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SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

JOHNSONVILLE FOSSIL PLANT
ASH DISPOSAL SITE EXPANSION

Benton, Houston, and Humphreys Counties, Tennessee

PREPARED BY:
TENNESSEE VALLEY AUTHORITY

MAY 2009

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ACRONYMS, ABBREVIATIONS, AND SYMBOLS

µg/L	Micrograms per Liter
APE	Area of Potential Effect
BIP	Bivens Industrial Park
BMPs	Best Management Practices
CCC	Criterion Continuous Concentration
cm/sec	Centimeters per Second
CMC	Criterion Maximum Concentration
COC	Contaminant of Concern
DO	Dissolved Oxygen
EA	Environmental Assessment
EO	Executive Order
FBP	Fuel By-Products
FML	Flexible Membrane Liner
FONSI	Finding of No Significant Impact
FRP	Flood Risk Profile
GCL	Geosynthetic Clay Liner
HDPE	High Density Polyethylene
HELP	Hydrologic Evaluation of Landfill Performance
JOF	Johnsonville Fossil Plant
KWT	Kentucky Watershed Team
L	Left-Descending Bank
LCS	Leachate Collection System
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
R	Right-Descending Bank
SEA	Supplemental Environmental Assessment
SPM	Suspended Particulate Matter
TDEC	Tennessee Department of Environment and Conservation
TRM	Tennessee River Mile
TVA	Tennessee Valley Authority
TVARAM	TVA Rapid Assessment Method
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WMT	Wetland Mitigation Tract

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FINAL SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

JOHNSONVILLE FOSSIL PLANT ASH DISPOSAL SITE EXPANSION
BENTON, HOUSTON, AND HUMPHRIES COUNTIES, TENNESSEE

TENNESSEE VALLEY AUTHORITY

MAY 2009

The Proposed Decision and Need

Tennessee Valley Authority's (TVA) current Fossil Power Group generating plan calls for the coal-fired Johnsonville Fossil Plant (JOF) to continue generation of electric power at least through calendar year 2021. Burning coal to produce electricity produces coal ash, which consists of fly ash and bottom ash. Since 2003, Trans-Ash Incorporated has contracted with TVA to haul coal ash from JOF to Bivens Industrial Park (BIP). The existing permitted disposal capacity for coal ash at BIP was exhausted on September 30, 2008. TVA is considering continuing disposal of coal ash at BIP, which requires increasing the ash disposal capacity there. Increased capacity at BIP would allow the JOF facility to continue operation beyond calendar year 2009. TVA proposes to deposit coal ash generated by coal combustion operations of the JOF at a 20.6-acre expansion of the existing ashfill at BIP in Camden, Benton County, Tennessee.

Background

At BIP, the ash is formed into a large level pile, which may be used in the future as structural fill for a light industry business park. Trans-Ash would operate both the existing ash disposal area at BIP and the proposed expansion. A map showing the general location of the BIP is presented in Figure 1.

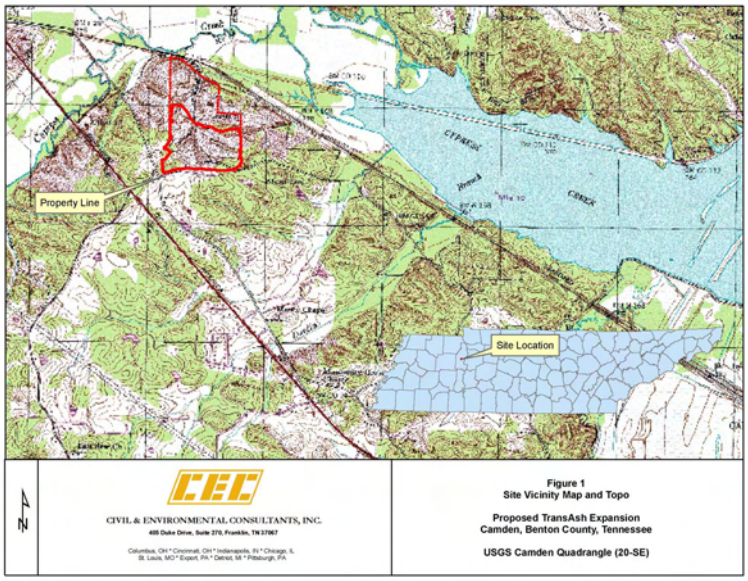
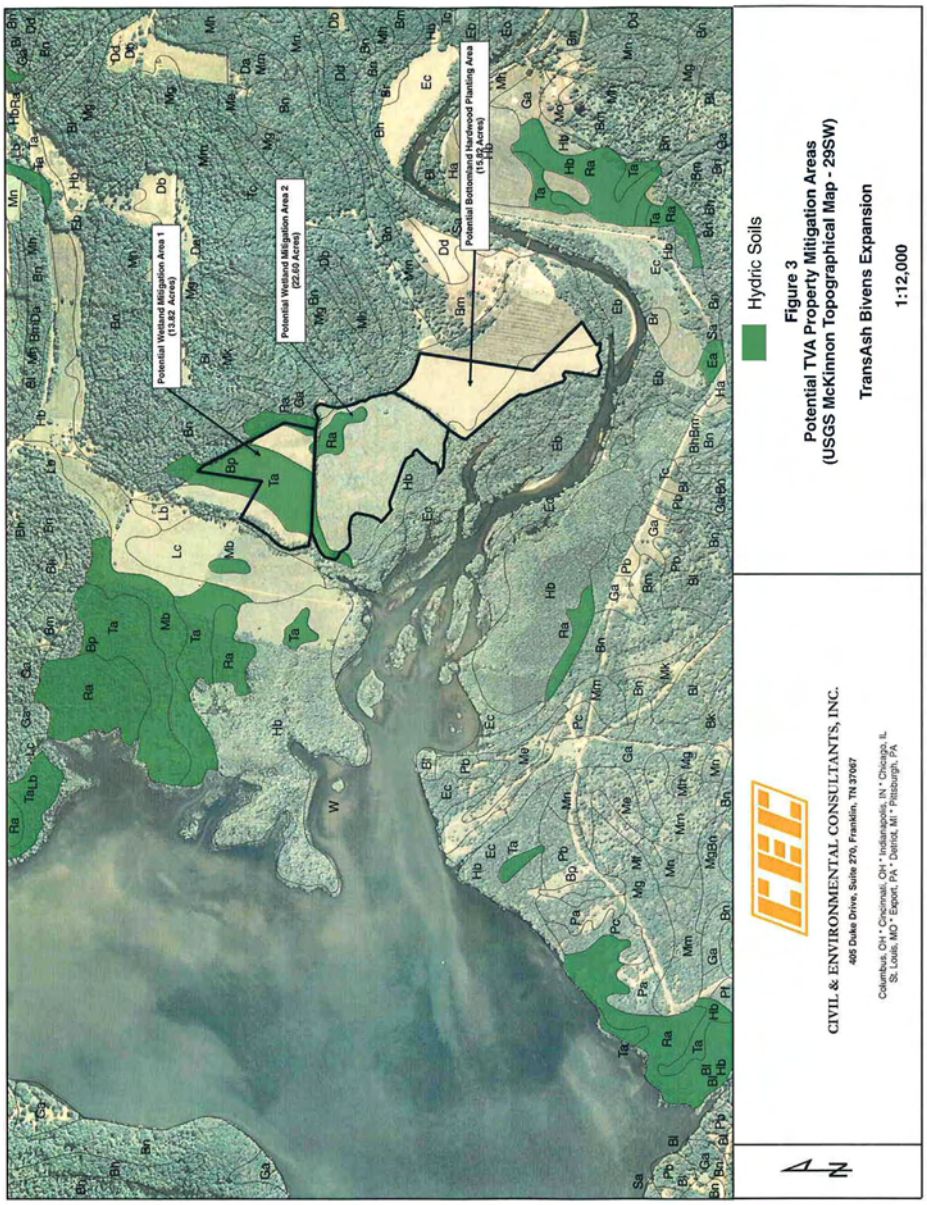


Figure 1. Map Showing General Location of Bivens Industrial Park, Benton County, Tennessee

In February 2002, TVA completed an environmental assessment (EA) and finding of no significant impact (FONSI) for JOF entitled *Johnsonville Fossil Plant – Development of Long-Term Ash Management Strategy*. In the 2002 EA, TVA assessed and evaluated environmental impacts related to the use of coal ash as structural fill at BIP. The alternative chosen in the 2002 EA was the creation of the first of two proposed phases of ashfill development at BIP, known as BIP Phase 1. The Phase 1 ashfill covers a total area of approximately 40 acres. Phase 1 and the proposed Phase 2 are both shown in Figure 2; Phase 2 is on the right side of the map, outlined in green on the top, bottom, and right, and red on the left.

Figure 2. Location of Bivens Industrial Park, Benton County, Tennessee, With Existing (Phase 1) and Proposed (Phase 2) Ashfill Development Shown

In this supplemental environmental assessment (SEA), TVA evaluated the potential impacts of the 20-acre expansion of the existing ashfill at BIP, known as BIP Phase 2. About 3 acres of low-quality wetlands would be lost during development of Phase 2. To mitigate for the loss of these wetlands, TVA Fuel By-Products Group (FBP) would convert about 18 acres of a 22-acre tract of TVA land adjacent to Kentucky Reservoir into wetlands. In the present SEA, the TVA land on Kentucky Reservoir is referred to as the wetland mitigation tract (WMT). An aerial photo showing the location of the WMT is presented in Figure 3. The agreement memorializing the use of the WMT for mitigation is presented in Appendix A.



(Labeled as Potential Mitigation Area 2 on the photo)

Figure 3. Location of the Wetland Mitigation Tract on Kentucky Reservoir, Houston County, Tennessee

Other Environmental Reviews and Documentation

- *Coal Combustion By-Products Marketing/Utilization and Listing of Approved Uses Final Environmental Assessment and Finding of No Significant Impact* (TVA 1987)

  In this EA and FONSI, TVA determined that coal ash could be used as structural fill in light industrial business parks without significantly impacting the environment.

- *Johnsonville Fossil Plant – Development of Long-Term Ash Management Strategy Final Environmental Assessment and Finding of No Significant Impact* (TVA 2002)

  TVA determined in this environmental review that the construction of BIP Phase 1 would have no significant impacts on the environment.

The Scoping Process

The 2002 EA addressed several resource topics in relation to Phase 1 that are still valid for Phase 2. Those topics are:

- Air quality
- Land Use
- Noise

TVA reviewed the following additional resource areas in the present SEA:

- Groundwater
- Surface Water
- Solid Waste
- Threatened and Endangered Species
- Terrestrial Resources
- Wetlands
- Aquatic Ecology
- Managed Areas
- Socioeconomics
- Visual Effects
- Floodplains and Flood Risk
- Cultural Resources and Historic Properties

Necessary Permits or Licenses

The No Action Alternative would require no additional permits or licenses.

The Action Alternative would require Trans-Ash to obtain the following permits and/or licenses:

- Section 404 Permit for wetlands from the U.S. Army Corps of Engineers (USACE)
- Section 401 Water Quality Certification from the Tennessee Department of Environment and Conservation (TDEC)
- Class II Solid Waste Landfill Permit from TDEC
- National Pollutant Discharge Elimination System (NPDES) Permit for leachate collection system (LCS) outfall from TDEC

Alternatives Including the Proposed Action

In this SEA, TVA considered the No Action and Proposed Action alternatives. Chapter 2 of the 2002 EA described in detail the No Action and Proposed Action alternatives. The types of activities associated with the present Proposed Action Alternative in this SEA are similar to those of Alternative A (Preferred Alternative) in the 2002 EA. The descriptions of the impacts of those alternatives are herein incorporated by reference.

No Action Alternative

Under the No Action Alternative, TVA would not contract with Trans-Ash to develop the expansion of BIP for coal ash disposal. Coal ash created during power generation at JOF would accumulate on site at the ash pond or the island. Within one year, coal ash storage on site at JOF would fill, and JOF would have to shut down. The No Action Alternative is impractical, as it would require JOF to cease operations. The electricity produced by JOF is necessary to meet baseload demand. TVA would not create the wetland mitigation cell in Houston County, Tennessee. The land managed by the Kentucky Watershed Team (KWT) would not be made into wetlands. The land would remain in its current land use, which is agricultural.

Proposed Action Alternative

The proposed action is to expand the ashfill at BIP by 20.6 acres, thereby creating an additional 2.2 million cubic yards of coal ash storage capacity for JOF. Expanding the ashfill would result in the loss of about 3 acres of low-quality wetlands at BIP. TDEC and USACE require mitigation for the activities resulting in the loss of the wetlands. Therefore, a related proposed action is to create about 18 acres of wetlands on a 22-acre tract of land managed by the KWT along White Oak Creek in Houston County, Tennessee. A drawing showing the boundary of the proposed wetland is shown in Figure 4. The WMT lies about 18 miles north-northeast of BIP. Drainage from the WMT flows into White Oak Creek, which empties into Kentucky Reservoir at about Tennessee River Mile (TRM) 81R (right-descending bank). The wetlands so created on the WMT would be managed and maintained by FBP in perpetuity.

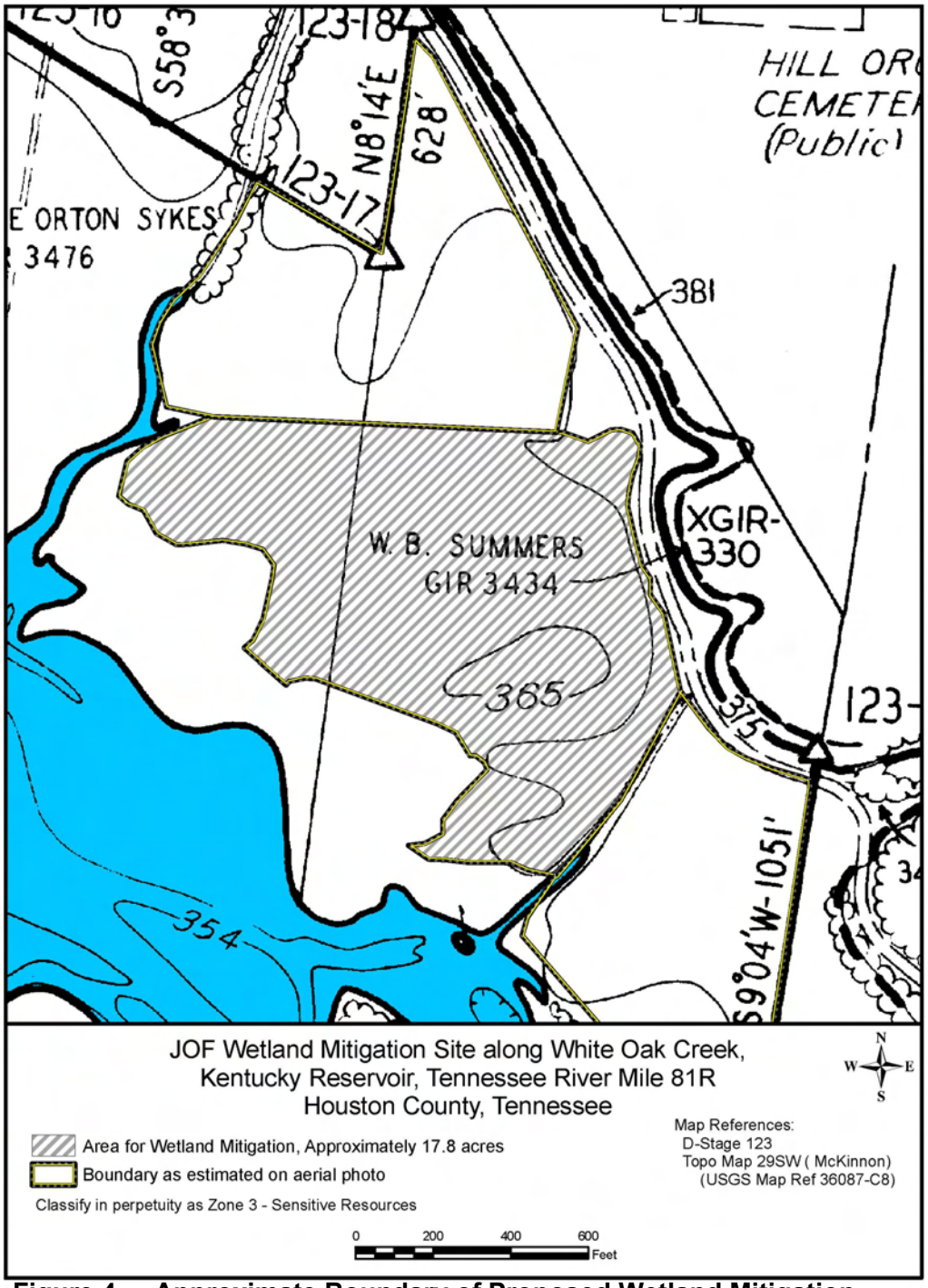


Figure 4. Approximate Boundary of Proposed Wetland Mitigation Along White Oak Creek, Houston County, Tennessee

Description of Alternatives Considered but Eliminated From Detailed Study

Other alternatives not considered in detail included Disposal of Coal Ash in the New Johnsonville Industrial Park Site and Disposal of Ash in Freemon Hollow. These sites located near JOF were initially considered for disposal of coal ash but were later rejected because of environmental concerns. The New Johnsonville Industrial Park was eliminated from consideration because of wetlands located within the proposed footprint and the necessity of relocating a small stream to the periphery of the site. The Freemon Hollow site was eliminated because of the potential discharge of pond effluent alongside the Johnsonville State Historic Park and through a marina.

