95	CRM4.0	17-Jul-09	373 / 377	--
Selenium, Dissolved	mg/L	--	0.05	--	0.001 / 0.002	ND	--	ND	--	--	0 / 123	--	0.00033 / 0.002	0.00033	0.0004686	0.00109	CRM4.0	20-Nov-09	35 / 377	--
Selenium, Total	mg/L	0.005	0.05	--	0.001 / 0.002	ND	--	ND	--	--	0 / 124	--	0.00033 / 0.002	0.00033	0.000471	0.00081	CRM4.0	14-Sep-09	41 / 377	--
Silica, Dissolved	mg/L	--	--	--	1 / 1	1.21	2.809	7.78	CRM0.0	25-Feb-09	23 / 27	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.0005 / 0.002	ND	--	ND	--	--	0 / 123	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 377	--
Silver, Total	mg/L	--	--	--	0.0005 / 0.002	ND	--	ND	--	--	0 / 124	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 377	--
Sodium, Dissolved	mg/L	--	--	--	--	2.09	7.379	11.1	CRM0.0	29-Dec-08	96 / 96	--	--	1.77	5.651	7.8	CRM4.0	11-Sep-09	377 / 377	--
Sodium, Total	mg/L	--	--	--	--	2.23	7.207	10.1	CRM4.0	21-Jan-09	97 / 97	--	--	1.8	5.747	8.05	CRM0.0	19-Aug-09	377 / 377	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0323	0.08517	0.113	CRM2.0	25-Jun-10	105 / 105	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0364	0.08621	0.114	CRM2.0	25-Jun-10	105 / 105	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	7.09	21.49	33.3	CRM4.0	30-Nov-09	165 / 165	
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 123	--	0.00025 / 0.002	0.00028	0.0005053	0.00079	CRM2.0	2-Oct-09	17 / 377	17>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 124	--	0.00025 / 0.002	0.00027	0.0004965	0.00096	CRM2.0	2-Oct-09	17 / 377	17>TWQC
Tin, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 27	--	--	--	--	--	--	--	--	--

TABLE H-8 SUMMARY STATISTICS FOR SURFACE WATER
CLINCH RIVER (DOWNSTREAM) - NON-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Tin, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 27	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 27	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 27	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	45	106.1	204	CRM4.0	25-Mar-09	35 / 35	--	--	40	133.3	194	CRM0.0	14-Sep-09	377 / 377	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 1.2	0.101	0.3625	1.93	CRM2.0	9-Jul-10	74 / 160	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 4.79	0.105	3.167	14.4	CRM4.0	2-Aug-10	9 / 164	--
Total Suspended Solids	mg/L	--	--	--		4	7.707	13.9	CRM2.0	8-Apr-09	80 / 80	--	--	1.2	8.296	36.8	CRM2.0	29-Jan-10	377 / 377	--
Vanadium, Dissolved	mg/L	--	--	--	0.001 / 0.004	ND	--	ND	--	--	0 / 96	--	0.00033 / 0.00462	0.00055	0.001562	0.00498	CRM2.0	17-Jul-09	109 / 377	--
Vanadium, Total	mg/L	--	--	--	0.001 / 0.004	0.0012	0.00283	0.00549	CRM0.0	23-Dec-08	3 / 97	--	0.00033 / 0.00537	0.00088	0.001854	0.00629	CRM2.0	17-Jul-09	176 / 377	--
Zinc, Dissolved	mg/L	0.12	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 123	--	0.0083 / 0.05	0.00837	0.009785	0.0112	CRM4.0	14-Sep-09	2 / 377	--
Zinc, Total	mg/L	--	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 124	--	0.0083 / 0.05	0.00838	0.01483	0.0266	CRM0.0	22-Mar-10	3 / 377	--

Notes:
CRM = Clinch River Mile
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-9 SUMMARY STATISTICS FOR SURFACE WATER
TENNESSEE RIVER (DOWNSTREAM) - NON-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	--	48.1	64.31	76.1	TRM568.5	24-Apr-09	29 / 29	--	--	37.6	71.68	121	TRM568.5	11-Sep-09	125 / 125	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.5	ND	--	ND	--	--	0 / 45	--	0.02 / 0.1	0.0252	0.03142	0.0502	TRM568.5	30-Apr-10	14 / 126	--
Aluminum, Total	mg/L	--	--	--	0.1 / 0.5	0.101	0.1754	0.256	TRM563.5	1-Apr-09	32 / 45	--	0.025 / 0.14	0.0664	0.2061	0.725	TRM563.5	29-Jan-10	114 / 125	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.3	0.11	0.1403	0.281	TRM568.5	30-Nov-09	18 / 53	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.001 / 0.002	0.0025	0.0025	0.0025	TRM568.5	13-Apr-09	1 / 45	--	0.00033 / 0.002	0.00036	0.0006125	0.00095	TRM568.5	30-Apr-10	4 / 125	--
Antimony, Total	mg/L	--	0.006	0.0056	0.001 / 0.002	0.00307	0.00307	0.00307	TRM568.5	3-Apr-09	1 / 44	--	0.00033 / 0.002	0.00037	0.0005633	0.00084	TRM568.5	5-Apr-10	3 / 125	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.001 / 0.002	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.0065	0.00033	0.0005535	0.00343	TRM568.5	28-Jun-10	54 / 125	--
Arsenic, Total	mg/L	--	0.01	0.01	0.001 / 0.002	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.002	0.00035	0.0006306	0.00349	TRM568.5	28-Jun-10	66 / 125	--
Barium, Dissolved	mg/L	--	2	--	0.005 / 0.0119	0.0141	0.02188	0.0273	TRM563.5	3-Apr-09	44 / 45	--	--	0.0134	0.02308	0.043	TRM568.5	28-Jun-10	125 / 125	--
Barium, Total	mg/L	--	2	--	--	0.0205	0.02444	0.0309	TRM563.5	3-Apr-09	45 / 45	--	--	0.0202	0.02606	0.0454	TRM568.5	28-Jun-10	125 / 125	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 125	--
Beryllium, Total	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 125	--
Boron, Dissolved	mg/L	--	--	--	0.05 / 0.1	ND	--	ND	--	--	0 / 45	--	0.0125 / 0.05	0.0125	0.01584	0.0313	TRM568.5	28-Jun-10	19 / 125	--
Boron, Total	mg/L	--	--	--	0.05 / 0.1	ND	--	ND	--	--	0 / 45	--	0.0125 / 0.05	0.0125	0.01533	0.0317	TRM568.5	28-Jun-10	21 / 125	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 125	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 125	--
Calcium, Dissolved	mg/L	--	--	--	--	14.9	19.33	24.3	TRM568.5	13-Feb-09	36 / 36	--	--	12.4	19.43	34.4	TRM568.5	23-Aug-10	125 / 125	--
Calcium, Total	mg/L	--	--	--	--	14.8	19.71	23.6	TRM568.5	23-Feb-09	44 / 44	--	--	14.4	19.85	36.1	TRM568.5	11-Sep-09	125 / 125	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	2.62	6.68	10	TRM568.5	31-Aug-09	53 / 53	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.001 / 0.002	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.002	0.00033	0.00083	0.0018	TRM568.5	1-Mar-10	6 / 125	--
Chromium, Total	mg/L	--	0.1	--	0.001 / 0.002	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.002	0.00033	0.0004883	0.00099	TRM563.5	29-Jan-10	47 / 125	--
Cobalt, Dissolved	mg/L	--	--	--	0.001 / 0.02	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 125	--
Cobalt, Total	mg/L	--	--	--	0.001 / 0.02	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.002	0.00033	0.00041	0.00053	TRM563.5	29-Jan-10	5 / 125	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.001 / 0.005	0.0133	0.0133	0.0133	TRM568.5	25-Feb-09	1 / 45	1>F&AL	0.00033 / 0.00755	0.00034	0.0005398	0.00201	TRM568.5	28-Jun-10	65 / 124	--
Copper, Total	mg/L	--	1.3	--	0.001 / 0.005	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.005	0.00044	0.001148	0.028	TRM568.5	25-Sep-09	75 / 124	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.134	0.11	0.1358	0.19	TRM568.5	30-Nov-09	33 / 53	--
Hardness (As CaCO3)	mg/L	--	--	--	--	55.6	72.51	88.2	TRM568.5	13-Mar-09	23 / 23	--	--	50.3	69.57	132	TRM568.5	11-Sep-09	125 / 125	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.1	ND	--	ND	--	--	0 / 45	--	0.0125 / 0.05	0.0274	0.05021	0.16	TRM568.5	23-Nov-09	16 / 125	--
Iron, Total	mg/L	--	--	--	--	0.0626	0.2236	0.378	TRM568.5	19-Jan-09	45 / 45	--	--	0.0572	0.2604	1.05	TRM568.5	16-Nov-09	125 / 125	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 26	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 125	--
Lead, Total	mg/L	--	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 26	--	0.00033 / 0.002	0.00033	0.0004525	0.00101	TRM563.5	29-Jan-10	32 / 125	--
Magnesium, Dissolved	mg/L	--	--	--	--	3.9	5.104	6.25	TRM568.5	13-Feb-09	45 / 45	--	--	2.75	4.722	9.72	TRM568.5	23-Aug-10	125 / 125	--
Magnesium, Total	mg/L	--	--	--	--	3.71	5.062	6.31	TRM568.5	13-Mar-09	45 / 45	--	--	3.37	4.862	10.2	TRM568.5	23-Aug-10	125 / 125	--
Manganese, Dissolved	mg/L	--	--	--	0.001 / 0.015	0.00533	0.0065	0.00767	TRM568.5	16-Feb-09	2 / 45	--	0.00033 / 0.005	0.00033	0.004769	0.023	TRM568.5	30-Apr-10	64 / 125	--
Manganese, Total	mg/L	--	--	--	--	0.0164	0.03904	0.051	TRM568.5	16-Feb-09	45 / 45	--	0.00033 / 0.0258	0.0169	0.05453	0.104	TRM568.5	16-Nov-09	124 / 125	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	0.00025	0.000245	0.00025	TRM568.5	23-Mar-09	1 / 29	1>TWQC	0.0001 / 0.0002	0.0001	0.000103	0.0001	TRM568.5	20-Nov-09	1 / 125	1>TWQC
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 29	--	0.0001 / 0.0002	0.00012	0.000115	0.00012	TRM568.5	2-Oct-09	1 / 125	1>TWQC
Molybdenum, Dissolved	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.005	0.00033	0.0005211	0.00179	TRM568.5	28-Jun-10	19 / 124	--
Molybdenum, Total	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.005	0.00033	0.0005048	0.00168	TRM568.5	28-Jun-10	21 / 124	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.001 / 0.01	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.005	0.00033	0.0004093	0.00054	TRM568.5	24-May-10	14 / 124	--
Nickel, Total	mg/L	--	0.1	0.61	0.001 / 0.01	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.005	0.00033	0.0005245	0.00271	TRM568.5	25-Sep-09	55 / 124	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.559	0.119	0.325	0.656	TRM568.5	12-Jan-10	50 / 53	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 52	--
pH	pH	--	--	--	--	7.3	7.85	8.6	TRM568.5	29-Apr-09	14 / 14	--	--	6.5	7.466	8.6	TRM568.5	1-May-09	125 / 125	--
Potassium, Dissolved	mg/L	--	--	--	--	1.06	1.718	2.12	TRM568.5	13-Feb-09	36 / 36	--	--	0.626	1.345	1.9	TRM568.5	4-Dec-09	125 / 125	--
Potassium, Total	mg/L	--	--	--	--	1.14	1.704	2.06	TRM568.5	13-Feb-09	36 / 36	--	0.25 / 1.82	0.918	1.386	1.83	TRM568.5	30-Oct-09	123 / 125	--
Selenium, Dissolved	mg/L	--	0.05	--	0.001 / 0.002	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.002	0.00033	0.0004567	0.0006	TRM568.5	30-Apr-10	3 / 125	--
Selenium, Total	mg/L	0.005	0.05	--	0.001 / 0.002	ND	--	ND	--	--	0 / 45	--	0.00033 / 0.002	0.00043	0.00043	0.00043	TRM568.5	28-Jun-10	1 / 125	--
Silica, Dissolved	mg/L	--	--	--	--	1.56	3.446	5.3	TRM568.5	9-Mar-09	9 / 9	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.0005 / 0.002	ND	0	ND			0 / 45	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 125	--
Silver, Total	mg/L	--	--	--	0.0005 / 0.002	ND	0	ND			0 / 45	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 125	--
Sodium, Dissolved	mg/L	--	--	--	--	3.73	8.509	10.9	TRM568.5	2-Jan-09	36 / 36	--	--	2.73	5.674	7.55	TRM568.5	17-Jul-09	125 / 125	--
Sodium, Total	mg/L	--	--	--	--	3.82	8.281	10.3	TRM568.5	2-Jan-09	36 / 36	--	--	3.49	5.756	8.42	TRM568.5	19-Aug-09	125 / 125	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0457	0.06264	0.103	TRM568.5	9-Aug-10	35 / 35	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0469	0.063	0.104	TRM568.5	9-Aug-10	35 / 35	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	3.75	10.96	25	TRM568.5	23-Aug-10	53 / 53	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 45	--	0.00025 / 0.002	ND	--	ND	--	--	0 / 125	--
Thallium, Total	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 45	--	0.00025 / 0.002	ND	--	ND	--	--	0 / 125	--
Tin, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--	--	--	--	--	--	--	--	--

TABLE H-9 SUMMARY STATISTICS FOR SURFACE WATER
TENNESSEE RIVER (DOWNSTREAM) - NON-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Tin, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--
Titanium, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--
Titanium, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 9	--
Total Dissolved Solids	mg/L	--	--	--	--	70	93.93	126	TRM568.5	25-Mar-09	14 / 14	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids	mg/L	--	--	--	--	5	6.652	10.6	TRM568.5	8-Apr-09	29 / 29	--
Vanadium, Dissolved	mg/L	--	--	--	0.001 / 0.004	ND	--	ND	--	--	0 / 36	--
Vanadium, Total	mg/L	--	--	--	0.001 / 0.004	ND	--	ND	--	--	0 / 36	--
Zinc, Dissolved	mg/L	0.12	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 45	--
Zinc, Total	mg/L	--	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 45	--

		Regulatory Values			Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Tin, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	61	97.14	185	TRM568.5	11-Sep-09	125 / 125	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	0.1 / 1.71	0.141	0.3079	1.01	TRM568.5	8-Sep-09	21 / 52	--
Total Phosphorus	mg/L	--	--	--	0.1 / 3.21	0.112	0.196	0.312	TRM568.5	3-Jun-09	3 / 53	--
Total Suspended Solids	mg/L	--	--	--	--	2.3	7.507	24	TRM563.5	29-Jan-10	125 / 125	--
Vanadium, Dissolved	mg/L	--	--	--	0.00033 / 0.00485	0.00059	0.001073	0.00306	TRM568.5	28-Jun-10	19 / 125	--
Vanadium, Total	mg/L	--	--	--	0.00033 / 0.004	0.001	0.001289	0.00298	TRM568.5	28-Jun-10	40 / 125	--
Zinc, Dissolved	mg/L	0.12	--	--	0.0083 / 0.05	0.0105	0.0105	0.0105	TRM568.5	5-Apr-10	1 / 125	--
Zinc, Total	mg/L	--	--	--	0.0083 / 0.05	0.0182	0.0182	0.0182	TRM568.5	25-Sep-09	1 / 125	--

Notes:
TRM = Tennessee River Mile
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-10 SUMMARY STATISTICS FOR SURFACE WATER
EMORY RIVER MILE 12.2 - POST-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	10 / 20	11	11.5	12	ERM12.2	11-Apr-09	2 / 14	--	10 / 37.9	10.3	22.23	64.8	ERM12.2	20-Jul-10	29 / 41	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.104	ND	--	ND	--	--	0 / 16	--	0.025 / 0.1	0.0328	0.05823	0.101	ERM12.2	10-Dec-09	12 / 41	--
Aluminum, Total	mg/L	--	--	--	0.1 / 0.174	0.134	0.3251	0.798	ERM12.2	27-Mar-09	13 / 16	--	0.025 / 0.254	0.068	0.4042	1.56	ERM12.2	22-Jan-10	35 / 41	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.146	0.112	0.117	0.122	ERM12.2	21-Dec-09	2 / 14	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 41	--
Antimony, Total	mg/L	--	0.006	0.0056	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 41	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	0.00033	0.000388	0.00046	ERM12.2	11-Jun-10	5 / 41	--
Arsenic, Total	mg/L	--	0.01	0.01	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	0.00033	0.0005474	0.00115	ERM12.2	17-Sep-09	19 / 41	--
Barium, Dissolved	mg/L	--	2	--	--	0.0212	0.02416	0.0276	ERM12.2	29-Jan-09	16 / 16	--	0.0025 / 0.0233	0.0194	0.02709	0.0421	ERM12.2	20-Jul-10	40 / 41	--
Barium, Total	mg/L	--	2	--	--	0.0231	0.02769	0.0349	ERM12.2	27-Mar-09	16 / 16	--	0.0025 / 0.0248	0.0223	0.03122	0.045	ERM12.2	20-Jul-10	40 / 41	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.002 / 0.004	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 41	--
Beryllium, Total	mg/L	--	0.004	--	0.002 / 0.004	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 41	--
Boron, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 16	--	0.0125 / 0.05	0.0136	0.01629	0.0193	ERM12.2	21-Sep-09	8 / 41	--
Boron, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 16	--	0.0125 / 0.05	0.0132	0.017	0.02	ERM12.2	20-Jul-10	7 / 41	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 41	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 41	--
Calcium, Dissolved	mg/L	--	--	--	--	4.83	5.821	7.68	ERM12.2	18-Feb-09	14 / 14	--	--	3.93	7.199	12.8	ERM12.2	20-Jul-10	41 / 41	--
Calcium, Total	mg/L	--	--	--	--	4.99	5.737	7.24	ERM12.2	18-Feb-09	15 / 15	--	--	4.28	7.281	12.9	ERM12.2	20-Jul-10	41 / 41	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	1 / 2.06	1.9	2.981	5.86	ERM12.2	15-Jul-09	13 / 14	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	0.00041	0.001665	0.00292	ERM12.2	27-Sep-09	2 / 41	--
Chromium, Total	mg/L	--	0.1	--	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	0.00039	0.0008125	0.00186	ERM12.2	22-Jan-10	16 / 41	--
Cobalt, Dissolved	mg/L	--	--	--	0.002 / 0.02	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	0.00048	0.00048	0.00048	ERM12.2	18-Jan-10	1 / 41	--
Cobalt, Total	mg/L	--	--	--	0.002 / 0.02	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	0.00035	0.0008527	0.00218	ERM12.2	22-Jan-10	15 / 41	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.005 / 0.005	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.005	0.00034	0.0004225	0.00066	ERM12.2	21-Sep-09	16 / 40	--
Copper, Total	mg/L	--	1.3	--	0.005 / 0.005	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.005	0.00036	0.0007658	0.00224	ERM12.2	22-Jan-10	24 / 40	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.11	0.107	0.1145	0.131	ERM12.2	12-Jul-10	4 / 14	--
Hardness (As CaCO3)	mg/L	--	--	--	--	16.9	19.19	23.5	ERM12.2	11-Apr-09	10 / 10	--	--	15.2	25.7	48.3	ERM12.2	20-Jul-10	41 / 41	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.0683	0.0525	0.05907	0.0674	ERM12.2	27-Mar-09	3 / 16	--	0.0125 / 0.05	0.0145	0.07719	0.175	ERM12.2	21-Sep-09	34 / 41	--
Iron, Total	mg/L	--	--	--	--	0.116	0.3366	0.922	ERM12.2	27-Mar-09	16 / 16	--	--	0.0902	0.5116	2.73	ERM12.2	22-Jan-10	41 / 41	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 12	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 41	--
Lead, Total	mg/L	--	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 7	--	0.00033 / 0.002	0.00034	0.0007843	0.00197	ERM12.2	22-Jan-10	14 / 41	--
Magnesium, Dissolved	mg/L	--	--	--	--	1.11	1.426	1.99	ERM12.2	18-Feb-09	16 / 16	--	0.25 / 1	0.962	1.811	3.84	ERM12.2	20-Jul-10	40 / 41	--
Magnesium, Total	mg/L	--	--	--	--	1.07	1.411	1.9	ERM12.2	18-Feb-09	16 / 16	--	--	1.04	1.828	3.9	ERM12.2	20-Jul-10	41 / 41	--
Manganese, Dissolved	mg/L	--	--	--	0.005 / 0.015	0.00827	0.02302	0.0405	ERM12.2	11-Apr-09	11 / 16	--	--	0.00123	0.02158	0.0642	ERM12.2	11-Nov-09	41 / 41	--
Manganese, Total	mg/L	--	--	--	--	0.0233	0.03771	0.0716	ERM12.2	27-Mar-09	16 / 16	--	--	0.0259	0.05692	0.144	ERM12.2	22-Jan-10	41 / 41	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 14	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 41	--
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 14	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 41	--
Molybdenum, Dissolved	mg/L	--	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.005	ND	--	ND	--	--	0 / 41	--
Molybdenum, Total	mg/L	--	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.005	0.00042	0.00042	0.00042	ERM12.2	23-Jul-10	1 / 41	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.005 / 0.005	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.005	0.00045	0.0009044	0.00151	ERM12.2	27-Sep-09	27 / 40	--
Nickel, Total	mg/L	--	0.1	0.61	0.005 / 0.005	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.005	0.0005	0.001493	0.00395	ERM12.2	22-Jan-10	27 / 40	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	0.105	0.159	0.238	ERM12.2	8-Feb-10	12 / 14	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 14	--
pH	pH	--	--	--	--	6.5	7.088	7.8	ERM12.2	11-Apr-09	8 / 8	--	--	6.6	7.173	8.2	ERM12.2	5-Feb-10	41 / 41	--
Potassium, Dissolved	mg/L	--	--	--	1 / 1	1.04	1.04	1.04	ERM12.2	29-Jan-09	1 / 14	--	0.25 / 1.02	0.508	1.065	1.73	ERM12.2	20-Jul-10	35 / 41	--
Potassium, Total	mg/L	--	--	--	1 / 1	1	1	1	ERM12.2	29-Jan-09	1 / 14	--	0.25 / 1	0.517	1.083	1.76	ERM12.2	20-Jul-10	37 / 41	--
Selenium, Dissolved	mg/L	--	0.05	--	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 41	--
Selenium, Total	mg/L	0.005	0.05	--	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 41	--
Silica, Dissolved	mg/L	--	--	--	--	2.06	2.665	3.27	ERM12.2	16-Mar-09	2 / 2	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 41	--
Silver, Total	mg/L	--	--	--	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 41	--
Sodium, Dissolved	mg/L	--	--	--	--	1.45	1.948	2.68	ERM12.2	18-Feb-09	14 / 14	--	--	0.963	2.343	5.24	ERM12.2	20-Jul-10	41 / 41	--
Sodium, Total	mg/L	--	--	--	--	1.52	1.925	2.78	ERM12.2	18-Feb-09	14 / 14	--	--	0.966	2.315	5.29	ERM12.2	15-Jul-09	41 / 41	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0222	0.04399	0.0541	ERM12.2	20-Jul-10	7 / 7	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0223	0.04361	0.0541	ERM12.2	20-Jul-10	7 / 7	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	7.45	10.03	16.2	ERM12.2	12-Jul-10	14 / 14	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00025 / 0.002	0.00025	0.00054	0.00076	ERM12.2	18-Sep-09	3 / 41	3>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.002 / 0.002	ND	--	ND	--	--	0 / 16	--	0.00025 / 0.002	0.00043	0.0006	0.00077	ERM12.2	18-Sep-09	2 / 41	2>TWQC
Tin, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--

TABLE H-10 SUMMARY STATISTICS FOR SURFACE WATER
EMORY RIVER MILE 12.2 - POST-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Tin, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	31	35.38	39	ERM12.2	11-Apr-09	8 / 8	--	--	13	42.49	74	ERM12.2	20-Jul-10	41 / 41	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.47	0.15	0.2758	0.357	ERM12.2	21-Sep-09	4 / 14	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 1	ND	--	ND	--	--	0 / 14	--
Total Suspended Solids	mg/L	--	--	--		1.3	9.25	23.7	ERM12.2	27-Mar-09	14 / 14	--	1 / 1	1.1	12.01	75.4	ERM12.2	22-Jan-10	40 / 41	--
Vanadium, Dissolved	mg/L	--	--	--	0.004 / 0.004	ND	--	ND	--	--	0 / 14	--	0.00033 / 0.004	0.00036	0.0005133	0.00059	ERM12.2	27-Sep-09	3 / 41	--
Vanadium, Total	mg/L	--	--	--	0.004 / 0.004	ND	--	ND	--	--	0 / 14	--	0.00033 / 0.00472	0.00042	0.001645	0.00318	ERM12.2	22-Jan-10	6 / 41	--
Zinc, Dissolved	mg/L	0.12	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 16	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 41	--
Zinc, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 16	--	0.0083 / 0.05	0.0111	0.01125	0.0114	ERM12.2	22-Jan-10	2 / 41	--

Notes:
ERM = Emory River Mile
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-11 SUMMARY STATISICS FOR SURFACE WATER
EMORY RIVER (DOWNSTREAM) - POST-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	10 / 20	10.1	28.02	114	ERM0.1	14-Mar-09	28 / 59	--	10 / 10	10	51.77	154	ERM1.75	23-Jul-10	171 / 195	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.5	0.144	0.1675	0.191	ERM0.1	7-Jan-09	2 / 77	--	0.025 / 0.104	0.0251	0.0548	0.118	ERM1.75	10-Dec-09	63 / 195	--
Aluminum, Total	mg/L	--	--	--	0.1 / 0.5	0.124	4.13	96	ERM1.75	7-Jan-09	64 / 77	--	0.025 / 0.24	0.0781	0.7637	13.7	ERM0.5ISCO	25-Jan-10	186 / 195	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.356	0.11	0.1526	0.206	ERM0.1	26-Jan-10	15 / 63	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.001 / 0.002	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.002	0.00035	0.0005583	0.00085	ERM2.1	28-Sep-09	6 / 195	--
Antimony, Total	mg/L	--	0.006	0.0056	0.001 / 0.002	0.00279	0.003187	0.00364	ERM0.1	7-Jan-09	3 / 77	--	0.00033 / 0.002	0.00033	0.0004467	0.00089	ERM0.1	21-Sep-09	15 / 195	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.001 / 0.002	0.00218	0.0141	0.0281	ERM1.75	7-Jan-09	6 / 77	3>TDWS; 3>TWQC	0.00033 / 0.002	0.00033	0.001479	0.00537	ERM1.75	13-Jul-09	112 / 195	--
Arsenic, Total	mg/L	--	0.01	0.01	0.001 / 0.002	0.00228	0.04867	0.189	ERM1.75	7-Jan-09	10 / 77	4>TDWS; 4>TWQC	0.00033 / 0.002	0.00041	0.002699	0.0274	ERM0.5ISCO	25-Jan-10	153 / 195	2>TDWS; 2>TWQC
Barium, Dissolved	mg/L	--	2	--	0.005 / 0.0238	0.0207	0.02742	0.11	ERM1.75	7-Jan-09	73 / 77	--	0.0025 / 0.0238	0.019	0.03067	0.0598	ERM0.5ISCO	11-Jun-10	191 / 195	--
Barium, Total	mg/L	--	2	--	--	0.0235	0.08541	1.91	ERM1.75	7-Jan-09	77 / 77	--	0.0025 / 0.0237	0.0223	0.04194	0.236	ERM0.5ISCO	25-Jan-10	194 / 195	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 195	--
Beryllium, Total	mg/L	--	0.004	--	0.001 / 0.02	0.00878	0.00878	0.00878	ERM0.1	7-Jan-09	1 / 77	1>TDWS	0.00033 / 0.002	0.00033	0.0006088	0.00212	ERM0.5ISCO	25-Jan-10	16 / 195	--
Boron, Dissolved	mg/L	--	--	--	0.05 / 0.1	0.0561	0.0709	0.0875	ERM2.1	18-Feb-09	3 / 77	--	0.0125 / 0.05	0.0125	0.02046	0.0382	ERM0.5ISCO	18-Jan-10	64 / 195	--
Boron, Total	mg/L	--	--	--	0.05 / 0.1	0.0805	0.1542	0.227	ERM1.75	7-Jan-09	4 / 77	--	0.0125 / 0.05	0.0127	0.0196	0.0371	ERM0.1	18-Sep-09	84 / 195	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 195	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.01	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 195	--
Calcium, Dissolved	mg/L	--	--	--	--	4.55	7.426	39.7	ERM1.75	18-Feb-09	69 / 69	--	--	3.76	14.22	36.7	ERM0.1	24-Jun-09	195 / 195	--
Calcium, Total	mg/L	--	--	--	--	4.71	8.581	38.4	ERM0.1	14-Mar-09	73 / 73	--	--	4.24	14.48	37.8	ERM0.1	23-Jul-10	195 / 195	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	1 / 2.15	1.66	3.514	7.09	ERM1.75	12-Jul-10	58 / 63	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.001 / 0.002	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.002	0.00033	0.0006976	0.00198	ERM4.0	11-Jun-10	21 / 195	--
Chromium, Total	mg/L	--	0.1	--	0.001 / 0.002	0.00647	0.04674	0.0829	ERM1.75	7-Jan-09	4 / 77	--	0.00033 / 0.002	0.00033	0.001189	0.0116	ERM0.5ISCO	25-Jan-10	111 / 195	--
Cobalt, Dissolved	mg/L	--	--	--	0.001 / 0.02	0.0014	0.0014	0.0014	ERM4.0	11-Apr-09	1 / 77	--	0.00033 / 0.002	0.00033	0.0003778	0.00056	ERM0.5ISCO	18-Jan-10	9 / 195	--
Cobalt, Total	mg/L	--	--	--	0.001 / 0.02	0.0022	0.02669	0.0546	ERM1.75	7-Jan-09	5 / 77	--	0.00033 / 0.002	0.00033	0.0009051	0.00825	ERM0.5ISCO	25-Jan-10	112 / 195	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.001 / 0.005	0.0016	0.00165	0.0017	ERM4.0	11-Apr-09	2 / 77	--	0.00033 / 0.005	0.00033	0.000654	0.00264	ERM0.5ISCO	18-Jan-10	110 / 195	--
Copper, Total	mg/L	--	1.3	--	0.001 / 0.005	0.001	0.09738	0.223	ERM1.75	7-Jan-09	5 / 77	--	0.00033 / 0.005	0.00034	0.002194	0.0277	ERM0.5ISCO	25-Jan-10	132 / 195	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.107	0.1	0.1166	0.151	ERM0.1	12-Jul-10	25 / 63	--
Hardness (As CaCO3)	mg/L	--	--	--	--	17	27.04	146	ERM0.1	14-Mar-09	39 / 39	--	--	15.3	52.59	140	ERM0.1	23-Jul-10	195 / 195	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.1	0.0508	0.06309	0.107	ERM2.1	19-Feb-09	23 / 77	--	0.0125 / 0.05	0.0132	0.07609	0.295	ERM0.5ISCO	18-Jan-10	123 / 195	--
Iron, Total	mg/L	--	--	--	--	0.0833	1.679	37.5	ERM1.75	7-Jan-09	77 / 77	--	0.0125 / 0.192	0.0821	0.6223	7.09	ERM0.5ISCO	25-Jan-10	193 / 195	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 69	--	0.00033 / 0.002	0.00038	0.000465	0.00055	ERM0.5ISCO	18-Jan-10	2 / 195	--
Lead, Total	mg/L	--	0.005	--	0.002 / 0.002	0.00985	0.06438	0.104	ERM1.75	7-Jan-09	4 / 62	4>TDWS	0.00033 / 0.002	0.00033	0.001343	0.0158	ERM0.5ISCO	25-Jan-10	105 / 195	2>TDWS
Magnesium, Dissolved	mg/L	--	--	--	--	1.2	2.222	13.2	ERM1.75	18-Feb-09	77 / 77	--	--	0.961	3.894	10.9	ERM0.1	10-Jul-10	195 / 195	--
Magnesium, Total	mg/L	--	--	--	--	1.16	2.434	12.2	ERM0.1	14-Mar-09	77 / 77	--	--	1.1	3.992	11	ERM0.1	10-Jul-10	195 / 195	--
Manganese, Dissolved	mg/L	--	--	--	0.001 / 0.015	0.00859	0.0296	0.0572	ERM4.0	18-Feb-09	47 / 77	--	0.00033 / 0.005	0.00038	0.03067	0.519	ERM4.0	22-Jun-09	164 / 195	--
Manganese, Total	mg/L	--	--	--	--	0.0244	0.06098	0.558	ERM1.75	7-Jan-09	77 / 77	--		0.0236	0.06901	0.666	ERM4.0	22-Jun-09	195 / 195	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 59	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 195	--
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 59	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 195	--
Molybdenum, Dissolved	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.005	0.00033	0.001009	0.0021	ERM0.1	11-Jun-10	41 / 195	--
Molybdenum, Total	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.005	0.00034	0.0009261	0.00235	ERM0.1	18-Sep-09	49 / 195	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.001 / 0.005	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.005	0.00033	0.0009101	0.00281	ERM2.1	26-Apr-10	122 / 194	--
Nickel, Total	mg/L	--	0.1	0.61	0.001 / 0.005	0.0011	0.04722	0.126	ERM1.75	7-Jan-09	6 / 77	1>TDWS	0.00033 / 0.005	0.00044	0.001946	0.0172	ERM0.5ISCO	25-Jan-10	138 / 194	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	0.1	0.2244	0.557	ERM0.1	15-Jul-09	48 / 63	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 63	--
pH	pH	--	--	--	--	6.8	7.248	7.8	ERM1.75	20-Apr-09	31 / 31	--	--	6	7.268	8.6	ERM1.75	5-Feb-10	195 / 195	--
Potassium, Dissolved	mg/L	--	--	--	0.2 / 1	0.93	1.171	2.08	ERM1.75	18-Feb-09	14 / 69	--	0.25 / 1.5	0.415	1.122	1.88	ERM1.75	24-Jun-09	178 / 195	--
Potassium, Total	mg/L	--	--	--	0.2 / 1	0.93	3.308	17.6	ERM1.75	7-Jan-09	19 / 69	--	0.25 / 1	0.503	1.224	2.53	ERM0.5ISCO	25-Jan-10	181 / 195	--
Selenium, Dissolved	mg/L	--	0.05	--	0.001 / 0.002	0.00233	0.0036	0.00512	ERM1.75	7-Jan-09	3 / 77	--	0.00033 / 0.002	0.00033	0.0004545	0.00063	ERM0.5ISCO	22-Jul-10	20 / 195	--
Selenium, Total	mg/L	0.005	0.05	--	0.001 / 0.02	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.002	0.00033	0.000491	0.00134	ERM0.5ISCO	25-Jan-10	31 / 195	--
Silica, Dissolved	mg/L	--	--	--	--	2	3.339	5.05	ERM2.1	16-Mar-09	8 / 8	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.0005 / 0.002	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 195	--
Silver, Total	mg/L	--	--	--	0.0005 / 0.02	ND	--	ND	--	--	0 / 77	--	0.00033 / 0.002	0.00038	0.00038	0.00038	ERM4.0	16-Oct-09	1 / 195	--
Sodium, Dissolved	mg/L	--	--	--	--	1.3	2.201	10.1	ERM1.75	18-Feb-09	69 / 69	--	--	0.892	3.049	7.8	ERM0.1	15-Jul-09	195 / 195	--
Sodium, Total	mg/L	--	--	--	--	1.35	2.267	9.84	ERM1.75	18-Feb-09	69 / 69	--	--	0.85	3.055	7.94	ERM0.1	15-Jul-09	195 / 195	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0206	0.07856	0.113	ERM0.5ISCO	10-Jul-10	39 / 39	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0215	0.07996	0.116	ERM1.75	23-Jul-10	39 / 39	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	1 / 1	6.2	13.46	32.7	ERM0.1	15-Jul-09	62 / 63	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 77	--	0.00025 / 0.002	0.00025	0.0005572	0.00108	ERM2.1	15-Oct-09	32 / 195	32>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.001 / 0.002	0.0033	0.00408	0.00491	ERM1.75	7-Jan-09	3 / 77	3>TDWS; 3>TWQC	0.00025 / 0.002	0.00025	0.0005744	0.00103	ERM2.1	15-Oct-09	41 / 195	41>TWQC
Tin, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 8	--	--	--	--	--	--	--	--	--

TABLE H-11 SUMMARY STATISICS FOR SURFACE WATER
EMORY RIVER (DOWNSTREAM) - POST-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Tin, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 8	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 8	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 8	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	28	37.19	52	ERM0.1	11-Apr-09	31 / 31	--	10 / 10	13	71.9	195	ERM0.1	13-Jul-09	193 / 195	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 1	0.214	0.3083	0.529	ERM4.0	15-Jul-09	6 / 63	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 1	0.101	0.101	0.101	ERM0.1	21-Sep-09	1 / 63	--
Total Suspended Solids	mg/L	--	--	--	--	1.5	15.06	100	ERM2.1	19-Feb-09	59 / 59	--	--	1.3	17.97	268	ERM0.5ISCO	25-Jan-10	195 / 195	--
Vanadium, Dissolved	mg/L	--	--	--	0.001 / 0.004	0.0131	0.02193	0.0265	ERM1.75	7-Jan-09	3 / 69	--	0.00033 / 0.00479	0.00037	0.001525	0.00445	ERM0.1	13-Jul-09	54 / 195	--
Vanadium, Total	mg/L	--	--	--	0.001 / 0.004	0.00476	0.1242	0.339	ERM1.75	7-Jan-09	6 / 69	--	0.00033 / 0.00606	0.00052	0.003888	0.0454	ERM0.5ISCO	25-Jan-10	105 / 195	--
Zinc, Dissolved	mg/L	0.12	--	--	0.005 / 0.05	0.227	0.227	0.227	ERM0.1	14-Mar-09	1 / 77	1>F&AL	0.0083 / 0.05	0.00936	0.00936	0.00936	ERM0.1	15-Oct-09	1 / 192	--
Zinc, Total	mg/L	--	--	--	0.005 / 0.5	0.104	0.104	0.104	ERM0.1	7-Jan-09	1 / 77	--	0.0083 / 0.05	0.00832	0.01205	0.032	ERM0.5ISCO	25-Jan-10	14 / 194	--

Notes:
ERM = Emory River Mile
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-12 SUMMARY STATISTICS FOR SURFACE WATER
CLINCH RIVER MILE 5.5 - POST-STORM EVENT SAMPLING

Analyte	Unit	Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 5-Jan-09 and 27-Aug-10							
		F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	--	96	109.2	120	CRM5.5	15-Apr-09	15 / 15	--	--	78.7	115.3	149	CRM5.5	23-Jul-10	39 / 39	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 19	--	0.025 / 0.1	0.0254	0.02905	0.0359	CRM5.5	10-Dec-09	8 / 39	--
Aluminum, Total	mg/L	--	--	--	0.1 / 0.152	0.131	0.2891	0.604	CRM5.5	12-Jan-09	16 / 19	--	0.025 / 0.217	0.0588	0.3695	2.39	CRM5.5	14-Dec-09	34 / 39	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.227	0.159	0.159	0.159	CRM5.5	8-Feb-10	1 / 14	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	0.00083	0.00083	0.00083	CRM5.5	21-Sep-09	1 / 39	--
Antimony, Total	mg/L	--	0.006	0.0056	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 39	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	0.00033	0.0005717	0.00202	CRM5.5	13-Jul-09	23 / 39	--
Arsenic, Total	mg/L	--	0.01	0.01	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	0.00043	0.0008081	0.00204	CRM5.5	13-Jul-09	26 / 39	--
Barium, Dissolved	mg/L	--	2	--	0.01 / 0.0167	0.0126	0.03157	0.0373	CRM5.5	18-Feb-09	18 / 19	--	0.0025 / 0.0352	0.0257	0.03322	0.0416	CRM5.5	13-Jul-09	38 / 39	--
Barium, Total	mg/L	--	2	--	--	0.0331	0.03672	0.0409	CRM5.5	11-Jan-09	19 / 19	--	--	0.0315	0.03677	0.0458	CRM5.5	14-Dec-09	39 / 39	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.002 / 0.004	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 39	--
Beryllium, Total	mg/L	--	0.004	--	0.002 / 0.004	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 39	--
Boron, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 19	--	0.0125 / 0.05	0.0127	0.01557	0.0285	CRM5.5	4-May-10	20 / 39	--
Boron, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 19	--	0.0125 / 0.05	0.0125	0.01523	0.0253	CRM5.5	4-May-10	25 / 39	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 39	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 39	--
Calcium, Dissolved	mg/L	--	--	--	--	17.7	32.98	39.7	CRM5.5	18-Feb-09	17 / 17	--	--	24.7	33.45	41.3	CRM5.5	11-Nov-09	39 / 39	--
Calcium, Total	mg/L	--	--	--	--	30.7	34.69	38	CRM5.5	11-Jan-09	18 / 18	--	--	24.6	33.63	42	CRM5.5	31-Oct-09	39 / 39	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	3.3	5.56	6.76	CRM5.5	24-Jun-09	14 / 14	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	0.00071	0.001143	0.00164	CRM5.5	4-May-10	3 / 39	--
Chromium, Total	mg/L	--	0.1	--	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	0.00035	0.0008417	0.00261	CRM5.5	14-Dec-09	18 / 39	--
Cobalt, Dissolved	mg/L	--	--	--	0.002 / 0.02	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 39	--
Cobalt, Total	mg/L	--	--	--	0.002 / 0.02	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	0.00039	0.0008229	0.0015	CRM5.5	14-Dec-09	7 / 39	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.005 / 0.005	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.005	0.00035	0.0005474	0.0008	CRM5.5	26-Apr-10	23 / 39	--
Copper, Total	mg/L	--	1.3	--	0.005 / 0.005	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.005	0.00053	0.001038	0.00275	CRM5.5	14-Dec-09	24 / 39	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.138	0.13	0.1443	0.17	CRM5.5	26-Apr-10	6 / 14	--
Hardness (As CaCO3)	mg/L	--	--	--	--	114	128.5	143	CRM5.5	14-Mar-09	10 / 10	--	--	89.2	124.3	148	CRM5.5	31-Oct-09	39 / 39	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	0	ND			0 / 19	--	0.0125 / 0.05	0.0275	0.03578	0.0518	CRM5.5	14-Dec-09	6 / 39	--
Iron, Total	mg/L	--	--	--	0.05 / 0.141	0.129	0.3203	0.784	CRM5.5	12-Jan-09	18 / 19	--	--	0.0322	0.4487	3.1	CRM5.5	14-Dec-09	39 / 39	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 39	--
Lead, Total	mg/L	--	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 15	--	0.00033 / 0.002	0.00038	0.0009258	0.0026	CRM5.5	14-Dec-09	12 / 39	--
Magnesium, Dissolved	mg/L	--	--	--	--	9.5	10.96	13.1	CRM5.5	18-Feb-09	19 / 19	--	--	6.4	9.697	11.9	CRM5.5	11-Nov-09	39 / 39	--
Magnesium, Total	mg/L	--	--	--	--	9.1	10.77	12.4	CRM5.5	11-Jan-09	19 / 19	--	--	6.77	9.783	11	CRM5.5	11-Nov-09	39 / 39	--
Manganese, Dissolved	mg/L	--	--	--	0.005 / 0.015	0.00588	0.007573	0.00866	CRM5.5	19-Feb-09	3 / 19	--	0.00033 / 0.005	0.00035	0.006647	0.0302	CRM5.5	27-Sep-09	25 / 39	--
Manganese, Total	mg/L	--	--	--	--	0.0307	0.04232	0.0741	CRM5.5	12-Jan-09	19 / 19	--	--	0.00435	0.04904	0.15	CRM5.5	14-Dec-09	39 / 39	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 15	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 39	--
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 15	--	0.0001 / 0.0002	0.00015	0.000163	0.00016	CRM5.5	22-Jan-10	1 / 39	1>TWQC
Molybdenum, Dissolved	mg/L	--	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.005	0.00037	0.0005438	0.00083	CRM5.5	26-Apr-10	13 / 39	--
Molybdenum, Total	mg/L	--	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.005	0.00033	0.000595	0.00104	CRM5.5	21-Sep-09	14 / 39	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.005 / 0.005	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.005	0.00034	0.00051	0.00079	CRM5.5	27-Sep-09	21 / 39	--
Nickel, Total	mg/L	--	0.1	0.61	0.005 / 0.005	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.005	0.00033	0.0009146	0.00282	CRM5.5	14-Dec-09	26 / 39	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.228	0.4346	0.641	CRM5.5	18-Jan-10	14 / 14	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 14	--
pH	pH	--	--	--	--	7.5	7.75	8	CRM5.5	17-Apr-09	8 / 8	--	--	6.6	7.446	7.9	CRM5.5	5-Feb-10	39 / 39	--
Potassium, Dissolved	mg/L	--	--	--	--	1.55	1.792	2.12	CRM5.5	29-Jan-09	17 / 17	--	--	1.36	1.581	1.91	CRM5.5	14-Dec-09	39 / 39	--
Potassium, Total	mg/L	--	--	--	--	1.51	1.814	2.12	CRM5.5	12-Jan-09	17 / 17	--	--	1.37	1.64	2.4	CRM5.5	14-Dec-09	39 / 39	--
Selenium, Dissolved	mg/L	--	0.05	--	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	0.00036	0.00036	0.00036	CRM5.5	31-Oct-09	1 / 39	--
Selenium, Total	mg/L	0.005	0.05	--	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 39	--
Silica, Dissolved	mg/L	--	--	--	--	2.08	2.615	3.15	CRM5.5	16-Mar-09	2 / 2	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 39	--
Silver, Total	mg/L	--	--	--	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 39	--
Sodium, Dissolved	mg/L	--	--	--	--	6.09	8.061	10.1	CRM5.5	18-Feb-09	17 / 17	--	--	3.33	6.02	7.65	CRM5.5	15-Jul-09	39 / 39	--
Sodium, Total	mg/L	--	--	--	--	5.8	7.913	10.1	CRM5.5	11-Jan-09	17 / 17	--	--	3.4	6.048	7.64	CRM5.5	15-Jul-09	39 / 39	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0739	0.09734	0.108	CRM5.5	10-Jul-10	5 / 5	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0739	0.09752	0.109	CRM5.5	23-Jul-10	5 / 5	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	16.8	25.49	32	CRM5.5	15-Jul-09	14 / 14	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00025 / 0.002	0.00037	0.0005375	0.00076	CRM5.5	31-Oct-09	4 / 39	4>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.002 / 0.002	ND	--	ND	--	--	0 / 19	--	0.00025 / 0.002	0.00037	0.000595	0.00077	CRM5.5	31-Oct-09	4 / 39	4>TWQC
Tin, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--

