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E.W. BROWN STATION, HERRINGTON LAKE, MERCER COUNTY, KENTUCKY

RAMBOLL

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E.W. BROWN STATION, HERRINGTON LAKE, MERCER COUNTY, KENTUCKY

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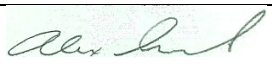
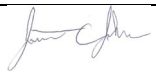
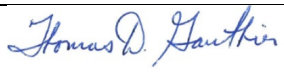
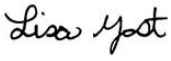
Prepared by: Alex Smith, Ramboll		June 24, 2019
Prepared by: Jon Johnson, Ramboll		June 24, 2019
Prepared by: Thomas Gauthier, Ramboll		June 24, 2019
Prepared by: Lisa Yost, Ramboll		June 24, 2019
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ACRONYMS AND ABBREVIATIONS

~	approximately
@	at
°C	degrees Celsius
#	number
%	percentage
µg/d	micrograms per day
µg/L	micrograms per liter
µm	micron or micrometer
AB	absorption
ABSd	dermal absorption of arsenic
ABSo	oral absorption (bioavailability) for arsenic
ACS	American Cancer Society
AF	skin-soil adherence
AI	aquatic invertebrates
AsIII or As3+	arsenite
AsV or As5+	arsenate
Asl	above sea level
AT	averaging time
ATB	ash treatment basin
ATSDR	Agency for Toxic Substances and Disease Registry
AV	aquatic vegetation
BAF	bioaccumulation factor
BCA	bias-corrected accelerated
BERA	baseline ecological risk assessment
bw	body weight
bws	below water surface
C	concentration
Cabinet	Kentucky Energy and Environment Cabinet
$CaCO_3$	calcium carbonate
CAP	corrective action plan
CBR	Critical body residue
CCR	coal combustion residuals
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act, aka "Superfund"
CF	conversion factor
CFD	Central Fisheries Division
CFD-A	Central Fisheries Subdivision A
CFD-B	Central Fisheries Subdivision B
CI	Curds Inlet
cm	centimeter
CPUE	catch-per-unit-effort
CSF	cancer slope factor
CSM	conceptual site model
COD	chemical oxygen demand
COPC	constituent of potential concern
COPEC	constituent of potential ecological concern
ISARA	Investigation, Source Assessment and Risk Assessment

CR	contact rate
Dix Dam	Dix River hydroelectric dam
DI	Daily intake
DGA	dense graded aggregate
DMAA	dimethylarsenic acid
DO	dissolved oxygen
DR	Dix River
dw	dry weight
EB	equipment blank
ED	exposure duration
EF	exposure frequency
ELCR	a unitless probability
ELG	effluent limitation guidelines
EPC	exposure point concentration
ERA	ecological risk assessment
ERAGS	Ecological Risk Assessment Guidance for Superfund Site
ESB	environmental services branch
ESV	ecological screening value
FD	field duplicate
FGD	flue gas desulfurization
ft	feet
FI	fractional intake
FMSM	Fuller Mossberger Scott & May Engineers, Inc.
FSP	field sampling plan
g	grams
GIS	geographic information system
GPS	global positioning system
GPP	gypsum processing plant
GWRAP	groundwater remedial action plan
GWAR	groundwater assessment report
HHRA	human health risk assessment
HDPE	high-density polyethylene
HQ Inlet	HQ Inlet
HQ	hazard quotient
hr.	hour
IDs	identification numbers
Ins	soil or sediment ingestion rate (mg/day)
INF	ingestion rate of fish
IRIS	Integrated Risk Information System
IRM	interim remedial measure
ISARA	Investigation, Source Assessment, and Risk Assessment
KAR	Kentucky Administrative Record
KDFWR	Kentucky Department of Fish and Wildlife Resources
KDOW	Kentucky Division of Water
kg	kilogram or kilograms
KM	Kaplan-Meier
KPDES	Kentucky Pollutant Discharge Elimination System
KU	Kentucky Utilities Company
KYDWM	Kentucky Division of Waste Management
KRAG	Kentucky Risk Assessment Guidance
LHL	lower Herrington lake
LLDP	linear low-density polyethylene

LOAEL	lowest observable adverse effects level
LSU	Louisiana State University
LVWA	Lake Village Water Association
MCL	maximum contaminant level
MDS	multiparameter display system
MeHg	methylmercury
MGD	million gallons per day
mg/kg	milligram per kilogram
mg/L	milligram per liter
MHL	middle Herrington lake
M	meter
mm	millimeter
MMAA	monomethylarsenic acid
mS/cm	milli Siemens per centimeter
MS/MSD	matrix spike/matrix spike duplicate
MSL	mean sea level
MW	megawatt
NCP	National Contingency Plan
ND	not detected
NELAP	National Environmental Laboratory Accreditation Program
NOV	notice of violation
NOAEL	no observed adverse effect level
NPDES	National Pollutant Discharge Elimination System
OSWER	office of solid waste and emergency response
Oz	ounce
pH	potential of hydrogen or acidity
Plant	E.W. Brown Generating Station
PNEC	predicted no-effect concentration
PRES	preserved in ethanol
PWS	process water system
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
QBI	Quality Bioresources Incorporated
RAGS	Risk Assessment Guidance for Superfund Sites
RAO	remedial action objective
R4	USEPA Region 4
RBC	risk-based concentration
RfD	oral reference dose
RME	reasonable maximum exposure
RML	removal management level
ROI	receptor of interest
RSL	regional screening level
RSV	refined screening value
s	second
SA	surface area of skin (cm^2)
SC	specific conductivity
SDG	sample data group
Se (0)	elemental selenium
$Se_{w,ss}$	steady-state concentration of selenium in surface water
SeIV or Se4+	selenite
SeVI or Se6+	selenate
Sonde	under-water instrument probe

SLERA	screening-level ecological risk assessment
SMDP	scientific management decision point
SOP	standard operating procedure
Study Area	the Phase I and Phase II combined CAP field sampling study area
SW	surface water
SWAC	surface weighted average concentration
SWS	Surface Water Standards –Here refers to Kentucky Statute KAR 224.10:031
TDCS	Toe Drain Collection System
TGI	Tri-State Geographic Initiative
TOC	total organic carbon
TRV	toxicity reference value
UCL	upper confidence level
UHL	upper Herrington Lake
USACE	United States Corps of Engineers
USDOI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFDA	United States Food and Drug Administration
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
WBFC	whole-body fish concentration
WET	whole effluent toxicity
WQC	water quality criteria
WQS	water quality standards – Refers to Kentucky Statute KRS 224.10-100, and 401 KAR Chapter 10
WW	wet-weight
YOY	young-of-the-year
YSI	Yellow Springs Instruments

EXECUTIVE SUMMARY

1. Introduction

This *Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report* (hereafter Corrective Action ISARA Report) is provided to the Kentucky Energy and Environment Cabinet (Cabinet) in accordance with the approved *Corrective Action Plan* (CAP) for Herrington Lake that was submitted to the Cabinet in August 2017. The work documented in this Corrective Action ISARA Report was performed to characterize conditions in Herrington Lake adjacent to E.W. Brown Station in accordance with the 2017 Agreed Order between Kentucky Utilities (KU) and the Cabinet. The activities completed to date are summarized in Figure ES-1 (Same as Figure 1-1E).

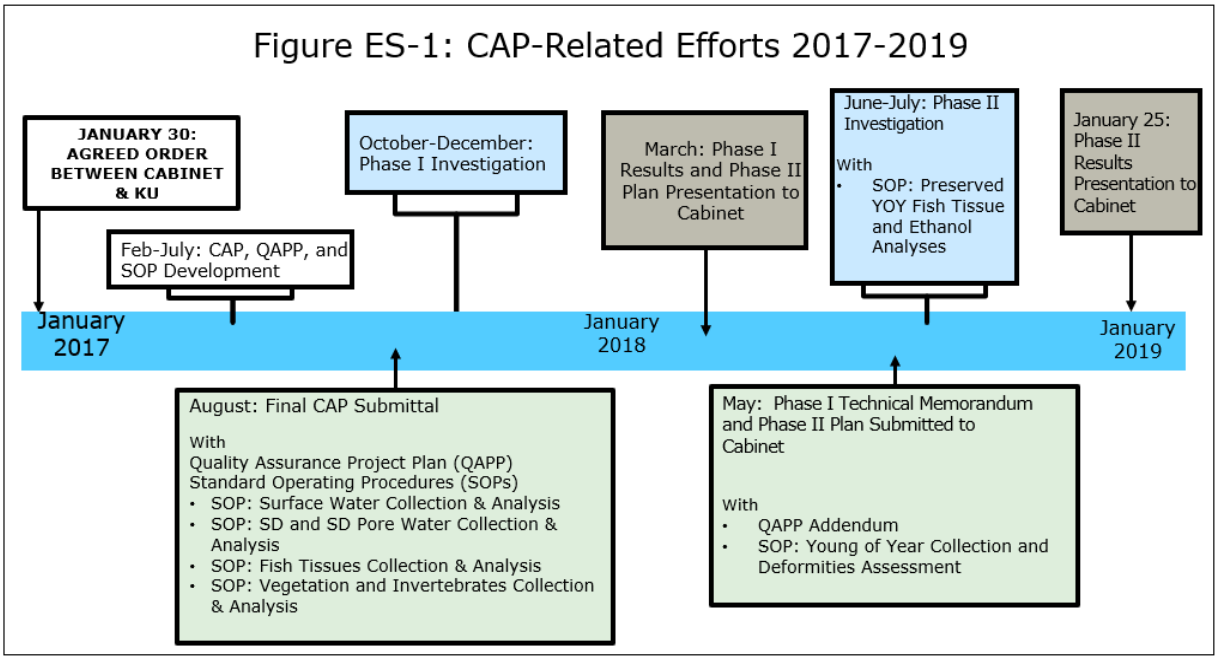


Figure ES- 1. CAP Related Efforts for 2017–2019

2. Chemical Nature and Extent

A. Field Investigation Overview

The Herrington Lake field effort described in this Corrective Action ISARA Report took place in a phased approach. The Phase I sampling effort was implemented October through December 2017 and included field sampling locations in the lower and middle Herrington Lake regions, and Dix River (Figure ES-2, same as Figure 1-3A). The Phase I effort included collection of fish, surface water, sediment pore water, sediment, aquatic vegetation, and aquatic invertebrates, which were collected and analyzed in accordance with the Cabinet Approved CAP, Quality Assurance Project Plan, and Standard Operating Procedures. Samples were analyzed for the following coal combustion residual (CCR) constituents:

- total and speciated selenium, total and speciated arsenic, total and methylated mercury
- additional metals: cadmium, boron, lead, zinc iron, and magnesium

Additional analyses were conducted to understand chemical fate, including sulfate, dissolved oxygen, lipids, moisture content, solids, and total organic carbon.