Comparison of Alternatives

The proposed Action Alternative would allow JOF to continue generating electricity beyond calendar year 2009. If the Action Alternative were selected, the creation of the WMT would have a net benefit on local terrestrial and aquatic species. Selecting the Action Alternative would allow for larger or more businesses to locate in BIP, potentially creating more jobs. Conversely, selection of the No Action Alternative could result in lost jobs and higher electricity rates.

Preferred Alternative

TVA's preferred alternative is to expand the ashfill at BIP by 20.6 acres to accommodate approximately 2.2 million cubic yards of additional coal ash from JOF, and develop about 18 acres of a 22.6-acre tract of KWT land in Houston County as wetland mitigation.

Affected Environment and Environmental Consequences

Site Description – Bivens Industrial Park

The affected environment at BIP is the area of the proposed expansion (20.6 acres), shown in Figure 2, and its receiving stream, Cypress Creek. Cypress Creek is an embayment on Kentucky Reservoir, which empties into the Tennessee River at approximately TRM 100L (left-descending bank). The 2002 EA described in detail the JOF plant and the BIP. Those descriptions are herein incorporated by reference.

Site Description – Wetland Mitigation Tract, Kentucky Reservoir

The affected environment beyond BIP is the WMT, a 22.6-acre portion of land adjacent to Kentucky Reservoir that is managed by the KWT. Figure 3 shows an aerial photo of the location of the proposed WMT, which lies along White Oak Creek and empties into Kentucky Reservoir at about TRM 81R. The specific location for wetland mitigation is the middle portion of a larger tract of land, which was under an agricultural license until December 31, 2008. All three tracts of land were mowed for hay. Within the 22.6-acre tract, 17.8 acres would be converted to constructed wetlands. The required acreage for the proposed action is 12.88 acres. The remaining 4.9 acres would be available for future TVA wetland mitigation needs.

Groundwater

Affected Environment

The proposed ashfill expansion would be developed within a portion of the former Bivens Quarry, which was previously mined for chert gravel from an outcrop of the Camden formation. The Camden represents one of the region's principal aquifers and generally consists of thinly bedded, sharply fragmented chert with occasional thin interbedded clay seams and pods. Total

thickness of this formation is approximately 150 feet (Wilson 1969). Refer to TVA 2002 for a more complete description of hydrogeologic conditions in the vicinity of the proposed site.

Past gravel mining generally penetrated to, or a few feet below, the water table, leaving numerous standing pools of shallow water over the bottom of the quarry. During site preparations for the existing Phase 1 ashfill, these water-filled depressions were backfilled and the ashfill footprint graded to achieve a minimum 3-foot-thick geologic buffer between the seasonal high water table and the base of the ash deposits. Soil materials available on the quarry property consisting of clay, silt, sand, and substantial amounts of chert gravel were used to create the geologic buffer. From the bounding quarry high walls on the south and west sides, base grade of the Phase 1 area was generally sloped to the northeast to promote ash leachate drainage. A 0.25-inch-thick geosynthetic clay liner (GCL) was placed above the geologic buffer, followed by a 1-foot-thick drainage blanket consisting of bottom ash. The GCL and drainage blanket terminate along the eastern margin of the Phase 1 area. Consequently, most downward percolating leachate reaching the GCL generally flows northeastward through the drainage blanket atop the GCL and ultimately discharges to groundwater or as seepage along the eastern side of the ashfill. Leachate is the water that flows through (and out of) the ashfill, plus the material and/or chemical compounds that get caught up in that water. Rain falls on the top of the ashfill, works its way down through the piled-up ash, and out through the bottom or the side of the pile of ash. When that water exits the pile of ash, it is called leachate at that point.

About 10 percent of the precipitation that falls onto the surface of the ashfill seeps directly through the GCL, as indicated by the ashfill hydrologic water budget analyses presented in Appendix B. A water budget is a way of accounting for the water that enters a system, leaves a system, and gets stored within a system. In this SEA, the existing and expanded ashfill is the system to which the water budget is applied. Because leachate was neither expected to significantly impact groundwater at BIP nor required by regulations, an LCS was not provided to capture ash leachate produced by infiltration of precipitation falling on the Phase 1 ashfill surface.

Groundwater monitoring wells installed for the Phase 1 ashfill are shown in Figure 5. Well MW-1 is screened at a depth of 90.4 feet in the Camden and represents the Phase 1 upgradient monitoring well. Downgradient Wells MW-2, MW-3, and MW-4 are screened within the shallow Camden formation at depths ranging from 20.5 to 27.5 feet. March 2008 water level measurements reported by TriAD (2008) for these wells and five exploratory borings in the proposed Phase 2 ashfill area indicate that the general direction of shallow groundwater movement is to the northeast toward the Cypress Creek floodplain (Figure 5). Shallow groundwater in the floodplain is expected to discharge into Cypress Creek or flow eastward, ultimately discharging into the Tennessee River.

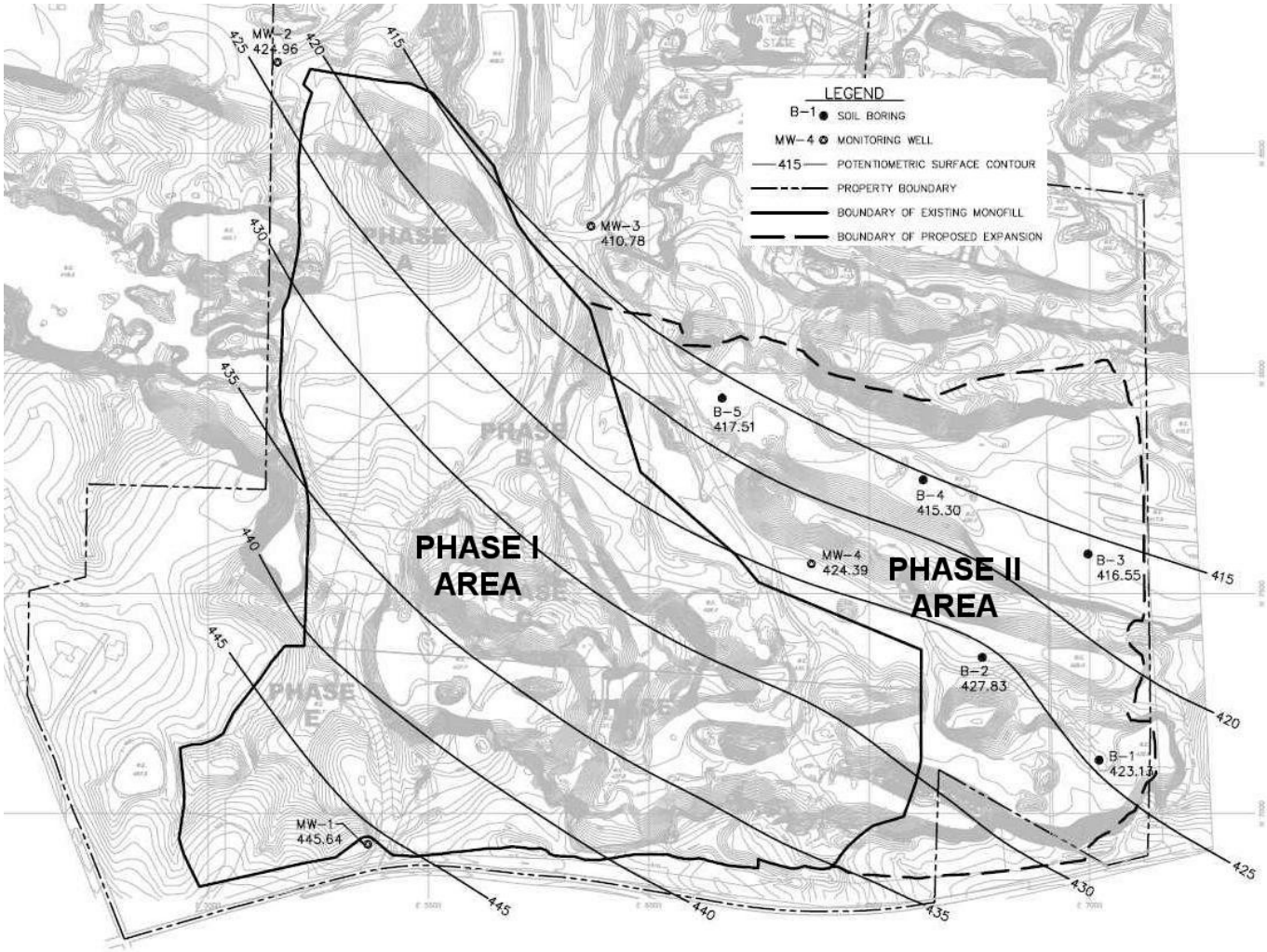


Figure 5. Proposed Expanded Ashfill Location Map Showing Monitoring Wells and March 2008 Groundwater Levels

Groundwater use in the vicinity of the quarry appears to be limited. Most residences located south and west of the quarry along U.S. Highway 70 and Old U.S. Highway 70 obtain water from the City of Camden, which operates a surface water intake on the Tennessee River. Known and suspected water supply wells within the quarry vicinity reported in TVA 2002 are shown in Figure 6 and listed in Table 1. A total of 15 known or inferred wells were identified within approximately 1 mile of the proposed ashfill. One additional well (Well Number 16) was recently identified by TriAD (2008) in a query of the water-well database of the Tennessee Division of Water Supply. None of the private groundwater supply wells are located downgradient of the proposed ashfill. Furthermore, future groundwater development in the Cypress Creek floodplain downgradient of the ashfill appears unlikely. The presence of the large sewage treatment lagoons operated by the City of Camden would likely discourage development of groundwater supplies in this region.

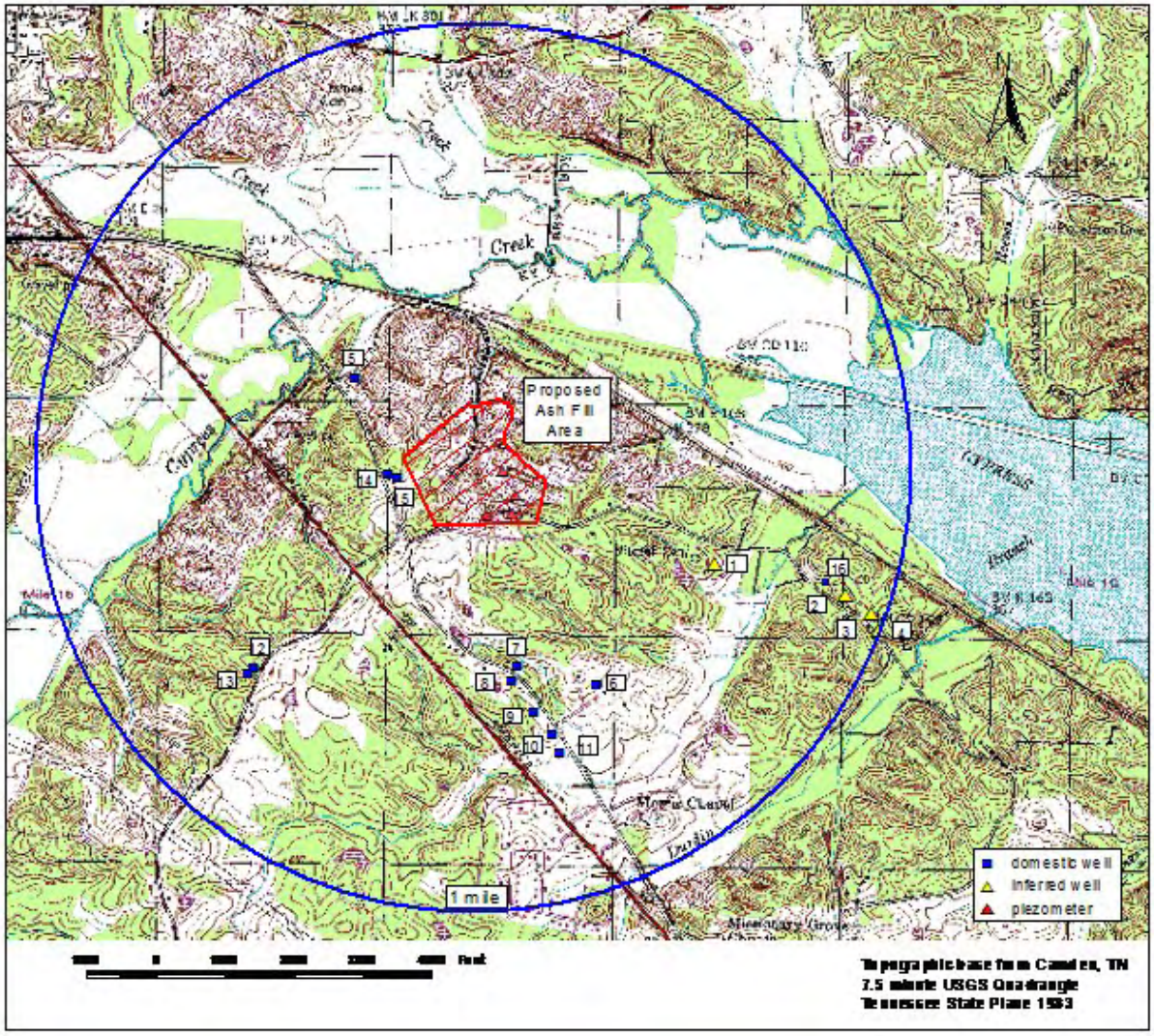


Figure 6. Groundwater Supply Wells in the Vicinity of Bivens Industrial Park

Groundwater quality has been monitored twice each year at facility monitoring Wells MW-1 through MW-4 since February 2003. Required groundwater monitoring constituents include arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, silver, strontium, vanadium, zinc, and total dissolved solids. Boron and sulfate, two characteristic ash leachate indicators, are also included. Monitoring results to date have not shown exceedence of any TDEC maximum contaminant level (MCL). However, over the past two years, Well MW-4 has exhibited increasing trends in concentrations of sulfate and boron (Figure 7). These results indicate that groundwater quality in the Phase 1 ashfill vicinity is likely being influenced by leachate from the Phase 1 ashfill.