TABLE H-12 SUMMARY STATISTICS FOR SURFACE WATER
CLINCH RIVER MILE 5.5 - POST-STORM EVENT SAMPLING

Analyte	Unit	Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 5-Jan-09 and 27-Aug-10							
		F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Tin, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	141	157.3	179	CRM5.5	17-Apr-09	8 / 8	--	--	113	153.8	182	CRM5.5	13-Jul-09	39 / 39	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.786	0.223	0.2675	0.312	CRM5.5	2-Nov-09	2 / 14	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	0.111	0.778	2.06	CRM5.5	14-Dec-09	3 / 14	--
Total Suspended Solids	mg/L	--	--	--	--	5.4	9.533	16	CRM5.5	19-Feb-09	15 / 15	--	--	1.6	13.04	69	CRM5.5	14-Dec-09	39 / 39	--
Vanadium, Dissolved	mg/L	--	--	--	0.004 / 0.004	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.004	0.00058	0.000802	0.00114	CRM5.5	26-Apr-10	5 / 39	--
Vanadium, Total	mg/L	--	--	--	0.004 / 0.004	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.004	0.00088	0.001815	0.00416	CRM5.5	14-Dec-09	11 / 39	--
Zinc, Dissolved	mg/L	0.12	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 19	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 39	--
Zinc, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 19	--	0.0083 / 0.05	0.00853	0.009515	0.0105	CRM5.5	14-Dec-09	2 / 39	--

Notes:
CRM = Clinch River Mile
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-13 SUMMARY STATISTICS FOR SURFACE WATER
CLINCH RIVER (DOWNSTREAM) - POST-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	--	16.8	67.88	114	CRM4.0	14-Mar-09	45 / 45	--	10 / 10	18.5	85.14	134	CRM2.0	11-Jun-10	132 / 133	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.5	0.156	0.295	0.378	CRM2.0	7-Jan-09	3 / 59	--	0.025 / 0.1	0.0251	0.04963	0.36	CRM4.0	10-Dec-09	29 / 133	--
Aluminum, Total	mg/L	--	--	--	0.1 / 0.5	0.152	2.739	57.8	CRM4.0	7-Jan-09	51 / 59	--	0.025 / 0.276	0.0347	0.4827	3.05	CRM4.0	22-Jan-10	125 / 133	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.362	0.109	0.143	0.231	CRM0.0	21-Sep-09	9 / 45	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.001 / 0.002	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.002	0.00034	0.0003633	0.0004	CRM0.0	14-Dec-09	3 / 133	--
Antimony, Total	mg/L	--	0.006	0.0056	0.001 / 0.002	0.00347	0.00347	0.00347	CRM2.0	7-Jan-09	2 / 59	--	0.00033 / 0.002	0.00033	0.00037	0.00041	CRM4.0	22-Jan-10	3 / 133	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.001 / 0.002	0.00213	0.01029	0.0242	CRM2.0	7-Jan-09	6 / 59	2>TDWS; 2>TWQC	0.00033 / 0.002	0.00033	0.001116	0.00464	CRM4.0	13-Jul-09	85 / 133	--
Arsenic, Total	mg/L	--	0.01	0.01	0.001 / 0.002	0.0013	0.02008	0.109	CRM4.0	7-Jan-09	13 / 59	3>TDWS; 3>TWQC	0.00033 / 0.002	0.00047	0.001812	0.00665	CRM4.0	22-Jan-10	96 / 133	--
Barium, Dissolved	mg/L	--	2	--	0.005 / 0.0267	0.016	0.03175	0.0923	CRM2.0	7-Jan-09	56 / 59	--	0.0025 / 0.0335	0.0169	0.03116	0.0539	CRM4.0	13-Jul-09	130 / 133	--
Barium, Total	mg/L	--	2	--	--	0.025	0.07025	1.04	CRM4.0	7-Jan-09	59 / 59	--	--	0.0217	0.03728	0.0711	CRM4.0	22-Jan-10	133 / 133	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.001 / 0.004	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 133	--
Beryllium, Total	mg/L	--	0.004	--	0.001 / 0.004	0.00614	0.00687	0.0076	CRM4.0	7-Jan-09	2 / 59	2>TDWS	0.00033 / 0.002	0.00035	0.000455	0.00056	CRM4.0	22-Jan-10	2 / 133	--
Boron, Dissolved	mg/L	--	--	--	0.05 / 0.1	0.0509	0.0509	0.0509	CRM2.0	7-Jan-09	1 / 59	--	0.0125 / 0.05	0.0126	0.01851	0.0726	CRM0.0	2-Nov-09	58 / 133	--
Boron, Total	mg/L	--	--	--	0.05 / 0.1	0.114	0.1285	0.143	CRM4.0	7-Jan-09	2 / 59	--	0.0125 / 0.05	0.0125	0.01752	0.0489	CRM4.0	18-Sep-09	69 / 133	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 133	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.01	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 133	--
Calcium, Dissolved	mg/L	--	--	--	--	8.53	22.35	39	CRM4.0	18-Feb-09	53 / 53	--	--	6.89	24.99	39	CRM4.0	2-Nov-09	133 / 133	--
Calcium, Total	mg/L	--	--	--	--	8.12	23.96	37.3	CRM4.0	14-Mar-09	56 / 56	--	--	6.97	25.07	37.2	CRM4.0	23-Jul-10	133 / 133	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	2.74	5.191	9.44	CRM0.0	15-Jul-09	45 / 45	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.001 / 0.002	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.002	0.00033	0.0007033	0.00135	CRM4.0	26-Dec-09	6 / 132	--
Chromium, Total	mg/L	--	0.1	--	0.001 / 0.002	0.00203	0.01293	0.0352	CRM4.0	7-Jan-09	6 / 59	--	0.00033 / 0.00221	0.00034	0.0008035	0.00355	CRM4.0	22-Jan-10	66 / 132	--
Cobalt, Dissolved	mg/L	--	--	--	0.001 / 0.02	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.002	0.00038	0.00043	0.00043	CRM4.0	10-Dec-09	1 / 133	--
Cobalt, Total	mg/L	--	--	--	0.001 / 0.02	0.00274	0.016	0.0321	CRM4.0	7-Jan-09	4 / 59	--	0.00033 / 0.002	0.00033	0.000641	0.00206	CRM4.0	22-Jan-10	48 / 133	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.001 / 0.005	0.0026	0.005655	0.00871	CRM2.0	11-Apr-09	2 / 59	--	0.00033 / 0.005	0.00034	0.000639	0.00211	CRM4.0	9-Jul-10	82 / 133	--
Copper, Total	mg/L	--	1.3	--	0.001 / 0.005	0.0021	0.03007	0.0938	CRM4.0	7-Jan-09	7 / 59	--	0.00033 / 0.005	0.00052	0.001572	0.00698	CRM4.0	22-Jan-10	82 / 133	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.133	0.1	0.1269	0.159	CRM4.0	9-Jul-10	23 / 45	--
Hardness (As CaCO3)	mg/L	--	--	--	--	27.9	74.02	142	CRM4.0	14-Mar-09	31 / 31	--	--	24.7	91.62	137	CRM4.0	23-Jul-10	133 / 133	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.1	0.0817	0.0817	0.0817	CRM4.0	22-Apr-09	1 / 59	--	0.0125 / 0.05	0.0139	0.06301	0.376	CRM4.0	10-Dec-09	28 / 133	--
Iron, Total	mg/L	--	--	--	--	0.118	1.079	20.9	CRM4.0	7-Jan-09	59 / 59	--	0.0125 / 0.025	0.0589	0.4611	2.61	CRM4.0	14-Dec-09	132 / 133	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.001 / 0.002	ND	--	ND	--	--	0 / 53	--	0.00033 / 0.002	0.00036	0.00037	0.00037	CRM4.0	10-Dec-09	1 / 133	--
Lead, Total	mg/L	--	0.005	--	0.002 / 0.002	0.00286	0.02665	0.0648	CRM4.0	7-Jan-09	5 / 45	4>TDWS	0.00033 / 0.002	0.00033	0.0009064	0.00349	CRM4.0	22-Jan-10	61 / 133	--
Magnesium, Dissolved	mg/L	--	--	--	--	2.01	7.138	12.9	CRM4.0	18-Feb-09	59 / 59	--	--	1.71	7.006	10.9	CRM2.0	21-Aug-09	133 / 133	--
Magnesium, Total	mg/L	--	--	--	--	2.06	7.159	12.2	CRM4.0	18-Feb-09	59 / 59	--	--	1.78	7.049	11	CRM4.0	9-Jul-10	133 / 133	--
Manganese, Dissolved	mg/L	--	--	--	0.001 / 0.015	0.00552	0.01578	0.0347	CRM0.0	27-Mar-09	26 / 58	--	0.00033 / 0.005	0.00043	0.009774	0.0401	CRM4.0	10-Dec-09	86 / 133	--
Manganese, Total	mg/L	--	--	--		0.0265	0.04952	0.175	CRM4.0	7-Jan-09	58 / 58	--	--	0.00348	0.05168	0.128	CRM4.0	14-Dec-09	133 / 133	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 45	--	0.0001 / 0.0002	0.0002	0.0002	0.0002	CRM2.0	22-Jan-10	1 / 133	1>TWQC
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 45	--	0.0001 / 0.0002	ND	0	ND			0 / 133	--
Molybdenum, Dissolved	mg/L	--	--	--	0.001 / 0.05	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.005	0.00033	0.0007795	0.00323	CRM4.0	18-Sep-09	39 / 133	--
Molybdenum, Total	mg/L	--	--	--	0.001 / 0.05	0.001	0.001	0.001	CRM2.0	11-Apr-09	1 / 59	--	0.00033 / 0.005	0.00033	0.0007611	0.0032	CRM4.0	18-Sep-09	47 / 133	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.001 / 0.005	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.005	0.00033	0.0007562	0.0114	CRM2.0	10-Jul-10	66 / 133	--
Nickel, Total	mg/L	--	0.1	0.61	0.001 / 0.005	0.0014	0.02257	0.053	CRM4.0	7-Jan-09	5 / 59	--	0.00033 / 0.005	0.00033	0.001159	0.00476	CRM4.0	22-Jan-10	84 / 133	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	0.107	0.3163	0.569	CRM4.0	24-Jun-09	44 / 45	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 45	--
pH	pH	--	--	--	--	7.2	7.576	8	CRM0.0	22-Apr-09	25 / 25	--	--	6.6	7.383	8.3	CRM4.0	13-Jul-09	133 / 133	--
Potassium, Dissolved	mg/L	--	--	--	0.2 / 1	1.05	1.476	2	CRM4.0	18-Feb-09	49 / 53	--	0.25 / 1	0.645	1.411	1.87	CRM4.0	24-Jun-09	131 / 133	--
Potassium, Total	mg/L	--	--	--	0.2 / 1	1.05	1.904	11.6	CRM4.0	7-Jan-09	51 / 53	--	--	0.748	1.474	2.26	CRM4.0	14-Dec-09	133 / 133	--
Selenium, Dissolved	mg/L	--	0.05	--	0.001 / 0.002	0.00264	0.00283	0.00302	CRM2.0	7-Jan-09	2 / 59	--	0.00033 / 0.002	0.00034	0.0004389	0.00061	CRM4.0	18-Sep-09	9 / 133	--
Selenium, Total	mg/L	0.005	0.05	--	0.001 / 0.02	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.002	0.00033	0.0004175	0.00064	CRM4.0	18-Sep-09	12 / 133	--
Silica, Dissolved	mg/L	--	--	--	--	2.2	2.985	3.64	CRM4.0	16-Mar-09	6 / 6	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.0005 / 0.002	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 133	--
Silver, Total	mg/L	--	--	--	0.0005 / 0.02	ND	--	ND	--	--	0 / 59	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 133	--
Sodium, Dissolved	mg/L	--	--	--	--	2.03	5.814	9.86	CRM4.0	18-Feb-09	53 / 53	--	--	1.34	5.215	7.88	CRM0.0	15-Jul-09	133 / 133	--
Sodium, Total	mg/L	--	--	--	--	1.89	5.81	9.87	CRM4.0	18-Feb-09	53 / 53	--	--	1.29	5.25	8.16	CRM0.0	31-Jul-09	133 / 133	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0379	0.07994	0.109	CRM4.0	10-Jul-10	22 / 22	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0405	0.081	0.11	CRM2.0	20-Jul-10	22 / 22	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	9.16	19.41	32.6	CRM4.0	15-Jul-09	45 / 45	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.001 / 0.002	ND	--	ND	--	--	0 / 59	--	0.00025 / 0.002	0.00025	0.0005308	0.00083	CRM4.0	18-Jan-10	12 / 133	12>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.001 / 0.002	0.00277	0.002965	0.00316	CRM4.0	7-Jan-09	2 / 59	2>TDWS; 2>TWQC	0.00025 / 0.002	0.00029	0.0005208	0.00083	CRM4.0	18-Jan-10	12 / 133	12>TWQC
Tin, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 6	--	--	--	--	--	--	--	--	--

TABLE H-13 SUMMARY STATISTICS FOR SURFACE WATER
CLINCH RIVER (DOWNSTREAM) - POST-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Tin, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 6	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 6	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 6	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	44	95.88	154	CRM4.0	18-Mar-09	25 / 25	--	--	43	118.8	184	CRM4.0	15-May-09	133 / 133	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 1.73	0.136	1.622	15.5	CRM0.0	8-Feb-10	12 / 45	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 1	0.113	1.312	7.04	CRM0.0	14-Dec-09	6 / 45	--
Total Suspended Solids	mg/L	--	--	--	1 / 1	5.5	15.99	80.6	CRM2.0	16-Mar-09	44 / 45	--	--	1.4	13.6	67	CRM4.0	14-Dec-09	133 / 133	--
Vanadium, Dissolved	mg/L	--	--	--	0.001 / 0.004	0.00434	0.01598	0.0231	CRM2.0	7-Jan-09	3 / 53	--	0.00033 / 0.00541	0.00061	0.001385	0.00426	CRM4.0	13-Jul-09	28 / 133	--
Vanadium, Total	mg/L	--	--	--	0.001 / 0.004	0.0018	0.03609	0.143	CRM4.0	7-Jan-09	9 / 53	--	0.00033 / 0.00623	0.00071	0.002684	0.01	CRM4.0	22-Jan-10	59 / 133	--
Zinc, Dissolved	mg/L	0.12	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 59	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 133	--
Zinc, Total	mg/L	--	--	--	0.005 / 0.05	0.077	0.0856	0.0942	CRM4.0	7-Jan-09	2 / 59	--	0.0083 / 0.05	0.00867	0.01163	0.0152	CRM0.0	11-Dec-09	3 / 133	--

Notes:
CRM = Clinch River Mile
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-14 SUMMARY STATISTICS FOR SURFACE WATER
TENNESSEE RIVER (DOWNSTREAM) - POST-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	--	50	65.49	80.1	TRM563.5	27-Mar-09	18 / 18	--	--	46	63.83	97.7	TRM568.5	21-Aug-09	50 / 50	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.1	ND	0	ND			0 / 24	--	0.025 / 0.1	0.0253	0.03407	0.0426	TRM563.5	10-Dec-09	10 / 50	--
Aluminum, Total	mg/L	--	--	--	0.1 / 0.174	0.128	0.3294	0.826	TRM568.5	9-Jan-09	16 / 23	--	0.025 / 0.172	0.0717	0.4238	4.02	TRM563.5	5-May-09	44 / 50	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.609	0.104	0.1355	0.173	TRM568.5	8-Feb-10	4 / 18	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	0.00034	0.0003825	0.00047	TRM568.5	13-Nov-09	4 / 50	--
Antimony, Total	mg/L	--	0.006	0.0056	0.002 / 0.002	0.00206	0.00206	0.00206	TRM568.5	27-Mar-09	1 / 24	--	0.00033 / 0.002	0.00034	0.00041	0.00053	TRM568.5	14-Dec-09	3 / 50	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	0.00035	0.0005615	0.00289	TRM563.5	5-May-09	27 / 50	--
Arsenic, Total	mg/L	--	0.01	0.01	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	0.00037	0.001099	0.0116	TRM563.5	5-May-09	32 / 50	1>TDWS; 1>TWQC
Barium, Dissolved	mg/L	--	2	--	0.01 / 0.0202	0.0141	0.02168	0.0311	TRM563.5	27-Mar-09	22 / 23	--	0.0025 / 0.0207	0.0161	0.02252	0.0346	TRM563.5	5-May-09	49 / 50	--
Barium, Total	mg/L	--	2	--	--	0.0181	0.02523	0.035	TRM563.5	27-Mar-09	23 / 23	--	0.0025 / 0.0229	0.0178	0.02769	0.0922	TRM563.5	5-May-09	49 / 50	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.002 / 0.004	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 50	--
Beryllium, Total	mg/L	--	0.004	--	0.002 / 0.004	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 50	--
Boron, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 24	--	0.0125 / 0.05	0.0125	0.01503	0.0191	TRM563.5	4-May-10	3 / 50	--
Boron, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 24	--	0.0125 / 0.05	0.0127	0.01498	0.0187	TRM563.5	4-May-10	6 / 50	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 50	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 50	--
Calcium, Dissolved	mg/L	--	--	--	--	13.8	19.48	26	TRM563.5	27-Mar-09	21 / 21	--	--	12.8	18.24	29	TRM568.5	21-Aug-09	50 / 50	--
Calcium, Total	mg/L	--	--	--	--	14.1	19.49	25.9	TRM563.5	27-Mar-09	22 / 22	--	--	11.8	18.31	27.5	TRM568.5	21-Aug-09	50 / 50	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	3.8	6.391	9.36	TRM568.5	15-Jul-09	18 / 18	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	0.00035	0.0004567	0.00065	TRM568.5	11-Nov-09	3 / 50	--
Chromium, Total	mg/L	--	0.1	--	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	0.00034	0.0007829	0.00381	TRM563.5	5-May-09	24 / 50	--
Cobalt, Dissolved	mg/L	--	--	--	0.002 / 0.02	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 50	--
Cobalt, Total	mg/L	--	--	--	0.002 / 0.02	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	0.00035	0.0007492	0.00237	TRM563.5	5-May-09	12 / 50	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.005 / 0.00578	ND	--	ND	--	--	0 / 23	--	0.00033 / 0.005	0.00038	0.0006042	0.00191	TRM568.5	26-Apr-10	33 / 50	--
Copper, Total	mg/L	--	1.3	--	0.005 / 0.005	ND	--	ND	--	--	0 / 23	--	0.00033 / 0.005	0.00046	0.001387	0.00934	TRM563.5	5-May-09	34 / 50	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.13	0.12	0.1281	0.14	TRM568.5	4-May-10	9 / 18	--
Hardness (As CaCO3)	mg/L	--	--	--	--	58	73.09	96.8	TRM563.5	27-Mar-09	14 / 14	--	--	41.9	64.29	101	TRM568.5	21-Aug-09	50 / 50	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 24	--	0.0125 / 0.05	0.0268	0.03889	0.0583	TRM568.5	26-Apr-10	14 / 50	--
Iron, Total	mg/L	--	--	--	--	0.0715	0.3419	1.21	TRM568.5	12-Jan-09	23 / 23	--	--	0.0997	0.4528	1.97	TRM563.5	5-May-09	50 / 50	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 15	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 50	--
Lead, Total	mg/L	--	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 14	--	0.00033 / 0.002	0.00033	0.0009876	0.00512	TRM563.5	5-May-09	21 / 50	1>TDWS
Magnesium, Dissolved	mg/L	--	--	--	--	3.82	5.111	7.89	TRM563.5	27-Mar-09	23 / 23	--	--	3.19	4.446	8.31	TRM568.5	21-Aug-09	50 / 50	--
Magnesium, Total	mg/L	--	--	--	--	3.6	5.045	7.82	TRM563.5	27-Mar-09	23 / 23	--	--	3.01	4.502	7.79	TRM568.5	21-Aug-09	50 / 50	--
Manganese, Dissolved	mg/L	--	--	--	0.005 / 0.015	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.005	0.00036	0.004391	0.0154	TRM563.5	22-Jan-10	34 / 50	--
Manganese, Total	mg/L	--	--	--	--	0.0203	0.04736	0.14	TRM568.5	9-Jan-09	23 / 23	--	--	0.0264	0.06134	0.157	TRM568.5	13-Nov-09	50 / 50	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 18	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 50	--
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 18	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 50	--
Molybdenum, Dissolved	mg/L	--	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.005	0.00034	0.0004	0.00054	TRM568.5	10-Jul-10	8 / 50	--
Molybdenum, Total	mg/L	--	--	--	0.005 / 0.05	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.005	0.00033	0.00039	0.00049	TRM563.5	4-May-10	10 / 50	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.005 / 0.005	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.005	0.00034	0.0004855	0.00087	TRM568.5	11-Jun-10	11 / 50	--
Nickel, Total	mg/L	--	0.1	0.61	0.005 / 0.005	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.005	0.00033	0.000915	0.00553	TRM563.5	5-May-09	30 / 50	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.103	0.3563	0.606	TRM568.5	8-Feb-10	18 / 18	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 18	--
pH	pH	--	--	--	--	7	7.517	8.1	TRM568.5	22-Apr-09	12 / 12	--	--	6.8	7.404	8.4	TRM568.5	5-Feb-10	50 / 50	--
Potassium, Dissolved	mg/L	--	--	--	--	1.15	1.571	2.08	TRM568.5	20-Feb-09	21 / 21	--	0.25 / 1.52	0.985	1.354	1.74	TRM568.5	10-Dec-09	48 / 50	--
Potassium, Total	mg/L	--	--	--	--	1.14	1.585	2.2	TRM568.5	20-Feb-09	21 / 21	--	0.25 / 1	0.946	1.41	1.91	TRM563.5	5-May-09	49 / 50	--
Selenium, Dissolved	mg/L	--	0.05	--	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 50	--
Selenium, Total	mg/L	0.005	0.05	--	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 50	--
Silica, Dissolved	mg/L	--	--	--	--	3.07	3.845	4.62	TRM568.5	16-Mar-09	2 / 2	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 50	--
Silver, Total	mg/L	--	--	--	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 50	--
Sodium, Dissolved	mg/L	--	--	--	--	5.21	7.541	10.5	TRM568.5	20-Feb-09	22 / 22	--	--	3.03	5.434	8.05	TRM568.5	15-Jul-09	50 / 50	--
Sodium, Total	mg/L	--	--	--	--	5.05	7.318	10.4	TRM568.5	20-Feb-09	21 / 21	--	--	3.11	5.487	7.97	TRM568.5	15-Jul-09	50 / 50	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0449	0.05501	0.0647	TRM568.5	4-May-10	8 / 8	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0493	0.05588	0.0644	TRM568.5	4-May-10	8 / 8	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	7.8	10.71	14.6	TRM568.5	24-Jun-09	18 / 18	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00025 / 0.002	0.00027	0.00027	0.00027	TRM563.5	14-Dec-09	1 / 50	1>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.002 / 0.002	ND	--	ND	--	--	0 / 24	--	0.00025 / 0.002	0.00036	0.00036	0.00036	TRM568.5	28-Sep-09	1 / 50	1>TWQC
Tin, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--

TABLE H-14 SUMMARY STATISTICS FOR SURFACE WATER
TENNESSEE RIVER (DOWNSTREAM) - POST-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Dec-08 and 30-Apr-09								Samples Collected Between 1-May-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Tin, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 2	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	79	95.67	121	TRM568.5	18-Mar-09	12 / 12	--	--	63	88.18	141	TRM568.5	21-Aug-09	50 / 50	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.501	0.206	0.251	0.291	TRM568.5	2-Nov-09	3 / 18	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--	0.1 / 0.1	0.111	0.1955	0.253	TRM568.5	21-Sep-09	2 / 18	--
Total Suspended Solids	mg/L	--	--	--	--	4.4	6.778	8.8	TRM563.5	18-Mar-09	18 / 18	--	--	2.8	12.7	78	TRM563.5	5-May-09	50 / 50	--
Vanadium, Dissolved	mg/L	--	--	--	0.004 / 0.004	ND	--	ND	--	--	0 / 22	--	0.00033 / 0.004	0.00064	0.000875	0.00117	TRM563.5	4-May-10	6 / 50	--
Vanadium, Total	mg/L	--	--	--	0.004 / 0.004	ND	--	ND	--	--	0 / 22	--	0.00033 / 0.004	0.001	0.002628	0.0141	TRM563.5	5-May-09	14 / 50	--
Zinc, Dissolved	mg/L	0.12	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 24	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 50	--
Zinc, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 24	--	0.0083 / 0.05	0.0106	0.0106	0.0106	TRM568.5	14-Dec-09	1 / 50	--

Notes:
TRM = Tennessee River Mile
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-15 SUMMARY STATISTICS FOR SURFACE WATER
EMORY RIVER PLUME MONITORING

		Regulatory Values			Samples Collected Between 19-Mar-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exdeecances
Alkalinity	mg/L	--	--	--	10 / 31.4	10.2	41.16	126	PLUME	23-Jun-09	321 / 351	--
Aluminum, Dissolved	mg/L	--	--	--	0.025 / 0.176	0.0253	0.09233	1.37	PLUME	22-Apr-10	133 / 351	--
Aluminum, Total	mg/L	--	--	--	--	0.111	5.176	89.6	PLUME	24-Sep-09	351 / 351	--
Ammonia, as N	mg/L	--	--	--	0.1 / 0.1	0.148	0.148	0.148	PLUME	1-Jul-09	1 / 2	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.00033 / 0.002	0.00033	0.0004994	0.00128	PLUME	14-Apr-10	48 / 351	--
Antimony, Total	mg/L	--	0.006	0.0056	0.00033 / 0.00298	0.00033	0.00143	0.00747	PLUME	24-Sep-09	144 / 351	1>TDWS; 2>TWQC
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.00033 / 0.00576	0.00033	0.004741	0.0383	PLUME	14-Apr-10	286 / 351	32>TDWS; 32>TWQC
Arsenic, Total	mg/L	--	0.01	0.01	0.00033 / 0.002	0.00056	0.01621	0.194	PLUME	24-Sep-09	334 / 351	147>TDWS; 147>TWQC
Barium, Dissolved	mg/L	--	2	--	0.0025 / 0.0237	0.0169	0.03868	0.1	PLUME	12-Sep-09	348 / 351	--
Barium, Total	mg/L	--	2	--	--	0.0247	0.1261	1.99	PLUME	24-Sep-09	351 / 351	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 351	--
Beryllium, Total	mg/L	--	0.004	--	0.00033 / 0.002	0.00033	0.001719	0.0192	PLUME	24-Sep-09	172 / 351	14>TDWS
Boron, Dissolved	mg/L	--	--	--	0.0125 / 0.05	0.0125	0.03128	0.225	PLUME	25-Mar-09	178 / 351	--
Boron, Total	mg/L	--	--	--	0.0125 / 0.05	0.0125	0.04449	0.319	PLUME	24-Sep-09	228 / 351	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 351	--
Cadmium, Total	mg/L	--	0.005	--	0.00033 / 0.005	0.00035	0.0004533	0.00062	PLUME	16-Jan-10	3 / 351	--
Calcium, Dissolved	mg/L	--	--	--	--	3.89	12.58	39	PLUME	19-Aug-10	351 / 351	--
Calcium, Total	mg/L	--	--	--	--	4.22	13.74	40.6	PLUME	24-Sep-09	351 / 351	--
Chloride	mg/L	--	--	--	--	3.38	4.125	4.87	PLUME	1-Jul-09	2 / 2	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.00033 / 0.002	0.00033	0.0008959	0.00523	PLUME	3-Oct-09	27 / 351	--
Chromium, Total	mg/L	--	0.1	--	0.00033 / 0.0034	0.00033	0.00643	0.0842	PLUME	24-Sep-09	245 / 351	--
Cobalt, Dissolved	mg/L	--	--	--	0.00033 / 0.002	0.00033	0.0004607	0.00096	PLUME	22-Apr-10	14 / 351	--
Cobalt, Total	mg/L	--	--	--	0.00033 / 0.002	0.00033	0.004709	0.0577	PLUME	24-Sep-09	236 / 350	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.00033 / 0.00716	0.00033	0.0006623	0.0112	PLUME	22-May-10	151 / 350	1>F&AL
Copper, Total	mg/L	--	1.3	--	0.00033 / 0.00625	0.00062	0.01616	0.226	PLUME	24-Sep-09	245 / 350	--
Fluoride	mg/L	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 2	--
Hardness (As CaCO3)	mg/L	--	--	--	--	15.5	49.8	143	PLUME	24-Sep-09	351 / 351	--
Iron, Dissolved	mg/L	--	--	--	0.0125 / 0.0674	0.0208	0.07115	0.61	PLUME	22-Apr-10	204 / 351	--
Iron, Total	mg/L	--	--	--	0.0125 / 2.2	0.0964	2.318	33.2	PLUME	24-Sep-09	349 / 351	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.00033 / 0.002	0.00086	0.00135	0.00184	PLUME	22-Apr-10	2 / 349	--
Lead, Total	mg/L	--	0.005	--	0.00033 / 0.00249	0.00043	0.009347	0.104	PLUME	24-Sep-09	247 / 332	115>TDWS
Magnesium, Dissolved	mg/L	--	--	--	--	1	3.319	11.2	PLUME	19-Aug-10	351 / 351	--
Magnesium, Total	mg/L	--	--	--	--	1.2	3.765	11.4	PLUME	5-Aug-10	351 / 351	--
Manganese, Dissolved	mg/L	--	--	--	0.00033 / 0.0113	0.00034	0.0488	0.726	PLUME	27-Jun-10	298 / 351	--
Manganese, Total	mg/L	--	--	--	--	0.0302	0.08935	0.722	PLUME	27-Jun-10	351 / 351	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0001 / 0.0002	0.00014	0.0001677	0.00019	PLUME	18-Mar-10	3 / 351	3>TWQC
Mercury, Total	mg/L	--	0.002	0.00005	0.0001 / 0.0002	ND	--	ND	--	--	0 / 351	--
Molybdenum, Dissolved	mg/L	--	--	--	0.00033 / 0.0093	0.00034	0.00178	0.0183	PLUME	25-Mar-09	144 / 351	--
Molybdenum, Total	mg/L	--	--	--	0.00033 / 0.025	0.00035	0.002175	0.0187	PLUME	25-Mar-09	162 / 351	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.00033 / 0.005	0.00034	0.000792	0.00209	PLUME	22-Apr-10	211 / 351	--
Nickel, Total	mg/L	--	0.1	0.61	0.00033 / 0.005	0.00071	0.009633	0.123	PLUME	24-Sep-09	241 / 351	1>TDWS
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 2	--
Ortho-phosphate	mg/L	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 2	--
pH	pH	--	--	--	--	6	7.244	8.6	PLUME	29-Dec-09	351 / 351	--
Potassium, Dissolved	mg/L	--	--	--	0.25 / 1	0.333	1.045	1.86	PLUME	27-Jun-09	303 / 351	--
Potassium, Total	mg/L	--	--	--	0.25 / 1.59	0.565	1.893	15.2	PLUME	24-Sep-09	321 / 351	--
Selenium, Dissolved	mg/L	--	0.05	--	0.00033 / 0.002	0.00033	0.0006675	0.00377	PLUME	25-Mar-09	60 / 351	--
Selenium, Total	mg/L	0.005	0.05	--	0.00033 / 0.01	0.00033	0.001121	0.0123	PLUME	24-Sep-09	151 / 351	2>F&AL
Silica, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 351	--
Silver, Total	mg/L	--	--	--	0.00033 / 0.01	ND	--	ND	--	--	0 / 351	--
Sodium, Dissolved	mg/L	--	--	--	--	0.72	2.744	7.42	PLUME	5-Jun-09	351 / 351	--
Sodium, Total	mg/L	--	--	--	--	0.971	2.937	7.56	PLUME	5-Jun-09	351 / 351	--
Strontium, Dissolved	mg/L	--	--	--	--	0.0228	0.06606	0.113	PLUME	19-Aug-10	63 / 63	--
Strontium, Total	mg/L	--	--	--	--	0.0329	0.107	0.567	PLUME	23-May-10	63 / 63	--
Sulfate	mg/L	--	--	--	--	15.6	23.6	31.6	PLUME	1-Jul-09	2 / 2	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.00025 / 0.002	0.00025	0.0004867	0.00092	PLUME	12-Sep-09	42 / 351	42>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.00025 / 0.002	0.00025	0.0008489	0.00456	PLUME	24-Sep-09	109 / 351	7>TDWS; 109>TWQC
Tin, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--

TABLE H-15 SUMMARY STATISTICS FOR SURFACE WATER
EMORY RIVER PLUME MONITORING

Analyte	Unit	Regulatory Values			Samples Collected Between 19-Mar-09 and 27-Aug-10							
		F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exdeecances
Tin, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	10 / 105	11	67.3	193	PLUME	7-Jul-09	350 / 351	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	0.496 / 0.496	ND	--	ND	--	--	0 / 1	--
Total Phosphorus	mg/L	--	--	--	0.1 / 0.1	ND	--	ND	--	--	0 / 2	--
Total Suspended Solids	mg/L	--	--	--	--	4.5	99.26	1840	PLUME	24-Sep-09	351 / 351	--
Vanadium, Dissolved	mg/L	--	--	--	0.00033 / 0.0106	0.00052	0.005078	0.025	PLUME	29-Oct-09	151 / 351	--
Vanadium, Total	mg/L	--	--	--	0.00033 / 0.00592	0.001	0.02252	0.355	PLUME	24-Sep-09	290 / 351	--
Zinc, Dissolved	mg/L	0.12	--	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 351	--
Zinc, Total	mg/L	--	--	--	0.0083 / 0.05	0.00835	0.03039	0.302	PLUME	24-Sep-09	132 / 351	--

Notes:
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-16 SUMMARY STATISTICS FOR SURFACE WATER IN THE STILLING POND

		Regulatory Values			Samples Collected Between 19-Mar-09 and 27-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	--	40.7	91.32	114	AP_IMP001	9-Sep-09	25 / 25	--
Aluminum, Dissolved	mg/L	--	--	--	0.02 / 0.566	0.0201	0.2444	1.31	AP_IMP001	23-Oct-09	223 / 265	--
Aluminum, Total	mg/L	--	--	--	0.02 / 1.11	0.225	0.8291	2.57	AP_IMP001	23-Mar-09	264 / 266	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	--	0.00227	0.006558	0.00998	AP_IMP001	5-Nov-09	5 / 5	3>TDWS; 3>TWQC
Antimony, Total	mg/L	--	0.006	0.0056	--	0.00232	0.006628	0.01	AP_IMP001	5-Nov-09	5 / 5	3>TDWS; 3>TWQC
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	0.00033 / 0.002	0.00239	0.02163	0.0949	AP_IMP001	2-Nov-09	265 / 266	203>TDWS; 203>TWQC
Arsenic, Total	mg/L	--	0.01	0.01	--	0.00387	0.02426	0.0994	AP_IMP001	2-Nov-09	266 / 266	228>TDWS; 228>TWQC
Barium, Dissolved	mg/L	--	2	--	--	0.0616	0.1052	0.203	AP_IMP001	18-Aug-09	5 / 5	--
Barium, Total	mg/L	--	2	--	--	0.0712	0.1156	0.223	AP_IMP001	18-Aug-09	5 / 5	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 5	--
Beryllium, Total	mg/L	--	0.004	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 5	--
Boron, Dissolved	mg/L	--	--	--	--	0.256	0.5618	0.834	AP_IMP001	27-Oct-09	5 / 5	--
Boron, Total	mg/L	--	--	--	--	0.258	0.575	0.87	AP_IMP001	27-Oct-09	5 / 5	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 266	--
Cadmium, Total	mg/L	--	0.005	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 266	--
Calcium, Dissolved	mg/L	--	--	--	--	20.6	28.7	40.3	AP_IMP001	18-Aug-09	5 / 5	--
Calcium, Total	mg/L	--	--	--	--	19.9	29.24	40.5	AP_IMP001	18-Aug-09	5 / 5	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.00033 / 0.00048	0.00037	0.002287	0.00605	AP_IMP001	18-Aug-09	3 / 5	--
Chromium, Total	mg/L	--	0.1	--	0.00033 / 0.00065	0.00044	0.002288	0.00711	AP_IMP001	18-Aug-09	4 / 5	--
Cobalt, Dissolved	mg/L	--	--	--	0.00033 / 0.002	0.00059	0.00059	0.00059	AP_IMP001	10-Nov-09	1 / 5	--
Cobalt, Total	mg/L	--	--	--	0.00033 / 0.002	0.00034	0.0004767	0.0006	AP_IMP001	10-Nov-09	3 / 5	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.00033 / 0.005	0.00035	0.0006333	0.00097	AP_IMP001	10-Nov-09	3 / 5	--
Copper, Total	mg/L	--	1.3	--	--	0.0009	0.0024	0.00665	AP_IMP001	18-Aug-09	5 / 5	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--
Hardness (As CaCO3)	mg/L	--	--	--	--	--	--	--	--	--	--	--
Iron, Dissolved	mg/L	--	--	--	0.0125 / 0.05	ND	--	ND	--	--	0 / 5	--
Iron, Total	mg/L	--	--	--	--	0.0784	0.1672	0.285	AP_IMP001	18-Aug-09	5 / 5	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 5	--
Lead, Total	mg/L	--	0.005	--	0.00033 / 0.002	0.00054	0.00068	0.00082	AP_IMP001	23-Dec-09	2 / 5	--
Magnesium, Dissolved	mg/L	--	--	--	--	2.68	4.204	9.01	AP_IMP001	18-Aug-09	5 / 5	--
Magnesium, Total	mg/L	--	--	--	--	2.8	4.264	9	AP_IMP001	18-Aug-09	5 / 5	--
Manganese, Dissolved	mg/L	--	--	--	0.00033 / 0.005	0.0104	0.039	0.0748	AP_IMP001	10-Nov-09	4 / 5	--
Manganese, Total	mg/L	--	--	--	--	0.0129	0.03796	0.0742	AP_IMP001	10-Nov-09	5 / 5	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0001 / 0.0002	0.0001	0.0001663	0.00028	AP_IMP001	20-Jan-10	3 / 265	3>TWQC
Mercury, Total	mg/L	--	0.002	0.00005	0.0001 / 1	0.0000	0.00003254	0.00018	AP_IMP001	29-Mar-10	6 / 338	1>TWQC
Molybdenum, Dissolved	mg/L	--	--	--	--	0.0215	0.0608	0.0913	AP_IMP001	5-Nov-09	5 / 5	--
Molybdenum, Total	mg/L	--	--	--	--	0.0212	0.06024	0.0916	AP_IMP001	5-Nov-09	5 / 5	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.00033 / 0.005	0.00038	0.00283	0.00528	AP_IMP001	10-Nov-09	2 / 5	--
Nickel, Total	mg/L	--	0.1	0.61	0.00033 / 0.005	0.00049	0.00189	0.00514	AP_IMP001	10-Nov-09	4 / 5	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--
pH	pH	--	--	--	--	7.2	7.2	7.2	AP_IMP001	27-Oct-09	1 / 1	--
Potassium, Dissolved	mg/L	--	--	--	--	0.929	1.416	2.06	AP_IMP001	18-Aug-09	5 / 5	--
Potassium, Total	mg/L	--	--	--	--	0.931	1.538	2.11	AP_IMP001	18-Aug-09	5 / 5	--
Selenium, Dissolved	mg/L	--	--	--	0.00033 / 0.00882	0.00056	0.004832	0.0244	AP_IMP001	2-Nov-09	264 / 266	--
Selenium, Total	mg/L	--	0.05	--	0.00033 / 0.00204	0.00077	0.004952	0.0246	AP_IMP001	2-Nov-09	263 / 266	109>F&AL
Silica, Dissolved	mg/L	0.005	0.05	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 5	--
Silver, Total	mg/L	--	--	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 5	--
Sodium, Dissolved	mg/L	--	--	--	--	1.72	2.92	7.27	AP_IMP001	18-Aug-09	5 / 5	--
Sodium, Total	mg/L	--	--	--	--	1.62	3.01	7.18	AP_IMP001	18-Aug-09	5 / 5	--
Strontium, Dissolved	mg/L	--	--	--	--	0.178	0.3614	0.519	AP_IMP001	27-Aug-10	53 / 53	--

TABLE H-16 SUMMARY STATISTICS FOR SURFACE WATER IN THE STILLING POND

Analyte	Unit	Regulatory Values			Samples Collected Between 19-Mar-09 and 27-Aug-10							
		F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Strontium, Total	mg/L	--	--	--	--	0.186	0.3672	0.529	AP_IMP001	27-Aug-10	53 / 53	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.00025 / 0.002	0.00025	0.0005277	0.00122	AP_IMP001	18-Nov-09	90 / 266	90>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.00025 / 0.002	0.00025	0.0005561	0.00131	AP_IMP001	23-Sep-09	102 / 266	102>TWQC
Tin, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--
Tin, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--
Titanium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	1.6	10.59	46.2	AP_IMP001	19-Mar-09	410 / 410	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids	mg/L	--	--	--	--	--	--	--	--	--	--	--
Vanadium, Dissolved	mg/L	--	--	--	--	0.0186	0.04714	0.0794	AP_IMP001	5-Nov-09	5 / 5	--
Vanadium, Total	mg/L	--	--	--	--	0.0212	0.0492	0.0826	AP_IMP001	5-Nov-09	5 / 5	--
Zinc, Dissolved	mg/L	0.12	--	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 5	--
Zinc, Total	mg/L	--	--	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 5	--

Notes:

F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life

ND = not detected

TDWS = Tennessee Domestic Water Supply Standard

TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-17 SUMMARY STATISTICS FOR SURFACE WATER
SWAN POND EMBAYMENT MONITORING - NON-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Apr-09 and 2-Jul-09								Samples Collected Between 8-Jul-09 and 26-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Actinium-228 (Gamma)	pCi/L	--	--	--	--	--	--	--	--	--	--	--	6.193 / 6.193	ND	--	ND	--	--	0 / 1	--
Alkalinity	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	103	108.5	114	CWDITCH	18-Aug-09	2 / 2	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.1	0.112	0.2218	0.344	DIKE2	11-Jun-09	6 / 17	--	0.025 / 0.191	0.0255	0.1575	0.9	SETTB	13-May-10	100 / 130	--
Aluminum, Total	mg/L	--	--	--	--	16.7	60.94	168	DIKE2	15-Jun-09	17 / 17	--	0.025 / 0.0984	0.264	1.906	20.9	SETTB	13-May-10	129 / 130	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.002 / 0.002	0.00213	0.004167	0.00565	DIKE2	15-Jun-09	3 / 17	1>TWQC	0.00033 / 0.00328	0.00033	0.002084	0.011	SETTB	10-Oct-09	101 / 129	4>TDWS; 5>TWQC
Antimony, Total	mg/L	--	0.006	0.0056	0.002 / 0.02	0.00219	0.004974	0.0145	DIKE2	15-Jun-09	14 / 17	2>TDWS, 2>TWQC	0.00033 / 0.00354	0.00033	0.002272	0.0116	SETTB	10-Oct-09	100 / 130	5>TDWS; 6>TWQC
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	--	0.0116	0.02556	0.0588	DIKE2	11-Jun-09	17 / 17	17>TDWS, 17>TWQC	--	0.00067	0.02479	0.0925	SETTB	1-Oct-09	128 / 128	93>TDWS; 93>TWQC
Arsenic, Total	mg/L	--	0.01	0.01	--	0.0529	0.2286	0.823	DIKE2	11-Jun-09	17 / 17	17>TDWS, 17>TWQC	--	0.00093	0.02922	0.0952	SETTB	22-Jun-10	128 / 128	105>TDWS; 105>TWQC
Barium, Dissolved	mg/L	--	2	--	--	0.0854	0.1153	0.174	DIKE2	11-Jun-09	17 / 17	--	--	0.0514	0.09743	0.181	SETTB	10-Oct-09	130 / 130	--
Barium, Total	mg/L	--	2	--	--	0.436	1.447	3.68	DIKE2	15-Jun-09	17 / 17	6>TDWS	--	0.0583	0.129	0.478	SETTB	13-May-10	130 / 130	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.002 / 0.002	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 130	--
Beryllium, Total	mg/L	--	0.004	--	0.002 / 0.04	0.00276	0.009786	0.0231	DIKE2	15-Jun-09	14 / 17	11>TWDS	0.00033 / 0.002	0.00034	0.0007552	0.0034	SETTB	13-May-10	42 / 130	--
Bismuth-214 (Gamma)	pCi/L	--	--	--	--	--	--	--	--	--	--	--	3.52 / 3.52	ND	--	ND	--	--	0 / 1	--
Boron, Dissolved	mg/L	--	--	--	--	0.0666	0.2718	1.04	DIKE2	15-Jun-09	17 / 17	--	--	0.0359	0.408	2.34	SETTB	8-Oct-09	128 / 128	--
Boron, Total	mg/L	--	--	--	--	0.124	0.4577	1.66	DIKE2	15-Jun-09	17 / 17	--	--	0.0371	0.4191	2.43	SETTB	10-Oct-09	128 / 128	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.005	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 130	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.02	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.00165	ND	--	ND	--	--	0 / 130	--
Calcium, Dissolved	mg/L	--	--	--	--	25.3	36.72	74.5	DIKE2	11-Jun-09	17 / 17	--	--	22.7	37.19	83.7	SETTB	8-Oct-09	130 / 130	--
Calcium, Total	mg/L	--	--	--	--	31.7	56.89	124	DIKE2	15-Jun-09	17 / 17	--	--	24	38.14	86.8	SETTB	10-Oct-09	130 / 130	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.002 / 0.002	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.002	0.00033	0.0005535	0.00228	SETTB	10-Oct-09	63 / 130	--
Chromium, Total	mg/L	--	0.1	--	--	0.0155	0.06665	0.208	DIKE2	15-Jun-09	17 / 17	5>TWDS	0.00033 / 0.00338	0.00034	0.002697	0.0189	SETTB	13-May-10	95 / 130	--
Cobalt, Dissolved	mg/L	--	--	--	0.002 / 0.01	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.002	0.00033	0.001007	0.00301	SETTB	16-Feb-10	30 / 130	--
Cobalt, Total	mg/L	--	--	--	0.002 / 0.02	0.00782	0.03611	0.0928	DIKE2	15-Jun-09	16 / 17	--	0.00033 / 0.002	0.00036	0.001752	0.0118	SETTB	13-May-10	103 / 130	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.005 / 0.005	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.0149	0.00033	0.0006376	0.00376	SETTB	16-Feb-10	66 / 129	--
Copper, Total	mg/L	--	1.3	--	--	0.0341	0.1514	0.438	DIKE2	15-Jun-09	17 / 17	--	0.00033 / 0.005	0.00058	0.005324	0.0408	SETTB	13-May-10	96 / 129	--
Hardness (As CaCO3)	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	135	139	143	CWDITCH	18-Aug-09	2 / 2	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.05	0.0546	0.05965	0.0667	DIKE2	18-Jun-09	4 / 17	--	0.0125 / 0.05	0.0258	0.06257	0.32	SETTB	13-May-10	26 / 130	--
Iron, Total	mg/L	--	--	--	--	7.23	24.55	61.5	DIKE2	15-Jun-09	17 / 17	--	0.0125 / 0.597	0.0775	0.8902	9.44	SETTB	13-May-10	129 / 130	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.002	0.00107	0.0011	0.0011	SETTB	13-May-10	1 / 130	--
Lead, Total	mg/L	--	0.005	--	--	0.0185	0.06651	0.2	DIKE2	15-Jun-09	17 / 17	17>TWDS	0.00033 / 0.002	0.00034	0.002879	0.0265	SETTB	13-May-10	104 / 130	14>TDWS
Lead-212 (Gamma)	pCi/L	--	--	--	--	--	--	--	--	--	--	--	2.717 / 2.717	ND	--	ND	--	--	0 / 1	--
Lead-214 (Gamma)	pCi/L	--	--	--	--	--	--	--	--	--	--	--	3.359 / 3.359	ND	--	ND	--	--	0 / 1	--
Magnesium, Dissolved	mg/L	--	--	--	--	9.53	12.55	17.4	DIKE2	11-Jun-09	17 / 17	--	--	6.15	11.62	15.3	SETTB	10-Aug-10	130 / 130	--
Magnesium, Total	mg/L	--	--	--	--	11.6	18.14	30.2	DIKE2	11-Jun-09	17 / 17	--	--	6.6	12.01	15.2	SETTB	10-Aug-10	130 / 130	--
Manganese, Dissolved	mg/L	--	--	--	--	0.0844	0.1956	0.386	DIKE2	18-Jun-09	17 / 17	--	0.00033 / 0.005	0.00143	0.1498	0.804	SETTB	5-Jan-10	117 / 130	--
Manganese, Total	mg/L	--	--	--	--	0.22	0.4892	0.773	DIKE2	12-Jun-09	17 / 17	--	--	0.017	0.1685	0.79	SETTB	5-Jan-10	130 / 130	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 16	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 130	--
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	0.00026	0.0004707	0.0012	DIKE2	15-Jun-09	7 / 16	7>TWQC	0.0001 / 0.0002	ND	--	ND	--	--	0 / 130	--
Molybdenum, Dissolved	mg/L	--	--	--	0.005 / 0.025	0.00693	0.02108	0.0914	DIKE2	15-Jun-09	14 / 15	--	--	0.00085	0.03175	0.195	SETTB	8-Oct-09	128 / 128	--
Molybdenum, Total	mg/L	--	--	--	0.005 / 0.05	0.00754	0.03187	0.0789	DIKE2	15-Jun-09	4 / 15	--	0.00033 / 0.007	0.00086	0.03144	0.183	SETTB	10-Oct-09	127 / 128	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.005 / 0.005	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.005	0.00033	0.000523	0.00128	SETTB	16-Feb-10	53 / 130	--
Nickel, Total	mg/L	--	0.1	0.61	--	0.0176	0.07348	0.195	DIKE2	15-Jun-09	17 / 17	6>TWDS	0.00033 / 0.005	0.00042	0.002909	0.0229	SETTB	13-May-10	103 / 130	--
pH	pH	--	--	--	--	7.4	7.4	7.4	DIKE2	23-Apr-09	1 / 1	--	--	7.8	7.875	7.9	CWDITCH	4-Aug-09	4 / 4	--
Potassium, Dissolved	mg/L	--	--	--	--	1.2	3.012	9.61	DIKE2	11-Jun-09	17 / 17	--	--	0.98	1.829	4.28	SETTB	10-Oct-09	130 / 130	--
Potassium, Total	mg/L	--	--	--	--	3.59	13.49	37.3	DIKE2	15-Jun-09	17 / 17	--	--	1.07	2.101	4.58	SETTB	10-Oct-09	130 / 130	--
Protactinium-234M (Gam	pCi/L	--	--	--	--	--	--	--	--	--	--	--	199.6 / 199.6	ND	--	ND	--	--	0 / 1	--
Radium-226	pCi/L	--	--	--	--	--	--	--	--	--	--	--	0.2612 / 0.2612	ND	--	ND	--	--	0 / 1	--
Radium-228	pCi/L	--	--	--	--	--	--	--	--	--	--	--	1.268 / 1.268	ND	--	ND	--	--	0 / 1	--
Selenium, Dissolved	mg/L	--	0.05	--	0.002 / 0.01	0.00204	0.004561	0.0136	DIKE2	15-Jun-09	7 / 16	--	0.00033 / 0.002	0.00044	0.00465	0.0413	SETTB	10-Oct-09	123 / 129	--
Selenium, Total	mg/L	0.005	0.05	--	0.002 / 0.1	0.00254	0.002595	0.00265	DIKE2	25-Jun-09	2 / 16	--	0.00033 / 0.002	0.00033	0.004641	0.0398	SETTB	10-Oct-09	125 / 129	39>F&AL
Silver, Dissolved	mg/L	0.0009	--	--	0.002 / 0.01	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 130	--
Silver, Total	mg/L	--	--	--	0.002 / 0.04	ND	--	ND	--	--	0 / 17	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 130	--
Sodium, Dissolved	mg/L	--	--	--	--	1.22	1.679	2.89	DIKE2	11-Jun-09	17 / 17	--	--	1.16	1.906	4.46	SETTB	16-Mar-10	130 / 130	--
Sodium, Total	mg/L	--	--	--	--	1.96	3.738	7.82	DIKE2	15-Jun-09	17 / 17	--	--	1.29	1.952	4.48	SETTB	16-Mar-10	130 / 130	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0607	0.2755	0.715	SETTB	29-Apr-10	37 / 37	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.0643	0.3017	0.734	SETTB	29-Apr-10	37 / 37	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.002 / 0.002	ND	--	ND	--	--	0 / 17	--	0.00025 / 0.002	0.00025	0.0004813	0.00099	SETTB	29-Jun-10	30 / 130	30>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.002 / 0.02	0.00208	0.005428	0.0133	DIKE2	11-Jun-09	11 / 17	11>TDWS, 11>TWQC	0.00025 / 0.002	0.00025	0.0005855	0.00182	SETTB	13-May-10	51 / 130	51>TWQC
Thallium-208 (Gamma)	pCi/L	--	--	--	--	--	--	--	--	--	--	--	5.107 / 5.107	ND	--	ND	--	--	0 / 1	--
Thorium-228	pCi/L	--	--	--	--	--	--	--	--	--	--	--	0.4094 / 0.4094	ND	--	ND	--	--	0 / 1	--
Thorium-230	pCi/L	--	--	--	--	--	--	--	--	--	--	--	--	1.158	1.158	1.158	CWDITCH	13-Oct-09	1 / 1	--

TABLE H-17 SUMMARY STATISTICS FOR SURFACE WATER
SWAN POND EMBAYMENT MONITORING - NON-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 22-Apr-09 and 2-Jul-09								Samples Collected Between 8-Jul-09 and 26-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Thorium-232	pCi/L	--	--	--	--	--	--	--	--	--	--	--	0.1694 / 0.1694	ND	--	ND	--	--	0 / 1	--
Thorium-234 (Gamma)	pCi/L	--	--	--	--	--	--	--	--	--	--	--	33.56 / 33.56	ND	--	ND	--	--	0 / 1	--
Total Dissolved Solids	mg/L	--	--	--	--	122	122	122	DIKE2	23-Apr-09	1 / 1	--	--	176	186	196	SETTB	18-Aug-09	2 / 2	--
Total Suspended Solids	mg/L	--	--	--	--	605	2719	9950	DIKE2	11-Jun-09	17 / 17	--	--	2.2	44.31	760	SETTB	18-Feb-10	130 / 130	--
Uranium	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	0.00194	0.001937	0.00194	CWDITCH	13-Oct-09	1 / 1	--
Uranium-234	pCi/L	--	--	--	--	--	--	--	--	--	--	--	--	0.8898	0.8898	0.8898	CWDITCH	13-Oct-09	1 / 1	--
Uranium-235	pCi/L	--	--	--	--	--	--	--	--	--	--	--	0.1588 / 0.1588	ND	--	ND	--	--	0 / 1	--
Uranium-238	pCi/L	--	--	--	--	--	--	--	--	--	--	--	--	0.7386	0.7386	0.7386	CWDITCH	13-Oct-09	1 / 1	--
Vanadium, Dissolved	mg/L	--	--	--	--	0.00542	0.01587	0.0556	DIKE2	15-Jun-09	17 / 17	--	0.00033 / 0.00525	0.00161	0.01986	0.0926	SETTB	1-Oct-09	125 / 128	--
Vanadium, Total	mg/L	--	--	--	--	0.0629	0.2573	0.751	DIKE2	15-Jun-09	17 / 17	--	0.00033 / 0.00128	0.00343	0.02551	0.1	SETTB	1-Oct-09	127 / 128	--
Zinc, Dissolved	mg/L	0.12	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 17	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 130	--
Zinc, Total	mg/L	--	--	--	0.05 / 1	0.0504	0.05876	0.0644	DIKE2	2-Jul-09	5 / 17	--	0.0083 / 0.05	0.00836	0.01389	0.0429	SETTB	13-May-10	52 / 130	--

Notes:
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-18 SUMMARY STATISTICS FOR SURFACE WATER
SWAN POND EMBAYMENT - POST-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 8-Aug-09 and 26-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Actinium-228 (Gamma)	pCi/L	--	--	--	5.672 / 6.174	ND	--	ND	--	--	0 / 2	--
Alkalinity	mg/L	--	--	--	--	--	--	--	--	--	--	--
Aluminum, Dissolved	mg/L	--	--	--	0.025 / 0.207	0.0258	0.1799	0.688	SETTB	17-Sep-09	118 / 139	--
Aluminum, Total	mg/L	--	--	--	--	0.256	2.795	23.1	SETTB	14-Oct-09	139 / 139	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.00007 / 0.00733	0.0004	0.003322	0.0118	SETTB	22-Sep-09	115 / 139	15>TDWS; 18>TWQC
Antimony, Total	mg/L	--	0.006	0.0056	0.00007 / 0.00293	0.00037	0.003484	0.0122	SETTB	17-Sep-09	118 / 139	17>TDWS; 20>TWQC
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	--	0.00171	0.02882	0.154	SETTB	24-Jun-10	139 / 139	1>F&AL; 110>TDWS; 110>TWQC
Arsenic, Total	mg/L	--	0.01	0.01	--	0.00336	0.03388	0.161	SETTB	24-Jun-10	139 / 139	119>TDWS; 119>TWQC
Barium, Dissolved	mg/L	--	2	--	0.001 / 0.107	0.039	0.09728	0.206	SETTB	17-Sep-09	137 / 139	--
Barium, Total	mg/L	--	2	--	--	0.0557	0.1408	0.558	SETTB	14-Oct-09	139 / 139	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.00008 / 0.002	0.00058	0.00058	0.00058	SETTB	11/10/2009	1 / 139	--
Beryllium, Total	mg/L	--	0.004	--	0.00008 / 0.002	0.00034	0.0007182	0.00323	SETTB	14-Oct-09	61 / 139	--
Bismuth-214 (Gamma)	pCi/L	--	--	--	3.473 / 3.611	ND	--	ND	--	--	0 / 2	--
Boron, Dissolved	mg/L	--	--	--	--	0.0524	0.6521	2.37	SETTB	17-Sep-09	138 / 138	--
Boron, Total	mg/L	--	--	--	--	0.0581	0.6685	2.48	SETTB	17-Sep-09	138 / 138	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.00003 / 0.001	ND	--	ND	--	--	0 / 139	--
Cadmium, Total	mg/L	--	0.005	--	0.00003 / 0.00165	0.00012	0.00012	0.00012	SETTB	07/15/2010	1 / 139	--
Calcium, Dissolved	mg/L	--	--	--	--	15.4	45.46	92	SETTB	17-Sep-09	139 / 139	--
Calcium, Total	mg/L	--	--	--	--	17.7	46.67	97.2	SETTB	17-Sep-09	139 / 139	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.0003 / 0.002	0.00033	0.0007902	0.0041	SETTB	12-Dec-09	85 / 139	--
Chromium, Total	mg/L	--	0.1	--	0.0003 / 0.0036	0.00066	0.003686	0.0166	SETTB	14-Oct-09	113 / 139	--
Cobalt, Dissolved	mg/L	--	--	--	0.0002 / 0.002	0.00033	0.0007217	0.00227	SETTB	10-Nov-09	35 / 139	--
Cobalt, Total	mg/L	--	--	--	0.0002 / 0.002	0.00044	0.002051	0.00921	SETTB	14-Oct-09	116 / 139	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.0003 / 0.005	0.00033	0.0007406	0.00734	SETTB	10-Nov-09	86 / 139	--
Copper, Total	mg/L	--	1.3	--	0.0003 / 0.00751	0.00099	0.006441	0.0382	SETTB	14-Oct-09	113 / 139	--
Hardness (As CaCO3)	mg/L	--	--	--	--	--	--	--	--	--	--	--
Iron, Dissolved	mg/L	--	--	--	0.0125 / 0.05	0.0269	0.07466	0.177	CWDITCH	20-Aug-09	33 / 139	--
Iron, Total	mg/L	--	--	--	0.0125 / 5.63	0.0914	1.45	8.81	SETTB	14-Oct-09	137 / 139	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.00009 / 0.002	0.00043	0.00196	0.00349	SETTB	10-Nov-09	2 / 139	1>F&AL
Lead, Total	mg/L	--	0.005	--	0.00009 / 0.002	0.00053	0.003692	0.0244	SETTB	14-Oct-09	119 / 139	24>TDWS
Lead-212 (Gamma)	pCi/L	--	--	--	2.014 / 2.675	3.403	3.403	3.403	SETTB	10/15/2009	1 / 2	--
Lead-214 (Gamma)	pCi/L	--	--	--	3.043 / 3.345	ND	--	ND	--	--	0 / 2	--
Magnesium, Dissolved	mg/L	--	--	--	--	3.91	10.43	15	CWDITCH	30-Jul-09	139 / 139	--
Magnesium, Total	mg/L	--	--	--	--	4.49	10.84	14.4	CWDITCH	12-Aug-09	139 / 139	--
Manganese, Dissolved	mg/L	--	--	--	0.0002 / 0.005	0.00372	0.1688	1.16	CWDITCH	20-Aug-09	133 / 139	--
Manganese, Total	mg/L	--	--	--	--	0.0206	0.1998	1.18	CWDITCH	20-Aug-09	139 / 139	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0001 / 0.0002	ND	--	ND	--	--	0 / 139	--
Mercury, Total	mg/L	--	0.002	0.00005	0.0001 / 0.0002	0.00035	0.00035	0.00035	SETTB	09/27/2009	1 / 139	1>TWQC
Molybdenum, Dissolved	mg/L	--	--	--	--	0.00235	0.05576	0.217	SETTB	17-Sep-09	137 / 137	--
Molybdenum, Total	mg/L	--	--	--	0.00033 / 0.005	0.00281	0.05327	0.214	SETTB	17-Sep-09	137 / 137	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.00009 / 0.005	0.00033	0.0005667	0.0038	SETTB	10-Nov-09	81 / 139	--
Nickel, Total	mg/L	--	0.1	0.61	0.00009 / 0.005	0.00075	0.003686	0.0204	SETTB	14-Oct-09	115 / 139	--
pH	pH	--	--	--	--	--	--	--	--	--	--	--
Potassium, Dissolved	mg/L	--	--	--	--	0.974	2.543	6.5	SETTB	20-Aug-09	139 / 139	--
Potassium, Total	mg/L	--	--	--	--	1.19	2.937	7.17	SETTB	14-Oct-09	139 / 139	--
Protactinium-234M (Gam	pCi/L	--	--	--	163.8 / 186.8	ND	--	ND	--	--	0 / 2	--
Radium-226	pCi/L	--	--	--	0.2495 / 0.2916	0.414	0.414	0.414	CWDITCH	10/15/2009	1 / 2	--
Radium-228	pCi/L	--	--	--	1.181 / 1.278	ND	--	ND	--	--	0 / 2	--
Selenium, Dissolved	mg/L	--	0.05	--	--	0.00069	0.01047	0.062	SETTB	17-Sep-09	139 / 139	2>TDWS
Selenium, Total	mg/L	0.005	0.05	--	--	0.00042	0.01028	0.065	SETTB	17-Sep-09	139 / 139	1>TDWS; 95>F&AL
Silver, Dissolved	mg/L	0.0009	--	--	0.0003 / 0.002	ND	--	ND	--	--	0 / 139	--
Silver, Total	mg/L	--	--	--	0.0003 / 0.002	ND	--	ND	--	--	0 / 139	--
Sodium, Dissolved	mg/L	--	--	--	--	0.687	2.033	4.18	CWDITCH	28-Mar-10	139 / 139	--
Sodium, Total	mg/L	--	--	--	--	0.848	2.149	5.92	CWDITCH	8-Apr-10	139 / 139	--
Strontium, Dissolved	mg/L	--	--	--	--	0.0712	0.5224	0.999	SETTB	29-May-10	30 / 30	--
Strontium, Total	mg/L	--	--	--	--	0.0811	0.5548	1.06	SETTB	29-May-10	30 / 30	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.00005 / 0.002	0.00026	0.0005516	0.00101	SETTB	10-Nov-09	55 / 139	55>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.00005 / 0.002	0.00025	0.0006367	0.00146	SETTB	14-Oct-09	76 / 139	76>TWQC
Thallium-208 (Gamma)	pCi/L	--	--	--	4.443 / 5.213	ND	--	ND	--	--	0 / 2	--

TABLE H-18 SUMMARY STATISTICS FOR SURFACE WATER
SWAN POND EMBAYMENT - POST-STORM EVENT SAMPLING

		Regulatory Values			Samples Collected Between 8-Aug-09 and 26-Aug-10							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Thorium-228	pCi/L	--	--	--	0.1415 / 0.1719	0.241	0.241	0.241	SETTB	10/15/2009	1 / 2	--
Thorium-230	pCi/L	--	--	--	0.2423 / 0.301	ND	--	ND	--	--	0 / 2	--
Thorium-232	pCi/L	--	--	--	0.08283 / 0.1993	ND	--	ND	--	--	0 / 2	--
Thorium-234 (Gamma)	pCi/L	--	--	--	28.93 / 33.93	ND	--	ND	--	--	0 / 2	--
Total Dissolved Solids	mg/L	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids	mg/L	--	--	--	--	4.1	65.11	529	SETTB	14-Oct-09	139 / 139	--
Uranium	mg/L	--	--	--	--	0.00204	0.003996	0.00595	SETTB	15-Oct-09	2 / 2	--
Uranium-234	pCi/L	--	--	--	--	1.131	2.057	2.983	SETTB	15-Oct-09	2 / 2	--
Uranium-235	pCi/L	--	--	--	0.1151 / 0.1151	0.2491	0.2491	0.2491	SETTB	10/15/2009	1 / 2	--
Uranium-238	pCi/L	--	--	--	--	1.149	2.103	3.057	SETTB	15-Oct-09	2 / 2	--
Vanadium, Dissolved	mg/L	--	--	--	0.0002 / 0.00204	0.00133	0.02516	0.153	SETTB	24-Jun-10	138 / 139	--
Vanadium, Total	mg/L	--	--	--	--	0.0037	0.03259	0.176	SETTB	24-Jun-10	139 / 139	--
Zinc, Dissolved	mg/L	0.12	--	--	0.0009 / 0.05	0.012	0.012	0.012	SETTB	10/06/2009	1 / 139	--
Zinc, Total	mg/L	--	--	--	0.0009 / 0.05	0.00832	0.01693	0.0421	SETTB	14-Oct-09	65 / 139	--

Notes:
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-19 SUMMARY STATISTICS FOR SURFACE WATER
EAST EMBAYMENT

		Regulatory Values			Samples Collected Between 11-Jun-09 and 1-Jul-09								Samples Collected Between 23-Jul-09 and 24-Nov-09							
Analyte	Unit	F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Alkalinity	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	88.3	88.3	88.3	CWEEMBAY	18-Aug-09	1 / 1	--
Aluminum, Dissolved	mg/L	--	--	--	0.1 / 0.1	0.136	0.141	0.141	EEMBAY	11-Jun-09	1 / 11	--	0.025 / 0.1	0.0352	0.08877	0.18	CWEEMBAY	24-Jul-09	7 / 24	--
Aluminum, Total	mg/L	--	--	--	--	0.676	3.766	16	EEMBAY	25-Jun-09	11 / 11	--	--	0.36	0.7801	1.94	CWEEMBAY	12-Nov-09	24 / 24	--
Ammonia, as N	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Antimony, Dissolved	mg/L	--	0.006	0.0056	0.002 / 0.002	0.00217	0.002385	0.0026	EEMBAY	25-Jun-09	2 / 11	--	0.00033 / 0.0027	0.00045	0.001411	0.0036	CWEEMBAY	10-Oct-09	10 / 24	--
Antimony, Total	mg/L	--	0.006	0.0056	0.002 / 0.002	0.00318	0.003265	0.00335	EEMBAY	25-Jun-09	2 / 11	--	0.00033 / 0.00283	0.00055	0.001487	0.00362	CWEEMBAY	10-Oct-09	9 / 24	--
Arsenic, Dissolved	mg/L	0.15	0.01	0.01	--	0.00734	0.0231	0.104	EEMBAY	25-Jun-09	11 / 11	9>TDWS; 9>TWQC	--	0.00315	0.01109	0.0248	CWEEMBAY	28-Jul-09	24 / 24	12>TDWS; 12>TWQC
Arsenic, Total	mg/L	--	0.01	0.01	--	0.0194	0.04086	0.13	EEMBAY	25-Jun-09	11 / 11	11>TDWS; 11>TWQC	--	0.00616	0.01464	0.025	CWEEMBAY	28-Jul-09	24 / 24	18>TDWS; 18>TWQC
Barium, Dissolved	mg/L	--	2	--	--	0.0403	0.06025	0.121	EEMBAY	25-Jun-09	11 / 11	--	--	0.0257	0.06875	0.102	CWEEMBAY	10-Oct-09	24 / 24	--
Barium, Total	mg/L	--	2	--	--	0.0587	0.1111	0.31	EEMBAY	25-Jun-09	11 / 11	--	--	0.0439	0.0816	0.116	CWEEMBAY	10-Oct-09	24 / 24	--
Beryllium, Dissolved	mg/L	--	0.004	--	0.002 / 0.002	ND	--	ND	--	--	0 / 11	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 24	--
Beryllium, Total	mg/L	--	0.004	--	0.002 / 0.002	0.00231	0.00231	0.00231	EEMBAY	25-Jun-09	1 / 11	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 24	--
Boron, Dissolved	mg/L	--	--	--	--	0.0578	0.1163	0.272	EEMBAY	24-Jun-09	11 / 11	--	--	0.0207	0.3054	0.752	CWEEMBAY	10-Oct-09	24 / 24	--
Boron, Total	mg/L	--	--	--	--	0.0636	0.1242	0.296	EEMBAY	24-Jun-09	11 / 11	--	--	0.0209	0.3097	0.759	CWEEMBAY	10-Oct-09	24 / 24	--
Cadmium, Dissolved	mg/L	0.00025	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 11	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 24	--
Cadmium, Total	mg/L	--	0.005	--	0.001 / 0.001	ND	--	ND	--	--	0 / 11	--	0.00033 / 0.001	ND	--	ND	--	--	0 / 24	--
Calcium, Dissolved	mg/L	--	--	--	--	13.1	19.53	34.5	EEMBAY	24-Jun-09	11 / 11	--	--	8.96	27.7	46.2	CWEEMBAY	10-Oct-09	24 / 24	--
Calcium, Total	mg/L	--	--	--	--	13.9	19.68	34.6	EEMBAY	24-Jun-09	11 / 11	--	--	9.37	28.22	46.7	CWEEMBAY	10-Oct-09	24 / 24	--
Chloride	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, Dissolved	mg/L	0.011	0.1	--	0.002 / 0.002	ND	--	ND	--	--	0 / 11	--	0.00033 / 0.002	0.00041	0.0005933	0.00083	CWEEMBAY	10-Oct-09	3 / 24	--
Chromium, Total	mg/L	--	0.1	--	0.002 / 0.002	0.002	0.00521	0.0133	EEMBAY	25-Jun-09	7 / 11	--	0.00033 / 0.002	0.0008	0.001433	0.00238	CWEEMBAY	12-Nov-09	12 / 24	--
Cobalt, Dissolved	mg/L	--	--	--	0.002 / 0.002	0.00214	0.00214	0.00214	EEMBAY	25-Jun-09	1 / 11	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 24	--
Cobalt, Total	mg/L	--	--	--	0.002 / 0.002	0.00228	0.004606	0.00974	EEMBAY	25-Jun-09	5 / 11	--	0.00033 / 0.002	0.00038	0.0006908	0.00132	CWEEMBAY	24-Nov-09	12 / 24	--
Copper, Dissolved	mg/L	0.009	1.3	--	0.005 / 0.005	ND	--	ND	--	--	0 / 11	--	0.00033 / 0.005	0.00039	0.000727	0.00095	CWEEMBAY	10-Nov-09	10 / 24	--
Copper, Total	mg/L	--	1.3	--	0.005 / 0.005	0.00567	0.01626	0.0322	EEMBAY	25-Jun-09	5 / 11	--	0.00033 / 0.005	0.00124	0.00239	0.00461	CWEEMBAY	24-Nov-09	11 / 24	--
Fluoride	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hardness (As CaCO3)	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	110	110	110	CWEEMBAY	18-Aug-09	1 / 1	--
Iron, Dissolved	mg/L	--	--	--	0.05 / 0.05	0.0514	0.2043	0.388	EEMBAY	1-Jul-09	8 / 11	--	0.0125 / 0.05	0.0162	0.1206	0.564	CWEEMBAY	24-Nov-09	12 / 24	--
Iron, Total	mg/L	--	--	--	--	0.941	2.125	6.32	EEMBAY	25-Jun-09	11 / 11	--	--	0.269	0.797	2.67	CWEEMBAY	24-Nov-09	24 / 24	--
Lead, Dissolved	mg/L	0.0025	0.005	--	0.002 / 0.002	ND	--	ND	--	--	0 / 11	--	0.00033 / 0.002	0.00035	0.00035	0.00035	CWEEMBAY	24-Nov-09	1 / 24	--
Lead, Total	mg/L	--	0.005	--	0.002 / 0.002	0.0027	0.007013	0.0211	EEMBAY	25-Jun-09	8 / 11	2>TDWS	0.00033 / 0.002	0.00064	0.001332	0.00266	CWEEMBAY	12-Nov-09	13 / 24	--
Magnesium, Dissolved	mg/L	--	--	--	--	2.92	3.785	5.6	EEMBAY	24-Jun-09	11 / 11	--	--	2.54	7.582	11.3	CWEEMBAY	28-Oct-09	24 / 24	--
Magnesium, Total	mg/L	--	--	--	--	3.14	4.034	6.22	EEMBAY	24-Jun-09	11 / 11	--	--	2.78	7.733	11.5	CWEEMBAY	28-Oct-09	24 / 24	--
Manganese, Dissolved	mg/L	--	--	--	--	0.0118	0.334	1.46	EEMBAY	25-Jun-09	11 / 11	--	0.00033 / 0.005	0.0165	0.1223	0.394	CWEEMBAY	23-Jul-09	15 / 24	--
Manganese, Total	mg/L	--	--	--	--	0.0962	0.4797	1.42	EEMBAY	25-Jun-09	11 / 11	--	--	0.0609	0.1622	0.463	CWEEMBAY	23-Jul-09	24 / 24	--
Mercury, Dissolved	mg/L	0.00077	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 11	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 24	--
Mercury, Total	mg/L	--	0.002	0.00005	0.0002 / 0.0002	ND	--	ND	--	--	0 / 11	--	0.0001 / 0.0002	ND	--	ND	--	--	0 / 24	--
Molybdenum, Dissolved	mg/L	--	--	--	0.005 / 0.00779	0.00584	0.01085	0.0241	EEMBAY	24-Jun-09	8 / 11	--	--	0.00121	0.02489	0.0632	CWEEMBAY	10-Oct-09	24 / 24	--
Molybdenum, Total	mg/L	--	--	--	0.005 / 0.00842	0.00525	0.01007	0.0226	EEMBAY	24-Jun-09	9 / 11	--	--	0.0014	0.02487	0.0624	CWEEMBAY	10-Oct-09	24 / 24	--
Nickel, Dissolved	mg/L	0.052	0.1	0.61	0.005 / 0.005	ND	--	ND	--	--	0 / 11	--	0.00033 / 0.005	0.00035	0.00051	0.00077	CWEEMBAY	5-Nov-09	11 / 24	--
Nickel, Total	mg/L	--	0.1	0.61	0.005 / 0.005	0.00543	0.01097	0.0201	EEMBAY	25-Jun-09	4 / 11	--	0.00033 / 0.005	0.001	0.001494	0.00275	CWEEMBAY	12-Nov-09	12 / 24	--
Nitrate-Nitrite Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ortho-phosphate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH	pH	--	--	--	--	--	--	--	--	--	--	--	--	7.9	7.95	8	CWEEMBAY	18-Aug-09	2 / 2	--
Potassium, Dissolved	mg/L	--	--	--	--	1.17	1.911	4.13	EEMBAY	25-Jun-09	11 / 11	--	--	0.644	2.105	3.51	CWEEMBAY	5-Aug-09	24 / 24	--
Potassium, Total	mg/L	--	--	--	--	1.52	2.579	7.24	EEMBAY	25-Jun-09	11 / 11	--	--	0.85	2.24	3.59	CWEEMBAY	5-Aug-09	24 / 24	--
Selenium, Dissolved	mg/L	--	0.05	--	0.002 / 0.002	0.0023	0.0023	0.0023	EEMBAY	24-Jun-09	1 / 11	--	0.00033 / 0.002	0.00074	0.004486	0.0111	CWEEMBAY	5-Aug-09	21 / 24	--
Selenium, Total	mg/L	0.005	0.05	--	0.002 / 0.002	0.00208	0.002635	0.00319	EEMBAY	24-Jun-09	2 / 11	--	0.00033 / 0.002	0.00042	0.004341	0.0109	CWEEMBAY	5-Aug-09	22 / 24	6>F&AL
Silica, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver, Dissolved	mg/L	0.0009	--	--	0.002 / 0.002	ND	--	ND	--	--	0 / 11	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 24	--
Silver, Total	mg/L	--	--	--	0.002 / 0.002	ND	--	ND	--	--	0 / 11	--	0.00033 / 0.002	ND	--	ND	--	--	0 / 24	--
Sodium, Dissolved	mg/L	--	--	--	--	1.08	1.671	2.77	EEMBAY	23-Jun-09	11 / 11	--	--	0.782	1.723	2.84	CWEEMBAY	1-Sep-09	24 / 24	--
Sodium, Total	mg/L	--	--	--	--	1.17	1.779	2.63	EEMBAY	23-Jun-09	11 / 11	--	--	0.723	1.752	2.77	CWEEMBAY	1-Sep-09	24 / 24	--
Strontium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Strontium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium, Dissolved	mg/L	--	0.002	0.00024	0.002 / 0.002	ND	--	ND	--	--	0 / 11	--	0.00025 / 0.002	0.00026	0.00056	0.00088	CWEEMBAY	10-Oct-09	4 / 24	4>TWQC
Thallium, Total	mg/L	--	0.002	0.00024	0.002 / 0.002	ND	--	ND	--	--	0 / 11	--	0.00025 / 0.002	0.00026	0.000575	0.00092	CWEEMBAY	10-Oct-09	4 / 24	4>TWQC
Tin, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tin, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Titanium, Dissolved	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE H-19 SUMMARY STATISTICS FOR SURFACE WATER
EAST EMBAYMENT

Analyte	Unit	Regulatory Values			Samples Collected Between 11-Jun-09 and 1-Jul-09								Samples Collected Between 23-Jul-09 and 24-Nov-09							
		F&AL	TDWS	TWQC	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances
Titanium, Total	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	149	149	149	CWEEMBAY	18-Aug-09	1 / 1	--
Total Kjeldahl Nitrogen	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Phosphorus	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids	mg/L	--	--	--	--	13.4	98.74	486	EEMBAY	25-Jun-09	11 / 11	--	--	10.1	21	56	CWEEMBAY	12-Nov-09	24 / 24	--
Vanadium, Dissolved	mg/L	--	--	--	0.004 / 0.00734	0.00482	0.006692	0.00829	EEMBAY	11-Jun-09	5 / 11	--	0.00033 / 0.00464	0.00124	0.00905	0.0245	CWEEMBAY	24-Jul-09	21 / 24	--
Vanadium, Total	mg/L	--	--	--	0.004 / 0.00592	0.00548	0.01813	0.0524	EEMBAY	25-Jun-09	10 / 11	--	--	0.00383	0.01117	0.0265	CWEEMBAY	24-Jul-09	24 / 24	--
Zinc, Dissolved	mg/L	0.12	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 11	--	0.0083 / 0.05	ND	--	ND	--	--	0 / 24	--
Zinc, Total	mg/L	--	--	--	0.05 / 0.05	ND	--	ND	--	--	0 / 11	--	0.0083 / 0.05	0.00961	0.048	0.118	CWEEMBAY	12-Nov-09	3 / 24	--

Notes:
F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
ND = not detected
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-20 SUMMARY STATISTICS FOR AIR MONITORING

Analyte	Unit	Action Level (24 hour)	Number of Detections / Samples	Mean of Detections	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result
Fixed Station Filter-Based Monitoring								
PM2.5 (FRM)	µg/m^3	26	488/488	12.62	3	26.9	PS09	2-Apr-10
PM10 (FRM)	µg/m^3	112	371/371	19.56	7.5	45.9	PS07	9-Mar-10
Aluminum	µg/m^3	*	81/114	0.18	0.0267	0.67	PS07	4-Apr-10
Arsenic (PM10)	µg/m^3	0.020	117/211	0.001	0.000032	0.0073	PS07	24-Mar-10
Arsenic (TSP)	µg/m^3	0.020	132/206	0.001	0.000058	0.0079	PS07	24-Mar-10
Barium	µg/m^3	*	48/114	0.01	0.0035	0.0422	PS07	4-Jul-10
Beryllium	µg/m^3	*	32/114	0.00005	0.0000043	0.00028	PS07	30-Mar-10
Cadmium	µg/m^3	*	91/114	0.0004	0.000018	0.00062	PS07	1-Oct-09
Chromium	µg/m^3	*	0/114	--	--	--	--	--
Crystalline Silica, Cristobalite	µg/m^3	10	0/220	--	--	--	--	--
Crystalline Silica, Quartz	µg/m^3	10	1/274	3.2	3.2	3.2	PS07	11-Jan-10
Crystalline Silica, Tridymite	µg/m^3	10	0/220	--	--	--	--	--
Lead	µg/m^3	*	109/114	0.0029	0.00096	0.00768	PS07	4-Jul-10
Manganese	µg/m^3	*	95/114	0.0059	0.0014	0.019	PS07	12-Nov-09
Mercury	µg/m^3	*	5/69	0.00014	0.000016	0.00058	PS07	19-Sep-09
Selenium	µg/m^3	*	84/114	0.0009	0.00029	0.0039	PS07	4-Jul-10
Thallium	µg/m^3	*	28/114	0.00008	0.000005	0.00019	PS07	5-Jan-10
Vanadium	µg/m^3	*	29/106	0.001	0.000009	0.0052	PS07	5-Apr-10
Fixed Station Real-Time Monitoring								
PM2.5 (FEM)	µg/m^3	26	10,840/10,840	11.51	0.1	52**	PS13	4-Jul-10
PM10 (FEM)	µg/m^3	112	--	--	--	--	--	--
Mobile Real-Time Monitoring								
PM10 (Mobile)	µg/m^3	112	228,704/228,704	28	0.1	1430***	--	12-Nov-09

Notes:

FRM = Federal Reference Methods (24-hour average value)
FEM = Federal Equivalent Method using a continuous particulate monitor (hourly reported value)
Mobile = measurements taken using a hand-held particulate monitor (instantaneous reported value)
PM = particulate matter
TSP = total suspended particulates
* = no action level; unusually high concentrations or trends were investigated
** = hourly reported value, not valid for comparison with 24-hour action level
** = instantaneous reported value, not valid for comparison with 24-hour action level

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TABLE H-21 SUMMARY STATISTICS FOR GROUNDWATER

		Regulatory Values		Samples Collected for Bedrock Between 2-Jan-09 and 15-Dec-09							Samples Collected for Shallow Bedrock Between 2-Jan-09 and 13-Jul-10							
Analyte	Unit	MCL	Secondary MCL	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections	Number of Exceedances
Aluminum	mg/L	--	0.05	0.025 / 0.1	ND	0	ND	--	0 / 5	--	0.025 / 0.1	0.0262	0.166	6AR	10-Mar-10	10 / 44	0.0894	5>sMCL
Aluminum, Total	mg/L	--	0.05	0.025 / 0.1	0.0685	0.0685	0.0685	15-Dec-09	1 / 6	1>sMCL	0.025 / 1	0.0251	2.43	AD1	15-Sep-09	29 / 49	0.321	25>sMCL
Ammonia, as N	mg/L	--	--	0.1 / 0.1	0.116	0.1873	0.267	19-Oct-09	4 / 5	--	0.1 / 0.42	0.101	1.12	22	19-Apr-10	33 / 48	0.4281	--
Antimony	mg/L	0.006	--	0.00033 / 0.002	ND	0	ND	--	0 / 5	--	0.00033 / 0.002	0.00036	0.00036	AD3	14-Dec-09	1 / 44	0.00036	--
Antimony, Total	mg/L	0.006	--	0.00033 / 0.002	ND	0	ND	--	0 / 6	--	0.00033 / 0.002	0.00035	0.00081	AD2	15-Sep-09	3 / 49	0.0005267	--
Arsenic	mg/L	0.01	--	0.00033 / 0.002	0.00062	0.00128	0.00233	17-Nov-09	3 / 5	--	0.00033 / 0.002	0.00033	0.014	AD2	23-Jul-09	34 / 46	0.002104	2>MCL
Arsenic, Total	mg/L	0.01	--	0.00033 / 0.002	0.00044	0.002066	0.00348	17-Nov-09	5 / 6	--	0.00033 / 0.002	0.00034	0.0297	AD2	11-Jun-09	38 / 51	0.003268	3>MCL
Barium	mg/L	2	--	--	0.287	0.3646	0.448	14-Sep-09	5 / 5	--	--	0.0254	0.0591	AD1	15-Dec-09	44 / 44	0.0389	--
Barium, Total	mg/L	2	--	--	0.356	0.4333	0.485	2-Jan-09	6 / 6	--	0.0025 / 0.1	0.0232	0.102	AD1	15-Sep-09	48 / 49	0.04262	--
Beryllium	mg/L	0.004	--	0.00033 / 0.002	ND	0	ND	--	0 / 5	--	0.00033 / 0.002	0.00059	0.00072	6AR	17-Dec-09	5 / 44	0.000688	--
Beryllium, Total	mg/L	0.004	--	0.00033 / 0.002	ND	0	ND	--	0 / 6	--	0.00033 / 0.002	0.00037	0.00076	6A	16-Jun-10	6 / 49	0.00064	--
Boron	mg/L	--	--	--	0.115	0.1198	0.128	15-Dec-09	5 / 5	--	--	0.121	1.12	22	16-Dec-09	44 / 44	0.4792	--
Boron, Total	mg/L	--	--	--	0.109	0.1238	0.144	11-Jun-09	6 / 6	--	--	0.116	1.14	22	16-Dec-09	49 / 49	0.4866	--
Cadmium	mg/L	0.005	--	0.00033 / 0.001	ND	0	ND	--	0 / 5	--	0.00033 / 0.001	0.00112	0.00233	6AR	14-Sep-09	5 / 44	0.001892	--
Cadmium, Total	mg/L	0.005	--	0.00033 / 0.001	ND	0	ND	--	0 / 6	--	0.00033 / 0.001	0.0004	0.00225	6AR	14-Sep-09	10 / 49	0.001282	--
Calcium	mg/L	--	--	--	10.6	16.54	21.3	15-Dec-09	5 / 5	--	--	3.06	161	AD3	13-Jul-10	44 / 44	54	--
Calcium, Total	mg/L	--	--	--	15.3	19.12	21.5	11-Jun-09	6 / 6	--	--	3.07	261	AD3	11-Jun-09	49 / 49	61.03	--
Cesium-137	pCi/L	--	250	4.623 / 4.623	ND	0	ND	--	0 / 1	--	4.459 / 9.06	ND	ND	--	--	0 / 5	0	--
Chloride	mg/L	--	--	--	3.1	4.63	9.67	15-Dec-09	5 / 5	--	1 / 5.1	1.41	17.6	AD2	11-Jun-09	43 / 47	7.312	--
Chromium	mg/L	0.1	--	0.00033 / 0.002	0.00044	0.00044	0.00044	19-Oct-09	1 / 5	--	0.00033 / 0.002	0.00033	0.00378	AD2	11-May-10	5 / 44	0.001508	--
Chromium, Total	mg/L	0.1	--	0.00033 / 0.002	ND	0	ND	--	0 / 6	--	0.00033 / 0.02	0.00033	0.00435	AD1	15-Sep-09	20 / 49	0.0008985	--
Cobalt	mg/L	--	--	0.00033 / 0.002	ND	0	ND	--	0 / 5	--	0.00033 / 0.002	0.00106	0.0973	6A	16-Jun-10	32 / 44	0.01697	--
Cobalt, Total	mg/L	--	--	0.00033 / 0.002	ND	0	ND	--	0 / 6	--	0.00033 / 0.002	0.00104	0.0991	6A	16-Jun-10	36 / 49	0.01549	--
Cobalt-60	pCi/L	--	--	4.44 / 4.44	ND	0	ND	--	0 / 1	--	4.179 / 10.24	ND	ND	--	--	0 / 5	0	--
Copper	mg/L	1.3	1.0	0.00033 / 0.005	ND	0	ND	--	0 / 5	--	0.00033 / 0.005	0.00033	0.00077	6AR	14-Sep-09	7 / 44	0.0004543	--
Copper, Total	mg/L	1.3	1.0	0.00033 / 0.005	0.00048	0.00048	0.00048	17-Nov-09	1 / 6	--	0.00033 / 0.05	0.00033	0.0151	AD1	15-Sep-09	21 / 49	0.001758	--
Fluoride	mg/L	--	2.0	0.1 / 0.156	0.148	0.1913	0.23	15-Dec-09	4 / 5	--	0.1 / 0.213	0.106	0.33	AD1	13-Jul-10	32 / 47	0.2242	--
Iron	mg/L	--	0.3	0.0125 / 0.05	0.0128	0.04517	0.0789	14-Sep-09	3 / 5	--	0.0125 / 0.143	0.0274	1.53	AD2	12-Jul-10	27 / 44	0.4939	15>sMCL
Iron, Total	mg/L	--	0.3	--	0.0526	0.2501	0.569	17-Nov-09	6 / 6	2>sMCL	--	0.0194	1050	6A	11-Jun-09	49 / 49	22.01	27>sMCL
Lead	mg/L	0.005	--	0.00033 / 0.002	ND	0	ND	--	0 / 5	--	0.00033 / 0.002	ND	ND	--	--	0 / 44	0	--
Lead, Total	mg/L	0.005	--	0.00033 / 0.002	0.00069	0.00069	0.00069	15-Dec-09	1 / 6	--	0.00033 / 0.002	0.00038	0.00162	AD1	15-Sep-09	6 / 49	0.0007233	--
Magnesium	mg/L	--	--	--	2.07	2.492	2.81	15-Dec-09	5 / 5	--	--	0.74	20.5	AD3	14-Jun-10	44 / 44	9.11	--
Magnesium, Total	mg/L	--	--	--	2.06	2.557	2.85	11-Jun-09	6 / 6	--	--	0.752	94.7	6A	11-Jun-09	49 / 49	11.25	--
Manganese	mg/L	--	0.05	--	0.00858	0.07448	0.108	15-Dec-09	5 / 5	4>sMCL	--	0.0318	35.3	6AR	14-Sep-09	44 / 44	5.27	36>sMCL
Manganese, Total	mg/L	--	0.05	0.00033 / 0.095	0.0627	0.0893	0.112	15-Dec-09	5 / 6	5>sMCL	0.00033 / 7.82	0.0344	179	6A	11-Jun-09	46 / 49	9.024	41>sMCL
Mercury	mg/L	0.05	--	0.0001 / 0.0001	ND	0	ND	--	0 / 4	--	0.0001 / 0.0002	0.00011	0.00016	AD3	16-Nov-09	1 / 43	0.000155	--
Mercury, Total	mg/L	0.05	--	0.0001 / 0.0002	ND	0	ND	--	0 / 5	--	0.0001 / 0.0002	ND	ND	--	--	0 / 48	0	--
Molybdenum	mg/L	--	--	0.00033 / 0.005	0.00064	0.001063	0.00134	17-Nov-09	4 / 5	--	0.00033 / 0.005	0.00034	0.00087	AD2	14-Dec-09	23 / 44	0.000503	--
Molybdenum, Total	mg/L	--	--	0.00033 / 0.005	0.00543	0.00543	0.00543	17-Nov-09	1 / 6	--	0.00033 / 0.05	0.00034	0.00097	AD2	11-May-10	17 / 49	0.0005718	--
Nickel	mg/L	0.1	--	0.00033 / 0.005	ND	0	ND	--	0 / 5	--	0.00033 / 0.005	0.00059	0.0447	6AR	14-Sep-09	27 / 44	0.00923	--
Nickel, Total	mg/L	0.1	--	0.00033 / 0.005	0.00037	0.00037	0.00037	17-Nov-09	1 / 6	--	0.00033 / 0.05	0.00033	0.0827	AD2	15-Sep-09	35 / 49	0.009888	--
Nitrate-Nitrite Nitrogen	mg/L	1	--	0.1 / 0.5	ND	0	ND	--	0 / 5	--	0.1 / 50	ND	ND	--	--	0 / 49	0	--
Potassium	mg/L	--	--	--	2.76	3.252	3.76	2-Jan-09	5 / 5	--	--	0.55	4.77	AD3	13-Oct-09	44 / 44	2.885	--
Potassium, Total	mg/L	--	--	--	2.88	3.383	3.8	15-Dec-09	6 / 6	--	0.25 / 10	0.612	5.07	AD3	16-Nov-09	48 / 49	3.003	--
Radium-226	pCi/L	--	--	0.562 / 0.562	ND	0	ND	--	0 / 1	--	0.3424 / 0.584	ND	ND	--	--	0 / 5	0	--
Radium-228	pCi/L	--	--	1.731 / 1.731	ND	0	ND	--	0 / 1	--	1.552 / 2.433	1.743	2.304	6AR	17-Dec-09	2 / 5	2.114	--
Selenium	mg/L	0.05	--	0.00033 / 0.002	ND	0	ND	--	0 / 4	--	0.00033 / 0.002	ND	ND	--	--	0 / 44	0	--
Selenium, Total	mg/L	0.05	--	0.00033 / 0.002	ND	0	ND	--	0 / 5	--	0.00033 / 0.02	ND	ND	--	--	0 / 48	0	--
Silver	mg/L	--	0.1	0.00033 / 0.002	ND	0	ND	--	0 / 5	--	0.00033 / 0.002	ND	ND	--	--	0 / 44	0	--
Silver, Total	mg/L	--	0.1	0.00033 / 0.002	ND	0	ND	--	0 / 6	--	0.00033 / 0.02	ND	ND	--	--	0 / 49	0	--
Sodium	mg/L	--	--	--	82.8	86.84	93	2-Jan-09	5 / 5	--	--	6.1	96	AD1	11-Jan-10	44 / 44	30.06	--
Sodium, Total	mg/L	--	--	--	77.3	87.73	93.9	11-Jun-09	6 / 6	--	--	6.38	94.3	AD1	11-Jun-09	49 / 49	30.37	--
Strontium	mg/L	--	--	--	0.321	0.3705	0.406	15-Dec-09	4 / 4	--	--	0.091	0.846	AD3	14-Jun-10	43 / 43	0.383	--
Strontium, Total	mg/L	--	--	--	0.328	0.3938	0.451	11-Jun-09	5 / 5	--	--	0.0916	0.87	AD3	14-Jun-10	48 / 48	0.3946	--
Sulfate	mg/L	--	250	--	12.2	20.2	45.8	11-Jun-09	5 / 5	--	--	18.9	3500	6A	11-Jun-09	47 / 47	199.4	5>sMCL
Thallium	mg/L	0.002	--	0.00025 / 0.002	0.00028	0.00063	0.00082	19-Oct-09	2 / 5	--	0.00025 / 0.002	0.00025	0.00096	AD3	16-Nov-09	9 / 44	0.0006256	--
Thallium, Total	mg/L	0.002	--	0.00025 / 0.002	0.00039	0.00039	0.00039	19-Oct-09	1 / 6	--	0.00025 / 0.002	0.00033	0.00092	AD3	16-Nov-09	11 / 49	0.0005836	--
Thorium-228	pCi/L	--	--	1.141 / 1.141	ND	0	ND	--	0 / 1	--	0.4368 / 1.309	ND	ND	--	--	0 / 4	0	--
Thorium-232	pCi/L	--	--	0.9282 / 0.9282	ND	0	ND	--	0 / 1	--	0.1455 / 0.5978	0.3757	0.3757	AD2	14-Dec-09	1 / 4	0.3757	--