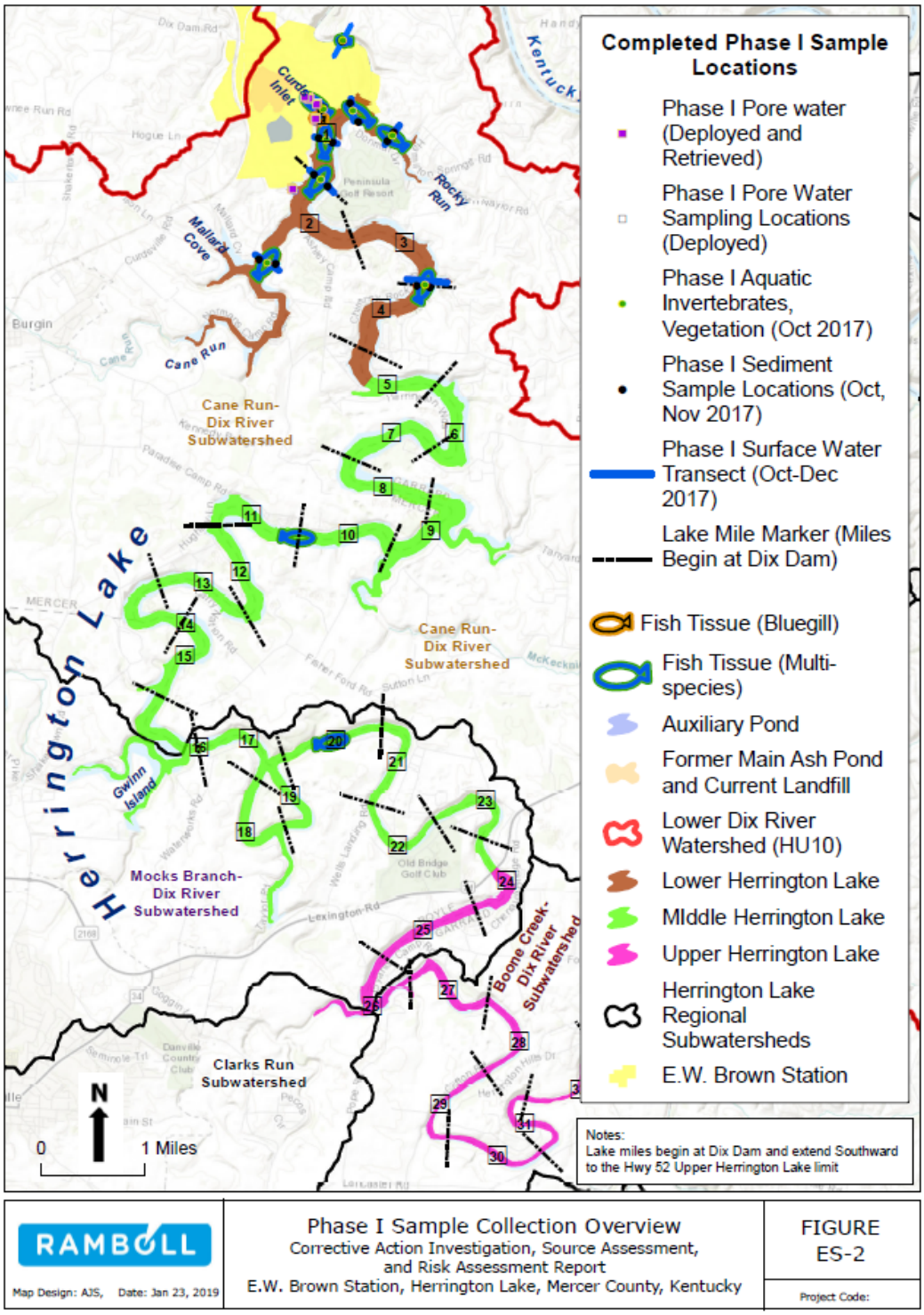


Figure ES- 2. Phase I Sample Collection Overview

PHASE I FIELD INVESTIGATION OVERVIEW

- Curds Inlet and ~6 miles of lower lake (biotic/abiotic media) and Dix River, downstream from Dix Dam
- Additional fish sampling in middle lake ~10-20 miles upgradient from Curds Inlet
- Samples were collected in Oct, Nov, and Dec 2017
- More than 200 individual samples collected and analyzed
  - Surface water: Approximately 45 samples from 13 transects
  - Sediment: Approximately 30 samples, including at depths up to 85ft (Mouth of Curds Inlet)
  - Sediment pore water: Approximately 20 samples
  - Aquatic plants: 12 samples
  - Sediment dwelling invertebrates: 12 samples
  - Adult fish (bluegill/green sunfish, largemouth and Kentucky bass, catfish, trout, sucker):
    - More than160 individual fish to represent ~60 fish composite samples
    - Fish ovaries (bass, catfish): ~20 Adult larger fish ovary samples

Upon completion of the Phase I field efforts, KU presented findings to the Cabinet and discussed potential Phase II data collection efforts designed to fill the data gaps identified following the Phase I effort. A *Phase I Technical Memorandum and Phase II Plan* (Phase I Technical Memorandum) was submitted to the Cabinet in May 2018. The Phase I Technical Memorandum summarized sampling results compared to Kentucky Water Quality Standards and other risk-based criteria to assess potential data gaps from Phase I sampling, identified potential data gaps for the Phase II investigation and guided the Phase II sampling effort. With approval from the Cabinet, KU initiated the Phase II sampling program in June and July of 2018 at locations illustrated in Figure ES-3 (source: Figure 1-4B).

The Phase II field effort consisted of the following elements (constituent analyses and young-of-the year [YOY] bluegill deformity assessment) approved by the Cabinet:

PHASE II FIELD INVESTIGATION OVERVIEW

- Approximately 70 samples were analyzed for selenium and other CCR constituents
- Abiotic Media
  - Surface Water: 13 samples from 7 transects (within and outside Curds Inlet)
  - Sediment: 18 samples in Curds Inlet
  - Sediment pore water: 18 samples from Curds Inlet
- Adult Fish Tissues, whole body selenium only
  - 5 bluegill, 3 bass, and 3 catfish composite fish samples (>30 individual fish)
- Young of the Year Fish Tissues
  - 12 composite samples from ~700 individual young bluegill, whole-body selenium only
  - Digital images of each fish sent for tissue residue analysis

PHASE II YOY BLUEGILL DEFORMITY ASSESSMENT

- YOY Deformities Assessment (Total YOY fish assessed: 4,316)
- More than 3,600 fish examined for the deformity assessment
  - Evaluated for spinal, facial, fin, and tail deformities
  - Louisiana State University Pathology Lab provided third-party validation
- Evaluated digital images for approximately 700 additional YOY fish
  - Fish sent for selenium chemical analysis evaluated for key anomaly and spinal deformities
- Conducted an additional tissue residue study from alcohol preserved YOY fish tissues
  - Abnormal fish vs healthy fish (4 YOY composite samples from ~250 fish) Digital images of each fish

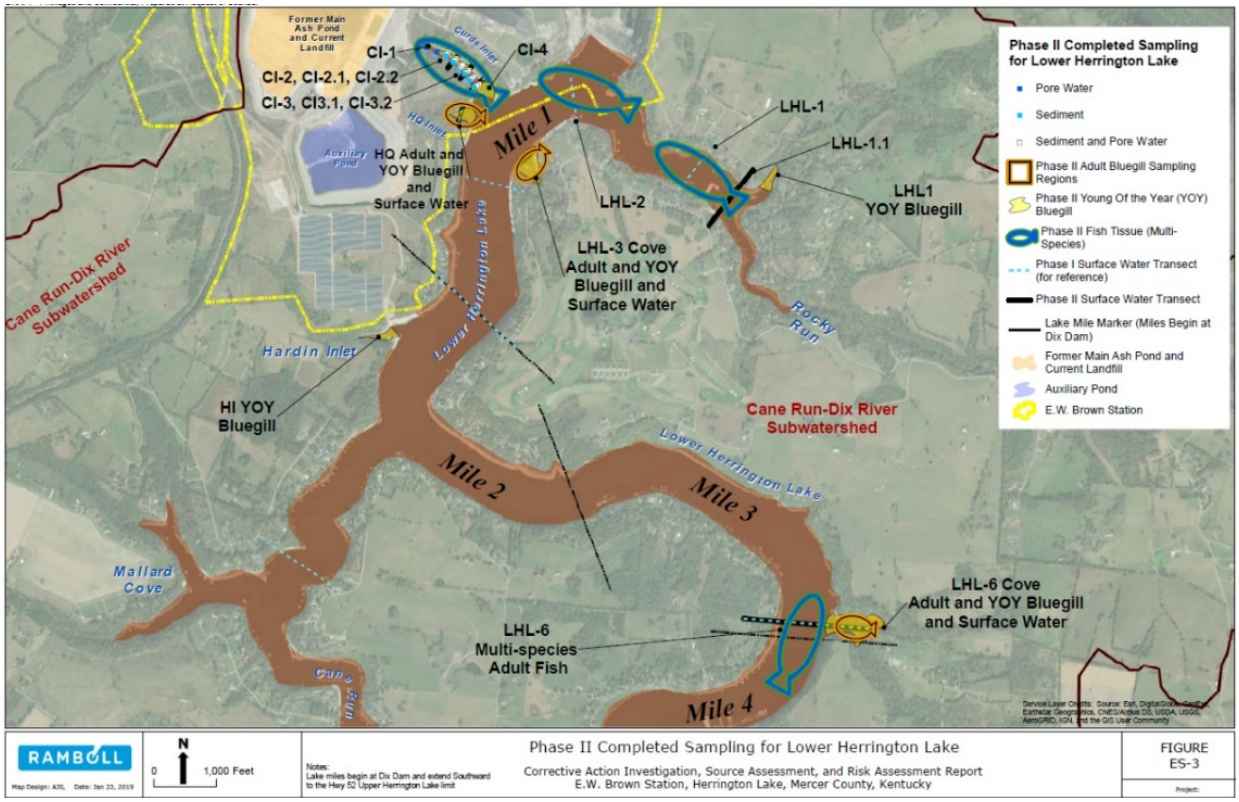


Figure ES- 3: Phase II Sampling for Lower Herrington Lake

Following implementation of the Phase II field effort, KU met with the Cabinet on January 25, 2019 to discuss the following results of the field program:

- The Phase II sampling to address Phase I data gaps.
- Comparison of results for split fish samples tested by the Cabinet (Kentucky Division of Water [KDOW] Ecological Services Branch) with the Phase II analytical results.
- The completeness and suitability of Phase I and Phase II data for the development of this Corrective Action ISARA Report, including the selenium source identification, the human health risk assessment (HHRA), and the ecological risk assessment (ERA).