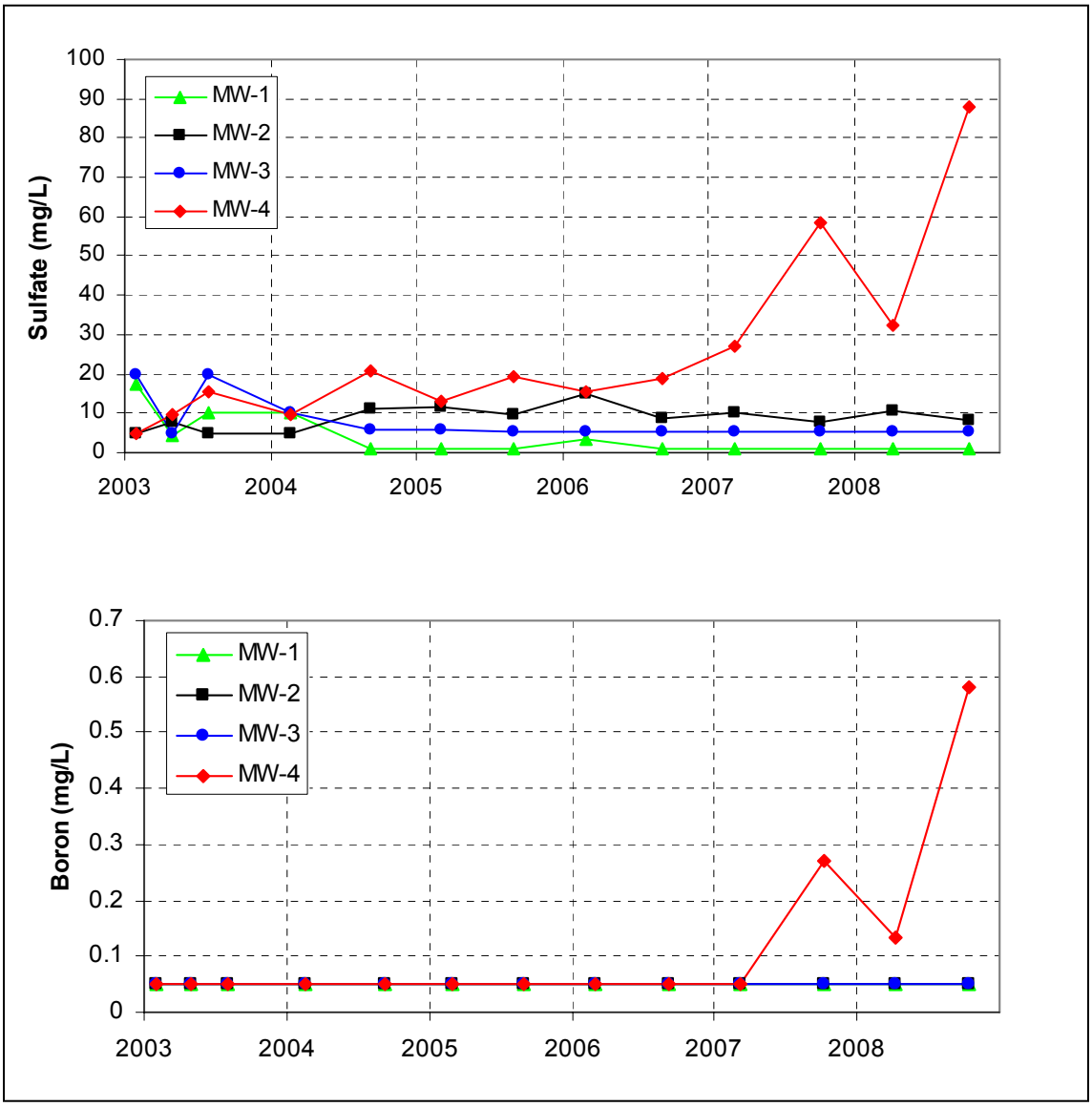


Figure 7. Groundwater Monitoring Data for Sulfate and Boron

Table 1. Inventory of Private Wells Within 1 Mile of Ashfill Area

Map Well No.	Owner	Distance from Ashfill (miles)	Use
15	Lynn Gibson	0.03	domestic
14	Lynn Gibson	0.05	domestic
5	Camden Gravel Co.	0.25	domestic
7	*unknown*	0.39	*unknown*
8	*unknown*	0.42	domestic
6	*unknown*	0.47	*unknown*
1	*unknown*	0.50	*unknown*
9	L. Thornton	0.52	domestic
10	*unknown*	0.59	*unknown*
12	Malcolm Kee	0.62	domestic
11	Tulley	0.63	domestic
13	W. Matlock	0.64	domestic
16	*unknown*	0.76	domestic
2	*unknown*	0.86	*unknown*
3	*unknown*	0.94	*unknown*
4	*unknown*	0.98	*unknown*

Mercury Concerns

TDEC sampled sediment and water (groundwater and surface water) at 37 locations within and near BIP between February 2009 and April 2009 after a local resident requested TDEC to sample a domestic well for mercury. Preliminary sampling results from February, March and April 2009 show that the concentrations of mercury in both sediment and water samples from BIP are comparable to mercury concentrations in nearby sediments and waters not likely influenced by BIP Phase 1. Mercury concentrations in sediment samples ranged from 0.082 milligrams per kilogram (mg/kg) to 0.28 mg/kg. The highest concentration of mercury in sediment was found in the sedimentation pond at BIP. Thirty water samples were collected by TDEC from drinking water wells and surface water in and near BIP. Twenty mercury analyses were below the analyzing laboratory's detection limit. Eight samples contained detectable quantities of mercury; however, the concentrations were below the laboratory's quantitation limit and are therefore considered estimates only. The highest concentrations of mercury in water were found in the private well belonging to the local resident mentioned earlier in this paragraph: 11 micrograms per liter (μg/L) on February 25, 2009, and 13 μg/L on March 13, 2009. MW-5 contained 7 μg/L total mercury and 3 μg/L dissolved mercury. The MCL for mercury is 2 μg/L. The Aquatic Toxicity Limit (ATL) is 0.8 μg/L. Mercury concentrations in sediment and water are shown in Figures 8 and 9, respectively.

Mercury is not uncommon in soils. Kopp (2001) reports the mercury concentration from one soil sample collected at U.S. Highway 70, 3 miles east of Camden, in Benton County, Tennessee, at 60 parts per billion (0.060 parts per million or mg/kg). Kopp also reports that a Tennessee Division of Superfund study "concludes that the naturally occurring background level of mercury in Tennessee is 0.18 ppm (180 ppb)."

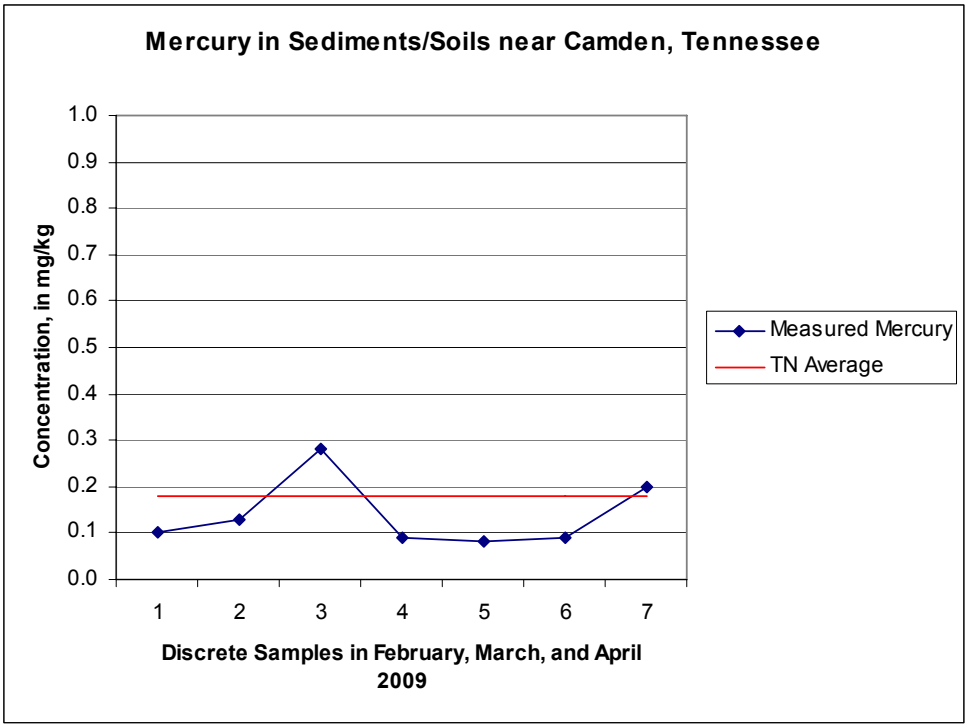


Figure 8. Mercury in Sediments/Soils Near Camden, Tennessee, March and April 2009

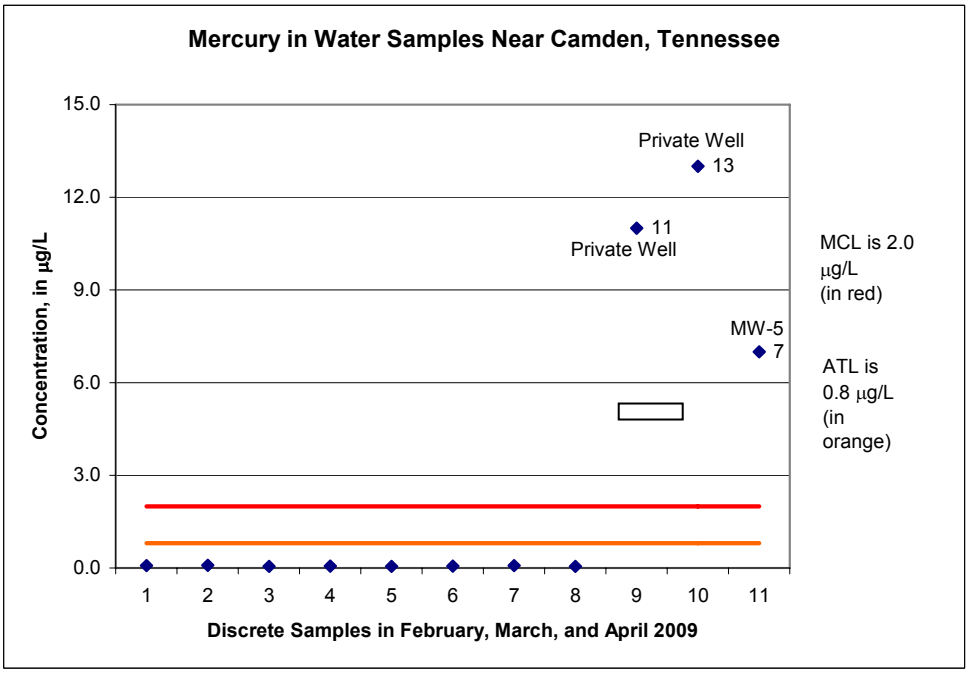


Figure 9. Mercury in Water Samples Near Camden, Tennessee, February, March, and April 2009

As a further check of leachate activity at BIP, TDEC requested the installation of three piezometers in the Phase 1 ashfill at BIP. The piezometers were installed in April 2009. A new monitoring well (MW-5) was installed at this time also, to replace MW-4, which is scheduled to be abandoned and buried by the Phase 2 ashfill. Piezometer PZ-1 was dry; therefore no water samples were collected from it. Water samples were collected from the piezometers PZ-2 and PZ-3 and the new monitoring well. The data are presented in Table 2 below.

Table 2. New Piezometer and Monitoring Well Results

Piezometer and New Monitoring Well Monitoring Results Trans-Ash, Inc. April 2009 Concentrations in mg/L			
Parameter	**PZ-2**	**PZ-3**	**MW-5**
Arsenic	<0.010	**0.0384/0.0236**	<0.010
Barium	**0.132/0.0779**	**0.322/0.253**	**0.0151/0.0137**
Boron	<0.050/**8.34**	**9.39/9.28**	<0.0500
Cadmium	**0.00150**/<0.0010	<0.0010	<0.0010
Chromium	<0.0050	**0.0485/0.0402**	<0.0050
Cobalt	<0.0200	<0.0200	<0.0200
Copper	<0.0100	**0.0147**/<0.0100	<0.0100
Fluoride	**0.778**	**0.399**	<0.100
Iron	**2.60**/<0.0500	**2.43**/<0.0500	**1.25/1.12**
Lead	<0.0050	**0.0166**/<0.0050	<0.0050
Mercury	<0.00020	<0.00020	**0.00748/0.00326**
Nickel	**0.0108**/<0.0100	<0.0100	<0.0100
Silver	<0.0050	<0.0050	<0.0050
Strontium	<0.0500/**4.55**	**5.93/6.07**	<0.0500
Vanadium	<0.0200/**0.176**	**0.132/0.122**	<0.0200
Zinc	**0.0743**/<0.0500	<0.0500	<0.0500
Sulfate	**57.8**	**739**	**4.00**
TDS	**606**	**1660**	**42.0**
TSS	**27.7**	**123**	**17.1**

Bold - Detected at concentration above laboratory detection limit
Slash denotes Total Metals(unfiltered)/Dissolved Metals(field filtered)

From the data presented in Table 2, mercury is below detection limits in the leachate samples; however, mercury is present above the MCL in both its suspended and dissolved forms in monitoring Well MW-5. Well MW-5 is plotted with the preliminary TDEC data in Figure 9. Further, based upon the fluoride, sulfate, and total dissolved solids data from the piezometers and the monitoring well, the monitoring well appears to contain water of a character different from the leachate in the Phase 1 ashfill.

Initial sampling results for MW-5 do not indicate that groundwater at that location has been affected by ash leachate, despite the presence of mercury. Appendix C shows the April 2009 data collected from the two new piezometers and MW-5. Unlike MW-4, boron results for MW-5 are consistent with background ranges for these parameters. Comparison of total (0.00748 mg/L) and dissolved (0.00326 mg/L) mercury data for MW-5 suggests solids present in the sample contain mercury. Assuming no mercury was introduced during well installation, suspended solids and consequently dissolved solids in the sample from MW-5 are most likely derived from natural aquifer materials.

The presence of detectable mercury in groundwater samples collected from upgradient MW-1 and downgradient MW-3 in November 2002, prior to ash disposal at BIP, further supports the notion of natural (or pre-existing) sources of mercury in shallow groundwater at the site. JOF ash leachate is an unlikely source of mercury in both the private well and MW-5, since mercury has never been detected in any of the historical TCLP, SGLP or SPLP tests performed on JOF ash samples. Those data are presented in Table 3.

From Figure 5, groundwater movement flows from the southwest corner of the ashfill toward the northeast corner. A final factor when considering the mercury in the domestic well is the fact that the well appears to lie cross-gradient to or upgradient from the groundwater in BIP Phase 1 (pin G on Figure 10).