TABLE H-21 SUMMARY STATISTICS FOR GROUNDWATER

		Regulatory Values		Samples Collected for Bedrock Between 2-Jan-09 and 15-Dec-09							Samples Collected for Shallow Bedrock Between 2-Jan-09 and 13-Jul-10							
Analyte	Unit	MCL	Secondary MCL	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Number of Exceedances	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections	Number of Exceedances
Total Dissolved Solids	mg/L	--	500	--	245	269.6	300	11-Jun-09	5 / 5	--	--	28	5280	6A	11-Jun-09	48 / 48	439.2	13>sMCL
Total Inorganic Carbon	mg/L	--	--	--	42.3	45.9	54.5	15-Dec-09	5 / 5	--	1 / 99.5	7.93	101	6A	11-Jun-09	41 / 48	41.37	--
Total Kjeldahl Nitrogen	mg/L	--	--	0.1 / 0.535	0.185	0.202	0.219	14-Sep-09	2 / 5	--	0.1 / 0.702	0.122	9.99	AD2	14-Dec-09	35 / 48	1.069	--
Total Suspended Solids	mg/L	--	--	1 / 1.33	1.6	7	12.4	15-Dec-09	2 / 5	--	1 / 1.33	1.1	131	6A	11-Jun-09	30 / 48	10.69	--
Uranium	mg/L	--	--	1 / 1	ND	0	ND	--	0 / 1	--	1 / 1	ND	ND	--	--	0 / 5	0	--
Uranium-234	pCi/L	--	--	--	0.1393	0.1393	0.1393	15-Dec-09	1 / 1	--	0.06818 / 0.2472	0.1904	0.9604	AD3	14-Dec-09	3 / 5	0.4645	--
Uranium-235	pCi/L	--	--	--	0.2273	0.2273	0.2273	15-Dec-09	1 / 1	--	0.08511 / 0.2386	ND	ND	--	--	0 / 5	0	--
Uranium-238	pCi/L	--	--	0.1328 / 0.1328	ND	0	ND	--	0 / 1	--	0.1236 / 0.1742	0.6864	0.6864	AD3	14-Dec-09	1 / 5	0.6864	--
Vanadium	mg/L	--	--	0.00038 / 0.004	ND	0	ND	--	0 / 5	--	0.00033 / 0.004	0.00033	0.00046	AD2	14-Dec-09	5 / 44	0.000402	--
Vanadium, Total	mg/L	--	--	0.00033 / 0.004	0.00039	0.000425	0.00046	15-Dec-09	2 / 6	--	0.00033 / 0.04	0.00053	0.00288	AD1	14-Oct-09	7 / 49	0.00111	--
Zinc	mg/L	--	5	0.0083 / 0.05	0.0206	0.0206	0.0206	15-Dec-09	1 / 5	--	0.0083 / 0.05	0.0364	0.0418	6A	16-Jun-10	5 / 44	0.03832	--
Zinc, Total	mg/L	--	5	0.0083 / 0.05	0.686	0.686	0.686	15-Dec-09	1 / 6	--	0.0083 / 0.5	0.0151	0.0441	AD2	15-Sep-09	7 / 49	0.0358	--

Notes:

F&AL = Tennessee Water Quality Criterion for Fish and Aquatic Life
MCL = maximum contaminant level
ND = not detected
sMCL = secondary MCL
TDWS = Tennessee Domestic Water Supply Standard
TWQC = Tennessee Water Quality Criterion for Human Consumption of Water and Organisms

TABLE H-22 SUMMARY STATISTICS FOR 2009 FISH FILLET SAMPLES IN THE EMORY RIVER

			Emory River 2009 Largemouth Bass Fillet Samples								Emory River 2009 Bluegill and Redear Sunfish Fillet Samples							
Analyte	Unit	Human Health Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value
% Lipids	%	--	--	0.17	1.676	7.3	ERM3.0	13-Oct-09	40 / 40	--	--	0.42	0.6735	1.4	ERM3.0	05/12/2009	17 / 17	--
% Moisture	%	--	--	76.3	79.24	81.5	ERM3.0	29-Apr-09	40 / 40	--	--	77.9	80.97	83.8	ERM3.0	05/12/2009	18 / 18	--
Aluminum	mg/kg	135	0.7878 / 25.01	0.9154	16.82	109.7	ERM3.0	13-Oct-09	14 / 40	--	0.8722 / 0.8786	1.012	1.895	4.664	ERM0.9	05/11/2009	16 / 18	--
Antimony	mg/kg	0.0541	0.01647 / 0.1088	0.02042	0.8007	2.247	ERM3.0	13-Oct-09	6 / 40	5	0.0183 / 0.01991	ND	0	ND	--	--	0 / 18	--
Arsenic	mg/kg	0.0021	0.01346 / 0.1801	0.01636	0.1646	0.3029	ERM0.9	21-Apr-09	31 / 40	31	0.01549 / 0.07956	0.0181	0.03605	0.09945	ERM0.9	05/11/2009	13 / 18	13
Barium	mg/kg	27	0.01763 / 0.1008	0.02548	0.04467	0.1027	ERM0.9	30-Sep-09	12 / 40	--	0.01958 / 0.02035	0.0267	0.08364	0.4074	ERM0.9	05/11/2009	15 / 18	--
Beryllium	mg/kg	0.27	0.00278 / 0.1008	ND	0	ND	--	--	0 / 40	--	0.0032 / 0.00337	ND	0	ND	--	--	0 / 18	--
Boron	mg/kg	27	0.05568 / 2.009	ND	0	ND	--	--	0 / 40	--	0.06335 / 0.06528	0.1627	0.1627	0.1627	ERM3.0	05/12/2009	1 / 18	--
Cadmium	mg/kg	0.135	0.00525 / 0.1008	0.01887	0.3016	1.325	ERM3.0	13-Oct-09	6 / 40	2	0.00586 / 0.00605	ND	0	ND	--	--	0 / 18	--
Calcium	mg/kg	--	42.69 / 99.33	100.2	227.3	750.3	ERM8.0	1-Apr-09	38 / 40	--	--	97.38	729.6	5607	ERM0.9	05/11/2009	18 / 18	--
Chromium	mg/kg	203	0.09888 / 0.1247	0.1071	0.2541	0.56	ERM0.9	30-Sep-09	20 / 40	--	0.1226 / 0.1249	ND	0	ND	--	--	0 / 18	--
Cobalt	mg/kg	0.0406	0.00424 / 0.1008	0.00498	0.008065	0.01299	ERM8.0	22-Apr-09	13 / 40	--	0.00481 / 0.01369	0.00571	0.009329	0.01351	ERM3.0	05/12/2009	10 / 18	--
Copper	mg/kg	5.41	0.1554 / 0.504	0.1862	0.2905	0.4872	ERM3.0	13-Oct-09	28 / 40	--	0.178 / 0.181	0.1782	0.3462	1.856	ERM0.9	05/11/2009	15 / 18	--
Iron	mg/kg	94.6	10.67 / 25.01	11.62	15.24	19.49	ERM0.9	30-Sep-09	3 / 40	--	12.37 / 12.53	ND	0	ND	--	--	0 / 18	--
Lead	mg/kg	--	0.00905 / 0.1008	0.03255	4.85	25.41	ERM3.0	13-Oct-09	12 / 40	--	0.01043 / 0.01068	0.01513	0.03851	0.06188	ERM0.9	05/11/2009	2 / 18	--
Magnesium	mg/kg	--	--	240.8	268.2	294.6	ERM3.0	13-Oct-09	40 / 40	--	--	243.4	277.7	343.4	ERM0.9	05/11/2009	18 / 18	--
Manganese	mg/kg	18.9	0.07192 / 0.504	0.0861	0.1421	0.26	ERM0.9	30-Sep-09	35 / 40	--	--	0.1412	0.6829	5.413	ERM0.9	05/11/2009	18 / 18	--
Mercury	mg/kg	0.0406	--	0.04884	0.103	0.3072	ERM0.9	30-Sep-09	40 / 40	40	0.00418 / 0.02431	0.02244	0.05766	0.181	ERM8.0	05/12/2009	17 / 18	11
Molybdenum	mg/kg	0.676	0.00928 / 1.008	0.0165	0.0165	0.0165	ERM8.0	20-Oct-09	1 / 40	--	0.01068 / 0.03298	0.011	0.01246	0.01458	ERM3.0	05/12/2009	4 / 18	--
Nickel	mg/kg	2.7	0.02784 / 0.1005	0.03298	0.07098	0.1509	ERM3.0	13-Oct-09	18 / 40	--	0.03247 / 0.03439	0.0336	0.07183	0.2316	ERM3.0	05/12/2009	14 / 18	--
Potassium	mg/kg	--	--	3423	3696	4263	ERM3.0	29-Apr-09	40 / 40	--	--	3158	3471	3885	ERM3.0	05/12/2009	18 / 18	--
Selenium	mg/kg	0.676	--	0.344	0.5507	0.7872	ERM0.9	30-Sep-09	40 / 40	7	--	0.3192	0.6727	1.042	ERM3.0	05/12/2009	18 / 18	12
Silver	mg/kg	0.676	0.00255 / 0.0504	ND	0	ND	--	--	0 / 40	--	0.0029 / 0.0031	ND	0	ND	--	--	0 / 18	--
Sodium	mg/kg	--	--	280.8	378.8	492.1	ERM8.0	22-Apr-09	40 / 40	--	--	233.5	302.2	355.3	ERM8.0	05/12/2009	18 / 18	--
Strontium	mg/kg	--	0.01333 / 0.26	0.03108	0.1585	0.615	ERM8.0	1-Apr-09	25 / 40	--	0.01501 / 0.0152	0.0366	0.6089	4.617	ERM0.9	05/11/2009	17 / 18	--
Thallium	mg/kg	0.00876	0.01253 / 0.1008	ND	0	ND	--	--	0 / 40	--	0.01458 / 0.01478	0.01608	0.01608	0.01608	ERM3.0	05/12/2009	1 / 18	1
Vanadium	mg/kg	0.681	0.0464 / 0.2009	ND	0	ND	--	--	0 / 40	--	0.05404 / 0.0555	ND	0	ND	--	--	0 / 18	--
Zinc	mg/kg	40.6	--	4.531	8.293	16.99	ERM8.0	20-Oct-09	40 / 40	--	--	7.084	10.86	16.78	ERM0.9	05/11/2009	18 / 18	--

Notes:
ERM - Emory River Mile
ND = not detected

TABLE H-22 SUMMARY STATISTICS FOR 2009 FISH FILLET SAMPLES IN THE EMORY RIVER

			Emory River 2009 Catfish Fillet Samples								Emory River 2009 Crappie Fillet Samples							
Analyte	Unit	Human Health Screen Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value
% Lipids	%	--	--	1.2	2.962	5.1	ERM3.0	13-Oct-09	21 / 21	--	--	0.38	1.576	4.3	ERM8.0	30-Apr-09	11 / 11	--
% Moisture	%	--	--	76.9	80.68	84.2	ERM3.0	13-Oct-09	21 / 21	--	--	78.6	79.76	81.4	ERM8.0	30-Apr-09	11 / 11	--
Aluminum	mg/kg	135	0.7995 / 25.15	2.993	4.511	7.069	ERM3.0	13-Oct-09	7 / 21	--	0.819 / 0.8904	1.261	2.972	4.683	ERM3.0	29-Apr-09	2 / 11	--
Antimony	mg/kg	0.0541	0.01673 / 0.148	0.2145	0.4732	0.7752	ERM3.0	13-Oct-09	3 / 21	3	0.01794 / 0.01932	0.01957	0.02922	0.0351	ERM8.0	7-May-09	5 / 11	--
Arsenic	mg/kg	0.0021	0.03027 / 0.101	ND	0	ND	--	--	0 / 21	--	--	0.1108	0.1969	0.315	ERM3.0	29-Apr-09	11 / 11	11
Barium	mg/kg	27	0.01848 / 0.101	0.0258	0.03918	0.09625	ERM0.9	6-Oct-09	10 / 21	--	0.01911 / 0.0399	0.0209	0.02555	0.03162	ERM8.0	30-Apr-09	4 / 11	--
Beryllium	mg/kg	0.27	0.00286 / 0.101	ND	0	ND	--	--	0 / 21	--	0.00312 / 0.00336	ND	0	ND	--	--	0 / 11	--
Boron	mg/kg	27	0.05508 / 2	ND	0	ND	--	--	0 / 21	--	0.06045 / 0.0651	0.2167	0.2167	0.2167	ERM3.0	29-Apr-09	1 / 11	--
Cadmium	mg/kg	0.135	0.00533 / 0.1221	0.01568	0.0323	0.056	ERM0.9	6-Oct-09	6 / 21	--	0.00564 / 0.00608	0.0252	0.0252	0.0252	ERM3.0	29-Apr-09	1 / 11	--
Calcium	mg/kg	--	43.45 / 100.2	57.99	74.23	135.3	ERM0.9	6-Oct-09	18 / 21	--	--	99.26	234.4	455.3	ERM3.0	29-Apr-09	11 / 11	--
Chromium	mg/kg	203	0.099 / 0.123	0.1242	0.23	0.632	ERM3.0	13-Oct-09	18 / 21	--	0.1151 / 0.1241	ND	0	ND	--	--	0 / 11	--
Cobalt	mg/kg	0.0406	0.00428 / 0.101	0.0062	0.01001	0.0135	ERM0.9	6-Oct-09	6 / 21	--	0.00449 / 0.00494	0.0065	0.006501	0.0065	ERM3.0	29-Apr-09	1 / 11	--
Copper	mg/kg	5.41	0.1571 / 0.4975	0.2292	0.3488	0.7965	ERM3.0	13-Oct-09	18 / 21	--	0.1677 / 0.1819	0.1767	0.2631	0.36	ERM3.0	29-Apr-09	6 / 11	--
Iron	mg/kg	94.6	10.87 / 25.15	ND	0	ND	--	--	0 / 21	--	11.58 / 12.54	ND	0	ND	--	--	0 / 11	--
Lead	mg/kg	--	0.00918 / 0.101	0.0122	1.49	7.67	ERM3.0	13-Oct-09	15 / 21	--	0.00975 / 0.01071	ND	0	ND	--	--	0 / 11	--
Magnesium	mg/kg	--	--	179.7	210	234	ERM0.9	6-Oct-09	21 / 21	--	--	245.5	271.8	296.1	ERM3.0	29-Apr-09	11 / 11	--
Manganese	mg/kg	18.9	0.07344 / 0.4975	0.1187	0.1726	0.2655	ERM3.0	13-Oct-09	18 / 21	--	--	0.0858	0.1137	0.1627	ERM3.0	29-Apr-09	11 / 11	--
Mercury	mg/kg	0.0406	0.00367 / 0.0697	0.02535	0.08516	0.2211	ERM0.9	6-Oct-09	20 / 21	14	--	0.01819	0.04536	0.0985	ERM3.0	29-Apr-09	11 / 11	5
Molybdenum	mg/kg	0.676	0.00938 / 1.01	ND	0	ND	--	--	0 / 21	--	0.01014 / 0.0132	ND	0	ND	--	--	0 / 11	--
Nickel	mg/kg	2.7	0.02856 / 0.101	0.0344	0.07748	0.3024	ERM3.0	13-Oct-09	18 / 21	--	0.0312 / 0.04422	0.07056	0.1469	0.2232	ERM8.0	30-Apr-09	2 / 11	--
Potassium	mg/kg	--	--	2950	3466	3900	ERM0.9	6-Oct-09	21 / 21	--	--	3540	3710	4236	ERM3.0	29-Apr-09	11 / 11	--
Selenium	mg/kg	0.676	0.04692 / 0.198	0.1462	0.2968	0.44	ERM0.9	6-Oct-09	20 / 21	--	--	0.2613	0.5039	0.642	ERM3.0	29-Apr-09	11 / 11	--
Silver	mg/kg	0.676	0.00265 / 0.04975	ND	0	ND	--	--	0 / 21	--	0.00272 / 0.00309	0.00588	0.00588	0.00588	ERM3.0	29-Apr-09	1 / 11	--
Sodium	mg/kg	--	--	231.1	307.4	456.3	ERM0.9	6-Oct-09	21 / 21	--	--	210.6	297.7	369.6	ERM3.0	29-Apr-09	11 / 11	--
Strontium	mg/kg	--	0.01363 / 0.1151	0.058	0.08215	0.1151	ERM0.9	6-Oct-09	8 / 21	--	0.01404 / 0.01505	0.0195	0.1582	0.36	ERM3.0	29-Apr-09	9 / 11	--
Thallium	mg/kg	0.00876	0.01285 / 0.101	ND	0	ND	--	--	0 / 21	--	0.01365 / 0.01478	0.01862	0.02021	0.022	ERM3.0	29-Apr-09	4 / 11	4
Vanadium	mg/kg	0.681	0.04692 / 0.199	ND	0	ND	--	--	0 / 21	--	0.0507 / 0.05564	ND	0	ND	--	--	0 / 11	--
Zinc	mg/kg	40.6	--	4.078	5.813	8.316	ERM8.0	3-Nov-09	21 / 21	--	--	4.665	6.092	6.974	ERM3.0	29-Apr-09	11 / 11	--

Notes:
ERM - Emory River Mile
ND = not detected

TABLE H-23 SUMMARY STATISTICS FOR 2009 FISH FILLET SAMPLES IN THE CLINCH RIVER

			Clinch River 2009 Largemouth Bass Fillet Samples								Clinch River 2009 Bluegill and Redear Sunfish Fillet Samples							
Analyte	Unit	Human Health Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value
% Lipids	%	--	--	0.23	1.857	4.9	CRM1.5	16-Oct-09	39 / 39	--	--	0.47	0.7942	1.6	CRM1.5	13-May-09	12 / 12	--
% Moisture	%	--	--	71.7	78.16	81.2	CRM25.0	19-Oct-09	39 / 39	--	--	78.7	80.9	83.6	CRM8.0	14-May-09	12 / 12	--
Aluminum	mg/kg	135	0.7668 / 25.17	ND	0	ND	--	--	0 / 39	--	0.792 / 0.8932	0.9774	1.971	3.268	CRM1.5	13-May-09	5 / 12	--
Antimony	mg/kg	0.0541	0.01661 / 0.1005	0.02743	0.07803	0.207	CRM1.5	16-Oct-09	13 / 39	5	0.01728 / 0.01991	0.0234	0.02566	0.02832	CRM8.0	14-May-09	6 / 12	--
Arsenic	mg/kg	0.0021	0.01363 / 0.1215	0.05858	0.2301	0.4047	CRM25.0	19-Oct-09	38 / 39	38	0.01404 / 0.078	0.04779	0.05966	0.0684	CRM8.0	14-May-09	6 / 12	6
Barium	mg/kg	27	0.01768 / 0.1004	0.01863	0.07061	0.2119	CR-1	9-Jan-09	19 / 39	--	--	0.027	0.05389	0.1274	CRM8.0	14-May-09	12 / 12	--
Beryllium	mg/kg	0.27	0.00277 / 0.1005	0.00567	0.005981	0.00629	CRM8.0	5-May-09	2 / 39	--	0.00288 / 0.0034	ND	0	ND	--	--	0 / 12	--
Boron	mg/kg	27	0.05538 / 2.018	ND	0	ND	--	--	0 / 39	--	0.0576 / 0.06534	ND	0	ND	--	--	0 / 12	--
Cadmium	mg/kg	0.135	0.00545 / 0.1005	0.00828	0.05583	0.1212	CRM1.5	16-Oct-09	4 / 39	--	0.0054 / 0.0138	ND	0	ND	--	--	0 / 12	--
Calcium	mg/kg	--	--	93.44	1138	7426	CR-1	9-Jan-09	39 / 39	--	--	153.8	717.1	2653	CRM8.0	14-May-09	12 / 12	--
Chromium	mg/kg	203	0.0987 / 0.1244	0.1019	0.1937	0.4646	CRM1.5	16-Oct-09	24 / 39	--	0.1116 / 0.1254	ND	0	ND	--	--	0 / 12	--
Cobalt	mg/kg	0.0406	0.00426 / 0.1005	0.00651	0.007202	0.00853	CRM8.0	5-May-09	4 / 39	--	0.00476 / 0.0146	ND	0	ND	--	--	0 / 12	--
Copper	mg/kg	5.41	0.1555 / 0.5094	0.1683	0.2882	1.062	CRM25.0	19-Oct-09	29 / 39	--	--	0.1725	0.2407	0.34	CRM1.5	13-May-09	12 / 12	--
Iron	mg/kg	94.6	10.8 / 25.17	13.97	13.97	13.97	CRM1.5	16-Oct-09	1 / 39	--	11.21 / 12.56	ND	0	ND	--	--	0 / 12	--
Lead	mg/kg	--	0.00916 / 0.1005	0.01555	0.5975	2.298	CRM1.5	16-Oct-09	16 / 39	--	0.00954 / 0.01064	0.01989	0.02817	0.03216	CRM1.5	13-May-09	4 / 12	--
Magnesium	mg/kg	--	--	183.1	280.2	374.6	CR-1	9-Jan-09	39 / 39	--	--	242.5	278.1	299.1	CRM8.0	14-May-09	12 / 12	--
Manganese	mg/kg	18.9	0.07242 / 0.5094	0.08325	0.224	1.048	CR-1	9-Jan-09	25 / 39	--	--	0.1525	0.4437	1.267	CRM8.0	14-May-09	12 / 12	--
Mercury	mg/kg	0.0406	0.00362 / 0.0451	0.01581	0.06942	0.1801	CR-1	9-Jan-09	34 / 39	29	--	0.03	0.05015	0.08733	CRM8.0	14-May-09	12 / 12	9
Molybdenum	mg/kg	0.676	0.00937 / 1.005	0.01155	0.0137	0.01584	CRM8.0	5-May-09	2 / 39	--	0.00972 / 0.01665	0.0101	0.01132	0.01253	CRM8.0	14-May-09	2 / 12	--
Nickel	mg/kg	2.7	0.02982 / 0.1005	0.02982	0.07053	0.2222	CRM1.5	16-Oct-09	15 / 39	--	0.03168 / 0.0576	0.03762	0.03934	0.0418	CRM1.5	13-May-09	6 / 12	--
Potassium	mg/kg	--	--	2620	3535	4160	CRM25.0	19-Oct-09	39 / 39	--	--	2968	3269	3628	CRM8.0	14-May-09	12 / 12	--
Selenium	mg/kg	0.676	--	0.3465	0.5384	0.9165	CRM25.0	19-Oct-09	39 / 39	9	--	0.4422	0.6455	0.855	CRM1.5	13-May-09	12 / 12	5
Silver	mg/kg	0.676	0.00256 / 0.05094	ND	0	ND	--	--	0 / 39	--	0.0027 / 0.00308	ND	0	ND	--	--	0 / 12	--
Sodium	mg/kg	--	--	328	429.3	614.1	CR-1	9-Jan-09	39 / 39	--	--	260.2	326.6	389.8	CRM1.5	13-May-09	12 / 12	--
Strontium	mg/kg	--	--	0.02062	0.9039	5.717	CR-2	12-Jan-09	39 / 39	--	--	0.062	0.5539	2.297	CRM8.0	14-May-09	12 / 12	--
Thallium	mg/kg	0.00876	0.01278 / 0.1005	0.01482	0.01601	0.01801	CRM8.0	5-May-09	4 / 39	4	0.01314 / 0.0285	ND	0	ND	--	--	0 / 12	--
Vanadium	mg/kg	0.681	0.04899 / 0.2018	ND	0	ND	--	--	0 / 39	--	0.0486 / 0.056	ND	0	ND	--	--	0 / 12	--
Zinc	mg/kg	40.6	--	5.114	9.77	35.87	CRM25.0	19-Oct-09	39 / 39	--	--	8.264	13.1	20.2	CRM8.0	14-May-09	12 / 12	--

Notes:

CRM = Clinch River Mile

ND = not detected

TABLE H-23 SUMMARY STATISTICS FOR 2009 FISH FILLET SAMPLES IN THE CLINCH RIVER

			Clinch River 2009 Catfish Fillet Samples								Clinch River 2009 Crappie Fillet Samples							
Analyte	Unit	Human Health Screen Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value
% Lipids	%	--	--	0.2	3.932	9.9	CRM25.0	28-Oct-09	31 / 31	--	--	0.87	1.562	2.6	CRM1.5	30-Apr-09	6 / 6	--
% Moisture	%	--	--	71.2	78.95	83.3	CRM1.5	21-Oct-09	31 / 31	--	--	77.6	79.2	80.2	CRM8.0	5-May-09	6 / 6	--
Aluminum	mg/kg	135	0.7696 / 24.99	1.206	3.655	6.122	CRM1.5	21-Oct-09	16 / 31	--	0.8064 / 0.8976	ND	0	ND	--	--	0 / 6	--
Antimony	mg/kg	0.0541	0.01706 / 0.1008	0.1596	0.3353	0.5016	CRM25.0	28-Oct-09	5 / 31	5	0.0177 / 0.01927	0.02244	0.0327	0.0406	CRM8.0	5-May-09	4 / 6	--
Arsenic	mg/kg	0.0021	0.01362 / 0.1008	0.01694	0.03603	0.0798	CRM25.0	28-Oct-09	10 / 31	10	--	0.2178	0.2431	0.2912	CRM1.5	30-Apr-09	6 / 6	6
Barium	mg/kg	27	0.01793 / 0.1008	0.02886	0.06722	0.1634	CR-1	12-Jan-09	13 / 31	--	0.01882 / 0.0609	0.03075	0.08596	0.1802	CRM8.0	5-May-09	3 / 6	--
Beryllium	mg/kg	0.27	0.00288 / 0.1008	ND	0	ND	--	--	0 / 31	--	0.00291 / 0.00337	ND	0	ND	--	--	0 / 6	--
Boron	mg/kg	27	0.05616 / 2.005	ND	0	ND	--	--	0 / 31	--	0.05824 / 0.06534	ND	0	ND	--	--	0 / 6	--
Cadmium	mg/kg	0.135	0.00522 / 0.1008	0.00718	0.03887	0.1398	CRM1.5	21-Oct-09	10 / 31	1	0.00538 / 0.00609	ND	0	ND	--	--	0 / 6	--
Calcium	mg/kg	--	43.58 / 99.8	51.83	303.3	1347	CR-1	9-Jan-09	30 / 31	--	--	94.25	383.4	671.9	CRM8.0	5-May-09	6 / 6	--
Chromium	mg/kg	203	0.09858 / 0.121	0.1044	0.257	0.9307	CRM8.0	21-Oct-09	20 / 31	--	0.1142 / 0.1247	ND	0	ND	--	--	0 / 6	--
Cobalt	mg/kg	0.0406	0.00431 / 0.1008	0.00437	0.007316	0.01022	CRM8.0	21-Oct-09	10 / 31	--	0.00448 / 0.00495	ND	0	ND	--	--	0 / 6	--
Copper	mg/kg	5.41	0.1566 / 0.507	0.208	0.3902	1.054	CR-1	12-Jan-09	22 / 31	--	0.1658 / 0.1816	0.1904	0.2986	0.5125	CRM8.0	5-May-09	3 / 6	--
Iron	mg/kg	94.6	10.87 / 24.99	ND	0	ND	--	--	0 / 31	--	11.42 / 12.53	ND	0	ND	--	--	0 / 6	--
Lead	mg/kg	--	0.00931 / 0.1008	0.02001	1.034	5.413	CRM25.0	28-Oct-09	18 / 31	--	0.00963 / 0.01061	ND	0	ND	--	--	0 / 6	--
Magnesium	mg/kg	--	--	181.3	213.2	247.8	CR-2	12-Jan-09	31 / 31	--	--	271.3	285.4	299.6	CRM1.5	30-Apr-09	6 / 6	--
Manganese	mg/kg	18.9	0.07264 / 0.507	0.1144	0.2851	0.8673	CR-1	9-Jan-09	21 / 31	--	--	0.09416	0.206	0.3654	CRM8.0	5-May-09	6 / 6	--
Mercury	mg/kg	0.0406	--	0.02	0.07977	0.2169	CRM1.5	21-Oct-09	31 / 31	22	--	0.00984	0.03762	0.08932	CRM8.0	5-May-09	6 / 6	2
Molybdenum	mg/kg	0.676	0.00953 / 1.008	ND	0	ND	--	--	0 / 31	--	0.00986 / 0.01089	ND	0	ND	--	--	0 / 6	--
Nickel	mg/kg	2.7	0.0288 / 0.1008	0.0356	0.08623	0.5487	CR-1	9-Jan-09	18 / 31	--	0.03136 / 0.1117	0.0328	0.0328	0.0328	CRM8.0	5-May-09	1 / 6	--
Potassium	mg/kg	--	--	3128	3549	4042	CR-1	12-Jan-09	31 / 31	--	--	3623	3738	3854	CRM8.0	5-May-09	6 / 6	--
Selenium	mg/kg	0.676	0.04767 / 0.2079	0.1717	0.2818	0.5083	CRM1.5	21-Oct-09	27 / 31	--	--	0.336	0.4004	0.492	CRM8.0	5-May-09	6 / 6	--
Silver	mg/kg	0.676	0.00266 / 0.05111	0.0028	0.0028	0.0028	CRM25.0	28-Oct-09	1 / 31	--	0.00269 / 0.00308	ND	0	ND	--	--	0 / 6	--
Sodium	mg/kg	--	--	259.9	378.6	505.3	CR-1	12-Jan-09	31 / 31	--	--	235.6	263.7	312.4	CRM1.5	30-Apr-09	6 / 6	--
Strontium	mg/kg	--	0.01317 / 0.1003	0.03762	0.2718	1.097	CR-1	9-Jan-09	28 / 31	--	0.01389 / 0.0153	0.06848	0.2668	0.4466	CRM8.0	5-May-09	5 / 6	--
Thallium	mg/kg	0.00876	0.01428 / 0.1008	ND	0	ND	--	--	0 / 31	--	0.01344 / 0.01465	0.01763	0.01769	0.01775	CRM8.0	5-May-09	2 / 6	2
Vanadium	mg/kg	0.681	0.04784 / 0.2079	ND	0	ND	--	--	0 / 31	--	0.04928 / 0.05544	ND	0	ND	--	--	0 / 6	--
Zinc	mg/kg	40.6	--	5.217	6.968	13.39	CRM1.5	21-Oct-09	31 / 31	--	--	4.537	6.866	9.588	CRM8.0	5-May-09	6 / 6	--

Notes:
CRM = Clinch River Mile
ND = not detected

TABLE H-24 SUMMARY STATISTICS FOR 2010 FISH FILLET SAMPLES IN THE EMORY RIVER

			Emory River 2010 Largemouth Bass Fillet Samples								Emory River 2010 Bluegill and Redear Sunfish Fillet Samples							
Analyte	Unit	Human Health Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value
% Lipids	%	--	--	0.36	1.126	3.6	ERM4.5	21-Apr-10	21 / 21	--	--	0.12	0.711	1.6	ERM4.5	21-Apr-10	40 / 40	--
% Moisture	%	--	--	76.8	78.84	81.4	ERM0.9	12-Apr-10	21 / 21	--	--	76.3	81.02	84.4	ERM8.0	11-May-10	40 / 40	--
Aluminum	mg/kg	135	3.614 / 8.28	ND	0	ND	--	--	0 / 21	--	3.593 / 57.6	4.503	6.133	7.268	ERM4.5	21-Apr-10	5 / 40	--
Antimony	mg/kg	0.0541	0.01314 / 0.02898	ND	0	ND	--	--	0 / 21	--	0.01299 / 0.2	ND	0	ND	--	--	0 / 40	--
Arsenic	mg/kg	0.0021	--	0.0744	0.1948	0.3654	ERM0.9	12-Apr-10	21 / 21	21	0.02436 / 0.4	0.03792	0.1025	0.2646	ERM0.9	10-May-10	35 / 40	35
Barium	mg/kg	27	0.04104 / 0.09522	0.0492	0.0574	0.0656	ERM4.5	21-Apr-10	2 / 21	--	0.0406 / 0.66	0.04833	0.1185	0.3621	ERM3.0	5-May-10	26 / 40	--
Beryllium	mg/kg	0.27	0.02592 / 0.06003	ND	0	ND	--	--	0 / 21	--	0.0261 / 0.42	ND	0	ND	--	--	0 / 40	--
Boron	mg/kg	27	0.3672 / 0.8487	ND	0	ND	--	--	0 / 21	--	0.3654 / 5.96	ND	0	ND	--	--	0 / 40	--
Cadmium	mg/kg	0.135	0.00679 / 0.01573	ND	0	ND	--	--	0 / 21	--	0.0069 / 0.11	ND	0	ND	--	--	0 / 40	--
Calcium	mg/kg	--	--	122	357.3	1316	ERM4.5	21-Apr-10	21 / 21	--	43.24 / 694	85.37	646.9	5432	ERM3.0	5-May-10	37 / 40	--
Chromium	mg/kg	203	0.1139 / 0.2691	0.1432	0.1432	0.1432	ERM4.5	21-Apr-10	1 / 21	--	0.1137 / 1.82	0.1365	0.1918	0.247	ERM0.9	10-May-10	2 / 40	--
Cobalt	mg/kg	0.0406	0.0127 / 0.02898	ND	0	ND	--	--	0 / 21	--	0.01259 / 0.2	0.01363	0.0183	0.02704	ERM4.5	21-Apr-10	9 / 40	--
Copper	mg/kg	5.41	--	0.1841	0.6195	7.279	ERM3.0	14-Apr-10	21 / 21	1	0.1299 / 2.08	0.1453	0.3031	0.531	ERM3.0	5-May-10	36 / 40	--
Iron	mg/kg	94.6	10.86 / 24.84	ND	0	ND	--	--	0 / 21	--	10.84 / 173.6	12.56	13.25	13.93	ERM0.9	10-May-10	2 / 40	--
Lead	mg/kg	--	0.02409 / 0.02982	0.2376	0.2376	0.2376	ERM3.0	14-Apr-10	1 / 21	--	0.02436 / 0.3536	0.02982	0.2122	0.52	ERM8.0	11-May-10	3 / 40	--
Magnesium	mg/kg	--	--	247.4	290.8	332.3	ERM0.9	12-Apr-10	21 / 21	--	43.24 / 694	225.8	270.5	394.1	ERM3.0	5-May-10	38 / 40	--
Manganese	mg/kg	18.9	0.1533 / 0.3519	0.1685	0.1948	0.246	ERM4.5	21-Apr-10	8 / 21	--	0.1523 / 2.46	0.2148	0.8165	2.233	ERM4.5	21-Apr-10	27 / 40	--
Mercury	mg/kg	0.0406	--	0.05913	0.1135	0.2976	ERM0.9	12-Apr-10	21 / 21	21	0.01035 / 0.166	0.02632	0.05885	0.1375	ERM0.9	10-May-10	38 / 40	29
Molybdenum	mg/kg	0.676	0.03066 / 0.07245	ND	0	ND	--	--	0 / 21	--	0.03132 / 0.5	ND	0	ND	--	--	0 / 40	--
Nickel	mg/kg	2.7	0.0876 / 0.2029	0.1085	0.4323	0.756	ERM3.0	14-Apr-10	2 / 21	--	0.08729 / 1.4	0.09805	0.1332	0.2189	ERM3.0	5-May-10	4 / 40	--
Potassium	mg/kg	--	220.3 / 3726	3480	3907	4334	ERM8.0	20-Apr-10	18 / 21	--	233.3 / 10420	2558	3465	3980	ERM8.0	11-May-10	38 / 40	--
Selenium	mg/kg	0.676	--	0.3712	0.5615	0.876	ERM3.0	14-Apr-10	21 / 21	3	0.0609 / 0.98	0.396	0.7587	1.285	ERM0.9	10-May-10	38 / 40	22
Silver	mg/kg	0.676	0.00259 / 0.006	ND	0	ND	--	--	0 / 21	--	0.00261 / 0.042	ND	0	ND	--	--	0 / 40	--
Sodium	mg/kg	--	--	319.8	413.1	507.8	ERM0.9	12-Apr-10	21 / 21	--	43.24 / 694	269.3	345.2	521.2	ERM4.5	21-Apr-10	38 / 40	--
Strontium	mg/kg	--	--	0.06003	0.2351	0.984	ERM4.5	21-Apr-10	21 / 21	--	0.0396 / 0.64	0.04732	0.6142	5.602	ERM3.0	5-May-10	36 / 40	--
Thallium	mg/kg	0.00876	0.01248 / 0.01428	0.01427	0.02223	0.03971	ERM3.0	15-Apr-10	8 / 21	8	0.01238 / 0.198	0.01463	0.0185	0.02418	ERM3.0	5-May-10	6 / 40	6
Vanadium	mg/kg	0.681	0.04104 / 0.1606	ND	0	ND	--	--	0 / 21	--	0.0406 / 0.66	ND	0	ND	--	--	0 / 40	--
Zinc	mg/kg	40.6	--	5.673	8.842	13.95	ERM0.9	12-Apr-10	21 / 21	--	1.949 / 31.4	8.198	12.96	21.66	ERM0.9	10-May-10	38 / 40	--

Notes:

ERM - Emory River Mile

ND = not detected

TABLE H-24 SUMMARY STATISTICS FOR 2010 FISH FILLET SAMPLES IN THE EMORY RIVER

			Emory River 2010 Catfish Fillet Samples								Emory River 2010 Crappie Fillet Samples							
Analyte	Unit	Human Health Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value
% Lipids	%	--	--	0.92	2.98	6.1	ERM4.5	27-May-10	26 / 26	--	--	0.22	1.067	3.8	ERM0.9	12-Apr-10	13 / 13	--
% Moisture	%	--	--	76.2	79.55	82.1	ERM8.0	17-Jun-10	26 / 26	--	--	77.5	80.05	82.5	ERM0.9	12-Apr-10	13 / 13	--
Aluminum	mg/kg	135	3.553 / 4.139	ND	0	ND	--	--	0 / 26	--	3.645 / 4.155	ND	0	ND	--	--	0 / 13	--
Antimony	mg/kg	0.0541	0.01273 / 0.01493	ND	0	ND	--	--	0 / 26	--	0.01328 / 0.01504	ND	0	ND	--	--	0 / 13	--
Arsenic	mg/kg	0.0021	0.0247 / 0.02985	0.03553	0.06336	0.09894	ERM2.0	14-Apr-10	7 / 26	7	--	0.1195	0.2119	0.3052	ERM0.9	12-Apr-10	13 / 13	13
Barium	mg/kg	27	0.0399 / 0.04654	0.04029	0.1037	0.228	ERM4.5	27-May-10	21 / 26	--	0.04142 / 0.04725	0.1182	0.1182	0.1182	ERM8.0	26-Apr-10	1 / 13	--
Beryllium	mg/kg	0.27	0.02574 / 0.03066	ND	0	ND	--	--	0 / 26	--	0.02616 / 0.03152	ND	0	ND	--	--	0 / 13	--
Boron	mg/kg	27	0.361 / 0.4378	ND	0	ND	--	--	0 / 26	--	0.3706 / 0.4334	ND	0	ND	--	--	0 / 13	--
Cadmium	mg/kg	0.135	0.00684 / 0.00796	ND	0	ND	--	--	0 / 26	--	0.00698 / 0.00792	ND	0	ND	--	--	0 / 13	--
Calcium	mg/kg	--	--	153.9	793.9	3439	ERM4.5	27-May-10	26 / 26	--	--	98.28	423.8	2837	ERM8.0	26-Apr-10	13 / 13	--
Chromium	mg/kg	203	0.1121 / 0.1313	ND	0	ND	--	--	0 / 26	--	0.1148 / 0.132	0.1452	0.1452	0.1452	ERM8.0	26-Apr-10	1 / 13	--
Cobalt	mg/kg	0.0406	0.01254 / 0.01453	0.01621	0.02201	0.02856	ERM4.5	27-May-10	4 / 26	--	0.01283 / 0.01466	ND	0	ND	--	--	0 / 13	--
Copper	mg/kg	5.41	--	0.1969	0.8717	10.3	ERM0.9	6-Apr-10	26 / 26	1	0.1305 / 0.1504	0.1547	0.4715	2.745	ERM3.0	14-Apr-10	12 / 13	--
Iron	mg/kg	94.6	10.68 / 12.46	ND	0	ND	--	--	0 / 26	--	10.98 / 12.49	17.47	17.47	17.47	ERM0.9	12-Apr-10	1 / 13	--
Lead	mg/kg	--	0.0237 / 0.02873	0.0304	0.1836	0.448	ERM0.9	6-Apr-10	4 / 26	--	0.02475 / 0.02955	0.04416	0.07096	0.09776	ERM3.0	14-Apr-10	2 / 13	--
Magnesium	mg/kg	--	--	221.5	243.9	275.5	ERM4.5	27-May-10	26 / 26	--	--	246.8	282.1	337	ERM0.9	12-Apr-10	13 / 13	--
Manganese	mg/kg	18.9	--	0.221	0.5671	1.71	ERM4.5	27-May-10	26 / 26	--	0.1553 / 0.1767	0.1675	0.2861	0.4728	ERM8.0	26-Apr-10	3 / 13	--
Mercury	mg/kg	0.0406	--	0.02328	0.09441	0.2509	ERM8.0	17-Jun-10	26 / 26	23	--	0.028	0.08274	0.1584	ERM3.0	20-Apr-10	13 / 13	12
Molybdenum	mg/kg	0.676	0.0304 / 0.03629	ND	0	ND	--	--	0 / 26	--	0.0315 / 0.03675	ND	0	ND	--	--	0 / 13	--
Nickel	mg/kg	2.7	0.0874 / 0.1015	0.198	0.3294	0.5512	ERM4.5	27-May-10	5 / 26	--	0.08938 / 0.1015	0.192	0.3498	0.5076	ERM3.0	14-Apr-10	2 / 13	--
Potassium	mg/kg	--	--	3514	3905	4338	ERM8.0	17-Jun-10	26 / 26	--	--	3535	3923	4466	ERM0.9	12-Apr-10	13 / 13	--
Selenium	mg/kg	0.676	--	0.1572	0.3004	0.4796	ERM2.0	15-Apr-10	26 / 26	--	--	0.175	0.47	0.6912	ERM3.0	20-Apr-10	13 / 13	1
Silver	mg/kg	0.676	0.00247 / 0.00299	ND	0	ND	--	--	0 / 26	--	0.00262 / 0.00305	ND	0	ND	--	--	0 / 13	--
Sodium	mg/kg	--	--	287.3	431.7	565.4	ERM4.5	27-May-10	26 / 26	--	--	255.9	313.8	427.5	ERM0.9	12-Apr-10	13 / 13	--
Strontium	mg/kg	--	--	0.1486	0.6483	2.394	ERM4.5	27-May-10	26 / 26	--	--	0.04887	0.2709	1.694	ERM8.0	26-Apr-10	13 / 13	--
Thallium	mg/kg	0.00876	0.01216 / 0.01433	ND	0	ND	--	--	0 / 26	--	0.0126 / 0.01418	0.01439	0.0237	0.03816	ERM0.9	12-Apr-10	8 / 13	8
Vanadium	mg/kg	0.681	0.0399 / 0.04776	ND	0	ND	--	--	0 / 26	--	0.04142 / 0.04728	ND	0	ND	--	--	0 / 13	--
Zinc	mg/kg	40.6	--	5.501	7.725	12.86	ERM0.9	6-Apr-10	26 / 26	--	--	5.712	7.632	12.12	ERM0.9	12-Apr-10	13 / 13	--

Notes:

ERM - Emory River Mile

ND = not detected

TABLE H-25 SUMMARY STATISTICS FOR 2010 FISH FILLET SAMPLES IN THE CLINCH RIVER

			Clinch River 2010 Largemouth Bass Fillet Samples								Clinch River 2010 Bluegill and Redear Sunfish Fillet Samples							
Analyte	Unit	Human Health Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value
% Lipids	%	--	--	0.27	1.456	6.9	CRM3.5	12-Apr-10	24 / 24	--	--	0.17	0.7202	3.4	CRM8.0	13-Apr-10	41 / 41	--
% Moisture	%	--	--	69.1	78.4	80.4	CRM1.5	14-Apr-10	24 / 24	--	--	75.1	80.98	84.1	CRM8.0	13-Apr-10	41 / 41	--
Aluminum	mg/kg	135	3.585 / 4.142	ND	0	ND	--	--	0 / 24	--	3.54 / 4.162	ND	0	ND	--	--	0 / 35	--
Antimony	mg/kg	0.0541	0.01298 / 0.01498	ND	0	ND	--	--	0 / 24	--	0.0127 / 0.01512	ND	0	ND	--	--	0 / 41	--
Arsenic	mg/kg	0.0021	--	0.0588	0.2588	0.4944	CRM25.0	17-May-10	24 / 24	24	0.02392 / 0.02886	0.03384	0.1611	0.3216	CRM1.5	12-May-10	40 / 41	40
Barium	mg/kg	27	0.04137 / 0.04807	0.104	0.2669	0.5871	CRM3.5	12-Apr-10	3 / 24	--	0.04 / 0.0483	0.043	0.1263	0.451	CRM8.0	13-Apr-10	24 / 40	--
Beryllium	mg/kg	0.27	0.02561 / 0.03135	ND	0	ND	--	--	0 / 24	--	0.02576 / 0.0315	ND	0	ND	--	--	0 / 41	--
Boron	mg/kg	27	0.374 / 0.4326	ND	0	ND	--	--	0 / 24	--	0.36 / 0.4325	0.4816	0.4816	0.4816	CRM8.0	40281	1 / 41	--
Cadmium	mg/kg	0.135	0.00682 / 0.00796	ND	0	ND	--	--	0 / 24	--	0.00662 / 0.008	0.01435	0.01435	0.01435	CRM25.0	40315	1 / 41	--
Calcium	mg/kg	--	--	89.04	1467	21414	CRM3.5	12-Apr-10	24 / 24	--	--	95.13	1084	7934	CRM8.0	13-Apr-10	41 / 41	--
Chromium	mg/kg	203	0.1143 / 0.1318	0.1624	0.2822	0.4334	CRM25.0	17-May-10	3 / 24	--	0.1104 / 0.1323	0.3162	0.3162	0.3162	CRM8.0	40281	1 / 41	--
Cobalt	mg/kg	0.0406	0.01254 / 0.01451	0.01761	0.01761	0.01761	CRM3.5	12-Apr-10	1 / 24	--	0.01233 / 0.0147	0.01544	0.01622	0.01699	CRM25.0	40315	2 / 41	--
Copper	mg/kg	5.41	--	0.1498	0.2864	0.5562	CRM3.5	12-Apr-10	24 / 24	--	0.127 / 0.1488	0.1488	0.2428	0.4576	CRM25.0	17-May-10	38 / 41	--
Iron	mg/kg	94.6	10.8 / 12.47	17.58	17.58	17.58	CRM3.5	12-Apr-10	1 / 24	--	10.66 / 12.52	ND	0	ND	--	--	0 / 35	--
Lead	mg/kg	--	0.0242 / 0.02926	0.04326	0.04326	0.04326	CRM25.0	17-May-10	1 / 24	--	0.02392 / 0.02941	0.02898	0.04704	0.0651	CRM1.5	12-May-10	2 / 41	--
Magnesium	mg/kg	--	--	244.3	304.2	550	CRM3.5	12-Apr-10	24 / 24	--	--	217.5	281.1	369	CRM8.0	13-Apr-10	41 / 41	--
Manganese	mg/kg	18.9	0.1518 / 0.1756	0.1695	0.4141	2.719	CRM3.5	12-Apr-10	14 / 24	--	0.149 / 0.1764	0.166	1.034	8.774	CRM8.0	13-Apr-10	30 / 41	--
Mercury	mg/kg	0.0406		0.02955	0.107	0.3952	CRM1.5	14-Apr-10	24 / 24	22		0.01154	0.05995	0.1383	CRM8.0	13-Apr-10	41 / 41	31
Molybdenum	mg/kg	0.676	0.0308 / 0.03744	ND	0	ND	--	--	0 / 24	--	0.03128 / 0.0369	ND	0	ND	--	--	0 / 41	--
Nickel	mg/kg	2.7	0.08668 / 0.2343	0.103	0.1483	0.2758	CRM25.0	17-May-10	5 / 24	--	0.08464 / 0.376	0.09417	0.1277	0.167	CRM25.0	17-May-10	4 / 41	--
Potassium	mg/kg	--	--	2426	3830	4494	CRM8.0	13-Apr-10	24 / 24	--	--	2528	3497	4240	CRM25.0	17-May-10	41 / 41	--
Selenium	mg/kg	0.676	--	0.3914	0.548	1.021	CRM25.0	4-May-10	24 / 24	3	--	0.3774	0.7458	1.286	CRM1.5	12-May-10	41 / 41	23
Silver	mg/kg	0.676	0.00256 / 0.00305	ND	0	ND	--	--	0 / 24	--	0.00257 / 0.00346	ND	0	ND	--	--	0 / 41	--
Sodium	mg/kg	--	--	336.9	502.9	1650	CRM3.5	12-Apr-10	24 / 24	--	--	233.6	408.7	662.5	CRM3.5	12-Apr-10	41 / 41	--
Strontium	mg/kg	--	--	0.04334	1.097	15.82	CRM3.5	12-Apr-10	24 / 24	--	0.038 / 0.0462	0.04922	0.875	5.822	CRM8.0	13-Apr-10	40 / 41	--
Thallium	mg/kg	0.00876	0.01232 / 0.01421	0.01271	0.01484	0.01797	CRM8.0	13-Apr-10	6 / 24	6	0.01196 / 0.01435	0.01376	0.0199	0.03015	CRM1.5	40310	12 / 41	12
Vanadium	mg/kg	0.681	0.04137 / 0.04807	0.08151	0.08151	0.08151	CRM8.0	13-Apr-10	1 / 24	--	0.04 / 0.0483	0.04464	0.04464	0.04464	CRM8.0	40281	1 / 41	--
Zinc	mg/kg	40.6	--	4.136	9.63	20.29	CRM25.0	17-May-10	24 / 24	--	1.92 / 10.99	7.987	14.22	20.8	CRM25.0	17-May-10	39 / 41	--

Notes:

CRM - Clinch River Mile

ND = not detected

TABLE H-25 SUMMARY STATISTICS FOR 2010 FISH FILLET SAMPLES IN THE CLINCH RIVER

			Clinch River 2010 Catfish Fillet Samples								Clinch River 2010 Crappie Fillet Samples							
Analyte	Unit	Human Health Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value	Detection Limit Range	Minimum Detected Result	Mean of Detections	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Count Exceeding Screening Value
% Lipids	%	--	--	0.57	2.566	5.1	CRM8.0	6-Apr-10	19 / 19	--	--	0.6	1.775	3.2	CRM8.0	13-Apr-10	12 / 12	--
% Moisture	%	--	--	76.5	79.51	83.3	CRM3.5	20-May-10	19 / 19	--	--	77.5	78.72	80.1	CRM8.0	13-Apr-10	12 / 12	--
Aluminum	mg/kg	135	3.507 / 4.121	ND	0	ND	--	--	0 / 19	--	3.507 / 4.137	ND	0	ND	--	--	0 / 12	--
Antimony	mg/kg	0.0541	0.01269 / 0.0149	ND	0	ND	--	--	0 / 19	--	0.0126 / 0.01491	ND	0	ND	--	--	0 / 12	--
Arsenic	mg/kg	0.0021	0.02505 / 0.02926	0.02678	0.04427	0.08492	CRM1.5	14-Apr-10	11 / 19	11	--	0.2354	0.2976	0.357	CRM8.0	13-Apr-10	12 / 12	12
Barium	mg/kg	27	0.0399 / 0.04824	0.04175	0.1136	0.3525	CRM8.0	6-Apr-10	12 / 19	--	0.0399 / 0.0483	0.054	0.054	0.054	CRM8.0	13-Apr-10	1 / 12	--
Beryllium	mg/kg	0.27	0.02505 / 0.03105	ND	0	ND	--	--	0 / 19	--	0.0252 / 0.0315	ND	0	ND	--	--	0 / 12	--
Boron	mg/kg	27	0.3674 / 0.4347	ND	0	ND	--	--	0 / 19	--	0.357 / 0.42	ND	0	ND	--	--	0 / 12	--
Cadmium	mg/kg	0.135	0.00668 / 0.00787	ND	0	ND	--	--	0 / 19	--	0.00663 / 0.00798	ND	0	ND	--	--	0 / 12	--
Calcium	mg/kg	--	--	101.9	1178	7661	CRM8.0	6-Apr-10	19 / 19	--	--	117.2	286.5	1337	CRM8.0	13-Apr-10	12 / 12	--
Chromium	mg/kg	203	0.1102 / 0.1307	0.1994	0.1994	0.1994	CRM1.5	6-Apr-10	1 / 19	--	0.1113 / 0.1323	0.1198	0.1198	0.1198	CRM1.5	40280	1 / 12	--
Cobalt	mg/kg	0.0406	0.01236 / 0.01449	0.01316	0.01904	0.03206	CRM8.0	6-Apr-10	7 / 19	--	0.01239 / 0.01452	ND	0	ND	--	--	0 / 12	--
Copper	mg/kg	5.41	--	0.2101	1.137	7.102	CRM1.5	14-Apr-10	19 / 19	1	--	0.1706	0.2399	0.441	CRM1.5	12-Apr-10	12 / 12	--
Iron	mg/kg	94.6	10.54 / 12.42	ND	0	ND	--	--	0 / 19	--	10.54 / 12.47	ND	0	ND	--	--	0 / 12	--
Lead	mg/kg	--	0.02505 / 0.02898	0.02775	0.1506	0.3088	CRM1.5	14-Apr-10	5 / 19	--	0.0252 / 0.0294	ND	0	ND	--	--	0 / 12	--
Magnesium	mg/kg	--	--	205.4	239.1	347.8	CRM8.0	6-Apr-10	19 / 19	--	--	252	281.4	313.9	CRM1.5	12-Apr-10	12 / 12	--
Manganese	mg/kg	18.9	--	0.1659	0.6702	2.961	CRM8.0	6-Apr-10	19 / 19	--	0.1491 / 0.1764	0.2068	0.3194	0.432	CRM8.0	13-Apr-10	2 / 12	--
Mercury	mg/kg	0.0406	--	0.04512	0.1057	0.3885	CRM3.5	20-May-10	19 / 19	19		0.0144	0.07024	0.1771	CRM8.0	13-Apr-10	12 / 12	8
Molybdenum	mg/kg	0.676	0.03006 / 0.03629	ND	0	ND	--	--	0 / 19	--	0.0315 / 0.03582	ND	0	ND			0 / 12	--
Nickel	mg/kg	2.7	0.08517 / 0.1005	0.1603	0.2659	0.4818	CRM1.5	6-Apr-10	6 / 19	--	0.0856 / 0.1012	0.1134	0.1134	0.1134	CRM1.5	12-Apr-10	1 / 12	--
Potassium	mg/kg	--	--	3049	3640	4222	CRM1.5	12-Apr-10	19 / 19	--	--	3696	4010	4338	CRM1.5	12-Apr-10	12 / 12	--
Selenium	mg/kg	0.676	--	0.1626	0.3128	0.4928	CRM1.5	6-Apr-10	19 / 19	--	--	0.2354	0.3168	0.441	CRM8.0	13-Apr-10	12 / 12	--
Silver	mg/kg	0.676	0.00251 / 0.00302	ND	0	ND	--	--	0 / 19	--	0.00252 / 0.00299	ND	0	ND			0 / 12	--
Sodium	mg/kg	--	--	349.4	463.1	748.2	CRM3.5	20-May-10	19 / 19	--	--	265.2	321.1	401.1	CRM1.5	12-Apr-10	12 / 12	--
Strontium	mg/kg	--	--	0.0777	0.8521	4.536	CRM8.0	6-Apr-10	19 / 19	--	--	0.0495	0.1698	0.9072	CRM8.0	13-Apr-10	12 / 12	--
Thallium	mg/kg	0.00876	0.01202 / 0.01427	ND	0	ND	--	--	0 / 19	--	0.01197 / 0.01428	0.0294	0.0294	0.0294	CRM8.0	13-Apr-10	1 / 12	1
Vanadium	mg/kg	0.681	0.0399 / 0.04761	ND	0	ND	--	--	0 / 19	--	0.0399 / 0.0483	ND	0	ND	--	--	0 / 12	--
Zinc	mg/kg	40.6	--	5.376	7.644	13.35	CRM8.0	6-Apr-10	19 / 19	--	--	5.234	6.654	8.883	CRM1.5	12-Apr-10	12 / 12	--

Notes:

CRM = Clinch River Mile

ND = not detected

TABLE H-26 RESULTS OF SEDIMENT BIOACCUMULATION TESTS

Analyte	KIF-ERM.VB.1										
	Sediment Concentration (mg/kg dry weight)	*C. fluminae* Concentrations (mg/kg dry weight)					Bioaccumulation Factors (BAFs)				
		CB.W.C.1-MS	CB.W.C.2-MS	CB.W.C.3-MS	CB.W.C.4-MS	CB.W.C.5-MS	CB.W.C.1-MS	CB.W.C.2-MS	CB.W.C.3-MS	CB.W.C.4-MS	CB.W.C.5-MS	Average BAF
Aluminum	14,200	433	126	165	76.1	85.7	0.031	0.009	0.012	0.005	0.006	0.012
Antimony	2.1	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Arsenic	70	1.7	1.7	1.7	0.78	0.74	0.024	0.024	0.024	0.011	0.011	0.019
Barium	410	8.7	4.7	8.5	2.7	2.8	0.021	0.011	0.021	0.007	0.007	0.013
Beryllium	3.3	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Boron	52.9	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Cadmium	0.31	ND	0.310	0.195	ND	ND	NA	1.001	0.629	NA	NA	NA
Calcium	6,750	435	1551	8268	992	479	0.065	0.230	1.225	0.147	0.071	0.347
Chromium	30.6	1.1	0.66	0.79	0.79	0.70	0.037	0.021	0.026	0.026	0.023	0.027
Cobalt	11.4	0.43	0.23	0.22	0.16	0.17	0.038	0.020	0.019	0.014	0.015	0.021
Copper	43.8	5.4	6.6	6.3	5.1	4.8	0.123	0.150	0.145	0.116	0.110	0.129
Iron	14,000	203	99.5	128	64.5	64.8	0.015	0.007	0.009	0.005	0.005	0.008
Lead	16.3	0.674	0.24	0.24	0.14	0.18	0.041	0.015	0.015	0.008	0.011	0.018
Magnesium	1,570	126	156	172	ND	ND	0.080	0.100	0.110	NA	NA	NA
Manganese	68	2.3	2.4	8.2	1.8	1.5	0.034	0.035	0.120	0.027	0.022	0.047
Mercury	0.12	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Molybdenum	3.6	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Nickel	24.3	0.81	0.32	0.35	0.24	0.25	0.033	0.013	0.015	0.010	0.010	0.016
Potassium	1,760	ND	375	424	ND	ND	NA	0.213	0.241	NA	NA	NA
Selenium	4.5	0.67	1.2	1.2	0.68	0.58	0.150	0.265	0.260	0.150	0.130	0.191
Silver	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Sodium	ND	ND	158	207	141	ND	NA	NA	NA	NA	NA	NA
Thallium	ND	ND	0.13	0.16	ND	ND	NA	NA	NA	NA	NA	NA
Vanadium	73.3	1.60	0.47	0.65	0.32	0.31	0.022	0.006	0.009	0.004	0.004	0.009
Zinc	37.2	17.4	25.9	26.8	16.0	15.9	0.467	0.696	0.721	0.430	0.426	0.548

Notes:

BAF = Bioaccumulation Factor [kg body weight (wet weight) / kg sediment (dry weight)].

ND -= Not detected above the sample quantitation limit.

NA = Not applicable; a BAF is not calculated if sediment concentrations or bioaccumulation concentrations are ND.

TABLE H-26 RESULTS OF SEDIMENT BIOACCUMULATION TESTS

Analyte	KIF-ERM.VB.2											
	Sediment Concentration	*C. fluminae* Concentrations (mg/kg dry weight)					Bioaccumulation Factors (BAFs)					
	(mg/kg dry weight)	CB.W.C.1-MS	CB.W.C.2-MS	CB.W.C.3-MS	CB.W.C.4-MS	CB.W.C.5-MS	CB.W.C.1-MS	CB.W.C.2-MS	CB.W.C.3-MS	CB.W.C.4-MS	CB.W.C.5-MS	Average BAF
Aluminum	18,800	136	253	65	506.1	64.5	0.007	0.013	0.003	0.027	0.003	0.011
Antimony	3.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Arsenic	96	0.8	1.2	0.4	1.77	0.50	0.009	0.013	0.005	0.018	0.005	0.010
Barium	411	3.0	4.7	1.5	7.8	1.5	0.007	0.011	0.004	0.019	0.004	0.009
Beryllium	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Boron	47.2	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Cadmium	0.47	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Calcium	5,240	425	723	246	315	272	0.081	0.138	0.047	0.060	0.052	0.076
Chromium	43.2	0.7	0.94	0.39	0.86	0.44	0.016	0.022	0.009	0.020	0.010	0.015
Cobalt	17.3	0.23	0.30	ND	0.45	0.12	0.013	0.017	NA	0.026	0.007	0.016
Copper	67.9	4.4	5.4	2.9	5.2	3.3	0.065	0.079	0.042	0.076	0.049	0.062
Iron	17,800	88	248.3	44	236.5	50.7	0.005	0.014	0.002	0.013	0.003	0.008
Lead	27.3	0.244	1.34	0.12	0.74	0.13	0.009	0.049	0.004	0.027	0.005	0.019
Magnesium	1,400	ND	122	ND	119.337	ND	NA	0.087	NA	0.085	NA	NA
Manganese	68	1.6	2.5	0.9	2.1	1.0	0.024	0.036	0.013	0.031	0.015	0.024
Mercury	0.19	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Molybdenum	3.5	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Nickel	40.4	0.37	0.60	0.22	0.96	0.23	0.009	0.015	0.005	0.024	0.006	0.012
Potassium	2,620	ND	ND	ND	132.597	ND	NA	NA	NA	0.051	NA	NA
Selenium	7.1	0.64	0.8	0.4	0.65	0.50	0.090	0.113	0.057	0.092	0.070	0.084
Silver	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Sodium	ND	119.490	152	ND	149	ND	NA	NA	NA	NA	NA	NA
Thallium	1.70	ND	0.13	ND	ND	ND	NA	0.079	NA	NA	NA	NA
Vanadium	102.0	0.64	1.11	0.32	1.99	0.35	0.006	0.011	0.003	0.019	0.003	0.009
Zinc	59.0	15.8	19.6	9.4	14.8	12.1	0.267	0.332	0.160	0.251	0.206	0.243

Notes:

BAF = Bioaccumulation Factor [kg body weight (wet weight) / kg sediment (dry weight)].

ND -= Not detected above the sample quantitation limit.

NA = Not applicable; a BAF is not calculated if sediment concentrations or bioaccumulation concentrations are ND.

TABLE H-26 RESULTS OF SEDIMENT BIOACCUMULATION TESTS

Analyte	KIF-ERM.VB.3											
	Sediment Concentration (mg/kg dry weight)	*C. fluminae* Concentrations (mg/kg dry weight)					Bioaccumulation Factors (BAFs)					
		CB.W.C.01-MS	CB.W.C.02-MS	CB.W.C.03-MS	CB.W.C.04-MS	CB.W.C.05-MS	CB.W.C.01-MS	CB.W.C.02-MS	CB.W.C.03-MS	CB.W.C.04-MS	CB.W.C.05-MS	Average BAF
Aluminum	16,522	1.9	2.4	0.93	2.2	2.0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Antimony	14.1	0.04	0.045	0.032	0.041	0.022	0.002	0.003	0.002	0.003	0.002	0.002
Arsenic	82	0.43	0.42	0.43	0.46	0.43	0.005	0.005	0.005	0.006	0.005	0.005
Barium	421	0.72	0.63	0.60	0.74	0.66	0.002	0.001	0.001	0.002	0.002	0.002
Beryllium	3.2	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Boron	60.7	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Cadmium	1.41	0.055	0.051	0.048	0.068	0.051	0.039	0.036	0.034	0.048	0.036	0.039
Calcium	6,476	248	194	183	209	496	0.038	0.030	0.028	0.032	0.077	0.041
Chromium	39.3	0.28	0.26	0.24	0.27	0.25	0.007	0.007	0.006	0.007	0.006	0.007
Cobalt	11.6	0.090	0.085	0.076	0.093	0.082	0.008	0.007	0.007	0.008	0.007	0.007
Copper	46.3	4.3	4.6	4.6	4.7	4.4	0.092	0.099	0.099	0.102	0.096	0.098
Iron	19,733	37.0	32.4	26.5	35.5	36.2	0.002	0.002	0.001	0.002	0.002	0.002
Lead	18.3	0.070	0.045	0.033	0.064	0.055	0.004	0.002	0.002	0.003	0.003	0.003
Magnesium	1,666	96.7	87.7	87.9	81.0	77.7	0.058	0.053	0.053	0.049	0.047	0.052
Manganese	89	1.8	1.5	1.4	1.8	2.0	0.020	0.017	0.016	0.020	0.022	0.019
Mercury	0.14	0.012	0.010	0.0088	0.0078	0.011	0.086	0.075	0.063	0.056	0.075	0.071
Molybdenum	4.3	0.14	0.14	0.14	0.15	0.14	0.033	0.033	0.033	0.036	0.033	0.034
Nickel	29.2	0.085	0.088	0.074	0.11	0.083	0.003	0.003	0.003	0.004	0.003	0.003
Potassium	2,332	64.8	69.4	66.7	71.0	53.0	0.028	0.030	0.029	0.030	0.023	0.028
Selenium	6.0	0.38	0.37	0.36	0.38	0.35	0.064	0.061	0.060	0.064	0.058	0.061
Silver	1.41	0.0045	0.0048	0.0059	0.0056	0.0052	0.003	0.003	0.004	0.004	0.004	0.004
Sodium	442.78	191	172	176	182	132	0.430	0.387	0.398	0.412	0.299	0.385
Strontium	NA	1.2	0.90	0.87	0.99	1.3	NA	NA	NA	NA	NA	NA
Thallium	2.81	0.049	0.038	0.042	0.054	0.042	0.018	0.014	0.015	0.019	0.015	0.016
Vanadium	77.6	ND	0.060	0.061	0.067	ND	NA	0.001	0.001	0.001	NA	NA
Zinc	43.2	12.7	11.8	12.0	12.1	11.1	0.294	0.274	0.277	0.279	0.256	0.276

Notes:

BAF = Bioaccumulation Factor [kg body weight (wet weight) / kg sediment (dry weight)].

ND -= Not detected above the sample quantitation limit.

NA = Not applicable; a BAF is not calculated if sediment concentrations or bioaccumulation concentrations are ND.

TABLE H-26 RESULTS OF SEDIMENT BIOACCUMULATION TESTS

Analyte	KIF-ERM.VB.4										
	Sediment Concentration (mg/kg dry weight)	*C. fluminae* Concentrations (mg/kg dry weight)					Bioaccumulation Factors (BAFs)				
		CB.W.C.01-MS	CB.W.C.02-MS	CB.W.C.03-MS	CB.W.C.04-MS	CB.W.C.05-MS	CB.W.C.01-MS	CB.W.C.02-MS	CB.W.C.03-MS	CB.W.C.04-MS	CB.W.C.05-MS	Average BAF
Aluminum	24,333	8.5	ND	3.64	7.9	3.4	0.0003	NA	0.0001	0.0003	0.0001	0.0002
Antimony	14.0	0.02	ND	0.020	0.027	0.021	0.002	NA	0.001	0.002	0.002	0.002
Arsenic	97	0.60	0.34	0.45	0.58	0.54	0.006	0.003	0.005	0.006	0.006	0.005
Barium	617	1.08	0.54	0.67	0.87	0.76	0.002	0.001	0.001	0.001	0.001	0.001
Beryllium	5.8	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Boron	81.7	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Cadmium	1.40	0.080	0.043	0.043	0.082	0.062	0.057	0.030	0.031	0.059	0.044	0.044
Calcium	9,032	388	187	228	273	269	0.043	0.021	0.025	0.030	0.030	0.030
Chromium	49.0	0.39	0.26	0.33	0.37	0.31	0.008	0.005	0.007	0.007	0.006	0.007
Cobalt	19.3	0.112	0.065	0.087	0.104	0.092	0.006	0.003	0.005	0.005	0.005	0.005
Copper	78.5	5.1	3.5	4.4	5.6	4.9	0.065	0.044	0.056	0.071	0.063	0.060
Iron	21,367	39.9	26.9	32.9	47.0	35.3	0.002	0.001	0.002	0.002	0.002	0.002
Lead	31.7	0.066	0.036	0.045	0.079	0.053	0.002	0.001	0.001	0.002	0.002	0.002
Magnesium	2,160	109.8	73.0	86.4	106.5	100.2	0.051	0.034	0.040	0.049	0.046	0.044
Manganese	88	1.9	1.5	1.7	2.1	2.1	0.022	0.017	0.019	0.023	0.024	0.021
Mercury	0.14	0.016	0.011	0.0077	0.0137	0.010	0.112	0.076	0.055	0.099	0.070	0.082
Molybdenum	4.2	0.22	0.15	0.13	0.21	0.16	0.053	0.035	0.031	0.049	0.037	0.041
Nickel	44.4	0.096	0.080	0.066	0.10	0.124	0.002	0.002	0.001	0.002	0.003	0.002
Potassium	3,435	114.0	ND	59.3	84.7	105.3	0.033	NA	0.017	0.025	0.031	0.026
Selenium	7.3	0.57	0.38	0.45	0.62	0.52	0.078	0.052	0.062	0.085	0.071	0.070
Silver	1.40	0.0057	0.0037	0.0051	0.0071	0.0047	0.004	0.003	0.004	0.005	0.003	0.004
Sodium	679.00	255	117	142	204	225	0.375	0.172	0.210	0.300	0.331	0.278
Strontium	NA	1.6	0.87	1.07	1.26	1.1	NA	NA	NA	NA	NA	NA
Thallium	2.81	0.058	0.030	0.038	0.057	0.055	0.021	0.011	0.013	0.020	0.020	0.017
Vanadium	123.5	0.106145251	ND	0.067	0.114	ND	0.001	NA	0.001	0.001	NA	NA
Zinc	66	15.0	10.1	11.0	15.0	13.9	0.228	0.154	0.168	0.228	0.212	0.198

Notes:

BAF = Bioaccumulation Factor [kg body weight (wet weight) / kg sediment (dry weight)].

ND -= Not detected above the sample quantitation limit.

NA = Not applicable; a BAF is not calculated if sediment concentrations or bioaccumulation concentrations are ND.

TABLE H-27 SUMMARY OF SPECIAL STUDIES

Matrix	TVA Special Studies
RA	**Ash Calcium Chloride Test Sample** Calcium chloride solution was proposed for use to settle dust during icy periods when water spray would not be feasible. For the purpose of assessing the potential for metals mobilization, a side-by-side bench scale laboratory test (bench test) using toxicity characteristic leaching procedure (TCLP) methods was performed. The bench test was conducted utilizing a single representative ash sample from KIF. The ash sample underwent a TCLP extraction using the method-defined acidic solution (US EPA SW-846 Method 1311). Results were compared to a separate aliquot of the same ash sample that underwent an extraction of the same duration and solid to liquid ratio using a 1 Normal calcium chloride solution. (Calcium Chloride Metals Mobilization Assessment Laboratory Bench Scale Test Work Plan TVA Kingston Fly Ash Recovery Project Kingston, Tennessee)
RA	**Ash Lime Test Sample** The objective of this test was to produce a product suitable for loading onto rail cars to support a cost analysis on the proposed use of lime materials (including cost of disposal). Information and recommendations from the tests included the following: 1. Type of lime or other material to add. 2. Amount of lime or other material to add for varying wet ash conditions; from very wet ash to ash around 32% moisture content. 3. Health and safety considerations during application. 4. Final state of the ash (hardening). 5. Methods of application to minimize the cost and minimize dust. The lime-treated ash was tested for pH after 12, 24, and 120 hours as well as sampled for TCLP analysis once the ash had dried. Temperature of the ambient air was recorded. Decant water was also sampled for pH. (Lime Test Work Plan)
RA	**Ash Physical Properties Sample (Vibracore)** Total organic carbon (TOC) in solid samples was quantified using a variety of commonly available methods that rely on differing chemistry. The study compared the analysis for TOC by the Walkley-Black, Lloyd Kahn, and ASTM D2974-00 methods. The difference in the underlying chemistry behind two of these methods had previously resulted in highly variable TOC results. This method comparison study was intended to identify a method for determining TOC that would produce reliable and reproducible results or means by which TOC measurement uncertainty can be assessed. (Total Organic Carbon Method Comparison Study Plan TVA Kingston Fossil Plant Kingston, Tennessee)
SW	**Ash Recovery System Special Study of filtered metals** Arsenic had been reported at higher values for 0.45 micron filtered samples than was believed to be typical for samples at the neutral pH values evident in the river. It was postulated that the force of the initial slide may have broken up arsenic containing particles into material that will pass through a 0.45 micron filter. To test this theory, samples were collected from puddles in the Cove area where Duke University reported higher than typical arsenic values. (KIF ICC Environmental – February 28, 2009 Arsenic Distribution by Particle Size)
RA	**Ash Settling Column Study** Ash was collected from various sources around the Kingston site including the intact portion of the dredge cell and ash from the spill area. The water used in the study was collected from the boat ramp at approximately Clinch River mile 4.5, near the Food City in Harriman, and then brought back to the Chickamauga Power Service Center (PSC) Building B where there are two settling columns approximately 7 feet in length. The ash was mixed to make 5% and 10% slurries of ash/river water in 55 gallon drums using a drum mixer for 15 minutes and then was allowed to sit for 5 minutes prior to being poured in to the settling columns. The slurries were added to the columns using a clean stainless steel bucket. Water in the column was stirred while being filled using a PVC pipe that was longer than the depth of the settling column as a stirrer. To reduce evaporation, the top of the column was covered. After filling the column, water samples were collected from six ports at regular time intervals. The ports were located at one-foot vertical intervals and were numbered in

TABLE H-27 SUMMARY OF SPECIAL STUDIES

Matrix	TVA Special Studies
	increasing height from the base of the column. Ports 1 thru 6 were sampled for a minimum of 24 hours. Total Suspended Solids (TSS) samples were collected from ports 2, 4, and 6. Turbidity readings were recorded using a Hach model 2100P turbidimeter from ports 1 thru 6, provided they had water at their height. TSS samples were placed in a refrigerator after collection prior to being placed on ice in a cooler and shipped to Test America for analysis. (email Adam Deimling 12/16/09)
RA/SED	**Ash Special Study for physical parameters** Jarrett Rudd with TDEC Air Pollution Control made a special request for sampling to better evaluate the possibility of ash becoming airborne, and the consequent potential health risk from airborne particulates due to metals/metalloids and silica. Four composite samples of ash were collected, two from the catwalk at the stilling pond discharge and two from the intact part of the dredge cell. GPS coordinates were obtained for each set of samples. Rob Crawford (TVA), Hal Irick(TVA), and Jarret Rudd split samples from the four locations. The first two samples were collected roughly 46 feet apart from the surface of what remains of the dredge cell. The top 1-2 inches was scraped away to remove the Flexterra coating and straw on the ground surface. TVA filled one, 1 liter, clear, glass jar while TDAPC requested a 500ml amber glass jar be filled. A precleaned (liquinox and DI water/ DI water triple rinsed), metal shovel was used to clear the surface. A similarly cleaned metal spoon was used to collect the samples. A mixing bowl was not used, however the containers were "filled by thirds" to ensure a homogenous, split sample was collected. The second two samples were collected using a precleaned Eckman dredge from the catwalk over the Ash Pond. There was some cat tail debris in the ash collected from this location that was removed from the sample by hand. Three scoops of material were placed in a precleaned stainless steel mixing bowl and homogenized with a precleaned spoon. The material was then transferred to precleaned containers. There was no need to collect by 'thirds' due to homogenizing in a bowl. (Rob Crawford email 3/17/09)
CN/OTH	**Cenosphere Sample** The purpose of this study was to evaluate and contrast the total metals concentrations between aliquots of “pure” cenospheres and non-cenosphere fly ash over pH 2 through pH 12. These data were used to enhance the knowledge base on differences in select chemical characteristics of cenosphere and non-cenosphere fly ash. The data were also used to verify/validate published total metals/metalloid data for fly ash at various pH ranges. (A Comparison of the Extractable Total Metals Concentrations between Cenosphere and Non-Cenosphere Fly Ash over a Wide Range of pH Values)
SED	**Clinch River Special Sampling for presence of ash PLM result** One sample (CITZENSED_CRM1.6) was provided to TDEC by a citizen who collected it from Clinch River Mile 1.6, north shore. The original sample was a rectangular block approximately six inches in thickness. The sample was delivered by TDEC – Barbara Scott to EPA- Dannena Bowman to TVA-Bill Rogers (COC P1DSED0316Y10A). Vertical sub-samples were examined under an optical microscope at 1-cm intervals to estimate the percent or absence of ash.
SED	**East Embayment confirmation PLM result** The data collected during this sampling event were designed to identify the presence/absence of ash and thickness by means of visual assessment. In addition, samples of each stratum encountered were sent off-site for laboratory polarized light microscopy (PLM) analysis. The information gathered during this sampling event was used to confirm that time-critical concurrence criteria for ash removal was complete in the northern end of the East Embayment. (East Embayment Sediment Sampling for Polarized Light Microscopy Kingston Fossil Plant Ash Spill February 17, 2010)
SW	**Surface water samples from Boy Scout and Church Camp swimming area** Art Ewing, director of Camp Buck Toms (Boy Scouts) and Vernon Tannahill, director of Cedine Bible Camp, requested that TVA sample the coves in which they hold recreation activities. Their desire was to send out a letter to all potential camp participants assuring them that it is safe to participate in water activities while at camp. Some families or campers were cancelling or hesitant to come, even though the camps were far downstream from any area directly affected by the ash spill. Sampling was performed in accordance with standard procedures and expedited turn time was requested from the laboratory in order to allow the camps to get out a letter in a timely fashion. (email from Dennis Yankee)

Appendix I
Safety and Health Summary

TABLE I-1 SAFETY AND HEALTH INCIDENTS (FY09)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
17-Jan-09	Recordable	Contusions/ Bruises	Work Practice	Finger / Hand /Arm	On Water	Southern Waste Services		A Southern Waste Services employee smashed his finger between a pump and a rock while trying to clear the equipment of debris.	1. Design and construct travel paths and work stations to allow for space and mobility during maintenance activities. 2. Prohibit travel and maintenance of any equipment on rocky surfaces. 3. Brief and train all technicians related to weight, configuration and proper handling of Foilex pump and any other equipment which may be used within work zones.
9-Feb-09	Recordable	Sprains/ Strains	Slips, Trips & Falls	Foot / Ankle / Leg	On Water	Southern Waste Services		Southern Waste Services employee suffered strained knee while descending a 45-50 degree angle boat ramp at Blue Springs Marina.	
20-Jul-09	Recordable	Contusions/ Bruises	Slips, Trips & Falls		Site Roads	Sevenson	WW Transport	Transport truck driver had load fall on him. Accident resulted in a fatality.	
29-Jul-09	Recordable	Contusions/ Bruises	Slips, Trips & Falls	Face / Mouth	Rail Line	Norfolk Southern		A Norfolk Southern employee was uncoupling an air hose with another employee. Employee slipped and struck another employee in the mouth.	
27-Aug-09	Recordable	Lacerations/ Punctures	Slips, Trips & Falls	Foot / Ankle / Leg	Processing Area	MACTEC		A MACTEC employee slipped and hit their knee. Note: this injury was upgraded after the laceration developed a staph infection.	
28-Aug-09	Recordable	Lacerations/ Punctures	Work Practice	Finger / Hand /Arm	Rail Spur	MACTEC		A MACTEC employee cut their arm while lining railcar. Several stitches were required to close wound.	1. Adequate lighting provided for work during times of low illumination. 2. Reviewed inspection procedures within site and unloading location.
30-Aug-09	Recordable	Sprains/ Strains	Slips, Trips & Falls	Foot / Ankle / Leg	Rail Spur	MACTEC		A MACTEC employee slipped getting into railcar and twisted their ankle.	
29-Dec-08	First Aid	Lacerations/ Punctures	Pocket Knife	Finger / Hand /Arm	General Site Area	Civil Projects		A Civil Projects employee cut finger with a pocket knife.	
31-Dec-08	First Aid	Contusions/ Bruises	Motor Vehicle Incident - All-Terrain Vehicle	Foot / Ankle / Leg	General Site Area	Civil Projects		A Civil Projects employee bruised foot that was run over by an all-terrain vehicle wheel.	
31-Dec-08	First Aid	Sprains/ Strains	Slips, Trips & Falls	Foot / Ankle / Leg	On Water	Southern Waste Services		A Southern Waste Services employee sprained ankle picking up material on the river bank.	
1-Jan-09	First Aid	Exposure	Thermal Stress		Processing Area	MACTEC		A MACTEC employee felt symptoms of heat stress. Employee was taken to paramedic for treatment and observation.	1. The MACTEC employee felt symptoms of heat stress. 2. Employee was taken to onsite paramedic for treatment and observation.
6-Jan-09	First Aid	Sprains/ Strains	Lifting	Back	General Site Area	Civil Projects		A Civil Projects laborer strained back while carrying pipe.	1. Ensure proper footing on surfaces. 2. Reinforce safe procedures for boarding/unboarding.
6-Jan-09	First Aid	Sprains/ Strains	Slips, Trips & Falls	Foot / Ankle / Leg	On Water	Hepaco		A Hepaco employee strained knee getting off boat.	1. More emphasis was placed on utilizing safe work practices while moving material. 2. The two-minute rule usage re-emphasized.
15-Feb-09	First Aid	Sprains/ Strains	Slips, Trips & Falls	Foot / Ankle / Leg	General Site Area	Civil Projects		A Civil Projects laborer stepped in a hole and twisted left knee while assisting a truck with back-up maneuver.	Stop and let loaded truck go by instead of pulling off of the road to pass.
17-Feb-09	First Aid	Sprains/ Strains	Slips, Trips & Falls	Back	On Water	Southern Waste Services		A Southern Waste Services slipped while lifting a hose and twisted his back.	
28-Feb-09	First Aid	Sprains/ Strains	Lifting	Back	General Site Area	Civil Projects		A Civil Projects employee strained their back while lifting a case of water.	Use caution when lifting.
20-Mar-09	First Aid	Lacerations/ Punctures	Work Practice	Finger / Hand /Arm	On Water	TVA River Ops		A TVA employee cut finger on boat propeller.	

TABLE I-1 SAFETY AND HEALTH INCIDENTS (FY09)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
27-May-09	First Aid	Sprains/ Strains	Slips, Trips & Falls	Foot / Ankle / Leg	On Water	Southern Waste Services		A Southern Waste Services employee twisted ankle when stepping in a hole on a barge.	1. Meeting held to inform that barge crew of hazards. 2. Readdress to the rest of the site in a safety meeting. 3. Painted the scuppers to increase visibility.
1-Jun-09	First Aid	Lacerations/ Punctures	Other		Support Houses	Civil Projects		A Civil Projects employee received minor lacerations when window panes fell out of a garage door he was closing near Dike T2.	
18-Jun-09	First Aid	Exposure	Thermal Stress	Thermal Stress	Rail Spur	Queen City		Event P575-09-22748. A Queen City employee passed out during work activities. Employee experienced heat stress when shoveling walkway ballast. He had drunk 4 bottles of water plus a Gatorade prior to event.	Personnel advised to drink more fluids and take breaks frequently in hot weather.
11-Jul-09	First Aid	Lacerations/ Punctures	Slips, Trips & Falls	Foot / Ankle / Leg	Site Roads	Civil Projects		A Civil Projects teamster was climbing into articulated dump truck when step leading to the cab broke.	1. Be more aware of surroundings when working. 2. Re-emphasis slips, trips, and fall hazards. 3. Educate on proper body positioning. 4. All articulated dump truck were inspected and steps repaired as needed.
11-Jul-09	First Aid	Contusions/ Bruises	Slips, Trips & Falls	Foot / Ankle / Leg	Site Roads	Civil Projects		A Civil Projects labor was pulling a trailer and tripped and fell.	
15-Jul-09	First Aid	Lacerations/ Punctures	Work Practice	Finger / Hand /Arm	Rail Spur	MACTEC		A MACTEC employee received a laceration from a sharp edge on a railcar while lining operation was taking place.	1. Increased awareness during inspections to look for sharp edges and have them identified or removed prior to lining. 2. Improved awareness during inspection procedures. 3. Selected improved glove that provides better laceration protection and incorporates some level of protection on top of the hand. 4. Instructed employees to keep hands away, to the extent practicable, form the edges of railcars.
27-Jul-09	First Aid	Lacerations/ Punctures	Slips, Trips & Falls	Finger / Hand /Arm	Railcar	MACTEC		A MACTEC employee received a laceration from a sharp edge on a railcar while lining operation was taking place.	
31-Jul-09	First Aid	Contusions/ Bruises	Slips, Trips & Falls		Site Roads	MACTEC		A MACTEC employee slipped getting out of the JIG aerial lift and hurt back. Employee suffered a back bruise resulting in a first aid when she fell while stepping onto the ground from a JIG she was operating.	1. Increased awareness during slippery conditions and ensure solid footing before exiting. 2. Ensured the lift was in good position with solid footing available for exit prior to exiting a man-lift. 3. Ensured the lift was as close to the ground as possible before personnel exit.
3-Aug-09	First Aid	Sprains/ Strains	Work Practice	Foot / Ankle / Leg	Site Roads	Civil Projects		A Civil Projects employee twisted ankle while working.	
5-Aug-09	First Aid	Lacerations/ Punctures	Slips, Trips & Falls		General Site Area	Sevenson		A Sevenson employee suffered an off duty ankle sprain but continued to work in spite of difficulty in working. Upon exiting the Exclusion Zone, the employee stumbled and scraped his arm.	
7-Aug-09	First Aid	Insect Bites	Other		General Site Area	Southern Waste Services		A Southern Waste Services employee was stung by a bee while working.	
8-Aug-09	First Aid	Contusions/ Bruises	Work Practice		Dragline Road	Sevenson		A mechanic working for Sevenson was replacing a fuel filter on an air compressor. A loose wire was hanging down and when the mechanic tried to reattach the fuel line he brushed the wire creating a spark. The spark ignited the residual gas in the line and was extinguished immediately. The mechanic suffered two blisters and refused medical treatment.	

TABLE I-1 SAFETY AND HEALTH INCIDENTS (FY09)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
13-Sep-09	First Aid	Contusions/ Bruises	Other	Foot / Ankle / Leg	Processing Area	MACTEC		A MACTEC employee injured the top of their foot by stepping on a rock awkwardly while placing bungee cords on railcars.	
2-Jan-09	Near Miss		Boating		On Water	Southern Waste Services		A Southern Waste Services boat started taking on water after it was overloaded. The occupants were retrieved and the boat was towed back to shore.	1. The swamped boat was taken out of service as a recovery boat. The motor was removed and reassigned into service for collection of shoreline materials. 2. A review of the other recovery boats was performed to ensure there were no other boats operating with marginal load capacities. 3. The Job Safety Analyses for these operations were revised to address the hazards and corrective actions identified by this incident. 4. The incident causes and corrective actions were reviewed with all Southern Waste Services crews during the morning safety briefing.
6-Feb-09	Near Miss		Slips, Trips & Falls	Foot / Ankle / Leg	On Water	Southern Waste Services		A Southern Waste Services employee slipped getting onto a barge and hit his shin.	1. Installed steps in area. 2. Stop work when unsafe hazards exist.
13-Mar-09	Near Miss		Slips, Trips & Falls	Foot / Ankle / Leg	General Site Area	Civil Projects		A Civil Projects employee tripped over a pipe and hit his knee. No treatment required.	Make sure work area was free of debris and good housekeeping practices maintained.
13-Jul-09	Near Miss		Slips, Trips & Falls		On Water	Trans Ash	Southern Shores	A Southern Shores employee fell overboard and was in the water for approximately seven minutes.	1. Discussed the incident with the crews and emphasized the need to maintain the requirement for never working alone. 2. Identified deviations in operations and associated red flags. Adjusted the Job Safety Analysis as necessary. 3. Procured whistles and lights for all personal flotation devices. 4. Identified alternatives to the over-boots that are worn to avoid walking through dredged ash or alternatives that allowed for workers to walk through clean areas and avoid the ash covered barges. 5. Installed ladders in common locations on all barges so crews in the water would know the location.
12-Aug-09	Near Miss				Rail Line	Norfolk Southern		A Norfolk Southern train derailed at the Kingston Ash Recovery Project entrance. There were no injuries or ash release.	1. Crews instructed to restore all switches to “normal” position after use. 2. Employees were instructed to double check their routes, including the position of switches, and where applicable, derails when making all moves. 3. During pre-shift job briefings with crews, Norfolk Southern supervisors discussed switch positioning requirements for crewmembers and the double checking of switches and derails when approaching in yard limits.