B. Phase I and Phase II Fish Sampling Results

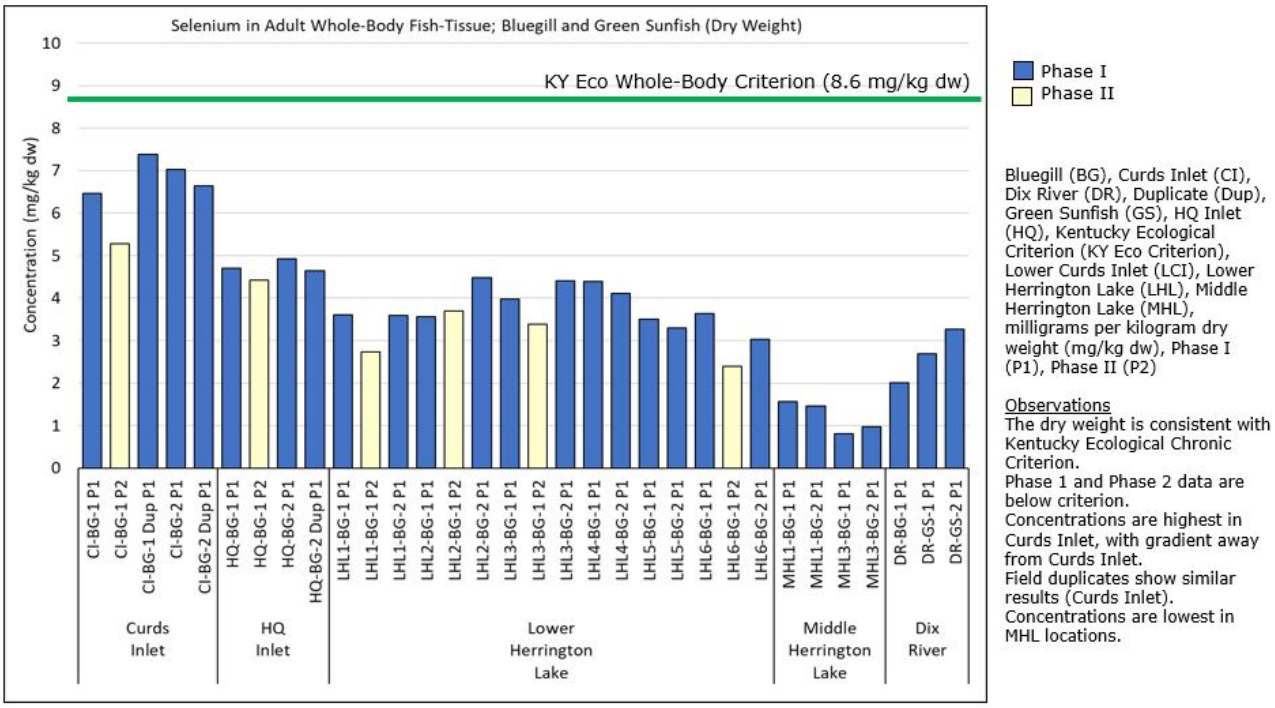
The key findings from the fish sampling include:

- More than 200 individual adult fish were collected to prepare 77 composite fish samples (Table ES-1 [source: Table 1-2A]).
- The adult fish selenium tissue concentrations (whole-body and ovaries) collected during the Phase I and Phase II investigations were less than the Kentucky whole-body dry weight fish tissue criterion and the Kentucky and United States Environmental Protection Agency (USEPA) ovary tissue criteria (Figures ES-4A–C [source: Figures 2-3A–C]).
- Selenium concentrations in YOY fish exceeded the Kentucky adult fish criterion and the Kentucky and USEPA ovary criteria for fish in Curds Inlet and HQ Inlet but not in other areas of Herrington Lake (Figure ES-4D [source: Figure 5-11A]). The YOY concentrations were greatest at the interior of Curds Inlet and decreased with distance from Curds Inlet.
- The significance of detected selenium concentrations in fish and other observations from the YOY assessment are discussed in the ERA.
- Detected chemical concentrations in fish fillet samples and whole-body fish samples were below human health and ecological screening levels for methylmercury except for two fish fillet samples (catfish) and three whole-body fish samples (two catfish and one bass). Methylmercury is discussed in the HHRA and ERA.

Table ES-1: Total Number of Adult Fish Individuals and Composite Samples Collected during Phase I and II Sampling

Species	Number of Fish Collected	Number of Composite Samples
Bluegill	98	27
Green Sunfish	7	2
Largemouth bass	43	17
Spotted (Kentucky) Bass	17	6
Channel Catfish	21	12
Flathead Catfish	19	10
Spotted Sucker	2	1
Northern Hogsucker	2	1
Brown Trout	1	1
Totals:	210	77
Panfish:	105	29
Larger Fish:	105	48

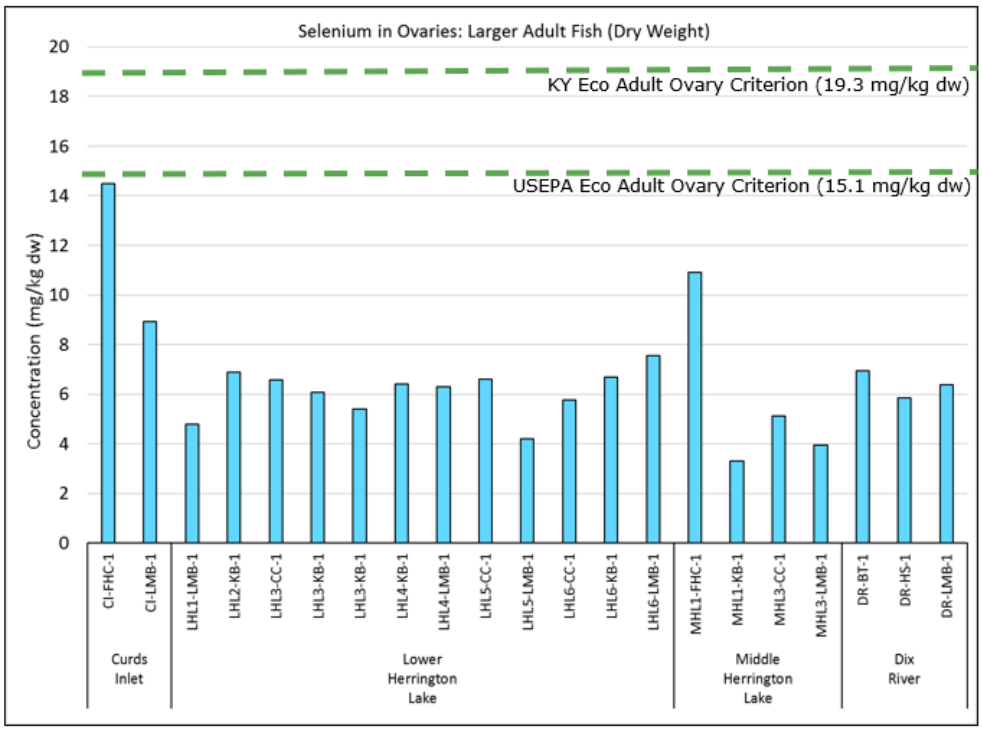
Table ES 1. Total Number of Adult Fish Individuals and Composite Samples Collected during Phase I and



Bluegill (BG), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Green Sunfish (GS), HQ Inlet (HQ), Kentucky Ecological Criterion (KY Eco Criterion), Lower Curds Inlet (LCI), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram dry weight (mg/kg dw), Phase I (P1), Phase II (P2)

Observations
The dry weight is consistent with Kentucky Ecological Chronic Criterion.
Phase 1 and Phase 2 data are below criterion.
Concentrations are highest in Curds Inlet, with gradient away from Curds Inlet.
Field duplicates show similar results (Curds Inlet).
Concentrations are lowest in MHL locations.

Figure ES-4A. Selenium in Adult Whole-Body Fish Tissue; Bluegill and Green Sunfish (Dry Weight)



Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Field Duplicate (FD), Flathead Catfish (FHC), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram dry weight (mg/kg dw), Northern Hogsucker (HS), Spotted Sucker (SS), United States Environmental Protection Agency (USEPA), Young-of-Year (YOY)

Observation
Measured selenium concentrations are less than the KY and USEPA ovary criteria. The Curds Inlet catfish ovary sample had the highest measured value of selenium in ovary tissues among for the locations sampled.