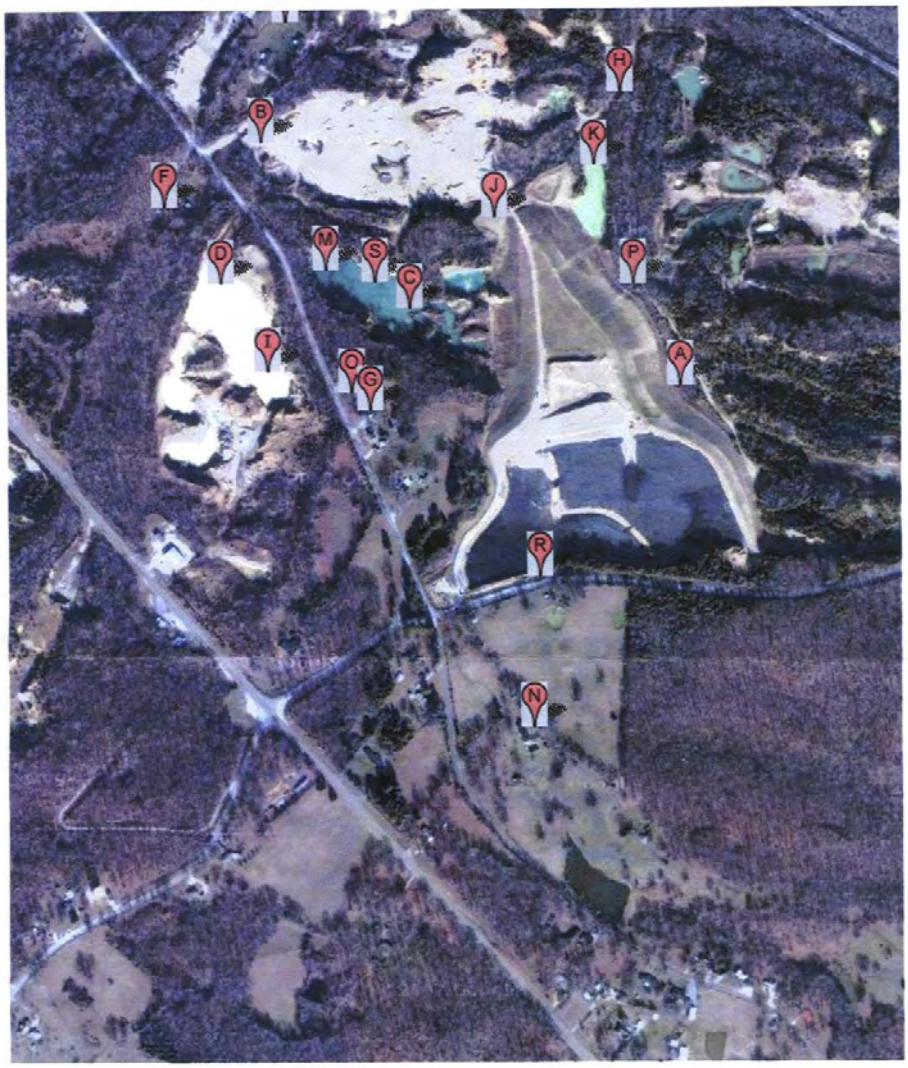


Figure 10. Surface Water, Groundwater and Sediment Sampling Locations, Camden, Tennessee, 2009

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Table 3. Summary of Johnsonville Fossil Plant Ash Leachate Toxicity Data

Sample Origin	Sample Date	Type Analysis	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver
Inactive Dredge Cell	Jun-95	TCLP	0.020	0.51	**0.0058**	0.012	<0.001	<0.0002		0.011	<0.01
Active Dredge Cell	Jun-95	TCLP	0.130	1.40	0.0055	0.018	<0.001	<0.0002		0.048	<0.01
Active Fly Ash Pond	Jun-95	TCLP	**0.280**	0.42	0.0051	0.008	<0.001	<0.0002		**0.31**	<0.01
Active Fly Ash Pond	Mar-02	TCLP	0.190	1.40	<0.005	<0.050	<0.05	<0.002		0.0038	<0.01
Active Fly Ash Pond	Mar-02	SGLP	0.129	<0.1	<0.0002	<0.050	**0.0051**	<0.00001		0.0228	**0.05**
Active Fly Ash Pond	Apr-04	TCLP	<0.1	1.39	<0.1	<0.500	<0.5	<0.01	<0.5	<0.10	<0.1
Active Fly Ash Pond	Jul-05	TCLP	<0.05	2.70	<0.05	<0.050	<0.05	<0.001		0.05	<0.05
Active Fly Ash Pond	Mar-06	TCLP	<0.1	1.62	<0.01	<0.050	<0.05	<0.01		<0.10	<0.05
Active Fly Ash Pond	Apr-07	TCLP	<0.1	**3.04**	<0.01	<0.050	<0.05	<0.01		<0.10	<0.05
Active Fly Ash Pond	Apr-08	TCLP	<0.1	2.70	0.0110	<0.050	<0.05	<0.01		<0.10	<0.05
Bottom Ash	Dec-08	SPLP	0.011	0.1	<0.0005	0.0026	<0.001	<0.0002	<0.001	0.0013	<0.0005
Fly Ash	Dec-08	SPLP	0.0045	0.62	<0.0005	**0.058**	<0.001	<0.0002	0.0013	0.021	<0.0005
Fly Ash	Dec-08	SPLP	0.0055	0.34	<0.0005	0.013	<0.001	<0.0002	0.001	0.01	<0.0005
Fly Ash	Dec-08	SPLP	0.004	0.6	<0.0005	0.055	0.0012	<0.0002	**0.0017**	0.019	<0.0005

Notes: Bolded values are maximum measured concentrations.
All units are mg/L.
TCLP = Toxicity Characteristic Leaching Procedure
SGLP = Synthetic Groundwater Leaching Procedure
SPLP = Synthetic Precipitation Leaching Procedure

Based upon the above-mentioned observations, mercury in groundwater, surface water, and sediments in and near BIP is likely due to levels naturally present in the environment and not likely due to leaching from the coal ash at BIP Phase 1.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, no further coal ash produced by JOF would be deposited at BIP, and BIP Phase 1 would be closed. Coal ash would be temporarily diverted to a permitted landfill in the plant vicinity.

The only action requiring consideration under the No Action Alternative of this SEA is the evaluation of potential long-term groundwater resource impacts associated with closure of the Phase 1 ashfill. Three cover alternatives were evaluated for final closure of the Phase 1 ashfill. These alternatives included: (1) completing the 2-foot-thick vegetated soil cap now covering most of the Phase 1 area, (2) adding a GCL overlain by 2-foot-thick vegetated soil cover, or (3) adding a flexible membrane liner (FML) overlain by 2-foot-thick vegetated soil cover. Hydrologic water budget simulations were performed using the Hydrologic Evaluation of Landfill Performance (HELP) model (Schroeder et al. 1994) to evaluate potential ash leachate production associated with each closure cover alternative. Model simulations assumed a 40-year post-closure time period for each case. Details regarding landfill geometry, cover design, and HELP input data for each alternative are provided in Appendix D.

Model simulations were performed for each of the three Phase 1 cover alternatives to obtain the average annual rate of ash leachate drainage from the base of the ashfill. Leachate contaminant mass loadings (in milligrams per day) were then computed using available ash leachate toxicity data for JOF ash samples. The leachate toxicity data are presented in Table 3. These nine metals were selected for modeling because they are not only typically present in coal ash, but also U.S. Environmental Protection Agency (USEPA) Primary Drinking Water contaminants. The maximum (worst-case) value for each contaminant of concern (COC) was selected for the mass loading calculation from data presented in Table 3. Because mercury was never detected in ash leachate, and analytical detection limits for mercury varied widely among samples, the mercury MCL of 0.002 milligrams per liter (mg/L) was conservatively applied for the mass loading estimate.

Cypress Creek is conservatively assumed as the final destination of any ash leachate entering shallow groundwater flowing beneath the ashfill. Concentrations for individual COCs in Cypress Creek were estimated assuming complete mixing of ash leachate with a 7Q10 flow rate of 0.34 cubic feet per second in Cypress Creek (Law et al. 2009). 7Q10 is a statistical term describing the lowest flow expected to occur at a particular point in a particular stream for seven consecutive days once every 10 years. Regulatory agencies often require evaluation of potential stream water quality impacts due to point source wastewater discharges using the 7Q10 stream flow. Direct transport of ash leachate to the stream without dilution or geochemical removal was also conservatively assumed. Background concentrations of COCs in Cypress Creek were assumed to be zero in the evaluation.

Degradation of groundwater quality in the locality of BIP is likely if the ashfill is closed with only a soil cover. The beginning of ash leachate contamination appears to be indicated by the increasing sulfate and boron trends observed at downgradient Well MW-4 during the past two years. Future increases in the less mobile, but more toxic, trace metals present in ash leachate would be expected with only a soil cover on Phase 1, since future rates of leachate drainage following closure would not be expected to decrease substantively from current rates.

Few, if any, groundwater quality issues would be expected if the facility were closed with either a GCL or an FML. The three scenarios of final covers of soil, GCL, and FML on Phase 1 were modeled in Cases 1, 2, and 3, presented in Table 4. Model results estimate that for the scenario of post-closure of the Phase 1 area alone, all concentrations of the metals listed in Table 4 would be less than the MCL or aquatic toxicity limits, or both, when either a GCL or an FML were used in addition to soil cover at closure. These findings indicate that closure of the existing ashfill would require a GCL or FML (or equivalent) cover in order to avoid long-term adverse impacts to Cypress Creek.

Leachate drainage of any remaining moisture in the ashfill prior to closure using a GCL or FML as final cover would likely quickly decrease following closure, as indicated by the leachate rates given for these cases in Table 4. It is uncertain whether short-term drainage following closure would be sufficient to cause leachate contaminants to exceed regulatory limits, but any such exceedences would be expected to be short-lived as ashfill drainage continued to diminish.

Action Alternative

Active Stacking Period

Under the proposed Action Alternative, disposal of fly ash in the Phase 2 portion of the ashfill would be expected to occur at a relatively constant rate over a 10-year period beginning in 2009. During Phase 2 stacking, the Phase 1 area would be inactive and covered with an FML and 2 feet of vegetated soil cover. The Phase 1 GCL bottom liner would be tied and sealed to the Phase 2 FML bottom liner prior to stacking in the Phase 2 area. In addition, an ash LCS would be constructed along the eastern margin of the ashfill to capture lateral drainage accumulating above the bottom liner of the expanded ashfill.

While the LCS was not considered in the original design of the expanded ashfill, modeling results for the closed Phase 1 area presented in the previous section suggest that allowing the combined lateral drainage of the Phase 1 and Phase 2 areas to discharge directly into groundwater would result in even greater predicted impacts to Cypress Creek. The LCS would limit ash leachate discharging into groundwater to the leachate that would seep through only the bottom liners beneath both areas. The LCS is discussed in further detail in the Surface Water section of this SEA.

Estimates of leachate drainage rates include cumulative drainage from both the inactive Phase 1 area and from the uncovered Phase 2 area. Results given in Table 5 predict that the cumulative selenium concentrations in Cypress Creek exceed the MCL between the sixth and tenth years of Phase 2 build-out. Additional model runs indicated that ash leachate concentrations were highest in the final years of Phase 2 build-out and that the optimal cover choice for Phase 1 under the Action Alternative would be an FML. Those interim modeling results are presented in Appendix E.

Table 4. No Action Alternative - Predicted In-Stream Contaminant of Concern Concentrations for Cypress Creek

				Case 1: Phase I 40-yr Post-Closure Soil Cover Leachate Rate = 0.071 cfs		Case 2: Phase I 40-yr Post-Closure GCL with Soil Cover Leachate Rate = 0.004 cfs		Case 3: Phase I 40-yr Post-Closure FML with Soil Cover Leachate Rate = 0.001 cfs	
COC Parameter	MCL (mg/L)	Worst-Case Leachate Concentration (mg/L)	Aquatic Toxicity Limit (mg/L)[f]	Mass Loading (mg/day)	In-Stream Concentration (mg/L)	Mass Loading (mg/day)	In-Stream Concentration (mg/L)	Mass Loading (mg/day)	In-Stream Concentration (mg/L)
arsenic	**0.01**	0.28	0.15[a]	48687	**0.0585**	3041	0.0037	519	0.0006
barium	**2**	3.04	--	528606	0.6355	33019	0.0397	5637	0.0068
cadmium	**0.005**	0.0058	0.0002[b]	1009	0.0012	63	0.0001	11	0.0000
chromium	**0.1**	0.0580	0.0587[b]	10085	0.0121	630	0.0008	108	0.0001
lead	**0.015**	0.0051	0.0018[b]	887	0.0011	55	0.0001	9	0.0000
mercury	**0.002**	0.0020	0.0008[a]	348	0.0004	22	0.0000	4	0.0000
selenium	**0.05**	0.3100	0.005	53904	0.0648	3367	0.0040	575	0.0007
silver	**0.1**	0.0500	0.0018[c]	8694	0.0105	543	0.0007	93	0.0001

Notes: a.) Criterion continuous concentration (CCC)
b.) Computed criterion continuous concentration
c.) Computed criterion maximum concentration (CMC)
d.) Bold value indicates exceeds MCL
e.) Highlighted value indicates exceeds of CCC
f.) Computed values are based on equations given in TDEC rule 1200-4-3-.03. The equations are hardness derived; values used for hardness are from TDEC grab samples from Cypress Creek (2008).

Groundwater would be monitored routinely in accordance with TDEC regulations at BIP, and the results would be shared with TVA groundwater specialists. Groundwater monitoring at BIP is designed to trigger additional monitoring and corrective action when a statistically significant change occurs in the monitoring data. The additional monitoring and corrective actions ensure that steps to reduce impacts to groundwater are taken before a contaminant exceedence occurs. These requirements for monitoring: (1) are adequate to ensure the ability to identify changes in groundwater quality, (2) invoke more detailed study when a contaminant reaches an action level, (3) involve discussions with and agreement of the state to formulate additional monitoring and/or corrective actions, and (4) are intended to provide enough time to react if an action level is reached, but before an exceedence occurs. The groundwater monitoring plan for BIP is presented in Appendix F.

Post-Closure Period

Water budget simulations were performed to evaluate three possible cover design alternatives for the expanded ashfill during the post-closure period and are presented in Table 6. As shown by Case 9, covering both Phase 1 and Phase 2 with an FML at closure eliminates in-stream water quality issues for Cypress Creek. Leachate drainage of any remaining moisture in the ashfill prior to closure would likely quickly decrease following closure as indicated by the leachate rate predicted by Case 9. It is uncertain whether short-term drainage following closure would be sufficient to cause leachate contaminants to exceed regulatory limits, but any such exceedences would be expected to be short-lived as ashfill drainage continued to diminish. The combination of an FML bottom liner in Phase 2, an LCS and an FML cap overlain by 2 feet of vegetated soil on Phase 1 yielded the most favorable estimates of in-stream concentrations of COCs at year 10 of Phase 2 build-out, as shown in Table 6.

Surface Water

Affected Environment

The affected environment for surface water remains the same as described in TVA 2002. The lower Tennessee River is not listed in the 2008 TDEC 303(d) List; therefore, it is not considered impaired and assumed to fully meet its designated uses.

Surface water and groundwater at the BIP ashfill site would drain to Cypress Creek. Cypress Creek was listed by TDEC in 2008 as fully supporting its uses (fish and aquatic life, livestock watering and wildlife, and irrigation) along its entire length. Cypress Creek empties into the Tennessee River at about TRM 100L.

Environmental Consequences

The receiving stream for surface water at the site is an unnamed tributary of Cypress Creek, which is a tributary of the Tennessee River and is classified under Tennessee Rule Chapter 1200-4-4 for Fish and Aquatic Life, Recreation, Livestock and Wildlife Watering, and Irrigation. The unnamed tributary is, under Chapter 1200-4-4, classified as “other surface waters named and unnamed in the Western Valley Tennessee River Basin” and is classified for the same uses as Cypress Creek. The most stringent water quality criteria that apply to the unnamed tributary are, therefore, those for Fish and Aquatic Life, Criterion Continuous Concentration (CCC).

Table 5. Proposed Action Alternative – Predicted in-Stream Contaminant of Concern Concentrations for Cypress Creek During Phase 2 Build-Out

				Case 12A: Phase II Stacking Year 3 FML Cover on Phase I, FML Liner on Phase II Leachate Rate = 0.001 cfs		Case 12B: Phase II Stacking Year 6 FML Cover on Phase I, FML Liner on Phase II Leachate Rate = 0.004 cfs		Case 12C: Phase II Stacking Year 10 FML Cover on Phase I, FML Liner on Phase II Leachate Rate = 0.008 cfs	
COC Parameter	MCL (mg/L)	Worst-Case Leachate Concentration (mg/L)	Aquatic Toxicity Limit (mg/L)[f]	Mass Loading (mg/day)	In-Stream Concentration (mg/L)	Mass Loading (mg/day)	In-Stream Concentration (mg/L)	Mass Loading (mg/day)	In-Stream Concentration (mg/L)
arsenic	**0.01**	0.28	0.15[a]	741	0.0009	2528	0.0030	5515	0.0066
barium	**2**	3.04	--	8044	0.0097	27444	0.0330	59880	0.0720
cadmium	**0.005**	0.0058	0.0002[b]	15	0.0000	52	0.0001	114	0.0001
chromium	**0.1**	0.0580	0.0587[b]	153	0.0002	524	0.0006	1142	0.0014
lead	**0.015**	0.0051	0.0018[b]	13	0.0000	46	0.0001	100	0.0001
mercury	**0.002**	0.0020	0.0008[a]	5	0.0000	18	0.0000	39	0.0000
selenium	**0.05**	0.3100	0.005	820	0.0010	2799	0.0034	6106	0.0073
silver	**0.1**	0.0500	0.0018[c]	132	0.0002	451	0.0005	985	0.0012

Notes: a.) Criterion continuous concentration (CCC)
b.) Computed criterion continuous concentration
c.) Computed criterion maximum concentration (CMC)
d.) Bold value indicates exceeds MCL
e.) Highlighted value indicates exceeds of CCC
f.) Computed values are based on equations given in TDEC rule 1200-4-3-.03. The equations are hardness derived; values used for hardness are from TDEC grab samples from Cypress Creek (2008).