TABLE I-1 SAFETY AND HEALTH INCIDENTS (FY09)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
1-Sep-09	Near Miss				On Water	Sevenson		A Sevenson spud failed causing it to fall on the barge below.	1. The barge in question was taken out of service pending the results of an inspection of the second spud, the tugger, wire rope, pulleys and spud wells. 2. New equipment was inspected and a routine inspection process implemented of all equipment used onsite. 3. Recognition that the platform in which equipment was sitting on the water, such as barges, were to be routinely inspected as part of the work system. 4. Enforced stop work requirements when conditions deviated from what were recognized as routine activities. 5. Identified a vessel captain for each work platform and enforced accountability by the vessel captain for the equipment onboard as well as the work platform on which the equipment was placed. 6. Developed individual Job Safety Analyses when non-normal situations developed. 7. Review of the Dredging Work Plan required from supervision personnel and safety personnel. 8. Developed alternative means to manually lift spuds that prevented the need to rig spuds below the center of gravity. If two machines were used, one should always maintain control above the spuds center gravity. 9. Routinely reviewed/audited equipment inspection forms.
1-Jan-09	Property - Near Miss				On Water	Phillips & Jordan		Two boats from Phillips & Jordan broke loose and were retrieved by TVA Police.	
1-Jan-09	Property - Near Miss				General Site Area	HED		A fiberglass manhole was uncovered and damaged during ash excavation activities. Line appeared to be isolated.	
3-Jan-09	Property - Near Miss		Fire Onboard		On Water	Southern Waste Services		A Southern Waste Services boat fire initiated by a portable heater. The occupants were safely retrieved but the boat was significantly damaged.	1. At the time of the incident, all River Operation contractors were advised by TVA Safety to immediately inspect for and discontinue the use of any portable heaters on vessels that were not manufacturer designed and installed. 2. All vessels on the project were inspected to ensure design configuration of fuel system allowed for external venting of pressure/vacuum relief and that no vessels were operating onsite with non-manufacturer approved retrofitting of fuel system. 3. All vessels were inspected to ensure portable fire extinguishers were present, located properly, and of proper size (2½ lbs. for less than 17 feet and 5 lbs. for greater than 17 feet). 4. All vessels were required to conduct safety inspections at the start of each shift prior to disembarking. The inspections were to be documented, maintained on the vessel, and include inspection of fuel system for leaks, presence and availability of proper safety equipment, and compliance with other Coast Guard vessel safety requirements. 5. All boat captains reviewed the safety precautions and lessons learned from this incident with their crew as part of their morning safety briefing.
4-Jan-09	Property - Near Miss		Motor Vehicle Incident		Public Roads	Hepaco		A Hepaco boat trailer backed into and damaged a property owner's fence.	1. Corrective Action - Use 2 spotters or do not move vehicle until spotter can move to front of vehicle. 2. Reduce size of trailer.
4-Jan-09	Property - Near Miss		Motor Vehicle Incident		Public Roads	Hepaco & Civil Projects		A Hepaco and Civil Projects vehicle struck each other's mirrors when passing on a narrow road.	1. All Hepaco vehicles and Hepaco subcontractor vehicles to stop on narrow roads and allow oncoming vehicles to pass before moving.

TABLE I-1 SAFETY AND HEALTH INCIDENTS (FY09)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
5-Jan-09	Property - Near Miss		Fire On Board		On Water	Phillips & Jordan		A Phillips & Jordan boat had a small electrical short and the smoke was extinguished immediately.	1. Boats were to be continually inspected for proper operation. 2. Fire extinguishers were verified to be charged and present prior to boat operation.
24-Jan-09	Property - Near Miss		Motor Vehicle Incident		Site Roads	Southern Waste Services		A Southern Waste Services employee backed into a vehicle in a parking lot.	Advised to take a moment to become familiar with our surroundings, adjust mirrors accordingly, and back up slowly to give others the time to react.
15-Feb-09	Property - Near Miss		Slips, Trips & Falls		Site Roads	Civil Projects		A Civil Projects back dump slid off the road into a ditch.	
31-Mar-09	Property - Near Miss		Motor Vehicle Incident		Site Roads	Civil Projects		Event P575-09-22768. Vehicle accident at ramp to Skimmer Wall parking Dike C. Civil Projects fuel truck backed into Trans Ash pickup truck.	1. Use spotters when backing vehicles in congested areas. 2. Incorporate better traffic control for site. 3. All commercial vehicles equipped with backup alarms loud enough to hear in another vehicle.
11-May-09	Property - Near Miss				On Water	Southern Waste Services		Event P575-09-22767. A Southern Waste Services' debris boat started taking on water at Plant Intake and had to be towed to shore. Conclusions were that the weight capacity of the boat was exceeded and was further aggravated the situation by making a sharp turn and driving too fast for conditions.	1. Weight capacities of boats should never be exceeded. Bags should not be overfilled beyond the 30 lbs limit. 2. Maneuvers in the boats were closely monitored at all times, especially when carrying a load that lowers the boat in the water. 3. Boat speeds were limited so that turns do not severely dip the edge of the boat near the water.
27-Jun-09	Property - Near Miss		Damage to Instrumentation		Processing Area	MACTEC		Event P575-09-22749. At 1630, a MACTEC equipment operator struck two instrumentation conduits in the Ball Field area. One conduit housed multiple low voltage instrumentation cables (16 volt), the other was a PVC pipe filled with tap water. The inspection showed that the cables had been severed at the junction box and would need to be repaired. In addition, the water pipe was refilled and bled of all air in order for the associated instruments to work properly.	1. The employee was immediately attended to by the onsite medical staff, returning to work later in the day. 2. The truck was taken out of service and repaired. 3. The other dump trucks were inspected for possible step failure.
30-Jun-09	Property - Near Miss		Operator error		Ash Pond	Civil Projects		Event P575-09-22736. At 1630, a TVA operator was using a 200 John Deer long reach track-hoe to reposition a turbidity curtain along the discharge of the Sluice Trench into the Ash Pond. Upon extending the boom to apply tension to the curtain, the right track of the excavator immediately adjacent to the pond began to sink under the force. New piles of ash may have created conditions which lead to ground instability. Work in other areas of the site adjacent to known soft or wet areas was performed with specialized equipment with pontoon track mounts vs. a standard track mount assembly.	1. Two Civil Projects D-6 dozers equipped with winches were brought to the incident location and attached to the excavator with shackles and straps by a certified rigger. 2. A TVA mechanic assisted in the selection of attachment points to prevent damage to the equipment. 3. The first dozer was utilized to stabilize the excavator and prevent further sinking. Next, the dozers reoriented the excavator in the east/west direction and then assisted in pulling the equipment out to stable ground. 4. Heavy equipment activities performed on ash where stability issues may be in question require more than just a visual inspection from the cab prior to access. 5. A walk-down of the area was utilized to assist in stability determination as well as experience when working on ash in close proximity to water.
15-Jul-09	Property - Near Miss		Non-Injury	Sluice Trench area (East)	Site Roads	Civil Projects & Gibbons Farms	No	Event P575-09-22766. A minor collision occurred between a TVA box truck backed into a contractor's SUV (Gibbons Farms). The estimated vehicle damage was $1500. Discretionary.	1. Reminded of best practices to maintain 3 second rule for following distances. 2. Some vehicle were instructed to keep 50 foot distance between moving vehicles. 3. Installed signage onsite. 4. Reminded of hazards of reversing on a road that was accessed by other vehicles.

TABLE I-1 SAFETY AND HEALTH INCIDENTS (FY09)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
18-Jul-09	Property - Near Miss		Train Derailment		Rail Line	Norfolk Southern		Event P575-09-23625. At approximately 1630, a train derailment was reported on the Kingston Fossil Plant main yard line involving 4 cars of a 22 car load that was being pushed up the main yard line in a southerly direction by 3 engines. Each of the 22 cars had been filled with fly ash in preparation for transportation offsite later in the day. The first 16 cars still on the main yard line track were on the southern (leading) end of the push.	1. It was reported that no spillage of ash occurred as a result of the event and that the risk for shifting of the cars resulting in ash spillage or personnel injury was negligible. 2. As a result, the scene was determined safe for investigation and quarantined by marking cones and caution tape.
4-Aug-09	Property - Near Miss		Motor Vehicle Incident - No Damage		Site Roads	MACTEC		Event P575-09-26009. A MACTEC employee pulled into the MACTEC support zone to pick up other associates in the truck. As the driver was backing out, he stopped just shy of the snow fence. As the drive pulled forward, the snow fence became entangled in the bumper and the fence was pulled down.	1. Counter measures applied to not back over the railroad tracks. 2. Advised drivers to turnaround in the flat area of the Support Zone and drive out onto the road. However, If this was not possible due to congestion, then a ground guide (spotter) must be present when backing.
4-Aug-09	Property - Near Miss		Damage to Contractor Barges		Site Roads	Trans Ash & Southern Shores	Southern Shores	A Southern Shores barge slipped off of truck because of improper securing of tie downs.	
8-Aug-09	Property - Near Miss				Ash Pond	Civil Projects		A Civil Projects excavator got stuck in the Ash Pond and was deeply entrenched. Excavator was safely removed with no injuries to the excavator operator.	
28-Aug-09	Property - Near Miss				Public Roads	Civil Projects	GUBMK	During trenching, GUBMK cut into natural gas line on Lakeshore Drive.	1. Implemented adequate excavation practice to require hand digging around known areas of utilities. 2. Adequate Job safety Analyses developed for all work onsite including identification of task steps, recognized hazards, and controls to be utilized. 3. Formally established responsibility to oversee all activities occurring onsite including groups such as GUBMK. 4. Instructed all personnel on site control procedures during a hazardous material release incident. 5. No groups were allowed to approach an active release incident without properly verifying area was safe using appropriate air monitoring equipment.
3-Sep-09	Property - Near Miss				Material Access Point	Sevenson		A Sevenson backhoe fell into a ditch.	

13-Sep-09
29-Dec-08

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
9-Nov-09	Recordable	Sprains / Strains	Muscle Stress	Shoulder	Ball Field	MACTEC		A MACTEC forklift operator injured their shoulder unloading 40-lb bags of polymer from a forklift to the top of railcars. At the time of injury the crew was on Track #1 at ~ railcar #17 of the cut of 22 cars. The employee described she was moving a bag off the pallet at approximately shoulder height. She turned and swung the bag across her body from right to left, tossing it into the car. She felt pain in her shoulder but kept working, finishing out the remaining cars in the cut of 22.	1. Employee reported the injury to her foreman, who reported to MACTEC safety personnel. The injured employee visited the onsite clinic and was taken by MACTEC supervision to Methodist Medical Center in Oak Ridge for further evaluation. The employee was prescribed medications and placed on medical restrictions; no lifting, pushing, pulling, or repetitive use of the right arm until a follow-up visit on November 11, 2009. 2. MACTEC and Jacobs safety personnel evaluated the techniques used by the crew to distribute polymer into the railcars. Based on the observations, several modifications were made to the height the forklift operator placed the top of the pallet in reference to the laborer removing the bags. Instruction was also given for proper movement of the bags by the laborers and a restriction from swinging the bags across the body to toss them into the railcar.
9-Dec-09	Recordable	Sprains / Strains	Muscle Stress	Strained Muscle	Dredge Boat	Sevenson		A Sevenson dredge boat operator pulled a muscle while pulling cables on the dredge boat.	River operations were terminated for the day at about 0900 on December 9, 2009.
23-Dec-09	Recordable	Lacerations / Punctures	Employee Judgment	Hand	On Water	TVA		A TVA employee severed four fingers after getting it caught in a pulley on a debris barge.	
4-Jan-10	Recordable	Sprains / Strains	Employee Judgment	Knee	Ball Field	MACTEC		A MACTEC laborer twisted their knee resoling in work restriction.	MACTEC-appointed personnel were responsible for removing the blue flag and contacting the railroad personnel to remove railcars. MACTEC-appointed personnel were instructed not to remove the blue flag or contact railroad personal until a foreman/supervisor verified that all personnel were out of the railcars and rail yard area.
29-Jan-10	Recordable	Contusions / Bruises	Slip	Bruised Calf	Dredge	Sevenson	L.W. Matteson	A L.W. Matteson employee slipped and bruised their calf. The employee received pain medicine from medical personal.	Other workers on the dredge were notified of the stair condition. The dredge surface and stairs were treated with deicing material during the inclement weather. Other workers on the dredge were notified of the stair condition. The dredge surface and stairs were treated with deicing material during the inclement weather.
4-Feb-10	Recordable	Sprains/ Strains	Unlevel Ground	Ankle	Parking lot, South Decon Area	Sevenson		The Sevenson worker sprained his right ankle, rolling it on a rock as he stepped out of a crew van. He was taken to the onsite clinic on the same day, examined, and returned to work. The incident was classified as a first aid case. He made two follow-up visits to the company occupational clinic over the next three weeks. On the second visit he was provided with a prescription for pain medication. This resulted in the injury being reclassified as an OSHA recordable case.	The other crew members were notified of this incident and need for vigilance when walking on steps during inclement weather. Investigating the ability to place a non-skid surface on the public dock.
5-Feb-10	Recordable	Sprains / Strains	Wet Flooring	Sprained Ankle	On Water	TVA		A TVA employee was returning from performing dredge plume monitoring within the river system. As she stepped off of the Carolina Skiff with her right foot onto the wood dock, her foot slipped out from under her causing her feet to split out. As she slipped, her left foot twisted outward (laterally) causing a sharp pain in her ankle and lower leg. The crew removed the boat and returned to the sampling house where they reported the incident to their supervisor and then drove to the onsite clinic for evaluation. The paramedic recommended further evaluation at Park Med in Oak Ridge, TN. A crew member and supervisor transported the individual to the medical center.	Ibuprofen, cold pack, ace bandage. Referred to TVA nurse. The other crew members were notified of this incident and need for vigilance when walking on steps during inclement weather. Nonskid material was applied to all docks.

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
14-Feb-10	Recordable	Fractures	Fall	Arm	On Water	Sevenson		A Sevenson tug boat captain slipped going down boat steps and broke their arm.	1. Install structures for workers to grab onto for descending the ladders. This will involve a retrofitting of the area around the vault hatch. 2. Attach new non-slip tape to the ladder steps, covering exposed metal spots. 3. Post a co-worker at the hatch opening as a sentry when the engine room another worker is in the engine room.
14-Feb-10	Recordable	Contusions/ Bruises	Slip	Head / Back	Equipment	Civil Projects		A Civil Projects laborer slipped while getting off a water truck and fell, striking their head and back on the pavement.	Briefed work crews on precautions to be taken when exiting vehicles.
18-Feb-10	Recordable	Sprains/ Strains	Muscle Stress	Back	Equipment	Sevenson		A Sevenson operator twisted their back reaching for a bottle of water to clean windshield.	Incident was investigated and crew briefed on the details of the incident.
19-Feb-10	Recordable	Sprains/ Strains	Broken Axel	Back	Rail Yard	MACTEC		At approximately 1310, MACTEC laborers were lining railcars along Track 6 and 7 in the lining yard. The lift was running north straddling the rail with its tires on Track 7. The basket of the lift was trailing the body of the lift and was slightly elevated (approximately horizontal) to provide line of sight for driving when the axle of the right wheel closest to the basket broke in half and the wheel fell off. The frame of the lift came to rest on the west rail of Track 7. The operator and passenger were both jarred due to the impact. The passenger had some general discomfort and was taken to the onsite medical clinic for evaluation and was released to return to work. The lift operator also visited the clinic prior to leaving site for an evaluation. Follow up was made with both the operator and the passenger prior to leaving the site at the end of shift to ensure they understand the protocols if increasing pain sets in while offsite for the night. The employee stated he was in a lift basket with required PPE in place, the lift was approximately 6 to 7 feet off the ground, and was being moved to a railcar when the axel shaft broke causing the lift to fall. The basket landed on the rails of the track and did not turn over.	1. All lifts associated with the lining tracks were checked by the ICS mechanic (MACTEC subcontract mechanic) for extent of conditions. One lift was found to have two wheels that had minor oil leaks. All lining track aerial lifts were moved off of the tracks and parked and received a Hertz rental mechanic inspection prior to being put back in service. 2. Blue flag protection was in place for the operation on the lining tracks. The broken lift remained in place along Track 7 until repairs by Hertz rental mechanics were complete, then the lift was driven off the tracks.
1-Mar-10	Recordable	Sprains/ Strains	TBD	Shoulder	Filter Press	Sevenson		The Sevenson worker was a member of the Filter Press area crew. His primary task is to manually separate filtering plates that dewater the ash dredged from the Ash Pond. This manual activity occured throughout the shift. The worker experienced tightness in his right shoulder and numbness / tingling in his hand after his shift on 2/27. He was not scheduled for work on 2/28. He reported the injury to the contractor on the morning of 3/1 and was taken to the contractor's occupational clinic that day, where the diagnosis was a possible shoulder strain. He was placed on restricted duty.	1. Crew members to take breaks or change tasks throughout the shift. 2. Performed additional ergonomic study of the activity and developed controls for the ergonomic hazards.
2-Mar-10	Recordable	Fractures	Employee Judgment	Pelvis / Liver	Filter Press	Sevenson		A Sevenson operator fell off the Filter Press resulting in a fractured hip and liver. The operator stated he was on the catwalk of the press when he tripped in a "hole" causing him to fall, hitting a pump approximately 3 to 4 feet down, then landed on some hoses on the ground, approximately 8 feet down.	1. Filter Press area was shut down and crews were briefed on the incident. 2. Sevenson senior management prepared for stand down activities for day and night shifts on March 3, 2010. 3. Sevenson and Jacobs safety performed an extent of condition walk through to verify all railings and catwalks were adequate and that all hazard markings remained in place.

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
25-Mar-10	Recordable	Fractures	Rated Capacity of the Crane was Exceeded	Head / Face / Neck	Sluice Trench	Sevenson		At 0853, an accident involving a crane occurred at the Kingston Ash Recovery Project site. A Sevenson contract employee was operating a crane when the clam shell bucket struck the cab of the crane knocking him from the cab onto the railing of the cat-walk. A drug screen was preformed at the emergency department. The employee was injured and taken to the local hospital for evaluation. The employee had multiple facial injuries and was in stable condition.	1. Full immobilization, air-lifted to trauma center. 2. The scene was secured and an investigation performed.
15-Apr-10	Recordable	Sprains/ Strains	Material Handling	Back	Filter Press	Sevenson		Around 0130, a Sevenson employee was performing his normal assigned task of pulling press plates when he felt tightness in his lower back. He continued pulling the rest of the press then took a water break. Upon returning to pull another press at 0140, the pain increased at which time supervisor was notified.	
14-May-10	Recordable	Insect Bite		Leg	River Shoreline	Southern Waste Services		At approximately 1500, a Southern Waste Services employee was working on the shoreline at New Hope Cove in waders removing debris from the water when he felt a pinching sensation in his left calf. Suspecting an insect bite, he swatted at the affected area and the sensation stopped. The employee felt no symptoms or discomfort from the bite at the time of the incident and returned to his hotel for the night. When he woke up the following morning, the affected area had grown slightly red and swollen at the area where the bite occurred. He proceeded to go to work but throughout the course of the day he noticed increased swelling, discomfort, and puss buildup in the affected area. He notified his supervisor who called the Eagle/Southern Waste Services safety officer.	The employee was taken to visit the onsite clinic and was advised to see a doctor at Park Medical Urgent Care Center. An antibiotic was prescribed to treat the infection and the employee returned to work as scheduled Monday morning May 17, 2010. On Tuesday, May 18, 2010, Eagle/Southern Waste Services Safety Officer Kent Fedoroff conducted a full review of biological hazards with all onsite Eagle/Southern Waste Services personnel. Topics included bee and wasp stings, spider bites, ticks, and snakes local to the area.
29-Jun-10	Recordable	Insect Bite				Facilities		A Facilities Maintenance employee was stung by a hornet as he walked across a yard. The employee was treated at the onsite clinic and was sent to the emergency room where he was diagnosis as having an allergic reaction and was given an EpiPen injection and Benadryl. The employee returned to work.	Provided awareness to employee about working around bees and hornets. Sprayed hornets nest.
9-Jul-10	Recordable	Insect Bite				Facilities		A Facilities employee was performing maintenance work and was stung by an unidentified insect; broke out in a rash; EpiPen administered along with 50 mg of Benadryl. The employee was given a steroid injection while at Roane County Medical Center emergency room. Cooks Pest Control was notified and responded same day to spray specific property.	
1-Oct-09	First Aid	Lacerations / Punctures	Slip	Leg	T-2 Settlement Pond	Civil Projects	Wilco Marsh Buggy	A Wilco Marsh Buggy operator slipped while accessing the equipment and suffered a small abrasion on his left shin.	Worker was taken to the onsite clinic where the abrasion was treated (cleaned, antibiotic ointment, bandage). The employee was returned to normal duty.
2-Oct-09	First Aid	Sprains / Strains		Finger / Hand / Arm	Processing Area	Civil Projects		A Civil Projects laborer was cleaning the tracks of a dozer when he struck a steel plate between the tracks resulting in a strain to the arm and shoulder.	The employee was taken to the onsite clinic and given Ibuprofen and ice. The employee was released to normal duties.
14-Oct-09	First Aid	Lacerations / Punctures	Struck Against	Fingers / Thumb	Trailer City	Civil Projects	James Bolton Modular Homes	A James Bolton Modular Homes employee stated he was pulling a piece of tin and scratched his finger.	Cleaned and bandaged
16-Oct-09	First Aid	Lacerations / Punctures	Struck Against	Arm / Elbow	Trailer City	Civil Projects	James Bolton Modular Homes	A James Bolton Modular Homes employee stated a drill became stuck and he was pulling it loose when his forearm hit a 2x4 and knocked an existing scab off.	Cleaned, antibiotic ointment, bandaged

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
20-Oct-09	First Aid	Sprains / Strains	Slips, Trips & Falls	Foot / Ankle	Offsite fuel station	Civil Projects		A Civil Projects employee stated he was getting out of the truck at a gas station. As he stepped down from the truck onto the ground his foot twisted on the uneven pavement suffering a low ankle sprain while exiting the vehicle.	Ace bandage, cold pack, elevate
28-Oct-09	First Aid	Lacerations/ Punctures		Finger / Hand /Arm	Trailer City	Civil Projects	Bolton Modular	A James Bolton Modular Homes employee received a puncture wound to his finger when a nail gun accidently shot in the wrong direction. The employee stated he was putting plastic on the trailer to be moved when the staple gun he was using slipped and a staple went into his finger.	Cleaned, antibiotic ointment, bandage. Discussed with the crew different methods of abatement and best method was determined to be to screw metal down with self-tapping screw to the 2x4.
26-Apr-10	First Aid	Lacerations/ Punctures	Rubbed / Abraded	Arm/Elbow	Rail Yard	MACTEC		A MACTEC employee stated he was lining the railcars when his upper arm rubbed against the top of the car and caught on a metal shard.	Cleaned, antiseptic, steri-strip, bandage
26-Apr-10	First Aid	Sprains/ Strains	Slips, Trips & Falls	Foot/Ankle	Sluice Trench	Sevenson		A Sevenson employee stated he was getting out of his articulating truck, missed the bottom step, and his ankle twisted when his foot landed on the ground.	Ibuprofen, cold pack, Ace bandage, elevate
19-Nov-09	First Aid	Lacerations/ Punctures		Finger	Barge	Sevenson		A Sevenson laborer's right index finger was punctured by a shard from a wire rope. The laborer was wearing leather work gloves at the time. The laborer was on a barge handling anchor cable, when the barge shifed due to wave action, causing the slack in the cable to tighten. Upon tightening, a metal shard protruding from the rope puntured through the glove into his finger but did not fully embed into his finger.	First aid was administered by the site paramedic, and the laborer returned to work. Corrective measures were reviewed and included upgrades to hand protection for specific tasks and changed work practices when handling wire rope.
4-Dec-09	First Aid	Lacerations / Punctures	Rubbed / Abraded	Fingers / Thumb	Lakeshore	TVA		A TVA employee stated she was putting her personal trash in the Dumpster and caught her finger on the Dumpster.	Cleaned, antibiotic ointment, bandaged
5-Dec-09	First Aid	Foreign Body	Rubbed / Abraded	Eye	Dike D	Civil Projects		A Civil Projects employee stated he rubbed his cheek with his gloved hand and some dirt got into his eye.	Flushed, Refresh drops
7-Dec-09	First Aid	Sprains / Strains		Back		Southern Waste		A Southern Waste Services employee suffered a strained back while moving boom and falling in a hole.	
8-Dec-09	First Aid	Contusions / Bruises	Slips, Trips & Falls Elevation	Shoulder	Dike T2	Civil Projects		A Civil Projects employee stated he climbed onto the C-frame of the dozer to check the oil, and while raising the hood he became overbalanced and fell backward onto the dirt/gravel ground.	Ibuprofen
14-Dec-09	First Aid	Sprains / Strains	Caught In / Between / Under	Leg / Knee	Sluice Trench	Civil Projects		A Civil Projects employee stated that while walking to his crane his right leg sank into the wet ash and while trying to free his right leg he twisted his left knee stating he heard a "pop."	Cold pack, ibuprofen
18-Dec-09	First Aid	Foreign Body		Eye	Trailer City	Jacobs		A Jacobs employee stated she thought she might have an eyelash in her eye and couldn't get it out.	Flushed, Refresh drops
8-Jan-10	First Aid	Sprains / Strains		Groin Area		Sevenson		A Sevenson operator reported a pulled muscle while climbing onto an excavator. Sevenson safety took him to the TVA clinic for evaluation. The paramedic diagnosed a pulled groin muscle and recommended that the employee go home and place ice on the affected area. The employee went home. Sevenson generated an incident report and an investigation and report followed.	
13-Jan-10	First Aid	Sprains / Strains	Body Position	Shoulder	Trailer City	Facilities		At approximately 0800, a GUBMK employee stated he was loading 4x4's into the back of a truck when he heard and felt a pop.	Ibuprofen, cold pack, Biofreeze

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
22-Jan-10	First Aid	Sprains/ Strains	Slips, Trips & Falls Same Level	Leg / Knee	Northeast Embankment	Civil Projects		A Civil Projects employee stated that he started to step out of a dike around 12-inch pump, his left foot slipped over to the other side of dike and his right foot slipped back inside dike into a semi-split, then he fell.	Ibuprofen, cold pack, Biofreeze
27-Jan-10	First Aid	Lacerations / Punctures	Wall Collapsing	Fingers / Thumb	Ball Field	Sevenson		A Sevenson track hoe turned over on the secondary containment dike wall in the Ball Field area as the operator was tracking northward. The wall collapsed causing the track hoe to turn over.	Cleaned, antibiotic ointment, bandage, ibuprofen. An immediate stand-down was initiated by Sevenson management. The area in which this incident occurred was controlled with caution tape, workers were instructed to refrain from entering this area until it could be confirmed as safe. Once the area was deemed safe to enter, operators were instructed to remove material surrounding the overturned equipment and stabilize the secondary containment wall to prevent further sloughing. Once the area was stabilized and the initial investigation complete, operators were instructed to widen and maintain the tracking area along the top of the wall to no less than 25 feet and decreased the height of the containment by 6 feet to approximately 12 feet. A lighting survey was conducted to determine if lighting levels are adequate in the area. The ranges recorded during the survey ranged from 1 to 20 foot candles. The basic site requirement is 10 foot candles of task illumination.
28-Jan-10	First Aid	Lacerations / Punctures	Struck BY	Head / Face / Neck	Scrubber	Civil Projects		A Civil Projects employee stated he had removed a part of the downspout of a gutter on the maintenance building, and he was attempting to refit it when it came off hitting him in the lip.	Cleaned, antibiotic ointment, steri-strip
29-Jan-10	First Aid	Sprains / Strains	Material Handling	Shoulder	Press Pad	Sevenson		A Sevenson employee stated his shoulder became sore three days prior and was getting worse; however, could not recall any trauma to his shoulder.	Ibuprofen, Biofreeze, hot pack
14-Feb-10	First Aid	Fractures	Slips, Trips & Falls Elevation	Arm / Elbow	Sevensons' Tug Boat in the Emory River	Sevenson		A Sevenson employee stated he was on a tug boat, opened a hatch and started to descent down a ladder when he lost his footing and fell 6 feet, face first into the engine room floor. He also stated he lost consciousness and was unsure how he got out of the engine room to find help and did not know if anyone else was on the boat with him.	Immobilized extremity, sent to the emergency room.
15-Feb-10	First Aid	Sprains/ Strains		Shoulder	Dike D	Civil Projects		A Civil Projects laborer stated that while mucking tracks he hit a piece of metal with the shovel. The laborer was suffering from shoulder/muscle aches. The laborer was seen by the onsite medic, given Motrin and an icy hot patch, and released back to normal work.	Ibuprofen, cold pack, Biofreeze
17-Feb-10	First Aid	Sprains/ Strains	Body Position	Foot/Ankle	Trailer City	Civil Projects	Headway	A Civil Projects employee stated he was lifting a 5 gallon jug of water and felt a sharp pain in his ankle.	Ibuprofen, cold pack, ace bandage. Referred to TVA nurse. The other crew members were notified of this incident and need for vigilance when walking on steps during inclement weather. Nonskid material was applied to all docks.
19-Feb-10	First Aid	Sprains/ Strains	Slips, Trips & Falls Elevation	Shoulder	Rail Yard	MACTEC		A MACTEC employee stated he was driving a JLG lift when the shaft axel broke and the wheel came off causing the lift to fall. The lift was approximately 6 to 7 feet off the ground and landed on the rails of the track and did not turn over.	Ibuprofen, cold pack, Biofreeze
20-Feb-10	First Aid	Lacerations/ Punctures	Material Handling	Hand / Wrist	Dredge	Sevenson		Pulling a cable.	Cleaned, antibiotic ointment, bandage. Discussed with the crew different methods of abatement and best method was determined to be to screw metal down with self-tapping screw to the 2x4.
25-Feb-10	First Aid	Sprains/ Strains	Material Handling	Hand / Wrist	Filter Press Pad	Sevenson		Mucking.	Ibuprofen, Biofreeze .

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
25-Feb-10	First Aid	Sprains/ Strains	Material Handling	Back	Filter Press Pad	Sevenson		Lifting a pipe.	Cold pack, ibuprofen.
26-Feb-10	First Aid	Sprains/ Strains	Material Handling	Trunk	Filter Press Pad	Sevenson		A Sevenson employee stated she had been pulling presses.	Self administered cold pack, ibuprofen.
1-Mar-10	First Aid	Sprains/ Strains	Material Handling	Back	Ball Field	MACTEC		Lifting bags.	Employee refused treatment.
17-Mar-10	First Aid	Contusions / Bruises		Hand	Booster Pump	Sevenson		A Sevenson employee's hand was pinched during pipe assembly, involving a 90 degree angled pipe. The employee received first aid treatment and an X-ray to evaluate hand condition. No work restrictions.	Taken to the Methodist Medical Center Emergency Room for evaluation.
1-Apr-10	First Aid	Sprains/ Strains	Material Handling	Back	Ball Field	MACTEC		A MACTEC employee stated he was driving a JLG lift that hit a hole with the front tire. He said he informed his foreman. When he woke up Wednesday morning his back was stiff so he stayed home. Thursday morning he was still hurting, so safety was informed and he was brought to the onsite clinic.	Ibuprofen, Biofreeze
1-Apr-10	First Aid	Exposure	Contact with (Chemical)	Internal	Intake Channel at Plant	Southern Waste Services		A Southern Waste Services employee stated she had walked up, smelled a strong odor, became short of breath, light-headed, dizzy, and nauseated. She left and informed safety.	Evaluated
1-Apr-10	First Aid	Exposure	Contact with (Chemical)	Internal	Intake Channel at Plant	Southern Waste Services		A Southern Waste Services employee stated he walked up, smelled an odor, started the pump, and the odor worsened. He became light-headed, nauseated, and anxious.	Evaluated
2-Apr-10	First Aid	Contusions/ Bruises	Slips, Trips & Falls Same Level	Trunk	Dike T2	Civil Projects		A Civil Projects employee stated he was putting pipe together when the center of the clamp broke causing him to fall on his side and back on the ground.	Ibuprofen, cold pack
3-Apr-10	First Aid	Sprains/ Strains	Body Position	Leg/knee	Ball Field	Sevenson		A Sevenson employee stated she walking on the platform to a dump truck, bent down, and when she stood up the ligament in the back of her knee tightened up.	Ibuprofen
4-Apr-10	First Aid	Sprains/ Strains	Slips, Trips & Falls Same Level	Leg/knee	Boat Dock	Sevenson		A Sevenson employee stated he was stepping off a john boat onto the tank and fell through a fuel hold.	Ibuprofen, cold pack, cleaned and dressed
5-Apr-10	First Aid	Lacerations/ Punctures	Caught In / Between / Under	Hand / Wrist	U Building	Civil Projects	ESS	A Civil Projects employee stated that while trying to free up a sticking pin on a transmission, the transmission fell off of the jack and pinned his hand to the floor.	Clean, steri-strip, bandage
8-Apr-10	First Aid	Lacerations/ Punctures	Material Handling	Fingers / Thumb	Press Pad	Sevenson		A Sevenson employee stated that he was removing filters from the press pad when the box cutter slipped and went thru his glove.	Cleaned, antibiotic ointment, bandage. Discussed with the crew different methods of abatement and best method was determined to be to screw metal down with self-tapping screw to the 2x4.
15-Apr-10	First Aid	Exposure	Weather Heat/Cold	Internal	Ball Field	Sevenson	Acton Trucking	A Sevenson employee delivered a trailer to the site. While using a sledge hammer to secure stakes for the tie-downs he became overheated.	Cooled and hydrated
22-Apr-10	First Aid	Sprains/ Strains	Material Handling	Back	Ball Field	MACTEC		A MACTEC employee stated he was closing the railcars when his leg slipped causing him to turn wrong and he felt a pain in his back.	Biofreeze, Back-Off tabs
6-May-10	First Aid	Exposure	Weather Heat/Cold	Internal	Rail Yard	MACTEC		A MACTEC employee stated he was going up in the JLG lift when he started "feeling funny" the next thing he knew he was on the ground. Witness stated the employee "passed out."	Cooled and hydrated

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
17-May-10	First Aid	Sprains/ Strains	Slips, Trips & Falls Elevation	Foot / Ankle	Dredge "Kylee"	Sevenson		A Sevenson employee stated he was walking down the steps on the dredge when he slipped and fell down several steps landing on his behind.	Cold pack, ibuprofen, Ace bandage, elevate
17-May-10	First Aid	Insect Bite		Head / Face / Neck	North Dock CONEX	Sevenson		A Sevenson employee stated that the previous afternoon he was in the CONEX at the North Dock when he felt something bite him on the back of the head, so he swatted it off and went on with his work. He stated that he woke up around 0200 on this morning with a headache, and upon rubbing the back of his head, noticed it was swollen so he went to the onsite clinic first thing.	Sent to doctor for evaluation.
21-May-10	First Aid	Insect bites		Head / Face / Neck	Dike C	Stantec		A Stantec employee stated prior to the end of shift the previous day several mosquitoes had bitten her in the head area and she assumed it was a mosquito bite. She stated she cleaned it with alcohol the previous night and noticed it was swollen.	Cleaned, antibiotic ointment, tetanus
24-May-10	First Aid	Insect Bite		Leg / Knee	Berkshire House	Civil Projects		A Civil Projects employee stated he was outside the basement area during the morning meeting. After as the meeting was over he was starting to walk away he felt a painful sting on his leg. He pulled his pant leg up and found a yellow jacket stuck in his sock.	Sting swab, ibuprofen, bandage
24-May-10	First Aid	Exposure	Contact with (Debris)	Arm / Elbow	South Dock	Sevenson		A Sevenson employee stated he noticed a rash on both his arms the previous night after he got home. He also stated that there is lots of poison ivy at the South Dock where he has been working taking apart and removing pipes.	Cleaned, Benadryl cream, hydrocortisone cream
2-Aug-10	First Aid	Insect Bite				Facilities		At approximately 1630, an Facilities employee stated that while pulling on his gloves he felt a sting to his right hand. He informed his foreman that something had bitten him in two places and did not require treatment. The employee was not taken to onsite clinic. The following day he complained of pain and swelling in the right hand and forearm. His foreman brought him to onsite first aid clinic for evaluation.	
22-Oct-09	Near Miss	Foreign Body	Material Handling	Fingers / Thumb	Ash Pond Dredge	Civil Projects		A Civil Projects employee stated he was pulling cable with his gloves on and a small sliver came through his gloves. He removed a small piece from just beneath the skin of his right middle finger and left palm, between first and middle finger.	Employee removed splinter.
30-Oct-09	Near Miss				Lakeshore	Civil Projects		A Civil Projects employee stated he was backing up an articulating truck and backed into a water truck.	None required.
17-Nov-09	Near Miss		Employee Judgment		Vehicle Maintenance Area	Sevenson		A Sevenson mechanic was grinding on an excavator when sparks from the grinder caught residual grease on fire.	The fire was extinguished by the mechanic with a nearby fire extinguisher. There was no property damage or injuries.
23-Apr-10	Near Miss					Marsh Wilco		A Marsh Wilco employee and amphibious track hoe were involved in an onsite incident and a near miss including a track hoe becoming stuck in the ash / water.	Established inspection criteria for amphibious track hoe pontoons and a process for implementing and monitoring results.
17-Nov-09	Near Miss				Former Dredge Cell	Civil Projects		A Civil Projects employee stated that while driving an articulating dump truck he ran into a sink hole. Employee stated he had no injuries.	None required.
21-Nov-09	Near Miss		Employee Judgment			Sevenson	MACTEC	A MACTEC operator went to sleep in the cab of the heavy equipment.	
6-Dec-09	Near Miss		Employee Judgment			MACTEC		A MACTEC employee dropped a bag of polymer on another employees' lanyard.	

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
6-Dec-09	Near Miss				Railcar	MACTEC		A MACTEC employee slipped on ice in a railcar.	
9-Dec-09	Near Miss		Weather		River	TVA		A pontoon and two skiffs swamped as a result of high water flows on the Emory River.	1. Identify and communicate to boating crews the best means and technique for securing small craft to docks. 2. River monitored visually through the night for velocity and depth, reported as not a problem at 0500. Preparatory actions began at 0600 when problem became apparent. There was no way to measure for flow volume or rate of change for flow volume locally. 3. A means to monitor flow volume and rate of change should be considered for local measurements. 4. A water operations preparatory procedure should be developed outlining what actions to take given predefined check points.
22-Dec-09	Near Miss				Dike T2	Civil Projects		Post non-injury incident.	None required.
29-Dec-09	Near Miss				Emory River	Sevenson		A spud cable broke on a barge on the Emory River.	A locked out tag was placed on the barge winch and the key removed.
13-Jan-10	Near Miss				Filter Press	Sevenson		Between 0400 and 0500 the end cap of Filter Press #2 failed, dropping the cap onto the catwalk of the Filter Press.	Sevenson locked out all presses and power to the west side of filter press pad. Sevenson inspected the remaining 11 presses and discovered cracks in three other presses. Sevenson locked out the four damaged presses. Sevenson created an inspection document for the remaining six presses which was performed throughout the shift.
23-Jan-10	Near Miss		Employee Judgment		Dike D	Civil Projects		A Civil Projects employee stated while traveling west on Dike D in an articulating dump truck, he veered off the road to the right hand side into a steep ditch. While trying to get back on the road the bed of the dump turned over. The employee had no complaints of injuries.	
2-Feb-10	Near Miss		Employee Judgment		East Embayment	Civil Projects		A Civil Projects fuel truck's back passenger tire was torn and the back right side of truck was scratched as the truck clipped a dozer's blade in the East Embayment area while allowing another driver to pass around.	
13-Feb-10	Near Miss						Utility Contractor	A utility contractor struck an abandoned sewer line.	The contractor stopped work, notified the construction manager to verify line struck was in fact the abandoned line that had been inaccurately marked by the utility company. Upon verification of the line, the construction crew started pumping the water out of the pit into a filter bag.
14-Feb-10	Near Miss				Lakeshore Drive	Facilities		GUBMK struck gas line on Lakeshore Drive.	

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
17-Feb-10	Near Miss				On Water	Sevenson		A Sevenson employee entered the water after the skiff he was being towed on sank.	1. Verify all crews working on the water have been properly trained to do so and are briefed on the current Job Safety Analysis for the associated activity. All Job Safety Analyses involving tugboat / towing operations were to specify that no personnel were to remain in the vessel under tow. 2. Reinforce to all captains the authority and responsibility they have over their vessels. This included responsibility for all passengers, equipment, and operations. 3. Emphasize to all crews that everyone has stop work authority, even when supervisory personnel are involved. Either the tugboat operator or the deckhand could have requested the individual leave the skiff prior to getting underway. 4. Discuss the rescue efforts of this incident with all water crews. Stress the importance of rescue skiff availability, then need to take quick action when a man goes in the water and the need to wear proper exposure suits for high risk crews. 5. Review methods used to secure the skiff to the tug and verify it is done to prevent swamping. Even if there was no one in the skiff when it swamped, it would still have had the potential to cause equipment damage and / or release fuel to the river. In addition, it potentially puts crews at risk during recovery operations.
19-Feb-10	Near Miss				U Building	Civil Projects		A Civil Projects employee stated he was using a pry bar, lost his grip, and fell backward. The employee denied experiencing any pain/injury.	None required.
5-Mar-10	Near Miss				Lakeshore	Civil Projects		A Sevenson employee was assisting laborers in lining up a Porta-John to be picked up by fork lift when he hit his hand against the fork lift.	None required.
19-Mar-10	Near Miss					RSI		A RSI boat operator hit a dredge line while traveling on the river. The U.S. Coast Guard recommended markers be placed at least every 75 feet on each dredge line in the river.	
26-Mar-10	Near Miss					Civil Projects		At approximately 1040 a Civil Projects teamster was attempting to pull out an articulating water truck R28420 #132 from the maintenance area located in the north Materials Access Point when he struck the blade on a dozer which was parked in front of the truck.	
27-Mar-10	Near Miss				Material Access Point	Civil Projects		A Civil Projects employee stated that he pulled out and hit a dozer. The supervisor stated he had picked up his articulating truck from being serviced at the Material Access Point area and as he pulled out, turned right and caught the left front corner of dozer blade.	None required.
1-Apr-10	Near Miss	Exposure	Contact with (Chemical)	Internal	Intake Channel at Plant	Southern Waste Services		A Southern Waste Services employee stated he was only there a short time and smelled the order but had no complaints of illness.	None required.
28-Apr-10	Near Miss					MACTEC		A MACTEC employee damaged a JLG man-lift while maneuvering the lift to line railcars on Track 17. The damage caused a minor oil spill of less than a half quart of motor oil.	1. Conducted continuous evaluation of employees operating lifts. Address areas of concern by incorporating more experienced and skilled operators with those less skilled at all times. 2. Implemented a visual aid to assist in identifying when lifts were getting too close to railcars. 3. Re-emphasized spotter use requirements.

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
30-Apr-10	Near Miss					Mayse Construction	Hiwassee Construction	Hiwassee Construction who was working for Mayse Construction Company, damaged a passenger vehicle while pushing a steel drill rod through a previously drilled directional bore. The car had two tires damaged and possible damage to the suspension after running over the drill rod as it had breached the bore and inadvertently traveled across the east bound lanes of Interstate 40. No injuries occurred.	Implement a new standard practice for movement of the drill rod. The tracking head was always be used while the drill rod was moving forward. This made it possible to track the drill rod through the entire drill path. If the drill rod deviated from the drill path or the tracking equipment failed the advancement of the drill rod would cease until the problem was corrected or the equipment repaired. The advance of the drill rod was slowed to no faster than 2 minutes per 15 foot section. A new Job Safety Analysis was developed to address the changes.
4-May-10	Near Miss				On Water	Sevenson		At 1100, two Sevenson employees went into the water when a steel work boat they were using to move a 18-inch HDPE dredge pipe from the dredge "*Shirley*" became swamped with water. The pipe was attached by a rope to the D-ring of the work boat when it began to sink and pulled the bow of the boat down with it. The workers attempted to untie the rope from the pipe but were unsuccessful and abandoned the boat by entering the water. They were rescued by two vessels in the vicinity that were working the pipe with them.	
11-May-10	Near Miss	Exposure	Contact with (Debris)	Internal	Drag Line Road	Sevenson		A Sevenson employee stated he was standing on Drag Line Road flagging. The water truck came by and sprayed him in the face. He also stated he swallowed some of the water and started to feel stomach cramps.	Bismuth tabs
24-May-10	Near Miss				Stilling Pond	Civil Projects	Southern Waste Services	A Civil Projects employee stated he was on the corner of the Stilling Pond holding a vacuum hose when a surge of water came thru the hose causing it to whip around and knock him down.	None required.
6-Jan-10	Near Miss - Non TVA				Emory River	Non TVA	Appalachian. State	A sampling crew from Appalachian State violated the Emory River closure. Occupants were not wearing their PPE.	Developed orientation to include more detailed river operations and hazards. Expanded the Exclusion Zone on the site map in orientation package to include river operations. Obtained and review operator's qualifications and insured they have completed the National Association of State Boating Safety Law Administrator's course. Obtained and reviewed all required safety documentation prior to being allowed to execute work. Provided river operations escort familiar with the hazards and this person was posted on the vessel. Obtained signed hold harmless agreement from each member. Held meeting with all parties to explain exact expectations. Followed TVA site-specific procedure "Non-Routine Site Activities" for these type of activities.
23-Oct-09	Property - Near Miss				RSI Sampling Garage	Jacobs	RSI	A rollup door came off of its tracks at the RSI sampling garage.	
27-Oct-09	Property / Motor Vehicle Incident		Employee Judgment		Trailer City, Trailer 5, south side	Other		Employee backed car over marked water line stub-up.	
4-Nov-09	Property / Motor Vehicle Incident		Driver Error		Parking Lot South of Ash Recovery Trailer #1	Jacobs		At approximately 0630, an employee was driving their personal pick-up truck into the parking lot just south of Trailer City Trailer #1. He pulled past the parking spot and was backing in when the trailer hitch block on his back bumper struck the back bumper of a vehicle owned by another Jacobs employee. The second vehicle was unoccupied and sustained damage to the rear bumper.	The employee was prescribed medications and was placed on medical restrictions of no lifting, pushing or pulling, or repetitive use of the right arm until a follow-up visit on November 16, 2009.

TABLE I-2 SAFETY AND HEALTH INCIDENTS (FY10)

Date	Event Type	Injury Type	Direct Cause	Body Area	Location	Prime Contractor	Sub	Description	Actions
6-Nov-09	Property / Motor Vehicle Incident		Driver Error		Berkshire Area – North Embayment	Gibbons Farm		A Gibson Farm employee was attempting to relocate their hydroseed trailer so routine maintenance could be performed. The trailer was not properly connected or secured to their vehicle and subsequently broke free from the truck, traveled approximately 100 feet down Berkshire Road, and rolled off the road into a drainage swale.	1. The Gibbons Farms crew recovered their trailer in a safe manner. 2. On November 9, 2009, a stand down was conducted with the Jacobs construction manager to discuss the incident and all of the other safety expectations on the project. In addition, the crew discussed the importance of taking the time to think through and plan work activities, what can go wrong, and what they can do to protect themselves and others. 3. It was made clear to the crew that anyone has the right and the obligation to stop work. Also the attitude of improvisation and so called field modifications on equipment, tools, parts, and methods without approval from construction managers and safety personnel will not be tolerated.
10-Nov-09	Property / Motor Vehicle Incident		Driver Error; Incorrect Equipment		Ash Processing Area	Sevenson		A contractor van was damaged in an attempt to extract it from ash. The back of the van collided with the back of a forklift that was being used to pull it out. There were no injuries. The tow chain used to connect the vehicles was too short, not allowing for sufficient stopping distance between them. The van was in gear and accelerator was engaged during the towing, rather than it being in neutral.	The van extraction was completed with the van transmission in neutral. Sevenson will procure longer towing straps and make them available, notify all workers of this incident and instruct them on proper techniques for extracting stuck vehicles and modify the Job Safety Analysis for towing and pulling equipment steps to include operator actions inside the vehicle being towed and use of a proper cable length.
20-Nov-09	Property / Motor Vehicle Incident		Employee Judgement			Sevenson		A Sevenson vehicle had a faulty parking brake and hit another vehicle when disengaged.	The vehicle was promptly taken out of service for repair.