Figure ES-4B. Selenium in Adult Fish Ovaries (Dry Weight)

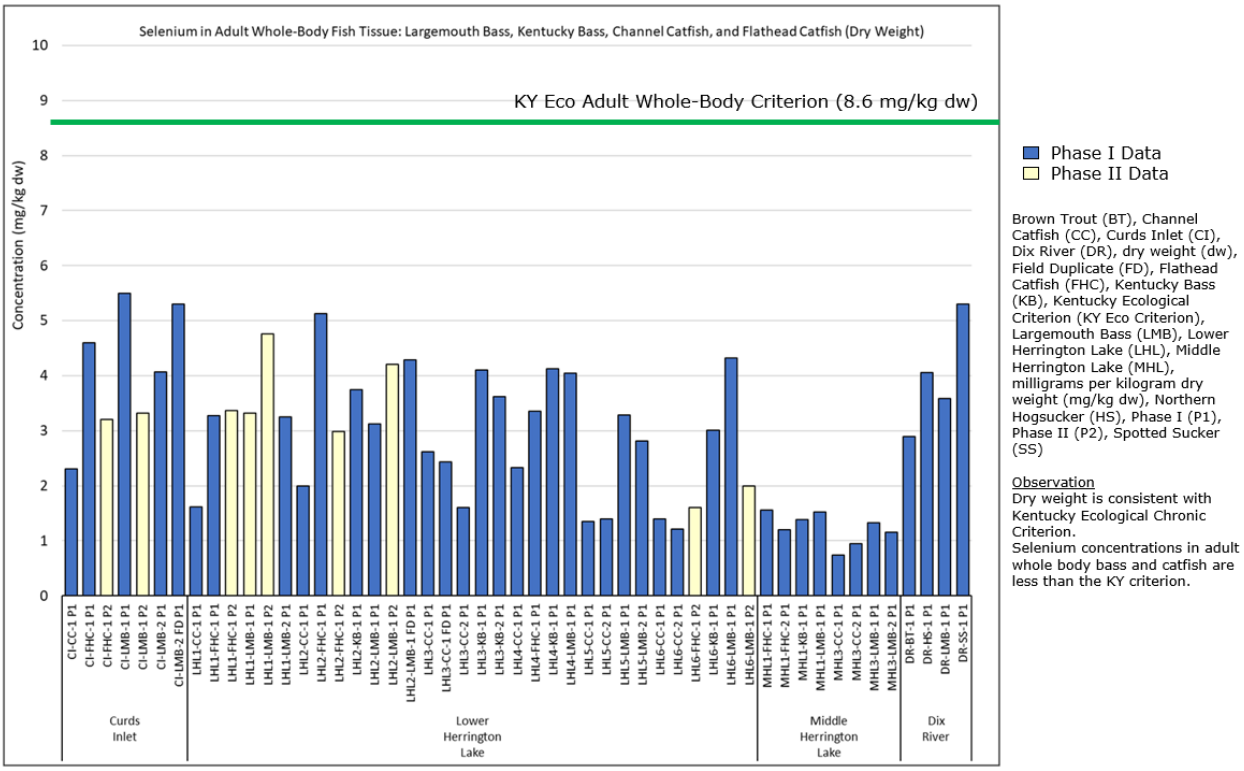


Figure ES-4C. Selenium in Adult Whole-Body Fish Tissue: Largemouth Bass, Kentucky Bass, Channel Catfish, and Flathead Catfish (Dry Weight)

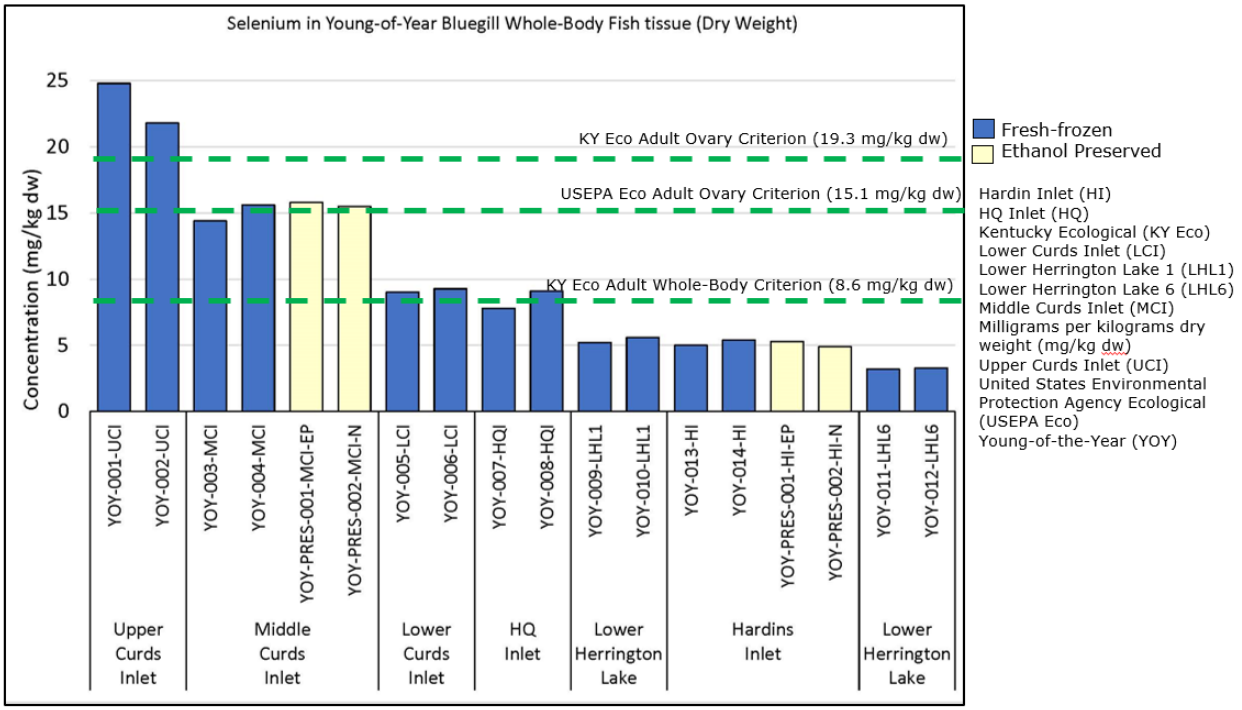


Figure ES-4D. Selenium in Young-of-the-Year Bluegill Whole-Body Fish Tissue (Dry Weight)

C. Results of Additional Field Sampling

This Corrective Action ISARA Report also presents the analytical data for surface water, sediment, sediment pore water, aquatic vegetation, and aquatic invertebrates from Phase I and Phase II sampling compared with relevant risk-based criteria, where available. As discussed in this report, most detected concentrations are below the risk-based screening levels, with some exceptions that are described below. The exceedances of risk-based criteria do not directly indicate adverse effects, but rather indicate that a more detailed HHRA and ERA should be performed to evaluate potential risks. The following observations were made for CCR-related constituents, with at least one detection similar to or exceeding risk-based criteria.

In surface water:

- Selenium concentrations in surface water samples collected when the lake was stratified and following fall lake overturn were below the Kentucky chronic water quality criterion at most sampling locations. However, selenium was detected at the innermost areas of Curds Inlet sampled during the Phase I overturn sampling and the Phase II stratified sampling at concentrations approximately equal to the Kentucky chronic criterion for surface water.
- Similarly, cadmium was also detected at the innermost portion of Curds Inlet at concentrations in the range of the Kentucky chronic water quality criterion.
- Total mercury was detected in the Phase I stratified sampling efforts in Curds Inlet, however, Phase I overturn sampling and Phase II stratified sampling did not identify elevated total mercury concentrations in Curds Inlet. There were three locations where methylmercury exceeded the risk-based screening level for wildlife, so mercury was evaluated as a bioaccumulating compound in the ERA.

In sediment and sediment pore water:

- Sediment concentrations for selenium and arsenic exceeded the associated USEPA Region 4 ecological screening values (ESVs) at most locations sampled in the lake, including samples collected miles away from E.W. Brown Station. Detected arsenic concentrations in sediment also exceeded human health screening levels for residential soils in sediments at many locations throughout the lake system.
- The detected constituent concentrations in sediment pore water were screened against Kentucky surface water quality criteria and USEPA Region 4 ESV, respectively. Humans are not directly exposed to pore water and fish are not exposed directly to pore water. The majority of sediment pore water concentrations did not exceed Kentucky surface water quality criteria and ESVs, which are conservative to use for screening pore water because ESVs are protective of aquatic life including fish and fish are not directly exposed to sediment pore water. Selenium in pore water exceeded the Kentucky surface water quality criteria in 2 of the 34 pore water samples, both within Curds Inlet. Speciated selenium concentrations in pore water exceeded the Kentucky surface water quality criterion in 1 location in the interior of Curds Inlet. Arsenic in pore water exceeded the Kentucky surface water quality criteria in 7 locations. The results for selenium and arsenic in pore water were considered in the discussion of potential mass loading from sediment to the water column of Curds Inlet. Other constituents, such as mercury, lead, and boron, did not exceed the Kentucky surface water quality criteria and exceeded ESVs in only 1 location (i.e., boron and iron). The ERA includes a focused discussion of risk-based screening values applicable for sediment dwelling organisms and plants.

- This Corrective Action ISARA Report also provides a discussion of the KDOW fish tissue sampling conducted in 2016 and 2018 and split tissue sample results analyzed by KDOW Ecological Services Branch using tissues collected as part of the Phase I and Phase II investigations. The 2016 KDOW whole body fish tissue selenium concentrations exceeded the KDOW standard for whole-body fish; the ovary results for 2016 did not exceed the KDOW or USEPA ovary criteria. In contrast to the 2016 KDOW fish tissue results, none of the more than 40 2018 KDOW fish tissue samples collected in Curds Inlet and other locations in Herrington Lake exceeded the KDOW standard for whole-body fish. Split sample results conducted by KDOW are comparable to the results identified in the Phase I and Phase II investigations, with all selenium concentrations in fish less than the Kentucky whole-body dry weight fish tissue criterion.

3. Chemical Fate and Transport and Source Identification:

A. Conceptual Site Model (CSM)

A conceptual model of surface flow patterns and discharge is illustrated in ES-5A and ES-5B. The E.W. Brown Station has generated and disposed of CCR since the 1950s. Ash was sluiced to the Main Ash Pond, located directly south of the generating station. As the Main Ash Pond filled, it was expanded twice, in 1973 and 1989, and at time-of-closure, it measured approximately 114 acres. In 2008, a second pond was constructed as a temporary settling pond until the Main Ash Pond could be expanded again. In late 2008, the Main Ash Pond was taken out of service, and the sluicing operation was switched to the Auxiliary Pond. Much of the Main Ash Pond was covered with a multi-layered Engineered Cap in preparation for the construction of a Landfill over the closed Main Ash Pond. The Landfill liner provides a cap for the Main Ash Pond. Prior to its closing, the Main Ash pond discharged via a permitted KPDES outfall into Curds Inlet.