Table 6. Proposed Action Alternative - Predicted in-Stream Contaminant of Concern Concentrations for Cypress Creek for 40-Year Post-Closure Period (Phases 1 and 2)

				Case 7: 40-yr Post-Closure Soil Cover on Phase I GCL Cover on Phase II Leachate Rate = 0.031 cfs		Case 8: 40-yr Post-Closure GCL Cover on Phase I & II Leachate Rate = 0.010 cfs		Case 9: 40-yr Post-Closure FML Cover on Phase I & II Leachate Rate = 0.001 cfs	
COC Parameter	**MCL (mg/L)**	**Worst-Case Leachate Concentration (mg/L)**	**Aquatic Toxicity Limit (mg/L)[f]**	**Mass Loading (mg/day)**	**In-Stream Concentration (mg/L)**	**Mass Loading (mg/day)**	**In-Stream Concentration (mg/L)**	**Mass Loading (mg/day)**	**In-Stream Concentration (mg/L)**
arsenic	**0.01**	0.28	0.15[a]	21010	**0.0253**	7139	0.0086	999	0.0012
barium	**2**	3.04	--	228107	0.2742	77504	0.0932	10844	0.0130
cadmium	**0.005**	0.0058	0.0002[b]	435	0.0005	148	0.0002	21	0.0000
chromium	**0.1**	0.0580	0.0587[b]	4352	0.0052	1479	0.0018	207	0.0002
lead	**0.015**	0.0051	0.0018[b]	383	0.0005	130	0.0002	18	0.0000
mercury	**0.002**	0.0020	0.0008[a]	150	0.0002	51	0.0001	7	0.0000
selenium	**0.05**	0.3100	0.005	23261	0.0280	7903	0.0095	1106	0.0013
silver	**0.1**	0.0500	0.0018[c]	3752	0.0045	1275	0.0015	178	0.0002

Notes: a.) Criterion continuous concentration (CCC)
b.) Computed criterion continuous concentration
c.) Computed criterion maximum concentration (CMC)
d.) Bold value indicates exceeds MCL
e.) Highlighted value indicates exceeds of CCC
f.) Computed values are based on equations given in TDEC rule 1200-4-3-.03. The equations are hardness derived; values used for hardness are from TDEC grab samples from Cypress Creek (2008).

The Fish and Aquatic Life criteria are found at Tennessee Rule Chapter 1200-4-3-.03, and include numeric criteria for 11 metals, including several of the metals monitored at the site (arsenic, cadmium, chromium, lead, mercury, selenium, and silver). Of these constituents, arsenic, mercury, and selenium have set CCC values. Cadmium, chromium, and lead CCC, and silver Criterion Maximum Concentration (CMC) values are calculated for individual streams based on the measured hardness of the stream water.

The surface water quality criteria set by Chapter 1200-4-3-.03 are calculated risk-based standards that are deemed protective of fish and aquatic life. They are calculated using models and assumptions found in USEPA's national criteria. The criteria are set to be protective of 95 percent of the taxa tested within the dataset used to derive it and are typically considered overprotective. This, combined with the absence of threatened or endangered species in the receiving waters, means the Tennessee surface water quality criteria are appropriate standards for BIP, and measured concentrations in leachate or treated leachate below these standards would indicate no significant environmental impact to surface water.

No Action Alternative

Under the No Action Alternative, no further coal ash produced by JOF would be deposited in the BIP Phase 2 expansion, and Phase 1 would be closed. Fly ash would be temporarily diverted to a permitted landfill in the vicinity of the plant. The only action requiring evaluation under the No Action Alternative is water quality impacts associated with the closure of the BIP Phase 1 ashfill.

The only impacts to surface water after closure of the BIP Phase 1 ashfill would result from groundwater entering Cypress Creek. Based on the groundwater assessment in the Groundwater section, if the Phase 1 ashfill were closed with either a GCL or an FML cover, no significant impacts to surface water would be expected. Under worst-case conditions, modeling results indicate that all Cypress Creek in-stream concentrations of COC would be below the TDEC Fish and Aquatic Life Criteria. See the Groundwater section for further discussion of conditions assumed for modeling.

Action Alternative

During construction of the proposed Action Alternative, best management practices (BMPs) identified in an updated/revised Storm Water Pollution Prevention Plan would be followed to reduce sediment loading in runoff from the construction area. The BMPs and commitments identified for Phase 1 in TVA 2002 would also be followed for Phase 2. On-site runoff is currently captured in the sedimentation pond.

The LCS initially mentioned in the Groundwater section would be constructed just north of the existing Phase 1 ashfill to capture, treat, and filter leachate that flows laterally across the drainage blanket of Phase 1 and through the exposed ash of Phase 2 and across its drainage blanket. TDEC would require an NPDES permit for the outfall from the LCS.

Leachate Collection System

Phase 2 of the ashfill would be designed with an LCS consisting of a 6-inch-diameter perforated high-density polyethylene (HDPE) leachate collection pipe network installed within a 1-foot-thick layer of bottom ash. This drainage layer would allow leachate to flow horizontally toward one of three leachate collection sumps. At each sump, leachate would enter a solid 8-inch-diameter HDPE conveyance pipe. Leachate would flow by gravity through the 8-inch pipe into a lined sediment pond, located north of the existing ashfill.

It is anticipated that the leachate would have low-level concentrations of several metals (arsenic, barium, cadmium, chromium, lead, nickel, selenium, and silver) and low dissolved oxygen (DO) content. Since the leachate may potentially exceed the water quality criteria for the receiving stream and the DO levels are likely to be outside optimal conditions for discharge, on-site treatment is planned. The on-site treatment would consist of a series of passive treatment technologies commonly employed for the treatment at acid mine drainage sites. The technologies are described in the following paragraphs.

Leachate collected from Phase 2 would discharge into the existing storm water sediment basin located north of the landfill. The sediment basin would serve several functions for the treatment of the leachate, including flow equalization, aeration, and settling. At the point of discharge into the existing sediment basin, some aeration of the leachate would occur. Within the pond, the leachate would mix with more pH-neutral and oxygenated storm water detained within the sediment basin. In this oxygenated environment, some dissolved metals (e.g., arsenic and iron) in the leachate would form metal hydroxides and precipitate out into the sediment basin.

The existing flow control structures associated with the sediment basin include a primary riser spillway and an emergency spillway. The primary spillway consists of a 48-inch-diameter perforated riser pipe. The riser is not perforated below an elevation of 409, thereby establishing an approximate permanent pool elevation of 409 mean sea level in the sediment pond, resulting in a pond depth of about 3 feet. The riser pipe is connected to an 8-inch-diameter barrel that would be configured to discharge to Treatment Basin 1. The sediment basin's rip-rapped emergency spillway would also discharge into Treatment Basin 1.

Treatment Basin 1 would employ a passive vertical-flow system through three distinct layers: a bottom 2-foot-thick aggregate drainage layer, a 1-foot-thick organic layer, and a 3-foot-thick permanent pool of collected storm water and leachate. Water within the treatment basin would flow vertically downward through the organic layer where several biological and geochemical processes would occur, reducing dissolved metal concentrations. Within the uppermost portion of the organic layer, DO in the water would be consumed by aerobic bacteria, resulting in anaerobic conditions (conditions wherein DO is absent). At greater depth within the organic layer, anaerobic sulfate-reducing bacteria would convert available sulfates in the water to sulfides. These sulfides would combine with dissolved metals (i.e., arsenic, cadmium, copper, iron, lead, silver, and zinc) to form metal sulfides, which would precipitate and be retained within either the organic layer or the aggregate drainage layer.

After the anaerobic water passes through the organic layer, it would enter the drainage layer where filtering would occur prior to discharge. Treatment Basin 1 would be equipped with a primary and overflow/emergency spillway, both of which would discharge to Treatment Basin 2. The overflow/emergency spillway would be designed to release the volume of storm water in excess of a 100-year, 24-hour storm event. Under this condition, water exiting through the overflow/emergency spillway would consist almost entirely of storm water, making treatment within this basin unnecessary.

Treatment Basin 2 would consist of a shallow aerobic wetland providing additional oxidation and sedimentation. The detention time in this basin would allow oxidation and sedimentation to occur within a controlled environment prior to discharge into the receiving stream. Basin 2 would provide a permanent pool 1 foot deep for the establishment of wetland vegetation. The vegetation would further aid in oxygenation of the water and precipitation of metals. This basin would be equipped with a primary riser spillway and an emergency rip-rapped spillway, which would discharge to the unnamed tributary to Cypress Creek.

Discharges from the LCS would be monitored in accordance with TDEC regulations, and those results would be reported to TDEC as part of the NPDES permit for the LCS. TVA surface water specialists would also review the reports to ensure that corrective actions would be taken to limit impacts to surface water should the data appear to trend upward.

Leachate That Migrates Directly to Groundwater and Cypress Creek

The other potential impact to surface water during active stacking in Phase 2 would be from groundwater that is not collected in the LCS. Modeling predicted that the worst-case scenario would occur between the sixth and tenth years of stacking in the Phase 2 area. The greatest amount of ash would contact rainfall in year 10 of build-out, thus creating leachate with the highest concentrations of contaminants. Based on results from the HELP model, selenium is the only COC with predicted concentrations above the TDEC CCC, and that scenario occurs sometime between years 6 and 10 of Phase 2 build-out.

The CCC for selenium is 0.005 mg/L, and the predicted worst-case concentration based on the HELP model was 0.0073 mg/L (Table 5, Case 12C). However, derivation of the selenium concentration was based on a conservative approach. Using the assumptions described below, it is highly unlikely that the actual selenium concentration would exceed the CCC:

1. The maximum value for each COC was used for the mass loading calculations. The maximum ash leachate concentration for selenium was 0.31 mg/L in 1995, but the next highest detected concentration was six times lower, at 0.05 mg/L in 2005. The selenium data from the ash leachate analyses ranged from 0.0013 to 0.31 mg/L.

2. The estimated 7Q10 flow of 0.34 cubic feet per second in Cypress Creek (Law 2009) is based upon a stream gaging station upstream from the location where groundwater is likely to intersect Cypress Creek. The contributing area of the watershed is smaller at this upstream gaging station, resulting in smaller predicted 7Q10 flows at the point of leachate intersection with Cypress Creek. The 7Q10 flow in Cypress Creek would likely be higher at the actual intersection of it and the leachate; therefore, resultant in-stream concentrations of selenium would be lower.

3. In addition, "[t]he physical distribution of various selenium species in surface water is regulated by sorption to or incorporation in suspended particulate matter (SPM), and complexation with inorganic and/or organic colloidal material. Both sorption to SPM and complexation with colloidal matter reduces bioavailability of the selenium species. The average fraction of selenium associated with the particulate phase (0.45-micrometer filtration) as determined from eleven different studies of various surface waters was found to be 16 percent (0-39 percent range) of the total selenium, i.e., an average operationally-defined dissolved selenium level of 84 percent" (USEPA 2004). Therefore, potential impacts to fish and aquatic life would be further reduced. In other words, the selenium that is "stuck to" or "caught up in" suspended particles of all types in the stream is not available for uptake and use by organisms. USEPA (2004) states that freshwater aquatic life should be protected if the chronic criterion is tissue-based for selenium and does not exceed 7.91 micrograms per gram dry weight of organism tissue, and the acute criterion concentration does not exceed 417 μg/L for waters with sulfate concentration of 100 mg/L. The TDEC acute criterion for total selenium is currently 20 μg/L (0.020 mg/L), which is more conservative than the 2004 USEPA draft criteria of 417 μg/L (0.417 mg/L). No TDEC equivalent exists for tissue-based selenium concentrations; however, TDEC's chronic criterion for selenium is 5 μg/L (0.005 mg/L).

4. The leachate seeping through the bottom liners of both phases of the ashfill does not mix with any other groundwater moving through the area prior to entering Cypress Creek.

5. If the average selenium concentration of 0.0612 mg/L (by assuming all concentrations below the detection limit of 0.10 mg/L are equal to 0.09 mg/L) were used in HELP model predictions, the concentration of selenium in Cypress Creek would be only 0.0014 mg/L. Recall that the worst-case ash sample selenium concentration (Table 5) produced a predicted in-stream concentration in Cypress Creek of 0.0073 mg/L.

Upon final closure of both phases of the BIP ashfill, the ashfill would be capped with an FML overlain by 2 feet of vegetated soil cover. The FML and vegetated soil cover would be installed on the top and side slopes of the combined ashfill. Most of the rainfall not evaporating would pass through the soil cover, run along the top of the FML cover, and down the side slopes of the ashfill to the sedimentation pond without contacting any ash. Results from the HELP model indicate no COC would have concentrations above the TDEC Fish and Aquatic Life Criteria after closure of the combined phases of the ashfill (Table 6, Case 9). In addition, after final closure, leachate seeping through the bottom liner of Phase 2 would quickly decrease. The LCS would no longer be needed and would be discontinued. With the LCS, FML top liner on Phase 1, and FML bottom liner on Phase 2, no significant impact to surface water would be expected during construction or active filling of the BIP Phase 2 ashfill nor after closure of the combined ashfill.

Solid Waste

Affected Environment

The affected environment for solid waste remains the same as described in TVA 2002. The lower Tennessee River is not listed in the 2008 TDEC 303(d) List; therefore, it is not considered impaired and assumed to fully meet its designated uses.

The 10 pulverized coal combustion units at JOF burn various percentages of Powder River Basin subbituminous, Colorado bituminous, and Illinois Basin bituminous coals. These coals are preblended at shipping terminals prior to delivery to the plant site by barge. Until recently, the predominant coal sources utilized at JOF were classified as bituminous. Fossil fuel combustion wastes are categorized by USEPA as special wastes and have been exempted from federal hazardous waste regulations under Subtitle C of the *Resource Conservation and Recovery Act* (USEPA 2009).

Production

The total amount of pulverized coal ash produced at JOF ranges from approximately 260,000 to 350,000 tons of ash per year. The ash is collected as either fly ash, which is fine enough or light enough to be carried with the flue gas stream exiting the boiler, or as bottom ash, which is coarser and heavier and falls to the bottom of the boiler. The fly ash/bottom ash split is about 80 percent fly ash and 20 percent bottom ash. The four-year average fly ash production for individual units at JOF from 2001 through 2004 was approximately 22,500 tons per year. JOF bottom ash production for the entire plant ranges from 50,000 to 60,000 tons annually.

Removal

All fly ash and bottom ash produced at JOF is sluiced to the main ash pond for handling. In this pond, bottom ash is continuously removed from the main ash sluice channel using either a dragline or trackhoe buckets to keep the channel open. As the bottom ash is removed (dipped) by the excavation equipment, it is stacked nearby and allowed to dewater. Because all of the fly ash is handled wet, there are few opportunities for marketing the material. Fly ash, which is

lighter than bottom ash, is carried by the sluice water past the dipping area either into the main pond area or directly into one of two cells in the main ash pond. To accomplish removal of the fly ash, these cells are alternately filled, dewatered, and cleaned out at least twice each year using trackhoes. Most bottom ash reclaimed within the ash pond at JOF is currently used to help build working areas and temporary dikes, which comprise the dewatering cells. Ultimately, the bottom ash is hauled with the reclaimed fly ash for use at BIP.