2-Aug-10 28
1-Oct-09

TABLE I-3 REPORTABLE AND NON-REPORTABLE ENVIRONMENTAL EVENTS (FY09)

Date	Event Type	Incident Type	Direct Cause	Location	Prime Contractor	Sub	Event Description	Actions
21-Feb-09	Reportable Environmental Event	NPDES Exceedance	Exceedence	Pond Closure	TVA		Event P575-09-19745 - The iron and copper limits established by the Kingston NPDES permit were exceeded during final closure of this pond. This qualifies as a Reportable Environmental Event for the Kingston Ash Recovery Project because Kingston is required to report the excursions on the monthly Discharge Monitoring Report to TDEC. The permit discharge limits of 1.0 ppm for iron and copper were exceeded on the following dates: 2/10/2009, iron 1.20 ppm; 2/21/2009, iron 1.25 ppm; 2/21/2009, iron 5.70 ppm; 2/21/2009, copper, 1.410 ppm. A total of 4 excursions were reported on the February DMR... This pond had to be closed to prepare the Ash Processing Area for the Kingston Ash Recovery Project. The first excursion was due to lowering the water level farther than normal to accommodate closure.	No immediate action or interim action was possible. The pond was closed. The other three excursions were a conscious decision shared by TVA and TDEC management and represented an appropriate balance of risk to the environment from delaying dredging activities as opposed to a brief excursion beyond permit limits for an internal discharge point. Prior notification of the potential for three of these excursions was provided TDEC. TDEC required no action be taken.
9-Apr-09	Reportable Environmental Event	Hydraulic Fluid Release	Mechnical	Dredging / Water	Trans Ash		Event P575-09-19765 - At 1650, dredge "Luzon" release approximately 5 gallons of Chevron Clarity Hydraulic oil (90 – 100% by weight of highly refined mineral oil: C15 – C50) from one of two main rams used to raise and lower the spuds. At the time of incident, "Luzon" was equipped with two 50-foot spuds with a weight of 4,000 lbs each. The dredge spuds are designed to utilize their own weight to drive into the base of the river and become a pivot point for dredge operation. The spuds were "shackled off" at 30 feet. This would allow for a 30 foot water depth drop of the spud prior to the hydraulic mechanism regaining tension on the spud. The starboard spud was in the down position and had anchored at approximately 25 feet. The operator had positioned the dredge to drop the port spud approximately 3 feet forward (walking the dredge forward). When the port spud was dropped, it did not contact any solid surface. When the 30 foot depth was achieved, the spud's weight and force were transferred back through the shackle and cabling to the hydraulic ram. The resulting force damaged the head of the ram causing the hydraulic leak.	Trans Ash began containment and cleanup immediately and contined spill cleanup on the dredge and on the water throughout the night. The spud system of operation for dredge "Luzon" was replaced by a three-wire positioning system which utilized a rear anchor cabled to a winch on the aft of the dredge in place of the spud system dredges "Emory" and "Clyde" were evaluated by Trans Ash to ensure the same mechanical failure mechanism was not present. Trans Ash replenished the consumed stock of spill response equipment and evaluated if the existing spill kits had the capacity to encircle the dredge completely. Trans Ash reviewed and revised their Job Safety Analysis for dredging operations to include the wire positioning sytems.
22-Apr-09	Reportable Environmental Event	Hydraulic Fluid Release	Debris	Dredging / Water	Trans Ash		Event P575-09-19766 - At 0630, <1 gallon of Chevron Clarity Hydraulic oil was released to the Emory River from the dredge "Luzon" cutter head drive shaft. This produced a sheen on the Emory River. Debris related - A 0.024-inch diameter wire wrapped around shaft and penetrated the hydraulic seal, compromising the seal fit. It appears that the wire was from the debris associated with the dredging ash operations. It is the first event.	Implemented a visual inspection of the exposed components during the cutter head cleanout operations. No fines associated per Coast Guard letter for the event and subsequent event on April 29. See Problem Evaluation Report dated April 29, 2009 for the letter.
26-Apr-09	Reportable Environmental Event	Hydraulic Fluid Release	Operator	Land	Trans Ash		Event P575-09-19767 - At 1600 hours, Trans-Ash water truck was refilling with water at the water station located just south of the Skimmer Wall. The truck developed a leak in the seal of the hydraulic reservoir while filling with water. The hydraulic oil washed west of the fill station and entered the Clinch River. The hydraulic fluid traveled approximately 75 feet through gravel before entering the river. Less than 1 pint actually entered the river. A rainbow sheen on the river approximately 2 feet from the bank and approximately 10-feet long was noted.	The causes are associated with the physical truck operation and with the configuration of the water filling station. The truck pad was not level and truck had a worn seal. The filling station is in close proximity to the river with minimal containment for releases. Actions included inspecting vehicles before usage, leveling the pad, and relocating the station from its current location or installing berms or booms along the road adjacent to the river.

TABLE I-3 REPORTABLE AND NON-REPORTABLE ENVIRONMENTAL EVENTS (FY09)

Date	Event Type	Incident Type	Direct Cause	Location	Prime Contractor	Sub	Event Description	Actions
29-Apr-09	Reportable Environmental Event	Hydraulic Fluid Release	Debris	Dredging / Water	Trans Ash		Event P575-09-19768 - At 1900, dredge Emory released approximately 4 gallons of Chevron Clarity Hydraulic fluid into the Emory River. The resultant sheen was contained within the booms. Dredging activities were ceased for all three dredges for the remainder of the shift. Internal notifications were made and the preliminary investigation was performed.	The apparent cause was due to encountering hidden debris capable of damaging the cutterhead. Based on a letter from the Coast Guard the damage was not due to a failure to properly maintain equipment and no monetary fine would be forthcoming.
29-May-09	Reportable Environmental Event	Hydraulic Fluid Release	Debris	Dredging / Water	Trans Ash		Event P575-09-21349 - Reporting cleanup item - At 1745, hydraulic dredge "Luzon" was dredging when a release of approximately 5 gallons of Chevron Clarity Hydraulic oil occurred. The source of the release was the main winch on the ladder. The dredge operator stated that as he was dredging, he heard unusual loud noises, shut the engine down and then saw oil releasing from the main winch. He began spill response measures and notified project management.	A spill response contractor was contacted and the dredge response crew continued with cleanup efforts. When Jacobs HSE arrived at the dredge at 1855, cleanup efforts were ongoing. Containment booms had already been deployed and appeared to be effectively containing the hydraulic fluid. Dredging was immediately stopped and containment booms were deployed around the floating fluid material. Surface water cleanup was completed. The relief valve and winch were replaced.
29-May-09	Reportable Environmental Event	Hydraulic Fluid Release	Debris	Dredging / Water	Trans Ash		Event P575-09-21350 - Reporting Cleanup - At 1330, hydraulic dredge "Emory" was dredging when a release of less than 1 gallon of Chevron Clarity Hydraulic oil (90-100% by weight of highly refined mineral oil: C-15 - C500) occurred. The source of the release was a breached seal within the cutter head drive shaft. The dredge operator noticed oil rising to the water surface when he began dredging operations.	A spill response crew arrived to complete the cleanup. A metal guard was installed on the drive shaft to prevent similar sized objectives and larger from entering the gap between the shaft and seal.
1-Jun-09	Reportable Environmental Event	Hydraulic Fluid Release	Debris	Dredging / Water	Trans Ash		Event P575-09-21365 - At 1600, hydraulic dredge "Emory" was dredging when a release of less than 1 gallon of Chevron Clarity Hydraulic oil (90-100% by weight of highly refined mineral oil: C15 – C50) occurred. The source of the release was a breached seal within the cutterhead drive shaft. This is the same type of seal that was breached on this dredge three days earlier. The dredge operator stated that while dredging he noticed that the vacuum gauge pressure was decreasing. He raised the cutter head, then noticed sheen on the water surface, and shut down the dredge. Spill response measures were begun immediately after the shutdown. A spill response crew arrived to complete the cleanup.	Notifications were made to Jacobs and TVA management. Jacobs HSE arrived at the dredge at 1755 to inspect the cleanup efforts and conduct the investigation. Containment curtains and spill booms had contained the spill. A work boat was deployed to begin disassembly of the cutterhead shaft. The damage to the guarding behind the cutter head was more sever during this event, with pieces of the guard and cage being removed. Dredging was stopped immediately and containment booms were deployed around the floating fluid material. Surface water cleanup was completed. The drive shaft housing was disassembled to assess the root cause. Review this incident with the dredging crews and support crews. Continue the program of scheduled visual inspections of the cutterhead and exposed components during the shift and during cutterhead cleanout operations. Consider possibility of modifying hydraulic pressure system on all dredges to reduce pressure to cutterhead shaft seal.

TABLE I-3 REPORTABLE AND NON-REPORTABLE ENVIRONMENTAL EVENTS (FY09)

Date	Event Type	Incident Type	Direct Cause	Location	Prime Contractor	Sub	Event Description	Actions
13-Jul-09	Reportable Environmental Event	Hydraulic Fluid Release	Hose / Fuel Line	Dredging / Water	Trans Ash	Southern Shores	Event P575-09-22687- Approximately 5 gallons of Komatsu Genuine Biodegradable Hydraulic Oil was released into the Emory River. A Southern Shores barge-mounted excavator was performing mechanical dredging of the Emory River when a hydraulic line separated from its compression fitting. The operator immediately shut the machine down, however the hose failure resulted in the release of approximately 5 gallons of hydraulic fluid. The root cause was determined to be a manufacturing defect of the hydraulic line. The line failed at the compression fitting and appeared to have pulled free from the fitting with no other damage apparent to the hose. The defective line, which had been in use approximately one month, was replaced by the manufacturer at no charge to Southern Shores. 4. At that time, three similar machines in use by Southern Shores, however the machine involved was the only one equipped with hoses by the manufacturer of the defective hose.	The operator shut the machine down, spill response measures were immediately implemented to contain the release and then remove the floating product from the surface of the water. Containment was established on the barge deck to prevent additional release of fluid to the water. The following ongoing actions were implemented by Southern Shores as a means to minimize the likelihood of additional releases and to increase response effectiveness: • Continue to include daily pre-use inspections of all heavy equipment, add a post-use inspection for the equipment used on water. • Add a more extensive hands-on weekly inspection for all heavy equipment used on water. • Increase focus of inspections on components recently repaired, adjusted or maintained by equipment mechanics. • Equip all floating work platforms with air horns as a means to alert nearby crews that response support is required. • Conduct pre-use spill kit training with all crews on site. Include a discussion on the capacity and limitations of existing equipment so crews will understand if additional resources are required. • Position spill response materials in a common location on all similar types of equipment.
2-Sep-09	Reportable Environmental Event	Tank Repair	Operator	Dredge / Water	Sevenson	L.W. Matteson	LW Matteson cleaned up a fuel tank area with Dawn dish soap to clean for repair purposes.	
29-Sep-09	Reportable Environmental Event	Hydraulic Fluid Release	Hose	Dredge / Water	Sevenson		At approximately 0500, the Sevenson 14-inch dredge "McKenzie" had a hydraulic fitting fail causing a release of approximately 10 gallons of biodegradable hydraulic fluid into the Emory River at Emory River Mile 3.0. Containment booms were deployed immediately and absorbent pads were used to remove the fluid from the water. The Shift Operations Supervisor was notified at 0700. As of 0910, cleanup continued and repairs to the hydraulic fitting were underway.	
1-Apr-09	Non-Reportable Environmental Event	Fuel Release	Hose / Fuel Line	Dredging / Water	Trans Ash		Event P575-09-22786 - Booster pump was leaking from the fuel line. Replaced fuel line. Utilized spill kit and clean up was completed. Leakage approximately 2 to 3 gallons of hydraulic fuel. Weight and force of spud loaded the hydraulic ram to a point of failure. Indirect: No physical or mechanical stop to prevent shock loading of the hydraulic ram. Unexpected sudden change in depth of solid base on the riverbed.	
30-May-09	Non-Reportable Environmental Event	Hydraulic Fluid Release	Hose / Fuel Line	Land	Trans Ash		Event P575-09-22108 - At 1605, Trans Ash water truck number WT-43 was traveling north up the Dike C ramp onto Dike C from the peninsula bridge when a release of 5 to 7 gallons of Rotella T Engine Oil SAE 10W-30 occurred. The source of the release was a ruptured hose in the engine compartment. The water truck operator noticed that his controls for starting the water spray were non-responsive. He stopped the truck and began a visual inspection of the truck which revealed the hydraulic leak. He immediately shut down the truck to relieve the pressure, began spill response measures and notified project management.	Speedy dry and absorbent pads were deployed to capture surface material. Jacobs HSE arrived at 1640 to inspect the cleanup efforts and conduct the investigation. Absorbent pads were being collected at that time. The fluid appeared to be contained within the roadbed. Trans-Ash performed spill response by scraping the affected layer of gravel with a dozer and placing the material in an articulating dump in preparation for proper disposal. Trans Ash replaced the failed hose and returned the equipment back to service. Hoses were visually inspected and replaced as necessary during the regularly scheduled preventative maintenance activities.

TABLE I-3 REPORTABLE AND NON-REPORTABLE ENVIRONMENTAL EVENTS (FY09)

Date	Event Type	Incident Type	Direct Cause	Location	Prime Contractor	Sub	Event Description	Actions
30-Jun-09	Non-Reportable Environmental Event	Hydraulic Fluid Release	Operator	Land	Civil Projects		Event P575-09-21688 - At 1300, a Civil Projects employee noticed fuel leaking from around the cap of the fuel tank. The employee checked the cap and loosened it slightly to relieve any pressure that was built up in the tank. He then took the cap off and stated the fuel level was to the top of the fueling tube. At this time, the Shift Operations Supervisor was informed and Civil Projects personnel pumped the tank empty. Based on what was pumped out, they estimated only 3 to 5 gallons of fuel had leaked out. The root cause was determined to be over filling of the fuel tank on the pump. This prevented the fuel from being able to expand and contract safely without overflowing. It was discovered these pumps were being stored at this location with full fuel tanks in the event they were needed to be put into service. Upon further investigation, it was discoved the other pumps also had full tanks and one pump had a fuel level that was in the fill tube. This was the first report of an incident of this nature. However, from the condition of the other pumps, there is a possibility of recurrence. The lid was loosened immediately with hopes of relieving any built up pressuer within the tank. When this did not improve the condition, arrangements were made to pump the fuel from the tank.	Civil Projects moved the skid and dug out contaminated soil. This soil was placed into drums and will be taken to the plant for proper disposal. A backhoe was brought onsite to dig up contaminated soil then placed into open top drums. The drums were then taken to the TVA Kinston Fossil Plant for proper disposal. Reviewed the incident with Civil Projects employees and support crews. Crews were instructed that in future re-fueling operations, always man the pump handle and do not rely on the automatic shut off to prevent over filling. Also, do not fill the tank where the fuel levels rise into the fill tube.
13-Jul-09	Non-Reportable Environmental Event	Coolant Release	Mechnical	Dredging / Water	Trans Ash	Southern Shores	Southern Shores tug moving mechanical dredging barges overheated and released coolant into the Emory River. The operator and foreman stated it was river water. It was observed that it was at least 2 gallons of ethylene glycol based coolant was added back to replace some the fluid that had been discharged by the tug. The tug overheated due to overuse of the single engine on a two-engine tug. One transmission was in despair, but the equipment was not taken down for repairs.	
15-Jul-09	Non-Reportable Environmental Event	Fuel Release	Hose / Fuel Line	Land – North Side of Dike T2	Civil Projects	Wilco	An amphibious excavator operator by a Civil Projects subcontractor released approximately 20 gallons of diesel fuel into the ash on the north side of Dike T2. The release was approximately 20 feet from the waters edge. He checked the reserve fuel tank and noticed that it was not full, even though fuel had been added overnight. The fuel tank has a capacity of 500 gallons, to which an unknown quantity had been added the night before. The leak was caused by a hole in the reserve fuel tank. The hole was initially noted the prior Saturday, but ht equipment was not taken out of service nor the fill spout for the tank tagged out.	The root cause was a process breakdown in which equipment was operated in defective condition. The defective fuel tank was removed from the unit. The liquid fuel was pumped out and the impacted soil was removed A formal inspection program for the remaining amphibious excavators was developed.
15-Jul-09	Non-Reportable Environmental Event	Fuel Release	Hose / Fuel Line	Land – Near Skimmer Wall	Trans Ash	Southern Shores	A Southern Shores electrical generator had a diesel fuel line fail and leaked approximately 5 gallons of diesel on to the ground near the skimmer wall. The secondary containment beneath the generator was partially filled with rainwater and could not contain the volume of fuel released. The generator was shut down, the impacted soil was removed, and staged on plastic. The liquid captured in the containment was drummed for disposal. Upon completion of the excavation, the soil was screened with a photo ionization detector (PID). The readings at the excavated face were 0 parts per million. As a result of the PID readings and visual inspection of the soil, the crew was authorized to backfill the area.	Southern Shores implemented the following: • Inspect all existing pieces of equipment for similar fuel line problems. • Inspec all secondary containment for rainwater accumulation. • It was recommended that all similar equipment onsite be provided with secondary containment to minimize or prevent any subsequent fuel releases to the surrounding environment or water. • It was also recommended that standard protocol be established to pump and properly dispose of rainwater that has accumulated into the secondary containment structures onsite.

TABLE I-3 REPORTABLE AND NON-REPORTABLE ENVIRONMENTAL EVENTS (FY09)

Date	Event Type	Incident Type	Direct Cause	Location	Prime Contractor	Sub	Event Description	Actions
30-Jul-09	Non-Reportable Environmental Event	Hydraulic fluid release	Hose / Fuel Line	Land – Loading	MACTEC		Event P575-09-26028 - At 1120, a hydraulic line on a JLG 450 aerial lift failed, causing a release of the fluid to the ground. The quantity released was approximately 1 quart. The contractor stated that the lift was being operated when the fluid release was detected by the operator. The source was a hole or cut in the hose from the hydraulic pump to the lift basket. This occurred alongside Track 2 in the Ash Processing Area, between the jersey barriers and the railcars.	The lift was shut down upon discovery of the release and the fluid was cleaned up and impacted gravel and ash was disposed of and the defective hose was replaced. The ash impacted by the release was removed and placed into a container for disposal. Inspections of hydraulic hoses were completed before use of the equipment. Hydraulic hoses underwent an additional inspection on a weekly basis. Faulty line was replaced. The fluid did not reach navigable waterways.
30-Jul-09	Non-Reportable Environmental Event	Hydraulic Fluid Release	Hose / Fuel Line	Land – near Swan Pond	Trans Ash	Rhino Specialized Transport	Event P575-09-26027 - Approximately 2 quarts of hydraulic oil was released onto the ground near the construction entrance on Swan Pond Road. A trucking company, Rhino Specialized Transport, who was hauling an oversized load (excavator) for Trans Ash had a hydraulic line fail as the driver attempted to raise the low boy trailer prior to departing the site. The operator shut the truck down and notified the onsite Jacobs superintendent.	Spill response measures were immediately implemented to contain the release and then remove the free product from the ground. Once the trailer was cleaned and standing liquid was removed with adsorbent pads, the dense grade (crusher run) beneath the trailer was removed and containerized for proper disposal. The ground and area was inspected below the trailer and it appeared adequate cleanup was performed. The contract trucking company would be hauling two more similar loads for Trans Ash. The hydraulic line was replaced, the others confirmed to be in serviceable condition.
1-Aug-09	Non-Reportable Environmental Event	Hydraulic Fluid Release	Hose / Fuel Line	Land – Rim Ditch	Sevenson		A frontend loader had a hydraulic line fail and release fluid onto the ground near the Rim Ditch area.	
14-Sep-09	Non-Reportable Environmental Event	Coolant Release	Hose / Fuel Line	Dredge / Water	Sevenson	L.W. Matteson	At approximately 1730, the dredge "Little Rock" punctured a cooling line and released an estimated 100 gallons of fluid into the Emory River. The fluid was estimated to have been 80% water and 20% 50/50 ethylene glycol antifreeze. Because the puncture was below the water line containment, recovery was not possible. The Shift Operations Supervisor was notified at 2000.	Root cause analysis - cooling line repaired.
25-Sep-09	Non-Reportable Environmental Event	Hydraulic Fluid Release	Hose	Land Based / Processing Stilling Pond	TVA	Rain 4 Rent	At approximately 1150, there was a release of hydraulic fluid at the Middle Dike between the Ash Pond and the Stilling Pond. The quantity released was estimated at one-half gallon and there was no release to the water. All was contained on the dike road. The source of the release was a Rain 4 Rent vendor truck delivering a roll off box. A hydraulic line in the truck had a hole, allowing the fluid to escape. The impacted soil was dug up and removed.	

TABLE I-4 REPORTABLE AND NON-REPORTABLE ENVIRONMENTAL EVENTS (FY2010)

Date	Event Type	Incident Type	Direct Cause	Location	Prime Contractor	Sub	Event Description	Actions
13-Oct-09	Reportable Environmental Event	Hydraulic Fluid Release	Human Factor/ Procedural	Water - Boat Launch on Emory River - Yellow Dredge	Civil Projects	Barnhart	Repositioning dredge to crane to get closer to radius. Had to use tug boat to reposition dredge. Bilge pump was shifted during move and came on making a sheen on water from oil.	Update the current dredge manual to include operational checks and inspection of bilge pump. Modify existing daily pre-operational check-sheet for dredge to include physically checking bilge pump specifically for compliance. Civil Projects developed a check sheet to be utilized for assembling or disassembling the Aamco Dredge to include disconnecting power to 1-1/2 inch bilge pump before moving.
4-Nov-09	Reportable Environmental Event	Hydraulic Fluid Release	Human Factor - Nipple Breakage Due to Cable	Water - Dredge "McKenzie" on Emory River	Sevenson		At approximately 0810, the 14-inch dredge "McKenzie" was dredging when it released approximately 3 gallons of Exxon Mobil EAL 224H hydraulic oil. The oil was characterized as biodegradable non-toxic hydraulic oil. The source of the release was a nipple that was pulled from a hydraulic reservoir tank by a spud cable. The cable caught within the nipple and when stretched, disconnected the threaded nipple from the tank. This does not appear to be the result of abnormal operations but is an artifact of the design of the dredge. Note that the cable had been recently installed.	The dredge operator stated that he noticed a problem while lifting the spud. He shut down the dredge and moved to the area of the cable to investigate further. He noticed the cable was stretched around the nipple. Fluid was releasing from the resultant hole in the reserve tank; he manually plugged the hole. The crew began containment and cleanup operations. Jacobs investigative team arrived at the scene and identified that cleanup operations were underway. Booms and cleanup pads had been deployed. This event was similar to the one that occurred on September 29, 2009, during which there was a release of hydraulic fluid from the same source on the same dredge. Post-incident corrective actions were not formalized.
10-Dec-09	Reportable Environmental Event	Hydraulic Fluid Release	Human Factor/ Procedural	Excavator Recovery Operatin	TVA		During recovery and cleaning of the excavator involved in the original ash release incident, there were speculations that there would be leakage of fluid during the process and even though it was planned, it could not be prevented.	Corrective actions were in place prior to the event and were carefully planned. Regulatory practices were notified that this minimized release due to planning.
21-Dec-09	Reportable Environmental Event	Hydraulic Fluid Release	Debris - Flexible Hose	Dredge "Sandpiper"	Sevenson	LW Matteson	The operator noticed a drop in hydraulic pressure. He immediately shut the dredge down and raised the cutter head. A work boat was deployed to investigate and discovered a leak in a flexible hydraulic hose attached to the dredge ladder. Sevenson and Jacobs were notified by the dredge "Sandpiper" crew. Additional support and absorbent booms were deployed to contain the released fluid. After containment was in place, the TVA Shift Operations Supervisor and TVA Environmental were notified. It was estimated that approximately 10 gallons of biodegradable hydraulic fluid was released to the Emory River near Emory River Mile 0.2. At that time, the spill had been contained and cleanup and repairs underway. An investigation was conducted, followed by a report.	The dredging was ceased and the damaged hose was replaced. The other hoses servicing the cutter head were inspected for damage. The dredge was returned to service.
24-Jan-10	Reportable Environmental Event	Fuel Release	Unknown	Water-Cove	Unknown Source		There was a release of 1 to 2 gallons of diesel fuel to the water contained within a dugout cove, east of and adjacent to Dike T2. It was reported by Civil Projects management to Jacobs HSE representative at 1545 . Jacobs and Sevenson responded to the site. The sheen was contained within a cove, none having appeared to have escaped to the river. Areas around the north dock, dredges, and fueling barges were reviewed with no sheen emanating from any of these areas. The source of the release could not be definitely identified. Civil Projects management met with Jacobs at the site to confirm the location of the release.	Southern Waste Services responders were contacted and a boom was placed across the inlet to the cove, containing the sheen. TVA Environmental management was contacted. The release was classified as a reportable release due to the hydraulic connection between the river and the affected area. At TVA's direction, Jacobs notified the Plant Shift Operations Supervisor, with instructions to report the incident to the National Response Center as preliminary report.

TABLE I-4 REPORTABLE AND NON-REPORTABLE ENVIRONMENTAL EVENTS (FY2010)

Date	Event Type	Incident Type	Direct Cause	Location	Prime Contractor	Sub	Event Description	Actions
4-Mar-10	Reportable Environmental Event	Hydraulic Fluid Release	Hose - Loose Fitting	Emory River	Sevenson		A visible sheen was discovered on the Emory River at the Sevenson dredge McKenzie. The dredge was not in operation at the time. The sheen was confined to the bow area between the outer pontoons. The source of the release was discovered to be from a loose fitting on a hose as part of the hydraulic winch system,. The fitting was tightened and a Sevenson crew was deployed to contain and clean up the release. The quantity of biodegradable hydraulic fluid released is estimated to be two to three gallons. A Sevenson crew was dispatched to deploy absorbent booms and clean the material.	Sheen was contained and removed by Southern Waste Services. No material escaped into navigable waters.
21-Mar-10	Reportable Environmental Event	Hydraulic Fluid Release		Emory River			At approximately 1345, approximately 30 gallons of hydraulic fluid (Environ 46) was released into the Emory River. The approximate location was Emory River Mile 2.0. The source of the spill was a Sevenson dredge tender boat which was pushing a barge transporting an excavator when the release occurred. The release appeared to have been from the tender boat thruster, located beneath the boat hull.	
8-Apr-10	Reportable Environmental Event	Hydraulic Fluid Release	Boom Broke	Water	Sevenson		At approximately 1150, a Sevenson PC-800 excavator was removing material from the Emory River approximately 100 yards off the Skimmer Wall dock, when a hydraulic line on the boom broke. It is estimated that only two gallons of biodegradable hydraulic oil was released with only a small percentage of that getting in the water.	The operator saw the break and immediately set the boom on the deck of the barge and oil pads/booms were immediately deployed. Sevenson move the barge to the Skimmer Wall dock to effect repairs and used two boats with an oil boom to encapsulate the material on the water and oil pads to soak up remaining hydraulic oil.
9-Apr-10	Reportable Environmental Event	Hydraulic Fluid Release	Hose	Emory River	Sevenson		At approximately 0630, a hydraulic hose fitting failed on the Sevenson dredge "Addison" releasing an estimated quantity of 3 gallons of biodegradable hydraulic oil to the Emory River. The dredge was working at approximately Emory River Mile 2.75.	Sevenson personnel responded to contain the spill and deployed absorbents. Southern Waste Services was contacted to complete the cleanup and the Shift Operations Supervisor was notified.
21-May-10	Reportable Environmental Event	Hydraulic Fluid Release		Dredge "Adelyn"	Sevenson		At approximately 0730, the Sevenson dredge "Adelyn" released an estimated quantity of 10 gallons of biodegradable hydraulic fluid to the Emory River. The release occurred around Emory River Mile 3.0.	
19-Jun-10	Reportable Environmental Event	Hydraulic Fluid Release		Dredge "Shirley"	Sevenson		At approximately 2135, a hydraulic fluid spill occurred aboard the dredge "Shirley" operated by Sevenson. While dredging, the vessel's operating system went in to emergency shutdown mode as it identified a system malfunction. When the operator(s) noticed the source of the leak, the crew immediately began cleanup procedures to contain the biodegradable hydraulic fluid coming from the cutterhead's arm. The estimated amount released was less than 5 gallons, most of which was contained with the absorbent materials. A severed bolt, (1 of 4 on the hydraulic-line connection) was identified inside of the dredging arm's housing.	Sevenson repaired the system.

TABLE I-4 REPORTABLE AND NON-REPORTABLE ENVIRONMENTAL EVENTS (FY2010)

Date	Event Type	Incident Type	Direct Cause	Location	Prime Contractor	Sub	Event Description	Actions
11-Feb-10	Non-Reportable Environmental Event	Water Sheen	Human Factor/ Procedural	Ash Pond	Sevenson		TVA observed a visible sheen in the Ash Pond. A Southern Waste Services crew deployed absorbent booms across the narrow waterway adjacent to Dike C. A light sheen could be seen on top of the water and could be followed upstream to the area of the Sevenson 14 inch and 16 inch booster pumps on Dike C. The sheen was contained to the area adjacent to Dike C and there was no release into the surrounding water system. An electric sump pump with a built-in float switch was found in the containment area of each booster pump. The discharge of these pumps were piped to area which drained through an absorbent boom into the narrow waterway adjacent to Dike C. The 14-inch booster containment area appeared to have ash and silt in the bottom which had been impacted by some type of petroleum product. A Sevenson crew had disassembled the pump housing for maintenance, releasing water into the containment. When the sump pump turned on, the ash and silt was discharged with the water flowing the product into the narrow waterway. The sump pumps were removed from both containment areas. The Sevenson foreman was directed to clean the ash and silt from the containment and not to reinstall the sump pumps. These areas were supposed to be pumped only by Southern Waste Services and not with the sump pumps.	Both sump pumps were removed from service.
10-Mar-10	Non-Reportable Environmental Event	Hydraulic Fluid Release	Hose	Dike D	Civil Projects		A Civil Projects excavator leaked hydraulic oil from Dike D to Drag Line Road. The hydraulic oil was cleaned up and none of the material reached any waterway.	
27-Mar-10	Non-Reportable Environmental Event	Hydraulic Fluid Release		North Material Access Point	Civil Projects		At approximately 1050, a Civil Projects teamster was attempting to pull an articulating water truck from the maintenance area located in the North Material Access Point when he struck the blade of a dozer. The top of the dozer blade struck the drain plug on the hydraulic oil tank releasing approximately 10 gallons of hydraulic oil. Oil was contained and cleaned up was started and completed.	

Appendix J
List of Briefings of Public Officials

APPENDIX J - LIST OF BRIEFINGS OF PUBLIC OFFICIALS

Public official	Date	Location of Briefing	Description of Briefing	Presenter
Roane Co. Executive Mike Farmer	22-Dec-2008	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Senator Ken Yager	23-Dec-2008	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
U.S. Representative Lincoln Davis	30-Dec-2008	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Governor Phil Bredesen and local officials	31-Dec-2008	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Representative Dennis Ferguson	31-Dec-2008	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Harriman Mayor Chris Mason	5-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Roane Co. Executive Mike Farmer	5-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Kingston Mayor Troy Beets	5-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
U.S. Representative Heath Shuler	5-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	Phillips and Jordan staff
Office of U.S. Representative Zach Wamp (staff)	5-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
U.S. Senator Bob Corker and local officials	5-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Harriman City Council	6-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Harriman City Council	6-Jan-2009	Kingston Ash Recovery Project Public Meeting	Kingston Recovery Meeting	Tom Kilgore, TVA CEO
Kingston City Council	6-Jan-2009	Kingston Ash Recovery Project Public Meeting	Kingston Recovery Meeting	Neil Carriker, TVA Management
Office of Representative John J. Duncan, Jr. (staff)	12-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Senator Ken Yager	12-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Roane County Emergency Services Director Howie Rose	12-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Kingston City Council	12-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
U.S. Representative John J. Duncan, Jr.	12-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management

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Public official	Date	Location of Briefing	Description of Briefing	Presenter
Roane County Commission	12-Jan-2009	Kingston Ash Recovery Project Public Meeting	Kingston Recovery Meeting	Tom Kilgore, TVA CEO
U.S. Surface Transportation Board Member Doug Buttrey	14-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Office of U.S. Sen. Lamar Alexander (staff)	15-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Office of U.S. Senator Bob Corker (staff)	15-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Representative Joe McCord	16-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Representative Frank Niceley	16-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Representative David Hawk	16-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Representative Bob Ramsey	16-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Representative John Litz	16-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Senator Steve Southerland	21-Jan-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Roane County Commission	6-Feb-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Office of U.S. Senator Bob Corker (staff)	6-Feb-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
TDOT Commissioner Gerald Nicely & staff	14-Feb-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
U.S. Representative Phil Roe	17-Feb-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
U.S. Representative Lincoln Davis	17-Feb-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Tennessee General Assembly	18-Feb-2009	Kingston Ash Recovery Project hearing	Kingston Recovery Joint Hearing	Tom Kilgore, Bill Sansom
U.S. Senator Lamar Alexander	19-Feb-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Representative Ron Lollar	23-Feb-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Roane County Executive Mike Farmer	10-Mar-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management

APPENDIX J - LIST OF BRIEFINGS OF PUBLIC OFFICIALS

Public official	Date	Location of Briefing	Description of Briefing	Presenter
Kingston Mayor Troy Beets	10-Mar-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
NE Valley Regional Field Team Meeting	10-Mar-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
U.S. Senator Bob Corker (via flyover)	9-Apr-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Southeast District Power Distributor Managers	15-Apr-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Office of U.S. Senator Lamar Alexander (DC staff)	16-Apr-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Valley Relations Congressional Tour – Knoxville	14-May-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
U.S. Representative Eddie Bernice Johnson	7-Jun-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Uniontown, AL elected officials	8-Jun-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
U.S. Government Accountability Office (GAO)	16-Jun-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Association of Tennessee Valley Governments (ATVG)	9-Jul-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Cumberland County Mayor and Commission	27-Jul-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
U.S. Representative Lincoln Davis	4-Aug-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Washington D.C. Staff Congressional Tour	12-Aug-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Roane County Long Term Recovery Committee	7-Oct-2009	Roane County Courthouse	General Update on Ash	TVA Management
Roane County Long Term Recovery Committee	18-Nov-2009	Roane County Courthouse, Kingston	General Update on Ash Recovery Project	TVA Management
Elected Stakeholders	14-Dec-2009	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project One-year Tour	TVA Management
Roane County Long Term Recovery Committee	16-Dec-2009	Roane County Courthouse, Kingston	General Update on Ash Recovery Project	TVA Management
Tennessee General Assembly	16-Feb-2010	Kingston Ash Recovery Project hearing update	Update Briefing on Ash Recovery Project	Steve McCracken, Bob Deacy
Roane County Long Term Recovery Committee	17-Feb-2010	Roane County Courthouse, Kingston, TN	General Update on Ash Recovery Project	TVA Management

APPENDIX J - LIST OF BRIEFINGS OF PUBLIC OFFICIALS

Public official	Date	Location of Briefing	Description of Briefing	Presenter
State Rep. Julia Hurley	22-Nov-2010	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
Roane County Executive Ron Woody	22-Nov-2010	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management
State Representative Ryan Haynes	22-Nov-2010	Kingston Fossil Plant, Harriman, TN	Kingston Ash Recovery Project Briefing and Tour	TVA Management

References (on DVD)

TVA Kingston Fossil Fuel Plant Release Site
Time-Critical Removal Action
On-Scene Coordinator Final Report Reference Documents

ACRONYMS USED ON THIS DISK

ADEM	Alabama Department of Environmental Management
ADPH	Alabama Department of Public Health
ERM	Emory River Mile
EPA	U.S. Environmental Protection Agency
ESI	Environmental Standards, Inc.
Geosyntec	Geosyntec Consultants
Hart Hat	Hard Hat Services
Jacobs	Jacobs Engineering Group Inc.
KIF	Kingston Fossil Plant
OIG	Office of the Inspector General
OSC	On-Scene Coordinator
SAIC	Science Applications International Corporation
Shaw	Shaw Environmental, Inc.
Stantec	Stantec Consulting, Ltd.
TDEC	Tennessee Department of Environment and Conservation
TDH	Tennessee Department of Health
TVA	Tennessee Valley Authority
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey

1 INCIDENT COMMAND SYSTEM UNIFIED COMMAND

1.1 Memorandum: *Transfer of Federal Lead Agency Authority*. From Steve Spurlin (EPA) to Tim Hope (TVA). January 10, 2009.

1.2 Incident Objectives ICS 202. June 7, 2009

1.3 Incident Organization Charts June 9, 2009 through July 13, 2010

2 PUBLIC HEALTH ASSESSMENT

2.1 *Public Health Assessment, Final Release, Tennessee Valley Authority (TVA) Kingston Fossil Plant, Coal Ash Release, 714 Swan Pond Road, Harriman, Roane County, Tennessee*. Prepared by TDH. September 7, 2010.

3 COMMUNITY INFORMATION

3.1 Community Involvement Plan

3.1.1 *Revised Draft Community Involvement Plan*. Document No. EPA-AO-020. Prepared by TVA. October 16, 2009 (EPA Approval).

3.1.2 Summation of Comments Received and Response to Comments, Tennessee Valley Authority (TVA) Kingston Ash Recovery Project, Draft Community Involvement Plan, Public Comment Period October 19-December 20, 2009.

3.2 CAG and Technical Assistance Plan

3.2.1 *Technical Assistance Plan* and *Draft Agreement Between TVA and the RCCAG*. Document No. EPA-AWP-049. Prepared by TVA. October 28, 2009 (EPA Approval).

3.2.2 Fact Sheet: *Technical Assistance Plan, TVA Kingston Fossil Fuel Plant Release Site*. Prepared by EPA. June 3, 2009.

3.2.3 Letter of Interest: Local Group Submits Letter of Interest to Request Technical Assistance Plan (TAP) for TVA Kingston Fossil Fuel Plant Release Site, Roane County, Tennessee. Prepared by EPA. 2009.

3.2.4 Request for Proposals, Technical Advisor for the TVA Kingston Fly Ash Release Site, 2009-2010. Prepared by EPA. 2009.

3.3 EPA Quarterly Factsheets

3.3.1 U.S. Environmental Protection Agency Quarterly Fact Sheet, TVA Kingston Fly Ash Release Site, Harriman, Roane County, Tennessee. No. 1, September 2009.

3.3.2 U.S. Environmental Protection Agency Quarterly Fact Sheet, TVA Kingston Fly Ash Release Site, Harriman, Roane County, Tennessee. No. 2, January 2010.

3.3.3 U.S. Environmental Protection Agency Quarterly Fact Sheet, TVA Kingston Fly Ash Release Site, Harriman, Roane County, Tennessee. No. 3, April 2010.U.S.

3.3.4 U.S. Environmental Protection Agency Quarterly Fact Sheet, TVA Kingston Fly Ash Release Site, Harriman, Roane County, Tennessee. No. 4, July 2010.

3.3.5 U.S. Environmental Protection Agency Quarterly Fact Sheet, TVA Kingston Fly Ash Release Site, Harriman, Roane County, Tennessee. No. 5, December 2010.

3.4 Health Information

3.4.1 Presentation: *Arsenic in Emory River.* Prepared by EPA. February 4, 2010.

3.4.2 Fact Sheet: Protecting Environmental Public Health in Tennessee. Prepared by the TDH. June 3, 2009.

3.4.3 Roane County Joint Information Center Kingston Ash Release. Press Release Number 002, December 29, 2008.

3.4.4 Presentation: *Selenium in Fish Tissue*. Prepared by EPA. February 4, 2010.

3.5 Presentations for Time Critical

3.5.1 *Time Critical Removal Action Update, TVA Kingston Ash Recovery Project*. Presentation to the public meeting by Leo Francendese (EPA). January 26, 2010.

3.5.2 *TVA Kingston Fossil Fuel Plant Release Site Removal Update*. Presentation to the Tennessee Legislature by Leo Francendese (EPA). February 16, 2010.

3.5.3 *TVA Kingston Fossil Fuel Plant Release Site Removal Update*. Presentation. April 12, 2010.

3.6 Press Releases

3.6.1 EPA to Oversee Cleanup of TVA Kingston Fossil Fuel Plant Release. Release date: 05/11/2009.

3.6.2 EPA Extends Public Comment Period on the Administrative Record for TVA's Kingston Fossil Fuel Site. Release date: 06/15/2009.

3.6.3 Joint Public Meeting on Kingston Recovery to be Held Tuesday. Release date: 06/17/2009.

3.6.4 Recreational Advisory Issued for Watts Bar Reservoir. Release date: 06/17/2009.

3.6.5 Applications Sought from Community Groups for $50,000 Technical Assistance Plan Grant for Kingston Cleanup. Release date: 06/24/2009.

3.6.6 EPA Approves Plan for Disposal of Coal Ash from TVA Kingston Site at the Arrowhead Landfill in Perry County, Alabama. Release date: 07/02/2009.

3.6.7 Portion of the Emory River to be Closed for 30 Days while TVA Kingston Cleanup Continues. Release date: 08/04/2009.

3.6.8 EPA Returns to Perry County, Alabama's Arrowhead Landfill. Release date: 09/10/2009.

3.6.9 Portions of the Emory to be Closed an Addition 30 Days while TVA Kingston Cleanup Continues. Release date: 09/11/2009.

3.6.10 Portions of the Emory River to be Closed through February 15, 2010 while TVA Kingston Cleanup Continues. Release date: 10/09/2009.

3.6.11 Work Plan for Non Time-Critical Cleanup Alternatives for Restoration of the TVA Kingston Site Released for Public Review. Release date: 10/21/2009.

3.6.12 Engineering Evaluation and Cost Analysis for Non-Time-Critical Cleanup Alternatives for Restoration of the TVA Kingston Site Released for Public Comment. Release date: 01/19/2010.

3.6.13 Emory River to be Closed Until Mid-May while TVA Kingston Cleanup Continues. Release date: 02/09/2010.

3.6.14 EPA Approves Cleanup Plan for Remaining Coal Ash at TVA Kingston Site. Release Date 05/18/2010.

3.7 River Advisories and Closures

3.7.1 Watts Bar Recreational Advisory. June 2009.

3.7.2 Additional 30 Day Emory River Closure. September 11, 2009.

3.7.3 Additional Emory River Closure. October 9, 2009.

3.7.4 Emory River Closing. February 9, 2010.

3.7.5 Additional Emory River Closure Update. May 7, 2010.

3.7.6 Emory River No-wake Zone Reduced. August 30, 2010.

3.7.7 EPA Website River Advisory and Closure Links.

3.8 Frequently Asked Questions

3.8.1 Questions & Answers on the Administrative Order on Consent for the Tennessee Valley Authority Kingston Fossil Fuel Plant Release. May 11, 2009.

3.8.2 Frequently Asked Questions Regarding the Disposal of Coal Ash at the Perry County Arrowhead Landfill, Uniontown, Alabama. Prepared by EPA. July 8, 2009.

4 DATABASE MANAGEMENT

4.1 Letter Report: *Evaluation of data practices for the TVA Kingston fly ash removal site*. Prepared by the DATA Team. January 26, 2009.

4.2 *Data Management Plan for the Tennessee Valley Authority Kingston Ash Recovery Project*, *TVA-KIF-DMP-001*. Document No. EPA-AO-019. Prepared by ESI. November 30, 2009 (EPA approval).

5 QUALITY ASSURANCE PROJECT PLAN

5.1 *Quality Assurance Project Plan for the TVA Kingston Ash Recovery Project. TVA-KIF-QAPP*. Document No. EPA-AO-014. Prepared by ESI. December 18, 2009 (EPA approval).

6 ENVIRONMENTAL MONITORING

6.1 Air and Surface Water Monitoring

6.1.1 January 2009 - October 2010 Air Quality

6.1.2 January 2009 - October 2010 Surface Water Quality

6.1.3 *Quality Assurance Handbook for Air Pollution Measurement Systems*, Volume II, Appendix D, "Critical Criteria, Filter-Based PM 2.5". *EPA-454/B-08-002.* March 24, 2008.

6.2 Perimeter Air Monitoring

6.2.1 *TVA Kingston Fossil Plant Ash Recovery Project, Time-Critical Action Site Dust Control and Air Monitoring Plan.* Document No. EPA-AO-006. Prepared by Jacobs. August 14, 2009 (EPA approval).

6.2.2 Memorandum: *Evaluation of the Perimeter Air Monitoring Strategy and Identification of Corrective Actions at the TVA Kingston Fly Ash Release Time-Critical Removal Action*. From Leo Francendese (EPA) to Steve McCracken (TVA). January 25, 2010.

6.2.3 Technical Memorandum: *Changes in Location of Air Monitoring Stations*. Prepared by TVA. April 8, 2010 (EPA approval).

6.2.4 *Corrective Action Plan for January 2010 Air Audit*. Document No. EPA-AO-027. Prepared by TVA. June 3, 2010 (EPA approval).

6.3 Water Quality Monitoring

6.3.1 *Draft Aquatic Life Water Quality Criteria for Selenium - 2004*. Office of Water. EPA-822-D-04-001. November 2004.

6.3.2 *Summary of Sediment Sampling Performed on Monday January 26, 2009*. Prepared by ESI.

6.3.3 Letter Report: *Radium Sediment and Ash Sampling Plan, TVA Kingston Plant, Kingston, Tennessee*. Prepared by ESI. June 17, 2009.

6.3.4 *Swan Pond Embayment Sampling Plan.* Document No. EPA-AO-015. Prepared by ESI. June 22, 2009 (EPA approval).

6.3.5 *Sediment and Ash Sampling Plan, Emory River Mile (ERM) 0.0 to 1.0, Kingston Fossil Plant Ash Spill.* Prepared by ESI. July 7, 2009.

6.3.6 *Surface Water Monitoring Plan for the Emory, Clinch, and Tennessee Rivers*. Document No. EPA-AO-013. Prepared by ESI. August 23, 2009 (EPA approval).

6.3.7 Memorandum: *OSC Determination Concerning Permit Requirements to Maintain the Free Water Volume of the Settling Pond at the Kingston Fly Ash Release Time Critical Removal Action*. From Leo Francendese (EPA) to Steve McCracken (TVA). October 9, 2009.

6.3.8 *Freshwater Mussel Survey of Impounded Area of the Clinch River Adjacent to the Power Plant, TVA, Kingston, Tennessee*. Prepared by the Yokley Environmental Consulting Service. October 14, 2005.

6.3.9 *Memorandum – Clarification for KIF Rainfall Sampling Events*. Document No. EPA-AO-016. Prepared by ESI. November 18, 2009 (EPA approval).

6.3.10 Letter: *Surface Water Data Collected During the Time-Critical Removal Action.* From Dennis Yankee (TVA) to Leo Francendese (EPA). June 1, 2010.