Since 2008, the Auxiliary Pond KPDES Outfall BRN001 has been the primary source of CCR-related constituents into Curds Inlet. This outfall discharges from the Auxiliary Pond to the uppermost portion of Curds Inlet. The Auxiliary Pond, which went into services in 2008, receives scrubber wastewater, other process wastewaters, and historically has been used as ash transport water. This is the primary wastewater outfall for E.W. Brown Station. Other KPDES permitted outfalls are BRN002 and BRN003, both of which return cooling water from the cooling towers to Curds Inlet (ES-5A, same as Figure 3-1L).

Neither BRN002 or BRN003 is a source of CCR-related constituents because the water is not directly involved with processing. BRN002 was retired in February 2019. KPDES BRN005 (not displayed) is the intake of lake water for cooling. KU completed several interim remedial actions during the years of 2014–2016 that are summarized in this Corrective Action ISARA Report (Section 1), including installation of the Toe Drain collection system and abutment drain water collection for discharge to the Auxiliary Pond.

In addition to the direct discharges via permitted outfalls already mentioned, groundwater from beneath E.W. Brown Station flows to Herrington Lake via springs found near Curds Inlet and HQ Inlet; locations of these springs are displayed on Figure ES-5A. HQ Spring and Briar Patch Spring are the primary springs that provide flow into HQ Inlet. Springs (Dam Toe Left, Middle, and Right) that previously flowed to Curds Inlet are now captured in the Toe Drain collection system that was installed in 2016. After construction of the Landfill over the closed Main Ash Pond and installation of the Toe Drain Collection System, Beaver Dam Cave Spring, Ditch Spring, and the South Abutment Spring have had limited flow or no flow documented. A transient seep, referred to as the North Curd Sink, was observed in 2015 in the inner portion of Curds Inlet near where the Toe Drain collection was ultimately installed.

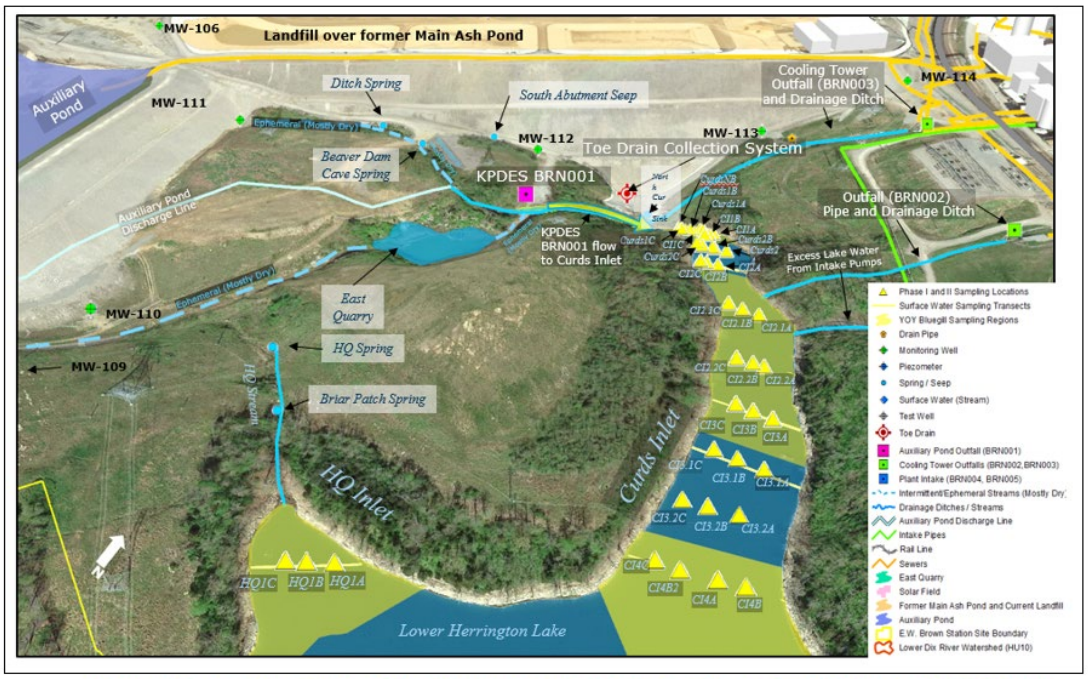


Figure ES-5A: Conceptual Site Model Source Identification: Curds Inlet and HQ Inlet with Springs and Groundwater Monitoring

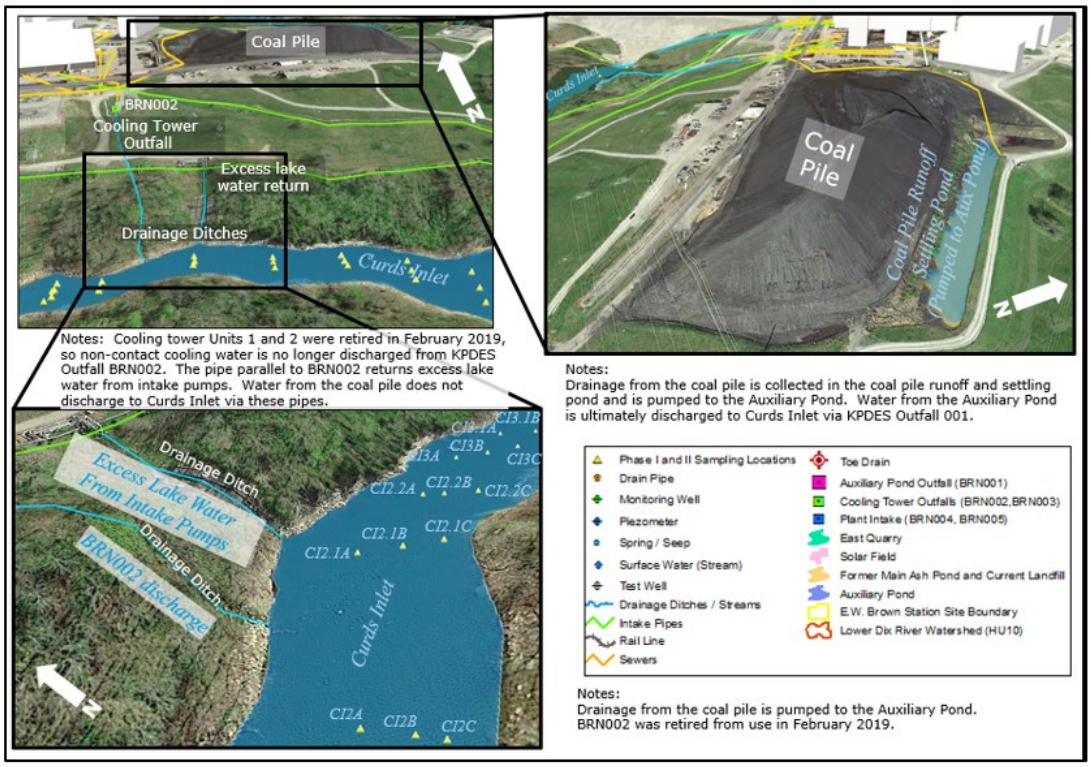


Figure ES- 5B: Conceptual Site Model Source Identification: Curds Inlet and Coal Pile Drainage View

The CSM in Figure ES-5A displays the Phase I and Phase II sampling areas. Figure ES-5A (same as Figure 3-1L) also provides a visual impression of the extensive sampling coverage in Curds Inlet. The groundwater wells between the Landfill/Main Ash Pond and Auxiliary Pond and Herrington Lake are displayed on Figure ES-5A (same as Figure 3-1F). The groundwater monitoring data are considered as part of the source identification for Herrington Lake. Groundwater that flows beneath the Landfill is potentially influenced by CCR-related constituents in seepage from the former Main Ash Pond. Since 2016, the water from the springs at the toe of the Main Ash Pond (Dam Toe Left, Middle, and Right) has been captured in the Toe Drain collection system and is pumped to the Auxiliary Pond.

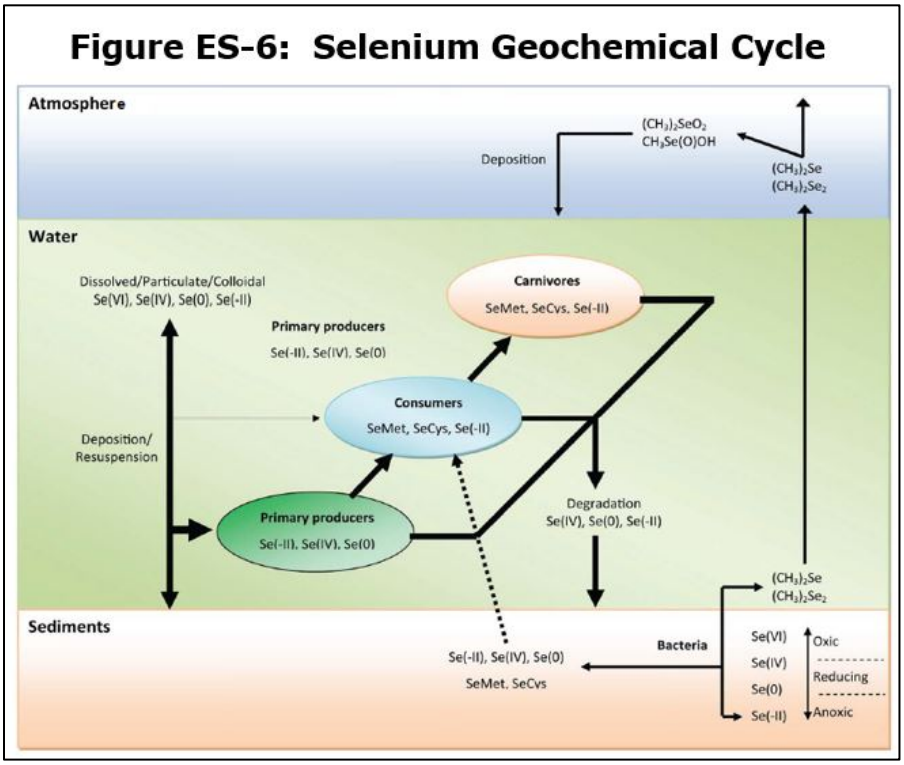
The coal pile runoff is collected via a settling pond and is also pumped to the Auxiliary Pond, as illustrated in Figure ES-5B (same as Figure 3-1J).