Since 2003, the fly ash removed from the pond has been taken by truck to BIP for use in the development of Phase 1 for light industrial use. This initial phase, which is at capacity, has been developed in accordance with TDEC Permit-by-Rule Regulations for coal ash. For the remaining 20.6-acre Phase 2 expansion area, TDEC is requiring permitting and development as a Class II industrial landfill in accordance with current solid waste regulations.

The moisture content of the ash going into the ashfill cannot exceed 27 percent; however, it is typically less than this, at around 25 percent. The ashfill is protected from failure to the south by the quarry walls; it also appears that there is capacity within the former quarry to the east to contain a failure. In a conceptual sense, if catastrophic failure of the ashfill occurred, the ash would likely migrate to the north or north-northeast toward the railroad and Cypress Creek. Ash would likely fill in low places of the old quarry before reaching the railroad tracks. The railroad tracks would provide secondary containment of the ash.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, the Phase 1 ashfill would be closed, Phase 2 would not be developed, and fly ash produced by JOF would no longer be deposited at BIP.

As noted in the Groundwater section of this SEA, the only factor requiring consideration under this alternative is the potential long-term impact of ashfill closure on groundwater resources. Groundwater sampling at the site indicates that leachate from the Phase 1 ashfill may be impacting these resources.

Closure Requirements

Minimum regulatory requirements for closure of a Permit-by-Rule coal ashfill are given in TDEC Division of Solid Waste Management Rule 1200-1-7-.02(1)(c)1.(ii)(IX). These requirements call for a cover of only recompacted soil. Hydrologic (HELP) models used to estimate the volume of leachate reaching the base of the ashfill show that if the Phase 1 area were closed with only a recompacted soil cover, degradation of groundwater would occur in the vicinity of the ashfill and would ultimately impact Cypress Creek.

Additional modeling indicates that a final Phase 1 cover system including either a GCL or an FML would reduce leachate production within the ashfill and diminish impacts to groundwater resources to levels not exceeding applicable MCLs or aquatic toxicity limits. It is uncertain whether continuing short-term drainage from the ashfill would result in leachate contamination of groundwater exceeding regulatory limits; however, once the leachate production volumes are reduced, groundwater impacts would be expected to decrease with time.

Action Alternative

Under the Action Alternative, the Phase 2 area of BIP would be developed as a Class II landfill to accept fly ash. Approximately 35,000 to 750,000 tons of fly ash would be deposited at the site for approximately 10 years beginning in 2009. TDEC Rule 1200-1-.04(4)(b) specifies that a

Class II landfill be located, designed, constructed, operated, and maintained in accordance with the standards of a Class I disposal facility, unless a waiver for one or more of the standards is obtained.

Geologic Buffer and Liner System

Standards include a geologic buffer and liner system to ensure that the concentration of COCs will not exceed the applicable MCLs in the uppermost aquifer at the relevant point of compliance.

The current design specifies a base with a GCL overlying recompacted soil graded to maintain a minimum 3-foot separation from the seasonal high groundwater elevation. Even though leachate modeling utilizing this design indicates the concentration of COCs would not exceed the applicable MCLs in the uppermost aquifer underlying the site (Camden formation), the design does not strictly meet TDEC's minimum requirements for a Class II disposal facility; therefore, waivers have been requested as described in Table 7.

Table 7. Requested Waivers for Landfill Components

Landfill Component	TDEC Rule	Requirement	Design	Reason for Waiver
Geologic Buffer and Liner	1200-1-7-.04(4)(a)	30-mil FML 2-feet 1.0×10^{-7} compacted clay liner with geologic buffer of 5 feet of 1.0×10^{-6} centimeters per second (cm/sec) soil	GCL with 3-feet 1.0×10^{-6} cm/sec compacted soil	Modeling results indicate performance of design is adequate
Cover	1200-1-7-.04(8)(c)3	2 feet 1.0×10^{-7} cm/sec compacted clay with 1-foot vegetated cover layer	18-inch 1.0×10^{-6} cm/sec soil cap with 6-inch vegetated cover layer	Modeling results indicate performance of design is adequate

Note: 30-mil is 30 millimeters in thickness

Cover

Regulations governing Class II landfill development also specify a cover system with a cap that minimizes the long-term migration of liquids through the closed facility in accordance with Rule 1200-1-7-.04(8)(c)3. The current design has a cover system that includes a GCL overlain by an 18-inch recompacted soil layer and topped by a 6-inch vegetated soil layer. As with the liner system, modeling has shown that the designed cover system would prevent long-term migration of leachate within the facility. However, as described in the liner section and shown in Table 7, because the design does not strictly meet Class II standards, a waiver has been requested.

Leachate Collection

For a Class II facility, leachate must be collected and removed in accordance with Rules 1200-1-7-.04(4)(a)5 and 1200-1-7-.04(4)(a)7 and must be managed in accordance with Rule 1200-1-7-.04(4)(a)8. An LCS to capture leachate from both Phase 1 and Phase 2 is included in the final design of the Phase 2 expansion area. A new NPDES Permit will be obtained for the discharge from this system.

The Permit-by-Rule Phase 1 area was constructed with a recompacted soil base, graded to slope to the east-northeast, and designed to provide a minimum separation of 3 feet between the bottom of the ashfill and the seasonal high groundwater elevation. This base also includes

a GCL overlain by a 24-inch-thick layer of bottom ash. No provisions were designed or constructed to facilitate collection or drainage of leachate at the outer edge of the Phase 1 base.

Modeling of Leachate

Similar to the modeling described above for Phase 1, HELP models for the active Phase 2 and post-closure periods for both Phases 1 and 2 show that the inclusion of either a GCL or an FML in the cover system would substantively reduce the development of leachate at the base of the ashfill and mitigate the predicted levels of COCs reaching Cypress Creek to insignificance.

The current design of the facility includes an FML in the cover of Phase 1 and an FML bottom liner for Phase 2. Based upon the models, this would achieve the threshold at which degradation of the groundwater resources is mitigated.

Threatened and Endangered Species (Plants)

Affected Environment

The TVA Natural Heritage database indicated there are no federally listed and one state-listed species (hairy umbrella sedge) recorded from within 5 miles of the proposed BIP Phase 2 and the WMT in Houston County.

TVA biologists conducted a field survey at BIP in 2001, 2007, and 2008 and the WMT in 2008. For Phase 1 of the ash disposal project, mitigation was required for wetland and rare plant resources before a portion of the old quarry could be used for ash disposal. The Tennessee state-listed species of special concern, *Fuirena squarrosa* (hairy umbrella sedge) continues to be part of the quarry flora within and outside of the mitigation area created for the sedge at BIP. The previous year's dead stems were seen during the 2008 field survey. Sedge growth in 2008 was not visible. Thus, information is limited on the current condition of hairy umbrella sedge populations at BIP. It occurs at three sites in Tennessee, with the largest population occurring at BIP. No other listed species were found during the 2008 field survey. There are no federally listed species in counties within 5 miles of the project. No caves, heron colonies, or other unique habitats were observed during field investigations.

Environmental Consequences

Discovered at BIP in 2001 during the environmental review for Phase 1, the hairy umbrella sedge is the only rare plant of concern at either the BIP or the WMT. Upon discovery of the hairy umbrella sedge in 2001, a plot of land was set aside at BIP (called the Phase 1 mitigation site), and most of the hairy umbrella sedge population was relocated to this plot of land, all prior to build-out of the Phase 1 ashfill. There would be no effects to federally listed plant species or their habitats.

No Action Alternative

Adoption of the No Action Alternative would result in no project-related impacts to the hairy umbrella sedge at BIP.

Action Alternative

The only rare plant issue for the Action Alternative is the viability of the hairy umbrella sedge. With the following steps, the impact of the Action Alternative would be insignificant on the hairy umbrella sedge:

1. There would be a long-term commitment to maintain the sedge at the mitigation site.

2. There would be a survey by TVA botanists for hairy umbrella sedge at both the ashfill Phase 2 site and the hairy umbrella sedge (Phase 1) mitigation site during the growing season (June through September).

3. If the survey finds low population numbers or restriction of the plant to a small area at the Phase 1 mitigation site, then seed or transplants from areas to be covered with ash would be used to enhance the Phase 1 mitigation site populations.

Threatened and Endangered Species (Terrestrial Animals)

Affected Environment

No federally or state-listed terrestrial animals were observed during field investigations on April 28-29, 2008. The TVA Natural Heritage database indicated that one federally listed terrestrial animal species (gray bat) is reported from Benton and Houston counties, Tennessee. The bald eagle is also reported from both counties. One state-listed species (alligator snapping turtle) is reported within 3 miles of the proposed activities in Benton and Houston counties (Table 8). The project area does not contain any designated critical habitat for federally listed species.

Table 8. Federally Listed Terrestrial Animal Species Reported From Benton and Houston Counties and State-Listed Terrestrial Animal Species Reported From Within 3 Miles of the Project Site

Common Name	Scientific Name	Federal Status	State Status (Rank)
Reptile			
Alligator Snapping Turtle	*Macrochelys temminckii*	–	NMGT (S2S3)
Bird			
Bald Eagle	*Haliaeetus leucocephalus*	BGEPA	NMGT (S3)
Mammal			
Gray Bat	*Myotis grisescens*	END	END (S3)

- = Not applicable
Status: END = Endangered; BGEPA = Protected by the *Bald and Golden Eagle Protection Act*; NMGT = In need of management
Rank: S2 = Very rare or imperiled; S3 = Rare or uncommon; S4 = Abundant; S#S# = Occurrence numbers are uncertain

Alligator snapping turtles are considered the most aquatic of freshwater turtles. The majority of their life history is carried out in a variety of aquatic environments including deep rivers, sloughs, lakes, and larger-sized creeks. The species rarely leaves water, usually only to nest (Soehren and Godwin 2004). One record exists for this species 2.7 miles from BIP and within 1 mile of the wetland mitigation site. Given the species' life history requirements, the species would not be found at either site.

Bald eagles were recently removed from the Endangered Species List; however, the species is protected under the *Bald and Golden Eagle Protection Act*. Typically, bald eagles nest in forested habitats near large bodies of waters, such as reservoirs and rivers, where they forage. Bald eagles nest in the White Oak embayment on Kentucky Reservoir, approximately 1.2 miles from the wetland mitigation site. No bald eagle habitat exists at either the wetland mitigation site or BIP.

Gray bats roost in caves year-round and typically forage over open water habitats including streams, rivers, and reservoirs. Two caves known to support gray bats are located approximately 20 and 29 miles south of BIP; the latter supports a substantial colony. No new caves were observed during field surveys. A historical record of gray bats exists for Benton County within 5 miles of the wetland mitigation site. Gray bats likely forage along Kentucky Reservoir in the vicinity of the wetland mitigation site and BIP.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed ashfill expansion would not be constructed, and there would be no project-related impacts to listed wildlife populations or habitats.

Action Alternative

Under the Action Alternative, Trans-Ash would expand the current ash disposal area to include an additional 20.6 acres of ashfill space for future coal ash disposal. The proposed action would not likely result in impacts to listed terrestrial animals. Within the proposed Phase 2 at BIP, there is no suitable habitat for the state-listed alligator snapping turtle.

Bald eagles nest along Kentucky Reservoir, both upstream and downstream of the WMT. The WMT is outside the 660-foot protective buffer zone surrounding the one nest noted in the area. The 660-foot buffer zone is suggested by the *Bald Eagle Management Guidelines* (USFWS 2007). Because no bald eagle nests or habitat occurs at either the WMT or BIP due to an overall lack of forested habitats and quality nest trees, the proposed action is not expected to result in impacts to this species or its habitat.

Due to the amount of open water, potentially suitable foraging habitat exists within the BIP for the endangered gray bat. However, the site does not support suitable roosting conditions for the species, and any foraging forays over the area are anticipated to be of secondary importance given the proximity of an abundance of foraging opportunities associated with nearby Kentucky Reservoir. Because of the availability of abundant foraging opportinities on Kentucky Reservoir, conversion of habitats supported within the project area to an ash disposal landfill would not result in impacts to gray bats. Gray bats may readily forage in the mitigation wetlands once they are created. The proposed project would not result in impacts to this species or its habitats.

Roosting habitat for endangered gray bats does not exist at the WMT or BIP. Gray bats likely forage within the BIP. Due to the abundance of foraging habitat on Kentucky Reservoir, and that gray bats would readily forage in the proposed mitigation wetlands, the proposed ashfill expansion would not result in impacts to gray bats or its habitats.

Threatened and Endangered Species (Aquatic Animals)

Affected Environment

The TVA Natural Heritage database indicated that three federally listed aquatic species (slenderhead darter, orangefoot pimpleback, and pink mucket) and state-listed aquatic species (orangefoot pimpleback and pink mucket) are known in Benton County, Tennessee, or within a 10-mile radius of the proposed ash disposal expansion site, or both. However, none of the listed species occur within the potentially affected watersheds. Therefore, no significant impacts to threatened and endangered aquatic species would occur as a result of the proposed BIP Phase 2.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed expansion of the existing ashfill would not occur. Current operating conditions and environmental effects would continue. No significant impacts to listed aquatic animals would occur.

Action Alternative

Under the Action Alternative, the proposed expansion of the existing ashfill would occur. The TVA Natural Heritage database indicated that the federally listed endangered pink mucket (*Lampsilis abrupta*) could potentially occur adjacent to the proposed wetland mitigation site. Potential impacts to the pink mucket could occur from increased erosion and siltation by heavy equipment, as a result of berm construction. However, ground disturbance would be minimized, and all work would be done using BMPs as outlined in TVA Standards and Conditions (TVA 2005). With proper implementation of the BMPs no impacts to water quality in the Tennessee River would occur. No state- or federally listed aquatic animals are known from areas directly or indirectly affected by development of the fill site. Therefore, no impacts to threatened and endangered aquatic species would occur as a result of the proposed Johnsonville Fossil ash disposal expansion. No impacts to the federally listed pink mucket are expected to occur as a result of development of the proposed wetland mitigation site.

The TVA Heritage database indicated that the federally listed endangered pink mucket (*Lampsilis abrupta*) potentially occurs in the Tennessee River adjacent to the proposed wetland mitigation site. Potential impacts to the pink mucket could occur from increased erosion and siltation by heavy equipment, as a result of berm construction. Ground disturbance would be minimized and all work would employ Best Management Practices (BMPs) as outlined in Standards and Conditions (TVA 2005).

Terrestrial Animals

Affected Environment

The proposed 20.6-acre ash disposal site would be located within an abandoned quarry, intensively mined for gravel in previous years. The site contains numerous mounds, berms, and spoil banks of mined chert gravel that are interspersed with remnant portions of hillsides. Vertical mining into the hilly terrain has created a complex of level basins and pits that frequently hold water during wetter times of the year. The remnant sections of hillsides and spoil banks are well drained and extend over 60 feet in elevation from the surrounding pits. These broken uplands currently support young to middle-aged mixed evergreen-deciduous forests (55 percent) with occasional open areas dominated by scrub-shrub/sapling habitats (15 percent). The wetter sites within the intervening basins contain shallow pools with emergent vegetation (15 percent) and deeper ponds (generally less than three feet) that support wetland vegetation along their margins (15 percent). (See discussions on plants and wetlands for further details.)

The mixed evergreen-deciduous forest that occupies the tops of spoil banks and hillside slopes provide poor habitat for wildlife. Dominant species of plants in this habitat include loblolly pine, sweetgum, red maple, sourwood, and dogwood. Past mining activity has resulted in very thin soils in the forested areas, further reducing the quality of this habitat for wildlife. Terrestrial animals that were observed in this habitat type include resident and migratory songbirds, mammals, and reptiles. Songbirds include eastern phoebe, white-eyed vireo, yellow-throated vireo, blue jay, tufted titmouse, Carolina wren, blue-gray gnatcatcher, eastern bluebird, northern parula, yellow-throated warbler, pine warbler, summer tanager, scarlet tanager, eastern towhee,

northern cardinal, indigo bunting, brown-headed cowbird, and American goldfinch. Mammals associated with this community include white-tailed deer and eastern gray squirrel. Reptiles observed within these habitats include ground skink and eastern fence lizard.