6.3.11 Memorandum: *Clarification for KIF Rainfall Sampling Events*. From Leo Francendese (EPA) to Steve McCracken (TVA). June 18, 2010.

6.4 Site-Specific Environmental Standard Operating Procedures

6.5 Tetra Tech Water Quality Monitoring Reports

6.6 Data Comparison Reports

7 NATURE AND EXTENT INVESTIGATIONS

7.1 Nature and Extent Select Graphics

7.1.1 Map: Aerial Photographs 12/23/08 thru 04/28/09

7.1.2 Map: Ash Sediment Transects June 17, 2009

7.1.3 Map: Key Map for Nature and Extent of Ash in the River Bottom as of August 5, 2009 (Phase 1)

7.1.4 Map: Nature and Extent of Ash in the Clinch River Bottom as of August 5, 2009 (Phase 1)

7.1.5 Map: Nature and Extent of Ash in the Emory River Bottom as of August 5, 2009 (Phase 1)

7.1.6 Map: Nature and Extent of Ash in the Tennessee River Bottom Downstream as of August 5, 2009 (Phase 1)

7.1.7 Map: Nature and Extent of Ash in the Tennessee River Bottom Upstream as of August 5, 2009 (Phase 1)

7.1.8 Map: EPA Tetra Tech Sampling Locations 12/23/2008

7.1.9 Map: TVA Kingston Fossil Plant Sediment Elevation Differences Between Pre and Post Flood Bathymetry

7.1.10 Map: TVA Kingston Fossil Plant Post Flood Bathymetry

7.1.11 Map: TVA Kingston Fossil Plant Pre Flood Bathymetry

7.1.12 Map: River System Box Core Sampling, June 2010

7.1.13 Map: Weir Bathymetry

7.1.14 Summary of ERDCWES Model Simulations

7.2 Nature and Extent Plans and Work Plans

7.2.1 *Kingston Ash Recovery Project Work Plan, Ash migration Investigation Using Sub-bottom Profiler*. Document No. EPA-AWP-026. Prepared by ESI. August 17, 2009.

7.3 Nature and Extent Support Documentation

7.3.1 *Final Report on the Background Soil Characterization Project at the Oak Ridge Reservation, Oak Ridge, Tennessee. Volume 1 – Results of Field Sampling Program*. DOE/OR/01-1175/V1. Prepared by the U.S. Department of Energy. 1993.

7.3.2 *Watts Bar Interagency Working Group Sediment Sampling Results in the Emory and Clinch Rivers*. Prepared by SAIC. March 2009.

7.3.3 *Kingston Ash Incident, Evaluation of Potential Legacy Contamination in Local Sediments*. Prepared by TVA. March 20, 2009.

7.3.4 *Time-Critical Removal Action Completion Report for River System Phase II Nature and Extent of Ash Investigation*. Prepared by TVA. April 21, 2010 (EPA approval).

7.4 EPA Air Audits

7.5 Air and Water Data Summaries

7.6 Selenium Reports

8 OFFSITE TRANSPORT AND DISPOSAL

8.1 Offsite Plans and Work Plans

8.1.1 *Sampling and Analysis Plan, Offsite Shipments of Ash for Remediation of the Tennessee Valley Authority Kingston Fossil Plant Ash Spill*. Prepared by ESI. August 7, 2009.

8.1.2 *Offsite Ash Disposal Options Analysis*. Document No. EPA-AO-001. Prepared Jacobs. July 2, 2009 (EPA approval).

8.1.3 *MACTEC Demobilization Plan, Revision 1*. Document No. EPA-AO-033. Prepared by MACTEC, Inc. November 4, 2010 (EPA approval).

8.1.4 *Final Ash Disposal Sampling Plan, TVA Kingston Plant, Kingston, Tennessee.* Prepare by ESI. April 28, 2009.

8.1.5 *Railcar Unloading Operation Work Plan*. Document No. EPA-AWP-001. Prepared by Jacobs. May 22, 2009 (EPA approval).

8.1.6 *Rail Spur Construction Work Plan*. Document No. EPA-AWP-004. Prepared by Jacobs. May 22, 2009 (EPA approval).

8.1.7 *Loading Work Plan*. Document No. EPA-AWP-023. Prepared by Jacobs. June 23, 2009 (EPA approval).

8.1.8 *Rail Modifications Work Plan*. Document No. EPA-AWP-036. Prepared by Jacobs. December 10, 2009 (EPA approval).

8.1.9 *Rail Modifications Work Plan, Revision 1*. Document No. EPA-AWP-046. Prepared by Jacobs. January 21, 2010 (EPA approval).

8.2 Supporting Documentation

8.2.1 Letter: *Waste Certification, Coal Ash with Absorbent and Petroleum Products*. From James L, Bryant, PE (ADEM) to Clint Courson (Hodges, Harbin, Newberry & Tribble, Inc.). December 14, 2009.

8.2.2 Letter: *Waste Certification, Fly Ash*. From James L, Bryant (ADEM) to Clint Courson (Hodges, Harbin, Newberry & Tribble, Inc.). April 9, 2009.

8.2.3 *Ash Loading Test Evaluation*. Prepared by Jacobs. May 28, 2009.

8.2.4 *Technical Evaluation Report, Assessment of the Radiological Dose Consequences of Disposing of Ash Waste Containing TENORM in a Municipal Solid Waste Landfill*. Prepared by Hodges, Harbin, Newerry & Tribble, Inc. June 22, 2009.

8.2.5 Summation of Comments Received and Response-to-Comments, Perry County Associates Landfill, Uniontown, Perry County, Alabama. Prepared by ADEM. July 2009.

8.2.6 Letter: *Perry County Associates Arrowhead Landfill - TVA Ash Project*. Prepared by Donald E. Williamson, M.D. (ADPH) to William F. Hodges (Hodges, Harbin, Newberry & Tribble, Inc.). June 22, 2009.

8.2.7 ADEM Permit No 53-03. July 20, 2009.

8.2.8 Letter: *Permit Modification, Perry County Associates Landfill, Permit Number 53-03 Modifications*. From Phillip D. Davis, Chief (ADEM) to Perry County Associates, LLC. July 20, 2009.

8.2.9 Letter: *Perry County Associates Landfill, TVA Ash Project, Sampling Frequency – Paint Filter*. From Hodges, Harben, Newberry and Tribble, Inc. to Mr. Ben Turner, President Phillips and Jordan, Inc. August 7, 2009.

8.2.10 Email: *Perry County Associates Landfill* (approval for additional agents). From Clint Courson (Hodges, Harbin, Newberry & Tribble, Inc.) to Eddie Dorsett, et. al. December 11, 2009.

8.2.11 Frequently Asked Questions Regarding the Disposal of Coal Ash at the Perry County Arrowhead Landfill, Uniontown, Alabama. Prepared by EPA.

9 OTHER TVA FACILITY ASSESSMENTS

9.1 *Phase 1 Facility Assessments for Coal Combustion Product Impoundments and Disposal Facilities in AL. KY, and TN*. Document No. EPA-AO-004. Prepared by Stantec. July 20, 2009 (EPA approval).

9.2 Letter: *Reports of Phase 2 Geotechnical Expiration at the Widows Creek and John Sevier Fossil Plants*. From Anda Ray (TVA) to Leo Francendese (EPA). February 26, 2010.

9.3 Letter: *Reports of Phase 2 Geotechnical Expiration at the Allen, Cumberland, Gallatin, Johnsonville, Paradise, and Shawnee Fossil Plants*. From McCracken (TVA) to Leo Francendese (EPA). August 2, 2010.

10 ASH PROCESSING

10.1 Ash Processing Plans and Work Plans

10.1.1 *Ash Processing Area Construction and Operation Plan*. Prepared by TVA Environmental Compliance. March 19, 2009 (TDEC approval).

10.1.2 *Kingston Fossil Plant Fly Ash Pond Incident Environmental Sampling Plan*. TVA-KIF-ESP. (Attachment 1 to the Kingston Fossil Plant Fly Ash Recovery Plan for Phase 1 Dredging Operation.) Prepared by TVA. March 19, 2009 (TDEC approval).

10.1.3 *Ash Stacking Heights in Processing Area Work Plan*. Document No. EPA-AWP-007. Prepared by Jacobs. June 9, 2009 (EPA approval).

10.1.4 *Rim Ditch Hydraulic Improvements Work Plan*. Document No. EPA-AWP-014. Prepared by Jacobs. July 14, 2009 (EPA approval).

10.1.5 *Rim Ditch Structural Improvements Work Plan*. Document No. EPA-AWP-015. Prepared by Jacobs. July 18, 2009 (EPA approval).

10.1.6 *Temporary Ash Stockpile in the Peninsula Borrow Area Work Plan*. Document No. EPA-AWP-027. Prepared by Jacobs. August 14, 2009 (EPA approval).

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10.1.8 *Wet Ash Storage to Support Time Critical Land-Based Ash Removal East of Dike #2 Work Plan*. Document No. EPA-AWP-025. Prepared by Jacobs. September 16, 2009 (EPA approval).

10.1.9 *Lime Test Work Plan.* Document No. EPA-AWP-032. Prepared by Jacobs. November 11, 2009 (EPA approval).

10.1.10 *Work Plan, Construction of Lateral Expansion Facilities-Phase 1*. Document No. EPA-AWP-033. Prepared by Jacobs. November 30, 2009 (EPA approval).

10.1.11 *Work Plan, Addendum to Construction of Lateral Expansion Facilities-Phase 1*. Document No. EPA-AWP-033A. Prepared by Jacobs. December 4, 2009 (EPA approval).

10.1.12 *Dredge Cell Relic Area Piezometer Installation Work Plan*. Document No. EPA-AWP-037. Prepared by Jacobs. December 11, 2009 (EPA approval).

10.1.13 *Work Plan, Mechanical Dewatering for Treatment of Ash Pond Fines*. Document No. EPA-AWP-038. Prepared by Jacobs. December 11, 2009 (EPA approval).

10.1.14 *Work Plan for New Road Construction along Sluice Trench*. Document No. EPA-AWP-041. Prepared by Jacobs. January 12, 2010 (EPA approval).

10.1.15 *Addendum to Ash Stacking Height in Processing Area Work Plan, Revision 1*. Document No. EPA-AWP-007A. Prepared by Jacobs. January 18, 2010 (EPA approval).

10.1.16 *Lime Application Work Plan*. Document No. EPA-AWP-047. Prepared by Jacobs. February 8, 2010 (EPA approval).

10.1.17 *Ash Pond Mechanical Dredging Work Plan*. Document No. EPA-AWP-048. Prepared by Jacobs. February 17, 2010 (EPA approval).

10.1.18 *Ball Field Reconfiguration Work Plan*. Document No. EPA-AWP-051. Prepared by Jacobs. February 25, 2010 (EPA approval).

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10.1.20 *Valley Area #2 Temporary Storage Work Plan, Revision 1*. Document No. RAWP-058. Prepared by Jacobs. March 15, 2010 (EPA approval).

10.1.21 *Work Plan, Construction/Operation of Excavation/Working Platform/Extended Platform on Lateral Expansion, Revision 1*. Document No. RAWP-053-R1. Prepared by Jacobs. April 8, 2010 (EPA approval).

10.1.22 *Storage of Mechanically Dredged Ash Work Plan, Revision 2*. Document No. RAWP-061. Prepared by Jacobs. April 9, 2010 (EPA approval).

10.1.23 *Lateral Expansion Platform Lime Treatment Work Plan*. Document No. RAWP-063. Prepared by Jacobs. April 15, 2010 (EPA approval).

10.1.24 *Kingston Fossil Plant Interim TSS Management Plan* (draft). Prepared by Jacobs. December 10, 2010.

10.2 Ash Processing Supporting Documentation

10.2.1 *Request for Use of Wick Drains in Ash Processing Area*. Prepared by TVA. February 20, 2009.

10.2.2 *Proposed Procedures for Construction, Operation, and Performance Monitoring, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, TN*. Prepared by TVA. February 24, 2009 (TDEC approval).

10.2.3 *Kingston Ash Recovery Project, Non-Time-Critical Removal Action, Embayment/Dredge Cell Action Memorandum*. Document No. EPA-AO-024. May 18, 2010 (EPA approval).

10.3 Ash Processing Completion Concurrence Forms

10.3.1 Time-Critical Concurrence Form KIF-10-005: *Time-Critical Concurrence: Ash Pond*. Prepared by Jacobs. March 12, 2010 (EPA approval).

11 EAST OF DIKE 2 DREDGING

11.1 Select Graphics of Time Critical Dredging Progress

11.1.1 Map: Dredge Production Segments February 16, 2010

11.1.2 Map: Dredge Segments February 2, 2009

11.1.3 Map: Emory River Bathymetry Progress October 8, 2009

11.1.4 Map: Emory River Bathymetry Progress November 10, 2009

11.1.5 Map: Emory River Bathymetry Progress November 17, 2009

11.1.6 Map: Emory River Bathymetry Progress December 4, 2009

11.1.7 Map: Emory River Bathymetry Progress December 17, 2009

11.1.8 Map: Emory River Bathymetry Progress October - December 2009

11.2 East of Dike 2 Dredging Plans and Work Plans

11.2.1 *Phase 1 Emory River Dredging Plan, Kingston Fossil Plant Ash Recovery Project*. Prepared by Shaw. February 25, 2009. TDEC approval March 2, 2009.

11.2.2 *Kingston Fossil Plant, Fly Ash Recovery Project, Sampling Plan for Phase I Dredging Operations*. Prepared by TVA Office of Environment & Research, Environmental Resources and Services. March 19, 2009.

11.2.3 *Relocation of the TVA Dredge Work Plan*. Document No. EPA-AWP-002. Prepared by Jacobs. May 22, 2009 (EPA approval).

11.2.4 *Construction/Implementation of Barge Offloading Area Work Plan*. Document No. EPA-AWP-005. Prepared by Jacobs. May 22, 2009 (EPA approval).

11.2.5 *Access Channel Construction and Debris Removal Operations Work Plan*. Document No. EPA-AWP-008. Prepared by Jacobs. June 1, 2009 (EPA Approval).

11.2.6 *Sampling Plan for Characterization of Radium-228 and Radium-226 in Recovered Fly Ash At the Tennessee Valley Authority Kingston Fossil Plant Kingston, Tennessee*. Prepared by ESI. June 8, 2009.

11.2.7 *Revised Emory River Dredging Plan, Kingston Fossil Plant Ash Recovery Project*. Document No. EPA-AO-011. Prepared by Jacobs. August 3, 2009 (EPA approval).

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11.2.9 *Kingston Fly Ash Recovery Project, Monitoring of Water Discharged During Dredged Fly Ash Dewatering Operations, Work Plan Update*. (draft). Prepared by Jacobs. October 27, 2009.

11.2.10 Not used

11.2.11 *Excavator Removal from the Emory River Work Plan*. Document No. EPA-AWP-034. Prepared by Jacobs. November 25, 2009 (EPA approval).

11.2.12 *Skimmer Wall Debris Removal Work Plan*. Document No. EPA-AWP-052. Prepared by Jacobs. February 25, 2010 (EPA approval).

11.2.13 *Weir 1 Removal Work Plan*. Document No. EPA-AWP-054. Prepared by Jacobs. March 5, 2010 (EPA approval).

11.2.14 *Dredge Plan Addendum-Completion of Time-Critical Removal Action, Revision 11*. Document No. EPA-AWP-065. Prepared by Jacobs. April 10, 2010 (EPA approval).

11.2.15 *Skimmer wall Debris Removal Work Plan, Revision 4*. Document No. RAWP-052A. Prepared by Jacobs. April 15, 2010 (EPA approval).

11.2.16 *Non-Time-Critical Removal Action for the River System, Sampling and Analysis Plan (SAP). Revision 3*. Document No. EPA-AO-021. Prepared by Jacobs. June 1, 2010 (EPA approval).

11.3 East of Dike 2 Dredging Support Documentation

11.3.1 *Request for Authorization to use Polymers to Enhance Treatment of Dredge Return Water*. March 23, 2009 (TDEC approval).

11.3.2 *Eckman Dredge and Visual Observation Survey for Portions of the Lower Emory River, Clinch River, and Tennessee River, Tennessee Valley Authority, May 22 and June 2, 2009, Report of Results*. Prepared by ESI. June 4, 2009 (issued date).

11.3.3 *Kingston Fly Ash Recovery Project, Dredged Fly Ash Dewatering Operation, Technical Memorandum. Rev. 2* (draft). Prepared by Jacobs. September 25, 2009.

11.3.4 *Review of Potential Selenium Issues Following a Coal Ash Spill*. Prepared by EPA Science Panel. Last updated December 2009.

11.3.5 *Dredged Fly Ash Dewatering Operation Technical Memorandum*. Prepared by Jacobs. January 8, 2010.

11.3.6 Memorandum: *Accuracy of Dredge Control Data Surface*. From John Trimble (Jacobs) and Paul Clay (ESI) to Dennis Yankee (TVA). March 4, 2010 (EPA approval).

11.3.7 Memorandum: *Documentation of the decision process for EPA approval of the final dredge depth determination for the time-critical removal action*. From Leo Francendese (EPA) to Steve McCracken (TVA). March 5, 2010.

11.3.8 Letter: *Vibecore Samples from Skimmer Wall Dock Area*. From Kathryn Nash (TVA) to Leo Francendese (EPA) and Barbara Scott (TDEC). August 26, 2010.

11.4 East of Dike 2 Dredging Completion Concurrence Forms

11.4.1 Time-Critical Concurrence Form KIF-10-001: *Dredging, Segment 4*. Prepared by Jacobs. January 19, 2010 (EPA approval).

11.4.2 Time-Critical Concurrence Form KIF-10-003: *Emory River, Segment 4, Grids G64 to G69*. Prepared by Jacobs. March 19, 2010 (EPA approval).

11.4.3 Time-Critical Concurrence Form KIF-10-004: Weir 1. Prepared by Jacobs. March 9. 2010 (EPA approval).

11.4.4 Time-Critical Concurrence Form KIF-10-007: *To the East of Grids A45, 46, and 47*. Prepared by Jacobs. March 26, 2010 (EPA approval).

11.4.5 Time-Critical Concurrence Form KIF-10-008: *River, Segment "Above Segment 5", Grids B112 and B114 to B118*. Prepared by Jacobs. April 8, 2010 (EPA approval).

11.4.6 Time-Critical Concurrence Form KIF-10-011: *Emory River, Segment 5, Grids D1 to D8.* Prepared by Jacobs. April 8, 2010 (EPA approval).

11.4.7 Time-Critical Concurrence Form KIF-10-012: *Emory River, Segment 1, Grids C49 to C50, D48 to D51, E48 to E51, and F50 to F51*. Prepared by Jacobs. May 4, 2010 (EPA approval).

11.4.8 Time-Critical Concurrence Form KIF-10-013: *Emory River, Segment 1, Grids D39 and D40*. Prepared by Jacobs. April 22, 2010 (EPA approval).

11.4.9 Time-Critical Concurrence Form KIF-10-014: *Emory River, Segment 3, Grids C57 and C58*. Prepared by Jacobs. May 4, 2010 (EPA approval).

11.4.10 Time-Critical Concurrence Form KIF-10-015: *Emory River, Segment 1, Grids E40 to E43*. Prepared by Jacobs. April 20, 2010 (EPA approval).

11.4.11 Time-Critical Concurrence Form KIF-10-016: *Emory River, Segment "Above Segment 5", Grids B111 and C112*. Prepared by Jacobs. April 28, 2010 (EPA approval).

11.4.12 Time-Critical Concurrence Form KIF-10-017: *Emory River, Segment "Above Segment 5", Grids D100 to D104*. Prepared by Jacobs. April 28, 2010 (EPA approval).

11.4.13 Time-Critical Concurrence Form KIF-10-018: *Emory River, Segment 2, Grids C55, C58, D55, D56, E53 to E66, and F52 to F56*. Prepared by Jacobs. May 10, 2010 (EPA approval).

11.4.14 Time-Critical Concurrence Form KIF-10-019: *Emory River, Segment "Above Segment 5", Grids A100, A101, and A102*. Prepared by Jacobs. April 24, 2010 (EPA approval).

11.4.15 Time-Critical Concurrence Form KIF-10-020: *Emory River, Segment "Above 5", Grids B103 and B104*. Prepared by Jacobs. May 4, 2010 (EPA approval).

11.4.16 Time-Critical Concurrence Form KIF-10-021: *Emory River, Segment 1, Grids D44 to D47 and E44 to E47*. Prepared by Jacobs. May 4, 2010 (EPA approval).

11.4.17 Time-Critical Concurrence Form KIF-10-022: Emory River, Segment "Above Segment 5", west corner of Grid E125, south corner E-136, west corner of A126, and north corner of A125. Prepared by Jacobs. May 5, 2010 (EPA approval).

11.4.18 Time-Critical Concurrence Form KIF-10-023: *Emory River, Segment "Above Segment 5", Grids B105 to B107*. Prepared by Jacobs. May 10, 2010 (EPA approval).

11.4.19 Time-Critical Concurrence Form KIF-10-024: *Emory River, Segment "Above Segment 5", Grids B121 to B123*.Prepared by Jacobs. May 14, 2010 (EPA approval).

11.4.20 Time-Critical Concurrence Form KIF-10-025: *Emory River, Segment 5, Grids A20 to A22*. Prepared by Jacobs. May 14, 2010 (EPA approval).

11.4.21 Time-Critical Concurrence Form KIF-10-026: *Emory River, Segment 5, Grids A1 to A4 and B1 to B4*. Prepared by Jacobs. May 14, 2010 (EPA approval).

11.4.22 Time-Critical Concurrence Form KIF-10-027: *Emory River, Segment "Above Segment 5", Grids B100 to B102*. Prepared by Jacobs. May 14, 2010 (EPA approval).

11.4.23 Time-Critical Concurrence Form KIF-10-028: *Emory River, Segment "Above Segment 5", Grids A127, A128, B127, B128, C125 to C128, D125, and D126.* Prepared by Jacobs. May 17, 2010 (EPA approval).

11.4.24 Time-Critical Concurrence Form KIF-10-030: *Emory River, Segment 3, Grids D57 and D58*. Prepared by Jacobs. May 17, 2010 (EPA approval).

11.4.25 Time-Critical Concurrence Form KIF-10-031: *Emory River, Segment "Above 5", Grids D111 to D113*. Prepared by Jacobs. May 20, 2010 (EPA approval).

11.4.26 Time-Critical Concurrence Form KIF-10-032: *Emory River, Segment Above 5, Grids C106 to C108 and D105 to D108*. Prepared by Jacobs. May 20, 2010 (EPA approval).

11.4.27 Time-Critical Concurrence Form KIF-10-033: *Emory River, Segment 1, Grids B47, C35 to C42, C47 and C48, and D31 to D35*. Prepared by Jacobs. May 14, 2010 (EPA approval).

11.4.28 Time-Critical Concurrence Form KIF-10-034: *Emory River, Segment 5, Grids A8, B8 to B18, C2, C3, B8 to B18, C2, C3, and C15*. Prepared by Jacobs. May 14, 2010 (EPA approval).

11.4.29 Time-Critical Concurrence Form KIF-10-035: *Emory River, Segment 4, Grid D66, E63 to E66, and F63 to F70*. Prepared by Jacobs. May 17, 2010 (EPA approval).

11.4.30 Time-Critical Concurrence Form KIF-10-036: *Emory River, Segment "Above Segment 5", Grids C119 to C122, D119 to D2122*. Prepared by Jacobs. May 17, 2010 (EPA approval).

11.4.31 Time-Critical Concurrence Form KIF-10-037: *Emory River, Segment "Above Segment 5", Grids D109, D110, and C10*7. Prepared by Jacobs. May 17, 2010 (EPA approval).

11.4.32 Time-Critical Concurrence Form KIF-10-038: *Emory River, Above Segment 5, Grids C104 and C105*. Prepared by Jacobs. May 17, 2010 (EPA approval).

11.4.33 Time-Critical Concurrence Form KIF-10-039: *Emory River, Segment 5, Grids A18 and A19*. Prepared by Jacobs. May 17, 2010 (EPA approval).

11.4.34 Time-Critical Concurrence Form KIF-10-040: *Emory River, Segment 1, Grids B34, B35, and C1 to C34*. Prepared by Jacobs. May 20, 2010 (EPA approval).

11.4.35 Time-Critical Concurrence Form KIF-10-041: *Emory River, Segment 5, Grids A5 to A7, and A9 to A11*. Prepared by Jacobs. May 17, 2010 (EPA approval).

11.4.36 Time-Critical Concurrence Form KIF-10-042: *Emory River, Segment 3, Grids D59, D60, E57 to E60, F57 to F60, and G57 to G59*. Prepared by Jacobs. May 20, 2010 (EPA approval).

11.4.37 Time-Critical Concurrence Form KIF-10-043: *Emory River, Segment 2, Grids G53 to G56*. Prepared by Jacobs. May 20, 2010 (EPA approval).

11.4.38 Time-Critical Concurrence Form KIF-10-044: *Emory River, Segment "Above 5", Grids B125, B126, C123 to C126, and D123 to D124*. Prepared by Jacobs. May 20, 2010 (EPA approval).

11.4.39 Time-Critical Concurrence Form KIF-10-045: *Emory River, Segment above 5, Grids C116 to C118 and D116 to D118*. Prepared by Jacobs. May 21, 2010 (EPA approval).

11.4.40 Time-Critical Concurrence Form KIF-10-046*: Segment "Above 5", Grids C114 to C115 and D114 to D115*. Prepared by Jacobs. May 25, 2010 (EPA approval).

11.4.41 Time-Critical Concurrence Form KIF-10-047: *Emory River, Segment "Above Above 5", Area 1, ERM 5.0 to 5.9*. Prepared by Jacobs. May 20, 2010 (EPA approval).

11.4.42 Time-Critical Concurrence Form KIF-10-048: *Emory River, Segment "Above Above Segment 5", Area 2, ERM 5.9 to 5.4*. Prepared by Jacobs. May 27, 2010 (EPA approval).

11.4.43 Time-Critical Concurrence Form KIF-10-049: *Emory River, Segment "Above Segment 5", Area 3, ERM 5.1 to 4.8*. Prepared by Jacobs. May 27, 2010 (EPA approval).

11.4.44 Time-Critical Concurrence Form KIF-10-050: *Emory River, Segment "Above Above 5", Area 4, ERM 4.6 to 4.2*. Prepared by Jacobs. May 27, 2010 (EPA approval).

11.4.45 Time-Critical Concurrence Form KIF-10-051: *Emory River, Segment "Above Above 5", Area 5, ERM 4.2 to 4.1*. Prepared by Jacobs. May 25, 2010 (EPA approval).

11.4.46 Time-Critical Concurrence Form KIF-10-053: *Emory River, Segment 4, Grids D67 to D71 and E67 to E71*. Prepared by Jacobs. May 20, 2010 (EPA approval).

11.4.47 Time-Critical Concurrence Form KIF-10-054: *Emory River, Segment 5, Grids A12 to A17*. Prepared by Jacobs. May 20, 2010 (EPA approval).

11.4.48 Time-Critical Concurrence Form KIF-10-055: *Emory River, Segment 1, Grids B27, C27, and D27*. Prepared by Jacobs. May 27, 2010 (EPA approval).

11.4.49 Time-Critical Concurrence Form KIF-10-056: *Emory River, Segment 5, Grid A24, A25, B25, B26, C23 to C26, and D25*.Prepared by Jacobs. May 27, 2010 (EPA approval).

11.4.50 Time-Critical Concurrence Form KIF-10-057: *Emory River, Segment 5, Grids B19 to B24*. Prepared by Jacobs. June 1, 2010 (EPA approval).

11.4.51 Time-Critical Concurrence Form KIF-10-058: *Emory River, Segment 5, Grids B5 to B7 and C4 to C7*. Prepared by Jacobs. May 27, 2010 (EPA approval).

11.4.52 Time-Critical Concurrence Form KIF-10-059: *Emory River, Segment "Above 5", Grids C100 to C103, Segment 5, C1*. Prepared by Jacobs. May 24, 2010 (EPA approval).

11.4.53 Time-Critical Concurrence Form KIF-10-060: *Emory River, Segment 1, Grid B33*. Prepared by Jacobs. May 27, 2010 (EPA approval).

11.4.54 Time-Critical Concurrence Form KIF-10-061: *Emory River, Segment 5, Grid A23*. Prepared by Jacobs. May 27, 2010 (EPA approval).

11.4.55 Time-Critical Concurrence Form KIF-10-062: *Emory River, Segment 1, Grids B28 to B30, C28 to C30, and D28 to D30*. Prepared by Jacobs. June 30, 2010 (EPA approval).

11.4.56 Time-Critical Concurrence Form KIF-10-063: *Emory River, Segment "East of Dike 2" Grid 29A1*. Prepared by Jacobs. June 30, 2010 (EPA approval).

11.4.57 Time-Critical Concurrence Form KIF-10-064: *Emory River, Segment "East of Dike 2", Grids 31B1 to 35B1 and 34A1 and 35A1*. Prepared by Jacobs. July 1, 2010 (EPA approval).

11.4.58 Time-Critical Concurrence Form KIF-10-065: *Emory River, Segment 1, Grids B44 to B46 and C44 to C48*. Prepared by Jacobs. June 30, 2010 (EPA approval).

11.4.59 Time-Critical Concurrence Form KIF-10-066: *Emory River, Segment 1, Grids B42, B43, and C43*. Prepared by Jacobs. June 30, 2010 (EPA approval).

11.4.60 Time-Critical Concurrence Form KIF-10-067: *Emory River, Segment 1, Grids B40 and B41*. Prepared by Jacobs. June 25, 2010 (EPA approval).

11.4.61 Time-Critical Concurrence Form KIF-10-068: *Emory River, Segment "East of Dike 2", Grids 33A1*. June 24, 2010 (EPA approval).

11.4.62 Time-Critical Concurrence Form KIF-10-069: *Emory River, Segment 1, Grids B36 to B39*. Prepared by Jacobs. June 25, 2010 (EPA approval).

11.4.63 Time-Critical Concurrence Form KIF-10-070: *Emory River, Segment "East of Dike 2", Grids 30A1 and 31A1*. Prepared by Jacobs. July 8, 2010 (EPA approval).

11.4.64 Time-Critical Concurrence Form KIF-10-071: *Emory River, Segment "East of Dike 2", Grids 36A1 and 36B1*. Prepared by Jacobs. June 24, 2010 (EPA approval).

11.4.65 Time-Critical Concurrence Form KIF-10-072: *Emory River, Segment "East of Dike 2", Grids 29C1, 29D1, 29E1, and 30D1*. June 30, 2010 (EPA approval).

11.4.66 Time-Critical Concurrence Form KIF-10-073: *Emory River, Segment "East of Dike 2", Grids 38A1 and 42A1*. Prepared by Jacobs. June 21, 2010 (EPA approval).

11.4.67 Time-Critical Concurrence Form KIF-10-074: *Emory River, Segment "East of Dike 2", Grids 28B1 and 29B1*. Prepared by Jacobs. June 24, 2010 (EPA approval).

11.4.68 Time-Critical Concurrence Form KIF-10-075: *Emory River, Segment "East of Dike 2", Grids 37A1 through 37D1.* Prepared by Jacobs. June 21, 2010 (EPA approval).

11.4.69 Time-Critical Concurrence Form KIF-10-077: *East of Dike 2, Land*. Prepared by Jacobs. June 24, 2010 (EPA approval).

11.4.70 Time-Critical Concurrence Form KIF-10-078: *Bob Summer's Road Area East of Dike 2*. Prepared by Jacobs. August 24, 2010 (EPA approval).

12 EAST OF DIKE 2 EXCAVATION

12.1 East of Dike 2 Excavation Plans and Work Plans

12.1.1 *Ash Movement East of Dike #2 Work Plan*. Document No. EPA-AWP-003. Prepared by Jacobs. May 22, 2009 (EPA approval).

12.1.2 *Time Critical Land-Based Ash Removal East of Dike #2 Work Plan*. Document No. EPA-AWP-009. Prepared by Jacobs. June 9, 2009 (EPA approval).

12.1.3 *Time Critical Land-Based Ash Removal East of Dike #2 Work Plan, Revised*. Document No. EPA-AWP-031. Prepared by Jacobs. July 1, 2009 (EPA approval).

12.1.4 *Time Critical Ash removal from East Embayment Work Plan.* Document No. EPA-AWP-013. Prepared by Jacobs. November 11, 2009 (EPA approval).

12.2 East of Dike 2 Excavation Completion Concurrence Forms

12.2.1 Time-Critical Concurrence Form KIF-10-006: *Completion of Northern Portion of the East Embayment*. Prepared by Jacobs. March 18, 2010 (EPA approval).

12.2.2 Time-Critical Concurrence Form KIF-10-010: *Rookery Island*. Prepared by Jacobs. April 9, 2010 (EPA approval).

12.2.3 Time-Critical Concurrence Form KIF-10-029: *Southern Portion of the East Embayment*. Prepared by Jacobs. May 11, 2010 (EPA approval).

12.2.4 Time-Critical Concurrence Form KIF-10-052: *East of Dike 2*. Prepared by Jacobs. June 22, 2010 (EPA approval).

12.2.5 Time-Critical Concurrence Form KIF-10-076: *East of Dike 2, North Point and Road to East Embayment*. June 24, 2010 (EPA approval).

13 KINGSTON DIKE EVALUATIONS AND MAINTENANCE

13.1 Kingston Dike Plans and Work Plans

13.1.1 *Piezometer 09-400 Abandonment Work Plan*. Document No. EPA-AWP-016. Prepared by Jacobs. July 20, 2009 (EPA approval).

13.1.2 *Dike D and Dike 2 Evaluation Report, Kingston Fly Ash Recovery Project*. Document No. EPA-AO-031. Prepared by Jacobs. August 26, 2009 (submittal date).

13.1.3 *Dike C Risk Mitigation Work Plan*. Document No. EPA-AWP-035. Prepared by Jacobs. December 2, 2009 (EPA approval).

13.1.4 *Dike C Buttress Work Plan - Section C*. Document No. EPA-RAWP-067. Prepared by Jacobs. April 24, 2010 (EPA approval).

13.1.5 *Work Plan for Construction Support Geotechnical Investigation of East Dike*. Document No. RAWP-059. Prepared by Jacobs. March 25, 2010 (EPA approval).

13.1.6 *Dike 2 Remediation Work Plan*. Document No. RAWP-076. Prepared by Jacobs. August 26, 2010 (EPA approval).

13.1.7 *Dike C Buttress Work Plan - Segment A*. Document No. RAWP-086. Prepared by Jacobs. January 27, 2011 (EPA approval).

13.2 Kingston Dike Support Documentation

13.2.1 *Environmental Assessment, Initial Emergency Response Actions for the Kingston Fossil Plant Ash Dike Failure, Roane County, Tennessee*. Prepared by TVA. February 2009.

13.2.2 Calculations Cover Sheet: *Slope Stability Analyses for Dike 2*. Prepared by Geosyntec. July 31, 2009.

13.2.3 *Report of Geotechnical Exploration and Slope Stability for Dike C*. Prepared by Stantec. August 3, 2009.

13.2.4 Email: *Drop out on KIF Dike D.* From Vernon Dotson, Jr. (TVA) to Leo Francendese (EPA) et. al. January 29, 2010.

13.2.5 Memorandum: *Document the Decision Process for EPA Delaying the Work Plan Pertaining to Dike D Stability Under Time-Critical Removal Action*. From Leo Francendese (EPA) to Steve McCracken (TVA). May 26, 2010.

13.2.6 Memorandum: *Request for Temporary Suspension of Dike C Buttress Construction Activity*. From Leo Francendese (EPA) to Steve McCracken (TVA). June 21, 2010.

13.2.7 Calculations Cover Sheet: *Seepage and Stability Study for East Dike and Raised Dike*. Prepared by Geosyntec. June 30, 2010.

13.2.8 Technical Memorandum: *Integrity Evaluation of Dike 2 for Extreme Rainfall Events*. From Neil Davies, et. al. (Geosyntec) to Jack Howard (Jacobs). Prepared by Geosyntec. July 14, 2010.

13.2.9 Memo: *Dike C Buttress*. From Stantec to Michelle Cagley (TVA) / Todd Woodson (Jacobs). July 19, 2010.

13.2.10 *Seepage and Stability Study for North End of East Dike*. Prepared by Geosyntec. December 2, 2010.

13.2.11 Technical Memorandum: *Organic Material in Buttress Sand*. From Steve McCracken (TVA) to Leo Francendese (EPA). March 7, 2011.

14 MISCELLANEOUS INFRASTRUCTURE

14.1 *Swan Pond Road Construction Entrance Work Plan*. Document No. EPA-AWP-022. Prepared by Jacobs. June 19, 2009 (EPA approval).

14.2 *Work Plan, Ball Field Modifications - Roads & Drainage*. Document No. EPA-AWP-043. Prepared by Jacobs. November 24, 2009 (EPA approval).

15 REMOVAL ACTION PRODUCTION GRAPHS

15.1 Graph: Daily Removal East of Dike #2. 02-23-09 - 04-19-09

15.2 Graph: Daily Removal East of Dike #2, 04-20-2009 to 05-17-2009

15.3 Graph: Daily Removal East of Dike #2, 05-18-2009 to 06-14-2009

15.4 Graph: Daily Removal East of Dike #2, 06-15-2009 to 07-12-2009

15.5 Graph: Daily Removal East of Dike #2, 07-13-2009 to 08-09-2009

15.6 Graph: Daily Removal East of Dike #2, 08-10-2009 to 09-06-2009

15.7 Graph: Daily Removal East of Dike #2, 09-07-2009 to 10-04-2009

15.8 Graph: Daily Removal East of Dike #2, 10-05-2009 to 11-01-2009

15.9 Graph: Daily Removal East of Dike #2, 11-02-2009 to 11-29-2009

15.10 Graph: Daily Removal East of Dike #2, 11-30-2009 to 12-27-2009

15.11 Graph: Daily Removal East of Dike #2, 12-28-2009 to 01-24-2010

15.12 Graph: Daily Removal East of Dike #2, 01-25-2010 to 02-21-2010

15.13 Graph: Daily Removal East of Dike #2, 02-22-2010 to 03-21-2010

15.14 Graph: Daily Removal East of Dike #2, 03-22-2010 to 04-18-2010

15.15 Graph: Daily Removal East of Dike #2, 04-19-2010 to 05-16-2010

15.16 Graph: Daily Removal East of Dike #2, 05-17-2010 to 06-13-2010

15.17 Graph: Total Removal (March thru September 2009)

15.18 Graph: Total Removal (April thru July 2010)

15.19 Graph: Total Removal (October 2009 thru March 2010)

16 DEMOBILIZATION

16.1 Sevenson Work Package for Phase 2 - Demobilization of Desanding Equipment, Tanks, and Pumps; Sevenson Work Package for Phase 3 - Demobilization of Filter Presses (canopy, plates, frames, stands). May 26, 2010 (EPA approval).

16.2 *Dredge Demobilization Work Plan.* Document No. RAWP-075. Prepared by Jacobs. May 27, 2010 (EPA approval).

16.3 *Filter Press Demobilization Work Plan*. Document No. RAWP-064. Prepared by Jacobs. April 30, 2010 (EPA approval).

16.4 *Heavy Equipment Demobilization Plan*. Document No. RAWP-073. Prepared by Jacobs. June 21, 2010 (EPA approval).

16.5 *Aquarius Debris Removal Demobilization Plan, Revision 1*. Document No. RAWP-074. Prepared by Jacobs. July 7, 2010 (EPA approval).

16.6 *Support Services Equipment Demobilization Work Plan, Revision 2*. Document No. RAWP-077. Prepared by Jacobs. August 3, 2010 (EPA approval).

16.7 *Work Plan for Removal of Cantilevered Sheet Piling Wall, Revision 3*. Document No. RAWP-079. Prepared by Jacobs. August 3, 2010 (EPA approval).

16.8 *Cenosphere Recovery Demobilization Work Plan, Revision 1*. Document No. RAWP-080. Prepared by Jacobs. August 20, 2010 (EPA approval).

16.9 *Addendum to the Aquarius Debris Removal Demobilization Plan; Decontamination of AM501 and AM504*. Document No. RAWP-074A. Prepared by Jacobs. September 10, 2010 (EPA approval).

17 STORMWATER MANAGEMENT

17.1 *Cenosphere Containment and Recovery and Shoreline Cleanup and Assessment Team (SCAT) Plan,* section "TVA Kingston Fly Ash Incident, Long Term Cenosphere Containment and Recovery Plan, January 24, 2009." Prepared by TVA. March 16, 2009.

17.2 *Tennessee Department of Environment and Conservation Commissioner's Order, Case No. OGC09-0001, Interim Drainage Plan and Controls - Ash Release Area, Kingston Fossil Plant, Revision 1*. Prepared by TDEC. April 3, 2009 (TDEC approval).

17.3 *Settling Area Outlet Work Plan.* Document No. EPA-AWP-019. Prepared by Jacobs. June 9, 2009 (EPA approval).

17.4 *Cenosphere Collection Area Consolidation Work Plan*. Document No. EPA-AWP-020. Prepared by Jacobs. June 19, 2009 (EPA approval).

17.5 *Clean Water Ditch in the East Embayment Work Plan*. Document No. EPA-AWP-021. Prepared by Jacobs. June 19, 2009 (EPA Approval).

17.6 *Site Storm Water Management Plan*. Document No. EPA-AO-002. Prepared by Jacobs. June 29, 2009 (EPA approval).

17.7 *Revised Cenosphere Collection Area Consolidation Work Plan*. Document No. EPA-AWP-020A. Prepared by Jacobs. October 27, 2009 (EPA Approval).

17.8 *Settling Basins Maintenance and Clean Out Plan*. Document No. EPA-AO-018. Prepared by Jacobs. October 30, 2009 (EPA approval).

17.9 Letter: *Storm Water Pollution Prevention Addendum*. From Michael Scott (TVA) to Leo Francendese (EPA). Document No. EPA-AO-002A. November 12, 2009 (EPA approval).

17.10 *Settling Areas 1A & 2A Maintenance and Cleanout Work Plan*. Document No. EPA-AWP-040. Prepared by Jacobs. January 12, 2010 (EPA approval).

18 TEST EMBANKMENT

18.1 *Test Embankment Program*. Prepared by Stantec. June 3, 2009.

18.2 *Assessment of Current Stability, Dredge Cell Test Embankment*. Prepared by Stantec. November 9, 2009.

18.3 Letter*: Updated Assessment and Recommendations to Improve Stability Dredge Cell Test Embankment*. From Alan Rauch and Mike Steele (Stantec) to Mike Scott (TVA). February 2, 2010.

18.4 *Test Embankment Buttress Work Plan*. Document No. EPA-AWP-055. Prepared by Jacobs. March 3, 2010 (EPA approval).

18.5 *Report of Test Embankment.* Prepared by Stantec. April 23, 2010.

19 TIME-CRITICAL TO NON-TIME-CRITICAL TRANSITION WORK PLANS

19.1 *North Embayment Ash Consolidation Work Plan, Revision 4*. Document No. RAWP-060. Prepared by Jacobs. April 8, 2010 (EPA approval).

19.2 *North Embayment Underpass Work Plan, Revision 1*. Document No. RAWP-062. Prepared by Jacobs. April 7, 2010 (EPA approval)

19.3 *Central Area Re-contouring Work Plan, Revision 4*. Document No. RAWP-068. Prepared by Jacobs. April 12, 2010 (EPA approval).

20 HEALTH AND SAFETY

20.1 Health and Safety Plans and Work Plans

20.1.1 *Health and Safety Accident Prevention Plan, Emory River Dredging, Tennessee Valley Authority Kingston Fossil Plant, Revision 1*. Prepared by Shaw. February 3, 2009.

20.1.2 *Site Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response, Revision 2*. Document No. EPA-AO-003. Prepared by Jacobs. April 6, 2009.

20.1.3 *Site Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response, Revision 3*. Document No. EPA-AO-003. Prepared by Jacobs. June 30, 2009 (EPA approval).

20.1.4 *Construction Site Security Plan*. Document No. EPA-AO-012. Prepared by TVA. August 14, 2009 (EPA approval).

20.1.5 *Work Plan for Vehicle Wheel Wash and Decontamination at Main Entrance/Exit.* Document No. EPA-AWP-029. Prepared by Jacobs. October 19, 2009 (EPA approval).

20.1.6 *Kingston Fossil Plant Emergency Response Plan, KIF.EP.14.00.001, (Revision 31*). Prepare by TVA. December 9, 2009.

20.1.7 *Site Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response, Revision 4*. Document No. EPA-AO-003. Prepared by Jacobs. February 26, 2010 (EPA approval).

20.1.8 *Site Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response, Revision 5*. Document No. EPA-AO-003. Prepared by Jacobs. October 21, 2010 (EPA approval).

20.2 Health and Safety Support Documentation

20.2.1 *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), OSWER Directive 9285.7-01B. 1991*. Prepared by EPA. December 1991.

20.2.2 *Standard Operating Safety Guide*. Publication 9255.1-03. Prepared by EPA. June 1992.

20.2.3 *Tennessee Valley Authority TVA Safety Manual*. Revision 13. January 26, 2009

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27 EPA POLLUTION REPORTS

27.1 POLREPS 2009

27.2 POLREPs 2010

27.3 POLREPs 2011

28 TVA WEEKLY REPORTS

28.1 TVA Weekly Reports 2009

28.2 TVA Weekly Reports 2010

28.3 TVA Weekly Reports 2011

29 CONTRACTOR DAILY REPORTS

29.1 Aquarius Daily Reports

29.2 Ash Disposal Team Daily Reports

29.3 Civil Projects Daily Reports

29.4 Dust Control Daily Reports

29.5 Hart Hat Daily Reports

29.6 Jacobs Dike C Buttress Construction Daily Reports

29.7 Jacobs Dredging Daily Reports

29.8 Jacobs Infrastructure Daily Reports

29.9 Jacobs QA Daily Reports

29.10 KIF Field Lab Daily Reports

29.11 MACTEC Daily Reports

29.12 Mayse Daily Reports

29.13 Phillips and Jordan Daily Reports

29.14 Sevenson Daily Dredge Logs

29.15 Sevenson Dredging Dailey Reports

29.16 Skimmer Wall Debris Removal Daily Reports

29.17 SWS Environmental Daily Reports

29.18 Tetra Tech Daily Reports for Cenosphere Recovery

29.19 Norfolk Southern Daily Reports

29.20 Stantec Daily Reports

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30.1 July 18, 2009 Incident

30.2 August 12, 2009 Incident

30.3 March 22, 2010 Incident

31 PROGRAM MANAGEMENT STANDARD OPERATING PROCEDURES

32 EPA WEBSITE USAGE

32.1 Graph: Website Usage (May 2009 - January 2011). Prepared by OTIE.