B. Source Identification, Fate and Transport

i. Geochemistry

The CCR constituents of greatest potential interest for this investigation are selenium and arsenic. The fate and transport for these constituents are influenced by the geochemical conditions in groundwater, sediment and surface water. For example, selenium is more mobile under oxidizing conditions and selenium mobility is limited under reducing conditions. Therefore, geochemistry is considered as part of the conceptual understanding of source identification. The selenium and arsenic geochemical cycles are described in the Corrective Action ISARA Report, and the results from Phase I and Phase II investigations are compared to expected conditions based on the observed geochemistry. A selenium geochemical cycle is shown in Figure ES-6 (source: Figure 3-3C).

Figure ES-6: Selenium Geochemical Cycle



In addition, microbially-mediated transformation of selenium to reduced forms facilitates selenium uptake and subsequent incorporation into higher trophic levels. Selenite (SeIV), and to a lesser degree selenate (SeVI), can be taken up directly by phytoplankton, bacteria, and microalgae to form organic selenium compounds (e.g. selenomethionine, selenocysteine).

One of the key questions considered in the source identification was whether the sediments are a significant source of selenium and arsenic into the water column, and therefore the food web, of Herrington Lake. The Phase I and Phase II investigations included analysis of speciated forms of selenium and arsenic in sediment pore water so that these pathways of ecological exposures could be evaluated using data from the lake.

It was observed in Phase I and Phase II investigation results that the highest concentrations of selenium in sediment in Curds Inlet occur in reducing areas (i.e., the thalweg). However, neither SeIV nor SeVI were detected in pore water at locations with the highest sediment concentrations, indicating that selenium is bound in the sediment matrix and the sediments with elevated concentrations in Curds Inlet are not posing a significant ongoing source of selenium to the Herrington Lake food web via water exposure pathways. This is supported by mass loading estimates showing that selenium flux from sediment to the water column of Curds Inlet is *de minimis*.

Contrary to selenium geochemistry, arsenic solubility increases under reducing conditions. Mobilization of arsenic in sediments to overlying water can occur in reducing conditions. The Phase I and Phase II investigation data for Curds Inlet indicated that in areas with the highest arsenic concentrations in sediment, arsenic was present in pore water as arsenite (AsIII) and arsenate (AsV). Arsenic pore water sampling from Curds Inlet indicated that the arsenic flux to water is likely to occur. However, the mass transfer between sediment pore water and overlying water is expected to be slow. As a result, the flux from sediment pore water to the overlying lake surface water is limited when compared the Auxiliary Pond Outfall KPDES BRN001.

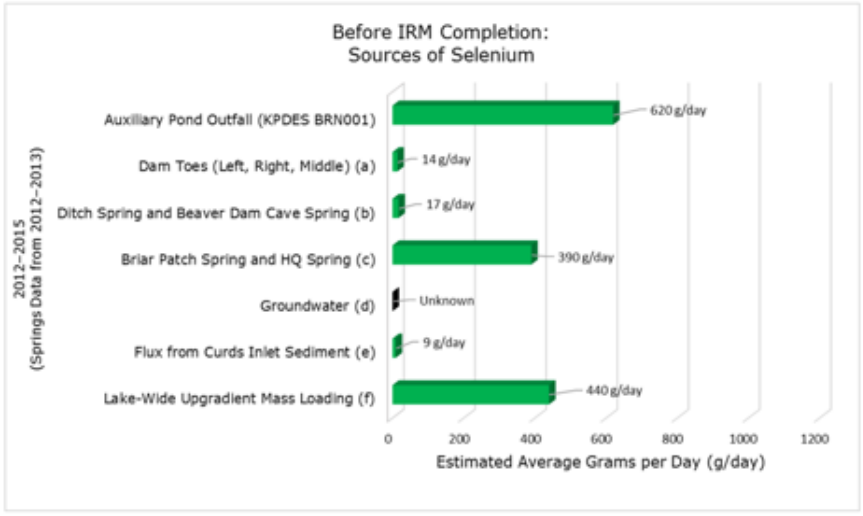
The selenium source identification includes consideration of the relationship between selenium and boron because literature studies have demonstrated that boron can be used as a tracer for leaching of CCR-related constituents. The relationships for selenium and boron are evaluated for the sediments and pore water from Phase I and Phase II investigations. In addition, the relationship for sediment, sediment pore water from the springs, the Toe Drain collection system, and groundwater monitoring wells are compared. The comparison shows a consistent relationship between selenium and boron across each of the sample types, suggesting a consistent ash source, however, the evaluation clearly shows that with distance from the Auxiliary Pond and the Main Ash Pond, the selenium concentrations diminish. Contour mapping of selenium, boron, and arsenic concentrations within Curds Inlet based on Phase I and Phase II sediment and sediment pore water is provided.

ii. Mass Loading Estimates

A mass loading comparison of relative contributions from selected sources of selenium and arsenic to Herrington Lake before and after implementation of the Interim Remedial Measures (IRMs) is provided in Figures ES-7A through ES-7B (same as Figure 3-11A and 3-11B) and Figures ES-7C and -7D (same as Figure 3-11B and 3-11C). The IRMs included the construction of a Toe Drain collection system that collects spring and groundwater influenced by the Main Ash Pond under the Landfill and redirects this water to the Auxiliary Pond. This Corrective Action ISARA Report includes mass loading estimates in grams per day (g/day) for the following potential sources:

- Springs and groundwater, including water collected in the Toe Drain collection system;
- Auxiliary Pond Outfall KPDES BRN001
- Sediment flux to surface water (based on pore water) and;
- Estimated upgradient lake wide mass loading conditions based on conditions at LHL5 and LHL6.

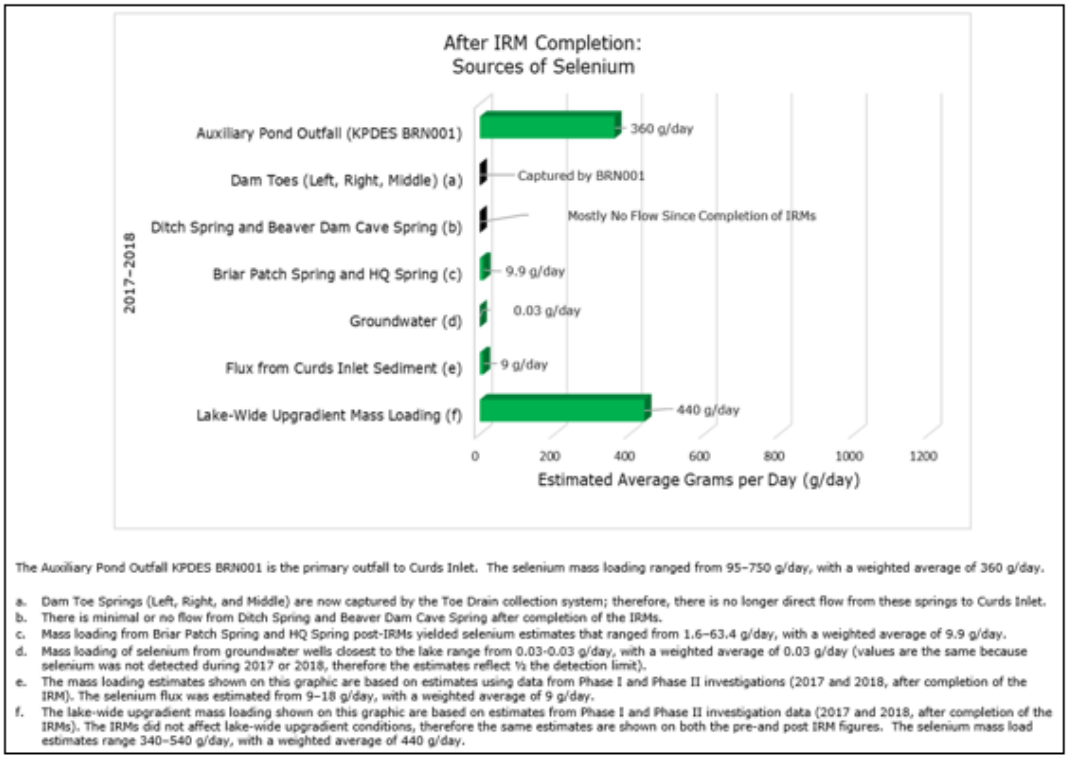
These mass loading calculations described in this Corrective Action ISARA Report are based on simplifying assumptions and are intended to provide order-of-magnitude estimates for comparing the relative contributions from identified sources. High and low mass loading estimates are presented to reflect ranges in concentrations detected and the ranges in flow over time. The estimated mass loading for each of the loading sources are presented in Figures ES-7A–D (Same as Figures 3-11A to 3-11D). Selenium and arsenic mass loading from groundwater was estimated based on sampling data from monitoring wells closest to the lake (MW109-114, MW116) during the 5 sampling events with data available (May 2017 to June 2018, the timeframe that is comparable to other mass loading estimates after the installation of the Toe Drain collection system). Mass flux from sediment to the overlying lake water is estimated, using sediment and pore water data from Phase I and Phase II sampling in Curds Inlet. As indicated in Figures ES-7A–B, mass loading estimates include data from before and after the installation of the Toe Drain collection. The upgradient lake wide mass loading estimates based on concentration data collected at LHL5 and LHL6 and using two estimates of lake flow are intended to reflect comparative conditions that are unimpacted by Curds Inlet and outfalls from Auxiliary Pond Outfall KPDES BRN001. Groundwater as a source is discussed using data from monitoring wells near Curds Inlet.



The Auxiliary Pond Outfall KPDES BRN001 is the primary outfall to Curds Inlet. The selenium mass loading ranged from 250-1000 g/day, with a weighted average of 620 g/day.

a. Dam Toe Springs (Left, Right, and Middle) flowed into Curds Inlet prior to completion of the Toe Drain collection system. The selenium loading ranged from 2.4–37 g/day, with a weighted average of 14 g/day.
b. Mass loading from Ditch Spring and Beaver Dam Cave Spring prior to IRMs ranged from 1.2–26 g/day, with a weighted average of 17 g/day.
c. Mass loading from Briar Patch Spring and HQ Spring prior to IRMs ranged from 84–530 g/day, with a weighted average of 390 g/day.
d. Weighted average mass loading estimates for groundwater to Curds Inlet are not available for the period before completion of the IRMs. The monitoring wells surrounding the landfill were installed in 2016 (i.e. pre-IRM GW data are unknown).
e. The mass loading estimates shown on this graphic are based on estimates using data from Phase I and Phase II investigations (2017 and 2018, after completion of the IRM). However, IRMs did not likely affect sediment flux, so the same estimates are shown on both figures. The selenium flux was estimated from 9–18 g/day, with a weighted average of 9 g/day.
f. The lake-wide upgradient mass loading shown on this graphic are based on estimates from Phase I and Phase II investigation data (2017 and 2018, after completion of the IRMs). The IRMs did not affect lake-wide upgradient conditions, therefore the same estimates are shown on both the pre-and post IRM figures. The selenium mass load estimates range 340–540 g/day, with a weighted average of 440 g/day.