The scrub-shrub habitats are dominated by blueberry, eastern red cedar, loblolly pine, and sweetgum. Species such as red maple, sycamore, and loblolly pine occur along the margins of wetter sites. Songbirds in these areas include white-eyed vireo, blue-gray gnatcatcher, prairie warbler, palm warbler, eastern towhee, northern cardinal, Louisiana waterthrush, and common yellowthroat. Additional terrestrial animals associated with this habitat include fence lizard, black racer, eastern cottontail, and white-tailed deer.

Of the habitats represented in the abandoned quarry, the wetter areas within the pits, basins, and margins of the site are most important from an ecological perspective. The shallow, temporary pools support mats of emergent vegetation such as woolgrass, needle rush, and dense *Sphagnum* sp. mats. The deeper ponds in the area likely dry during periods of drought. Collectively, these areas support populations of benthic macroinvertebrates, amphibians, and reptiles, and along habitat margins, the areas support birds and mammals. Amphibians observed in the wetland areas include red-spotted newt, northern cricket frog, upland chorus frog, spring peeper, American toad, green frog, and leopard frog. Larval southern two-lined salamanders and midland water snake were also observed along the margin of the site. Mammals that utilize these habitats include foraging bats, eastern cottontail, and potentially swamp rabbit. Birds utilizing the wetland margins and littoral zones include great blue heron and green heron. Although none were observed, shorebirds such as killdeer and spotted sandpiper may forage in portions of this habitat. However, the isolated wetlands in the project area have a hard pan subsurface and lack a soft mud/silt substrate generally favored by shorebirds. No caves, heron colonies, or other unique habitats were observed during field investigations.

The proposed wetland mitigation site is largely comprised of early successional field habitat typically found in pastures. This type of habitat is abundant in the area and is used primarily by more common species of wildlife.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed actions would not occur, and the project area would likely continue to support the species observed during recent field investigations. The various habitats currently supported would continue to mature and change through successional stages providing increased benefit to wildlife over time.

Action Alternative

Under the Action Alternative, the existing ash disposal site would be expanded by 20.6 acres. The proposed project would convert a former gravel quarry that currently contains a mixture of evergreen-deciduous forest, scrub-shrub uplands, and herbaceous dominated wetlands. These habitats are common in the immediate vicinity and in several areas within Benton County. Overall, none of the terrestrial habitats are uncommon from a local or regional perspective, and impacts to the communities are expected to be insignificant under this alternative.

Wildlife currently using the BIP would be displaced by the expansion of the ash disposal area. Mobile species such as birds and mammals would not be greatly impacted, as these individuals would be able to move into similar habitats in the surrounding landscape. The project would

likely result in direct mortality of individual amphibians and reptiles that reside in the wetland habitats within BIP. However, several isolated wetlands are located adjacent to the project area. These wetlands serve as mitigation sites and would be protected, providing habitat for wildlife near the BIP. None of the terrestrial animal species occurring on site are rare, and the proposed project would not result in direct, indirect, or cumulative impacts to terrestrial wildlife or their habitats.

Mitigation wetlands constructed at White Oak Creek would result in the conversion of 17.8 acres of pastureland into wetland habitats. These new wetlands would enhance the existing nearby wetlands found at White Oak Creek, resulting in increased wildlife diversity at the local level.

Wetlands

Affected Environment

The first portion of the TVA action is located in the Tennessee Western Valley (Kentucky Lake) watershed and the Cypress Creek subwatershed, where wetlands comprise approximately 4.2 percent of the overall land use types within the watershed (TDEC 2006). The existing and proposed ashfill areas lie over an abandoned chert quarry. The proposed Phase 2 includes eight wetlands and an intermittent stream that drains directly into the embayment of Cypress Creek along Kentucky Reservoir.

On April 28-29, 2008, a ground survey was conducted within the proposed Phase 2 site. Eight wetlands were identified within the proposed project footprint and classified into wetland type according to the Cowardin system (Cowardin et al. 1979). Wetland determinations were performed according to USACE standards (Environmental Laboratory 1987; Reed 1997; U.S. Department of Defense and USEPA 2003). Broader definitions of wetlands, such as those used by the U.S. Fish and Wildlife Service (Cowardin et al. 1979), the Tennessee definition (Tennessee Code 11-14- 401), and the TVA Environmental Review Procedures definition (TVA 1983), were also considered in this review.

The TVA Rapid Assessment Method (TVARAM) was used to assess wetland conditions and identify wetlands with potential ecological significance (Mack 2001). Using TVARAM, wetlands may be classified into three categories. Category 1 wetlands are considered “limited quality waters” and represent degraded aquatic resources that have limited potential for restoration and such low functionality that lower standards for avoidance, minimization, and mitigation can be applied. Category 2 includes wetlands of moderate quality and wetlands that are degraded but have reasonable potential for restoration. Avoidance and minimization are the first lines of mitigation for Category 2 wetlands. Category 3 generally includes wetlands of very high quality or of regional/statewide concern, such as wetlands that provide habitat for threatened or endangered species.

All wetland areas identified and delineated at BIP were located entirely within the project boundaries. All wetlands were considered “problem areas” due to the highly disturbed substrate over which these wetlands have developed. The USACE defines a “problem area” wetland as a wetland that is difficult to identify because it may lack indicators of wetland hydrology and/or hydric soils or its dominant plant species are more common of nonwetlands. Complete soil cores were not extractable because the wetland bottoms consisted of gravel beds remaining from the abandoned chert mine operations. All wetlands identified within the proposed BIP Phase 2 area function as storm water retention, erosion control, toxicant absorption, flood control, and offer wildlife habitat at a minimal level. Despite the beneficial qualities of these on-site wetlands, they all scored in Category 1 using TVARAM, which indicates relatively poor condition and provision of the above-listed wetland functions. The wetland areas and their

acreages are listed in Table 9. Detailed descriptions of each wetland area are presented in Appendix G.

Table 9. Affected Wetlands, by Size in Acres, at the Proposed Bivens Industrial Park Phase 2 Expansion Site

Wetland Identification	Wetland Acreage	TVARAM Score
W005	0.62	29
W002	0.60	29
W007	0.39	24
W001	0.38	25
W006	0.25	23
W008	0.23	24
W003	0.18	19
W004	0.08	23

The second portion of the TVA action is to transform a 22.6-acre tract of TVA land from agricultural usage to 17.8 acres of wetlands to mitigate for the loss of wetlands at the BIP site. The site is located along the White Oak Creek embayment of Kentucky Reservoir, approximately 18 straight-line miles from the BIP site and within the same watershed as the BIP site. Primarily an old field, the site has mapped hydric soils, with numerous depressional pockets that contain wetland vegetation such as buttonbush, rosemallow, soft rush, path rush, black willow, and fox sedge. Wetland tree seedlings such as sycamore, sweetgum, honey locust, river birch, and pin oak are also colonizing the site. The required acreage for the proposed action is 12.88 acres. The remaining 4.9 acres would be available for future TVA wetland mitigation needs.

Environmental Consequences

Activities in wetlands are regulated under Section 404 and Section 401 of the *Clean Water Act* and Executive Order (EO) 11990. Section 404 implementation requires that activities in wetlands be authorized through a Nationwide General Permit or Individual Permit issued by the USACE. Section 401 requires water quality certification by the state for projects permitted by the federal government (Strand 1997). EO 11990 requires agencies to minimize wetland destruction, loss, or degradation, and preserve and enhance natural and beneficial wetland values, while carrying out agency responsibilities. TVARAM can aid in guiding wetland mitigation decisions consistent with TVA's independent responsibilities under the *National Environmental Policy Act* (NEPA) and EO 11990. Using TVARAM, lower standards for avoidance, minimization, and mitigation can be applied to Category 1 wetlands. Avoidance and minimization should be the first lines of mitigation for Category 2 wetlands. Disturbance of any kind to Category 3 wetlands and their buffer zone should be avoided.

The majority of these wetlands (W001, W002, W004, W005, W006, W007, and W008) exhibit connectivity to a navigable waterway via the unnamed tributary on site, which empties directly into the Cypress Creek embayment along Kentucky Reservoir at approximately TRM 100L. Therefore, they are considered jurisdictional and regulated by the USACE under the *Clean Water Act*. W003 is an isolated wetland that would not be considered jurisdictional by the USACE; however, through EO 11990, TVA assesses and mitigates impacts to all wetlands (regardless of connectivity).

No Action Alternative

Under the No Action Alternative, the wetlands identified in the Affected Environment section of this SEA would not be disturbed.

Action Alternative

The proposed disposal of JOF coal ash at BIP Phase 2 would result in the filling of 2.39 acres of TVARAM Category 1 wetland area. The wetland impacts associated with this project would be subject to Section 404 federal permit requirements, Section 401 state water quality certification, and EO requirements. Trans-Ash has received approval from both USACE and TDEC to compensate for these wetland impacts through creating 12.88 acres of jurisdictional wetlands at the WMT on White Oak Creek.

The wetlands would be created via a series of berms that would hold water on the site. A conceptual layout of the wetlands is shown in Figure 11.

The mitigation includes a vegetation plan (Table 10) that calls for planting both wetland trees and shrubs and also allows for natural revegetation of the site. The resulting wetlands would be a mix of habitat types (forested, scrub-shrub, and emergent) within the same watershed as the BIP project.

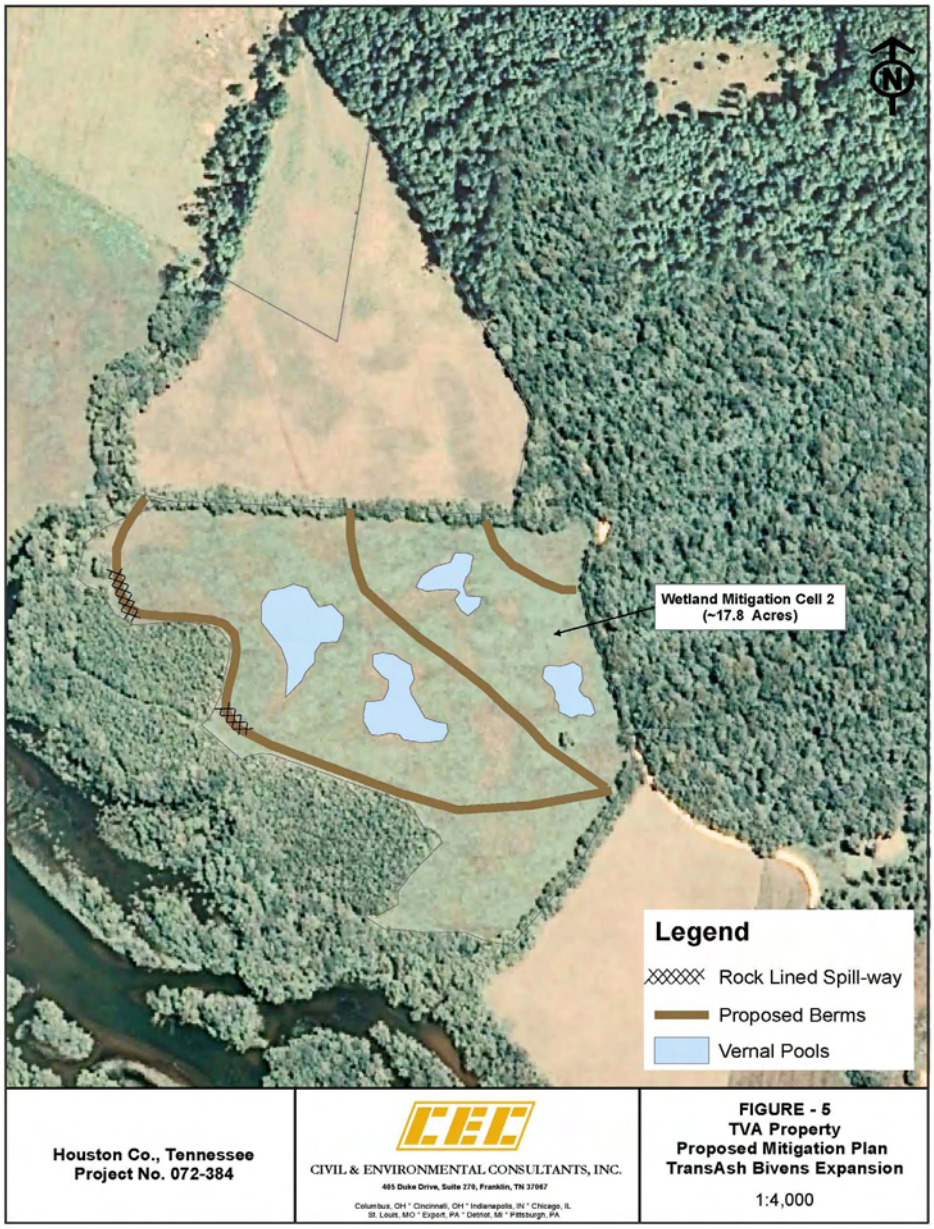

Figure 11. Conceptual Design of Wetland Mitigation at the Wetland Mitigation Tract, Houston County, Tennessee

Table 10. Proposed Vegetation Plan for Wetland Mitigation Tract on White Oak Creek, Tennessee

Proposed Vegetation Plan		
Species	**Common Name**	**Number**
Amorpha fruiticosa	False indigo bush	300
Cornus amomum	Silky dogwood	200
Itea virginica	Virginia sweetspire	200
Quercus bicolor	Swamp white oak	300
Quercus michauxi	Swamp chestnut oak	300
Quercus palustris	Pin oak	300
Quercus phellos	Willow oak	300
Taxodium distichum	Bald cypress	300
TOTAL		**2200**

Initial site preparation would include bush-hogging the site and construction of a series of berms as described above. During this time, there would be a minor, temporal loss of wetland function on site associated with the clearing of small, localized areas of wetland vegetation. This minor loss would be more than offset by the creation of an additional 17.8 acres of contiguous wetland habitat. Permit requirements include a five-year monitoring protocol and an adaptive management plan to ensure the site develops according to the mitigation plan. The site would be protected in perpetuity via a deed restriction by TVA as well as a TDEC Notice of Land Use Restrictions. The long-term protection measures, close proximity of the mitigation, amount of mitigation provided, and type of mitigation provided adequately offsets the impacts associated with the fill of the 2.39 acres of wetlands at the BIP site. As a result, overall wetland impacts are insignificant, and in the long term would be beneficial in an overall watershed context.

Aquatic Ecology

Affected Environment

The proposed JOF ash disposal expansion site occurs within the Western Highland Rim ecoregion. Streams in this ecoregion typically are characterized by moderate-gradient, coarse chert gravel and sand substrates with bedrock areas. The streams are usually clear with moderate to low productivity. However, the intermittent stream identified during a field survey on the expansion site does not fit the characteristics of typical Highland Rim streams. Its channel flows in and out of wetlands and has been altered in the past. Watercourses found on the proposed site are listed in Table 11.

Table 11. Watercourses Found on the Proposed Ash Disposal Expansion Site Within the Tennessee River Drainage, Benton County, Tennessee

Field Identification	Stream Category	Streamside Management Zone (SMZ) Category	Stream Name
AS01	Other	SMZ A	Pond
AS02	Other	SMZ A	Pond
AS03	Other	SMZ A	Pond
AS04	Other	SMZ A	Pond
AS05	Other	SMZ A	Pond
AS06	Intermittent	SMZ A	Tributary to Cypress Creek

Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed expansion of the ashfill at BIP would not occur. No impacts to aquatic ecology would result.

Action Alternative

Under the Action Alternative, the proposed expansion of the ashfill at BIP would occur. The ashfill area would be increased by 20.6 acres, which would in-turn increase the site's capacity to handle coal ash by 2.2 million cubic yards.