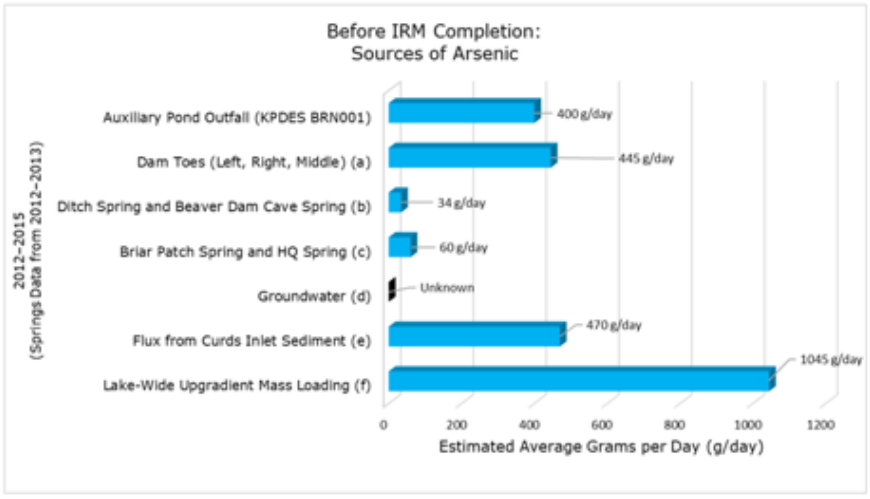
Figure ES- 7A: Selenium Mass Loading Estimates Before IRMs



The Auxiliary Pond Outfall KPDES BRN001 is the primary outfall to Curds Inlet. The selenium mass loading ranged from 95–750 g/day, with a weighted average of 360 g/day.

a. Dam Toe Springs (Left, Right, and Middle) are now captured by the Toe Drain collection system; therefore, there is no longer direct flow from these springs to Curds Inlet.
b. There is minimal or no flow from Ditch Spring and Beaver Dam Cave Spring after completion of the IRMs.
c. Mass loading from Briar Patch Spring and HQ Spring post-IRMs yielded selenium estimates that ranged from 1.6–63.4 g/day, with a weighted average of 9.9 g/day.
d. Mass loading of selenium from groundwater wells closest to the lake range from 0.03-0.03 g/day, with a weighted average of 0.03 g/day (values are the same because selenium was not detected during 2017 or 2018, therefore the estimates reflect ½ the detection limit).
e. The mass loading estimates shown on this graphic are based on estimates using data from Phase I and Phase II investigations (2017 and 2018, after completion of the IRM). The selenium flux was estimated from 9–18 g/day, with a weighted average of 9 g/day.
f. The lake-wide upgradient mass loading shown on this graphic are based on estimates from Phase I and Phase II investigation data (2017 and 2018, after completion of the IRMs). The IRMs did not affect lake-wide upgradient conditions, therefore the same estimates are shown on both the pre-and post IRM figures. The selenium mass load estimates range 340–540 g/day, with a weighted average of 440 g/day.

Figure ES- 7B: Selenium Mass Loading Estimates After IRMs



The Auxiliary Pond Outfall KPDES BRN001 is the primary outfall to Curds Inlet. The arsenic mass loading ranged from 95–790 g/day, with a weighted average of 400 g/day.

a. Dam Toe Springs (Left, Right, and Middle) flowed into Curds Inlet prior to completion of the Toe Drain collection system. The arsenic mass loading ranged from 78-1200 g/day, with an weighted average of 445 g/day.
b. Mass loading from Ditch Spring and Beaver Dam Cave Spring prior to IRMs ranged from 2.9–70 g/day, with a weighted average of 34 g/day.
c. Mass loading from Briar Patch Spring and HQ Spring prior to IRMs ranged from 38–290 g/day, with a weighted average of 60 g/day.
d. Weighted average mass loading estimates for groundwater to Curds Inlet are not available for the period before completion of the IRMs. The monitoring wells surrounding the landfill were installed in 2016 (i.e. pre-IRM GW data are unknown).
e. The mass loading estimates shown on this graphic are based on estimates using Phase I and Phase II investigation data (2017 and 2018, after completion of the IRM). However, IRMs did not likely affect sediment flux; therefore, the same estimates are shown on both figures. The arsenic flux was estimated from 180–760 g/day, with a weighted average of 470 g/day.
f. The udient mass loading shown on this graphic are based on estimates from Phase I and Phase II investigation data (2017 and 2018, after completion of the IRMs). IRMs did not affect lake-wide upgradient conditions, so the same estimates are shown on both figures. The arsenic mass load estimates range from 790–1,300 g/day, with weighted average of 1,045 g/day.

Figure ES- 7C: Arsenic Mass Loading Estimates Before IRMs

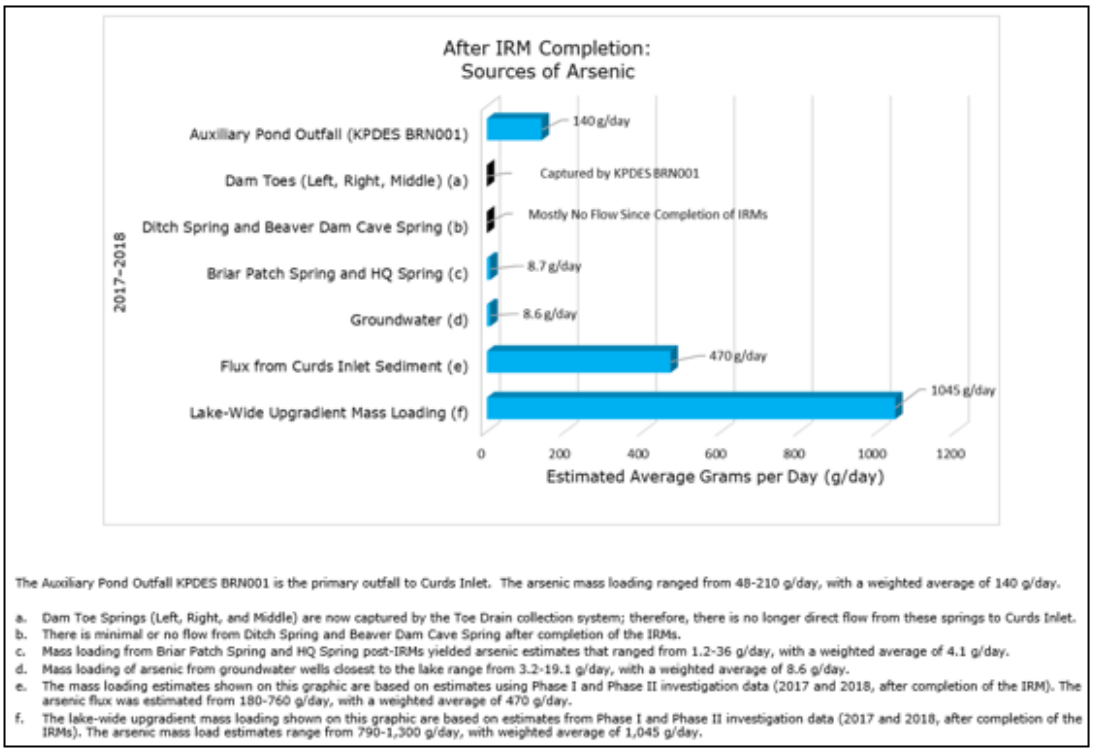


Figure ES- 7D: Arsenic Mass Loading Estimates After IRMs

The following conclusions can be drawn from the mass loading summary:

- The primary input of CCR-related constituents to Curds Inlet is from the Auxiliary Pond KPDES Outfall BRN001. The estimated discharge of selenium from the Auxiliary Pond KPDES Outfall BRN001 is slightly lower after the implementation of the IRMs.
- Springs also contribute CCR-related constituents to the lake. Ditch Spring, Beaver Dam Cave Spring, and the South Abutment Spring formerly flowed to Curds Inlet but have mostly been dry since the installation IRMs. Briar Patch Spring and HQ Spring continue to flow into HQ Inlet after the implementation of IRMs, but flow and thus mass load is reduced for Briar Patch and HQ Springs after the capping of the Main Ash Pond and repair of the Auxiliary Pond discharge pipeline.
- The Toe Drain captures groundwater flow from within and below the Main Ash Pond and pumps that groundwater to the Auxiliary Pond. The Toe Drain also captures water from springs (Dam Toe Right, Dam Toe Middle, and Dam Toe Left) and pumps the flow from these springs to the Auxiliary Pond. The springs (Dam Toe Right, Middle, and Left) are captured by the Toe Drain collection system. It is possible that there is seepage from the Main Ash Pond that is not captured by the Toe Drain collection system. However, the bottom of the pumping chamber, which is at an elevation of approximately 730 feet asl, is topographically lower than the base of the ash in the Main Ash Pond, and therefore would be expected to capture flow from the Main Ash Pond as it dewaters. Furthermore, pore water sampling in Curds Inlet conducted in Phase I and Phase II sampling in accordance with the CAP and Phase II Plan supports a conclusion that groundwater upwelling is not a source of CCR-related constituents to Curds Inlet. Therefore, if any groundwater with CCR-related constituents does not get captured by the Toe Drain collection system, it would be *de minimis*.

- The Groundwater Sampling and Analysis Report (AMEC 2018) concludes that the groundwater impacts identified from the CCR compliance monitoring are attributable to the Main Ash Pond, and not to the Landfill constructed on top of the Main Ash Pond. The data discussed in this Corrective Action ISARA Report show that selenium mass loading to the lake from groundwater is expected to be *de minimis.* Selenium was only detected in one well located near the lake (MW-111, October 2016) and selenium and was not detected in the groundwater from MW-111 in the following 10 sampling events. The flux of arsenic from groundwater toward the lake was determined by arsenic concentrations at three wells along the transect. MW-113, MW-112 and MW-109 each had detections of arsenic with MW-112 having the highest arsenic detections and mass loading. This segment includes the Toe Drain collection system. Comparatively, the arsenic mass loading from groundwater is small relative to those from other sources.