Only one intermittent stream (approximately 1,658 linear feet) and five ponds (approximately 1.5 total surface acres) were identified during a field survey. Alteration of the intermittent stream (approximately 1,658 linear feet) and ponds (approximately 1.5 total surface acres) through relocation or encapsulation to facilitate ash disposal would occur.

Aquatic life would be affected by the proposed action either directly by the alteration of habitat conditions within the stream or indirectly due to modification of the riparian zone and storm water runoff resulting from construction and maintenance activities. Potential impacts due to relocation or encapsulation to facilitate ash disposal include loss of in-stream habitat, increased erosion and siltation, alteration of stream banks and stream bottoms by heavy equipment, runoff of herbicides into streams, and increased stream temperatures.

Managed Areas

Affected Environment

No natural areas, including Nationwide Rivers Inventory streams, occur at or adjacent to the proposed Phase 2 expansion site at BIP or the proposed WMT on Kentucky Reservoir. Only one natural area is within 3 miles of the proposed Phase 2 expansion site. No natural areas are within 3 miles of the proposed wetland mitigation area.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, no expansion of the ash landfill would be implemented. Because the landfill is not adversely impacting the one natural area within 3 miles of the landfill

now, no impacts to this natural area are anticipated within the time bounds (i.e., present to 2019) of ash disposal at this site.

Action Alternative

Under the Action Alternative, the proposed actions (Phase 2 of BIP ashfill and wetland mitigation areas) would be implemented. The increase in landfill area by approximately 20 acres would not result in significant impacts to the Camden Wildlife Management Area, which is 1.7 miles southeast of the proposed expansion site. Because the distance from the proposed project to the Camden Wildlife Management Area is sufficient, no impacts to natural areas are anticipated as a result of the proposed action.

Socioeconomics

Affected Environment

The population of Humphreys County, where BIP is located, is 18,173, according to Census Bureau estimates for 2007 (http://www.census.gov/popest/counties). Benton County, across the Tennessee River from BIP, has a population of about 16,267.

The minority population in the area is small, 5.0 percent of the total in Humphreys County and 4.3 percent in Benton County in 2000 (http://factfinder.census.gov). The civilian labor force in Humphreys County in 2007 was 9,100 and in Benton County, 6,940. The unemployment rate in Humphreys County in 2007 was 5.6 percent and in Benton County, 6.2 percent; these are both higher than the state rate of 4.7 percent and the national rate of 4.6 percent. However, they are in the midrange for Tennessee counties, which range from a high of 8.3 percent to a low of 3.4 percent (http://www.sourcetn.org/analyzer). About 72 percent of adults (25 or older) in Humphreys County and 66 percent in Benton County have a high school or general equivalency diploma (http://factfinder.census.gov/). Per capita income is low, $26,780 per year in Humphreys County in 2006, about 73 percent of the national average of $36,714; in Benton County, per capita income is $23,049, about 63 percent of the national average. In 2000, employment by occupation in Humphreys and Benton counties is shown in Table 12.

Table 12. Year 2000 Employment by Occupation in Humphreys and Benton Counties, Tennessee

Occupation	Percent of Employed in Benton County	Percent of Employed in Humphreys County
Production, Transportation, and Material Moving	28.5	27.7
Management and Professional	20.7	20.3
Sales and Office	19.0	20.3
Service	15.5	13.7
Construction, Extraction, and Maintenance	14.9	17.4
Farming, Fishing, and Forestry	1.4	0.5

Source: http://factfinder.census.gov/

Environmental Consequences

No Action Alternative

The No Action Alternative would result in a lack of permitted ash storage capacity for JOF within the next year or less. This would require closure of the plant. Impacts on the local economy would be significant due to the loss of jobs and income. In addition, alternative sources of

electric power would be needed to replace the production at JOF. The location and magnitude of the impacts of replacement would depend on the decisions made, but likely would be significant.

Action Alternative

The Action Alternative, expansion of the existing disposal site and creation of the new wetlands, would allow continued use of the JOF facility and would maintain the jobs and income associated with operation of the facility, including the ash disposal operation at BIP. In the longer term, there would be a small increase in the acreage of the BIP. The result could be a small positive impact on jobs and income in the area by attraction of additional firms or by expansion of existing firms. Due to the low population density of the area and its relatively small minority population, no noticeable negative impacts to disadvantaged populations would be likely.

Visual Effects

Affected Environment

The affected environment for visual effects at BIP remains the same as described in TVA 2002.

The proposed wetland mitigation area would be located approximately 18.3 straight-line miles away, within the White Oak Creek embayment of Kentucky Reservoir in Houston County, south of Summers, Tennessee. The area is currently an open agricultural field and at the time of the field investigation for visual resources (December 2008) was not under crop cover. Traffic is light along Summers Road, the frontage road for the mitigation site.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed expansion of the ashfill would not occur. Therefore, there would be no impacts to visual resources.

Action Alternative

Under the Action Alternative, additional disturbance of the proposed ash disposal site would likely not be seen from Bivens Road or prominent peaks surrounding the site. Views of disturbance would be limited to construction workers accessing the site. Therefore, construction, operation, and long-term maintenance of the proposed ash disposal area would not significantly impact visual resources.

There likely would be no visual impacts as a result of mitigating the disturbed wetlands at the WMT. The small berm and proposed wetland vegetation would be visually similar to the agricultural field seen in the landscape now. Only local property owners and occasional visitors to the area would likely see the WMT. Therefore, there are no significant visual impacts anticipated as a result of construction of the WMT.

Floodplains and Flood Risk

Affected Environment

JOF is located at about TRM 100 on Kentucky Reservoir in Humphreys County, Tennessee. However, the potential area impacted by the ash management strategy would involve the BIP property located at about Cypress Creek Mile 13 in Benton County, Tennessee, and a wetland mitigation site at White Oak Creek Miles 4.2 to 4.9 in Houston County, Tennessee. Both of these sites are located on Kentucky Reservoir. The 100-year floodplain on Kentucky Reservoir

is the area that would be inundated by the 100-year flood. The 100-year flood elevation at Cypress Creek Mile 13 is 375.1, and at White Oak Creek, the 100-year flood elevation is 375.0. The Flood Risk Profile (FRP) elevation at Cypress Creek Mile 13 is 375.9, and at White Oak Creek, the FRP elevation is 375.0. All elevations are referenced to the National Geodetic Vertical Datum of 1929. At these locations, the FRP elevations are equal to the 500-year flood elevations and are used to control flood-damageable development for TVA projects and on TVA lands.

Environmental Consequences

No Action Alternative

Under this alternative, no new construction would take place at BIP, and the wetland mitigation area would not be created. Therefore, current conditions would not change. Any proposed development in the floodplain would be reviewed in advance by TVA to ensure that floodplain impacts would be minimized.

Action Alternative

Under this alternative, TVA would expand the existing ash disposal area at the BIP site. The BIP site is located outside of the 100-year floodplain. Therefore, no construction activity would occur within the 100-year floodplain, which would be consistent with EO 11988.

The proposed wetland mitigation area would involve activities within the 100-year floodplain and would, therefore, be subject to compliance with EO 11988. Consistent with EO 11988, TVA would consider creation of a wetland to be a functionally dependent use of the floodplain. The creation of a wetland would result in a positive but insignificant impact to natural and beneficial floodplain values. The creation of the wetland would result in the loss of approximately 8.2 acre-feet of flood control storage. We believe the amount of displaced flood control storage has been minimized while achieving the project objective. Therefore, the project would comply with the TVA Flood Control Storage Loss Guideline.

Cultural Resources and Historic Properties

Affected Environment

The affected environment for cultural resources at BIP remains the same as described in TVA 2002.

The archaeological area of potential effect (APE) at the WMT was determined to be the 22-acre footprint where the wetland mitigation would occur situated adjacent to and immediately north of White Oak Creek and east of Kentucky Reservoir. No aboveground berms associated with the proposed wetland would exceed a height of 3 feet nor would they have a potential to affect any architectural resources in or eligible for listing in the National Register of Historic Places (NRHP).

A preliminary records search was conducted prior to the survey and no previously recorded historic properties were identified within the APE. The archaeological survey identified three previously unrecorded archaeological sites (40HO75, 40HO76, and 40HO77) within the APE. Sites 40HO75 and 40HO76 are open habitation sites of undetermined cultural affiliation. These two sites are recommended ineligible for the NRHP. Site 40HO77 is a large Middle Woodland open habitation site that *is* recommended as *potentially* eligible for the NRHP.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed expansion of the ashfill would not occur. Therefore, there would be no impacts to cultural resources or historic properties.

Action Alternative

The impacts to cultural resources at BIP remain the same as described in TVA 2002.

Under the Action Alternative, the proposed expansion of the ashfill at BIP would occur. The *Phase I Archaeological Survey of the Proposed New Johnsonville Wetlands Mitigation Project, Houston County, Tennessee,* identified three previously unrecorded archaeological sites (40HO75, 40HO76, and 40HO77) within the APE at the WMT (Jones 2008). Site 40HO75 and 40HO76 are considered ineligible for the NRHP because they did not contain intact deposits. Site 40HO77 is considered potentially eligible for the NRHP for its high possibility to contain subsurface features. In order to avoid potential adverse effects to 40HO77, a 30-meter (98.4-foot) buffer would be placed around the site so that it is avoided during the wetland mitigation project. The Tennessee State Historic Preservation Office has concurred with TVA's determination that, with a 30-meter (98.4-foot) buffer surrounding Site 40HO77, no archaeological resources potentially eligible or eligible for the NRHP would be adversely affected by the proposed undertaking. The letter of concurrence is presented in Appendix H.

Cumulative Impacts

With proper implementation of BMPs, no significant impacts to the federally listed pink mucket would occur as a result of the proposed wetland mitigation at the WMT.

No designated critical habitat for federally listed species exists within BIP or the WMT. The proposed actions are not expected to directly, indirectly, or cumulatively impact federally or state-listed terrestrial animal species, or their habitats.

Wetland impacts associated with this project would have no cumulative impacts to wetlands within the project region. Wetlands comprise approximately 4.2 percent or 39,353 acres of the overall land use categories within the Tennessee Western Valley (Kentucky Lake) watershed (TDEC 2006). The loss of 2.39 acres of wetlands at the BIP site is less than 0.01 of 1 percent of the total overall wetland acreage in the watershed. The proposed creation of an additional 17.8 acres as mitigation would increase wetland acreage within the region and more than offset cumulative wetland impacts.

The construction of BIP Phase 2 would increase the size of the existing ashfill by 54 percent—from 38.6 acres to 59.2 acres.

No cumulative impacts to natural areas within the time and geographic bounds of this project are foreseeable.

With the LCS, FML top liner on Phase 1, and FML bottom liner on Phase 2, no significant impact to surface water would be expected during construction or active filling of the BIP Phase 2 ashfill, nor after closure of the combined ashfill.

Unavoidable Environmental Effects

Minor increases in noise, fugitive dust, and turbidity would occur during construction of both BIP Phase 2 and the WMT. BMPs would be used during construction to minimize increases of turbidity. Activity at the WMT would then decrease to three or four trips or less per year to perform routine maintenance, monitoring, and repair of the wetland cells.

Mitigation Measures

For the Expansion of the Ashfill (Phase 2) at Bivens Industrial Park

The geosynthetic clay bottom liner of Phase 1 would be tied in and sealed to the Phase 2 FML (or equivalent) bottom liner prior to stacking in the Phase 2 area. In addition, an ash LCS would be constructed along the eastern margin of the ashfill to capture lateral drainage accumulating above the bottom liner of the expanded ashfill. The LCS would be discontinued following closure of Phase 2.

At the BIP site, an FML (or equivalent) having a hydraulic conductivity of 1.0×10^{-13} centimeters per second (cm/sec) or less would be used for the bottom liner of Phase 2 and the liner would be installed with a minimum 3-foot geologic buffer above the estimated seasonal high water table. All commitments made in the 2002 EA for Phase 1 would remain in effect.

The closure cap for Phases 1 and 2 would consist of an FML (or equivalent) overlain by a minimum of 2 feet of soil cover. The FML (or equivalent) would have a hydraulic conductivity of 1.0 by 10^{-13} centimeters per second (cm/sec) or less.

Samples of raw ash leachate would be collected from the leachate collection pipe, upstream of Treatment Basin 1 and any other treatment unit or process. The raw ash leachate would be sampled on the same frequency as the routine groundwater monitoring, concurrent with that sampling. The constituents analyzed and their associated analytical methods would replicate the constituents and methods presented in Table 2-2 of the Groundwater Monitoring Plan in Appendix F of the SEA. Sampling of raw ash leachate would continue until the data set is determined by TVA groundwater technical review staff to characterize the leachate.

During active filling and after closure of the BIP Phase 2 ashfill, TVA would receive and review the report of routine storm water monitoring required by the Stormwater permit. In the event that data exhibited increasing trends in concentrations of a constituent of concern that indicated a potential for exceedence of permit limits or significant negative impact to surface water quality, then measures would be taken to halt or reverse the trend. Two effective measures, if they were to be needed, include partially covering the top of Phase 2 with an FML during active filling to reduce flow through the ashfill, or intercepting the groundwater flow and pumping it out for treatment if necessary.

Selenium would be added to the BIP groundwater monitoring program. It would be collected on the same frequency as the routine groundwater monitoring, concurrent with that sampling, and utilize the same analytical methodology.

The routine groundwater monitoring report would be submitted concurrently to TVA's Ash Management organization and groundwater specialists (OE&R/R&TA/EESE) for evaluation of information.

The routine NPDES monitoring report would be submitted concurrently to TVA's Ash Management organization and surface water specialists (OE&R/R&TA/EESE) for evaluation of information.

With the following steps the impact of the Proposed Action Alternative would be insignificant to the state-listed endangered plant, hairy umbrella sedge: TVA would continue long-term maintenance of the Phase 1 mitigation site. TVA botanists would survey for the sedge at both the Phase 2 expansion site and the Phase 1 mitigation site during the 2009 growing season (June through September). If the survey reveals low population numbers or restriction of the plant to a small area at the Phase 1 mitigation site, then seed or transplants from areas to be covered with ash would be used to enhance the Phase 1 mitigation site populations.

For the Wetland Mitigation Tract

The 2.39 acres of wetlands lost during build-out of BIP Phase 2 would be mitigated by creating 17.8 acres of wetlands at the wetlands mitigation tract (WMT) in Houston County, Tennessee. The required acreage for the proposed action is 12.88 acres, leaving approximately 4.9 acres of wetlands available for future TVA wetland mitigation needs. The wetlands so created on this tract of land would be managed and maintained by TVA's Fuel By-Products organization in perpetuity on behalf of JOF. The as-built boundary polygon of the wetland would be updated in the WMT agreement and TVA Regional Land Resource database to reflect the actual boundary.

In order to avoid potential adverse effects to archaeological site 40HO77 located at the WMT, a 30-meter (98.4-foot) buffer would encircle the site and extend out from its boundaries so that the site is not affected by the wetland mitigation project. The buffer's outer boundary would be delineated by high-visibility barrier fencing (e.g., 4-foot by 100-foot rolls, orange) on metal fence posts. The location of the barrier would be determined by the reporting archaeologist under contract with TVA.

Any future development proposed within the limits of the 100-year floodplain, elevation 375.0, would be consistent with the requirements of Executive Order 11988.

Creation of the wetland and any additional future development would be consistent with the requirements of TVA's Flood Control Storage Loss Guideline.

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Appendices

A. Agreement Between Fuel By-Products and the Kentucky Watershed Team for Perpetual Use of the Wetland Mitigation Tract
B. Summary of HELP-Predicted Ashfill Hydrologic Water Budgets
C. Mercury Data Collected by TriAD Environmental Consultants
D. Ash Leachate Seepage Modeling Methodology and Input Data
E. Interim Hydrologic Evaluation of Landfill Performance Model Results
F. Groundwater Monitoring Plan
G. Wetland Area Descriptions
H. Tennessee SHPO Letters of Concurrence