  Monitoring well MW-116 is the groundwater monitoring well furthest south and is closest to Hardin Inlet. Elevated CCR-related constituents were not detected in MW-116 during any sampling event, which is consistent with the established easterly groundwater flow direction. This demonstrates that there is no apparent migration of CCR-related constituents via groundwater to Hardin Inlet.

- The estimates of flux from sediment to the water in Curds Inlet (Figures ES-7A through ES-7D):
  - Selenium flux from sediments to water is orders of magnitude lower than selenium mass loading from the Auxiliary Pond Outfall KPDES BRN001.
  - Selenium flux from sediment is also below the lake-wide upgradient estimates of mass load.
  - Arsenic flux from sediment to the water in Curds Inlet is potentially similar to the arsenic load from spring water collected in the Toe Drain collection system but it is within the range estimated for the lake-wide upgradient mass loading.
  - The estimated loading from arsenic in sediments to the water column in Curds Inlet (via pore water flux) is comparable estimated mass loading from KPDES BRN001 in 2017-2018 and the Toe Drain collection system. In addition, the flux from sediment is comparable to the lake wide upgradient mass loading. Arsenic is closely considered in the human health and ecological risk assessments.
  - The amount of selenium and arsenic in pore water was consistent with flux from sediment and does not indicate mass loading from groundwater upwelling in Curds Inlet.

4. Key Findings for Human Health:

- A human health risk assessment was conducted following relevant guidance from the Cabinet and from the USEPA to assess the significance of measured concentrations from water, sediment and fish tissue sampling conducted in Phase I and II and considering conservative, protective assumptions for potential exposure.
- Health protective assumptions were applied to derive risk-based screening levels that were then compared with site data to identify constituents of potential concern (COPCs) in site media.
- No COPCs were identified for surface water based on residential domestic use. In addition, comprehensive drinking water well surveys were conducted in 2018 and 2019 to identify domestic drinking water wells and none were identified within a mile of E.W. Brown Station.
- No COPCs were identified for fish tissue assuming consumption of 50 meals per year. The measured fish tissue concentrations were below risk-based screening levels for selenium, inorganic arsenic, cadmium, boron, lead, and zinc. The concentrations of methylmercury in fish

tissue fillet (the most dominant form of mercury) were below risk-based screening levels for most of the fish samples, with two exceptions. Two flathead catfish had detected fillet tissue concentrations that exceeded the methylmercury risk-based screening criterion based on consuming 50 meals per year. One of these catfish was from LHL4, approximately 3 miles upgradient from E.W. Brown Station. The second catfish was from MHL1, approximately 10 miles upgradient from E.W. Brown Station. These mercury concentrations in the catfish are not considered to be due to discharges from E.W. Brown station into Curds Inlet because small home range bluegill fish did not indicate a pattern of elevated mercury concentrations in Curds Inlet.

- Analysis of sediment concentrations identified arsenic as a COPC in sediments using conservative exposure assumptions to evaluate recreational visitors.
    - Human health risk screening levels were derived for recreational visitor's exposure to arsenic in sediments throughout the lake for sediments under 24 or less feet of water.
    - Health protective assumptions were applied to estimate exposure for hypothetical recreational visitors including young children, older children and adults whom might visit the areas as often as 33 days per year for the young child and 65 days per year for adults.
    - Human health risk estimates for recreational visitors exposed to sediments are within levels generally considered acceptable by regulatory agencies.
        - Excess lifetime cancer risk estimates were less than the upper end of USEPA's target risk range from 1x10-6–1x10-4.
        - No hazard quotients were greater than 1 indicating no adverse effects would be expected for recreational visitors.

5. Key Findings for Ecological Risk Assessment

- The ERA was conducted to evaluate CCR-related constituent analysis in fish, water, sediment, sediment pore water, and biological organisms within the food web. The ERA followed relevant guidance from the Cabinet and from the USEPA.
- The ERA evaluated the survival, growth, and reproduction of fish populations, based on the following measurement endpoints:
    - Constituent concentrations in fish tissues collected during Phase I and Phase II sampling efforts were compared to whole-body tissue protective criteria for fish. The criteria used were from the Cabinet, the USEPA, and scientific literature. For selenium, the Kentucky adult fish and ovary standards were used.
    - The adult fish and the adult fish ovary samples from Phase I and Phase II sampling had selenium concentrations less than the Kentucky standards for whole-body fish and Kentucky and USEPA ovary tissues (see Figures ES-4A, -4B, and -4C).
    - YOY bluegill were collected to inspect for deformities (approximately 3,600 fish) and for tissue residue (approximately 700 additional fish) for a total of approximately 4,300 YOY bluegill.
    - The elevated Curds Inlet YOY bluegill whole-body tissue selenium levels decreased with increasing distance away from E.W. Brown Station and from Curds Inlet (see Figure ES-4D). The YOY bluegill collected from Upper Curds Inlet, nearest the Auxiliary Pond Outfall KPDES BRN001, had selenium tissue levels exceeding both the Kentucky adult whole-body and ovary criteria, of 8.6 and 19.3 mg/kg dw, respectively as well as the USEPA ovary criteria of 15 mg/kg dw.

- The 2018 YOY bluegill deformities assessment was conducted as a follow up to the YOY conducted in 2016 by Downstream Strategies, which focused solely on approximately 550 fish from Curds Inlet. For the 2018 study, bluegill was the target species because bluegill was available in 2018, bluegills are particularly sensitive to selenium, and bluegill were initially the stated target species in the 2016 YOY study of bass in Curds Inlet. The 2018 YOY bluegill study included the evaluation of approximately 3,600 YOY fish compared to approximately 550 YOY fish in 2016, which makes the 2018 YOY study more comprehensive. The 2018 YOY study also included three areas within Curds Inlet, one location within HQ Inlet, and three additional areas outside the influence of Auxiliary Pond Outfall KPDES BRN001, allowing a greater understanding of the fishery in and near Curds Inlet than was available from the 2016 YOY study.

- The 2018 YOY assessment demonstrated that nearly all of fish did not have skeletal, facial, fin, or tail teratogenic deformities. A summary of the teratogenic deformities is provided in Table ES-2 (same as Figure 5-6). Overall, only 35 of the more than 3,600 fish had some deformity, which is 0.97% of the fish. The rates in Curds and HQ Inlets (0.38–0.83%) were less than the rates observed outside the influence of Curds Inlet, with an observed occurrence at LHL1 of 2.1% and Hardin Inlet at 0.96%. The rate of occurrence at LHL6, approximately 2 miles upgradient from Curds Inlet was 0.66%, within a comparable range to that observed in Curds Inlet (outside the influence of E.W. Brown Station). These rates of skeletal, facial, fin, or tail teratogenic deformities do not indicate adverse impact to the population of fish in Herrington Lake.

Table ES-2: Young-of-the-Year Bluegill Deformities Assessment

Area	# Fish	# Skeletal, Facial, Fin, Tail, Deformities	Skeletal, Facial, Fin, Tail Deformity Rate (%)
Upper Curds Inlet (UCI)	600	5 (tail deformities)	0.83%
Middle Curds Inlet (MCI)	674	5 (scoliosis, lordosis, facial, caudal)	0.74%
Lower Curds Inlet (LCI, at mouth with lake)	524	2 (scoliosis)	0.38%
HQ Inlet	486	5 (scoliosis, lordosis, mouth/head)	1.0%
Lower Herrington Lake 1 (LHL1, Residential Cove near Rock Run Embayment	524	11 (scoliosis, lordosis, facial)	2.1%
Lower Herrington Lake 6 (LHL6 approximately 2 miles upgradient from Curds Inlet)	607	4 (mouth, facial, operculum, scoliosis)	0.66%
Hardin Inlet (HI)	209	2 (abbreviated dorsal spine)	0.96%
Total	3,624	35	0.97%

Table ES 2. Young-of-the-Year Bluegill Deformity Assessment

- During the YOY deformities assessment, a condition was noticed in approximately 5% of the 3,600 fish evaluated in the assessment. The condition, called exophthalmia, is more commonly referred to as "popeye". Popeye can be associated with selenium toxicity at high concentrations, so a detailed examination of the fish was conducted to see if there was a dose-response that was related to selenium. In addition, digital images of the approximately 700 YOY fish sent for tissue residue analysis were more closely examined for evidence of popeye. A summary of the fish with popeye from each of the locations and each of the sample types (tissue residue or assessment) is identified in Table ES-3 (same as Figure 5-9B).

Table ES-3: Percent of Popeye for Each Sample Type and Location					
YOY Location	YOY Analytical Sample	# Fish Evaluated	# Fish w/Popeye	% Popeye	Avg Popeye Per Location %
UCI	Sample 1 of 2	69	16	23.2%	3.2%
	Sample 2 of 2	49	7	14.3%	
	Assessment Sample	600	0	0.0%	
MCI	Sample 1 of 2	108	71	66%	25.4%
	Sample 2 of 2	69	52	75%	
	Assessment Sample	674	93	14%	
LCI	Sample 1 of 2	31	0	0%	0.2%
	Sample 2 of 2	30	1	3.3%	
	Assessment Sample	524	0	0%	
HQ	Sample 1 of 2	19	0	0%	0.2%
	Sample 2 of 2	26	0	0%	
	Assessment Sample	486	1	0.2%	
LHL1	Sample 1 of 2	83	7	8%	8.1%
	Sample 2 of 2	100	50	50%	
	Assessment Sample	524	0	0%	
HI	Sample 1 of 2	11	1	9%	37.2%
	Sample 2 of 2	19	2	11%	
	Assessment Sample	209	86	41%	
LHL6	Sample 1 of 2	31	0	0%	0.0%
	Sample 2 of 2	47	0	0%	
	Assessment Sample	607	0	0%	
Total Average (Assessment and Tissue Samples)		4,316	387	9.0%	

Table ES 3. Percent of Popeye for Each Sample Type and Location

- Considering the YOY assessment samples and YOY tissue residue samples, a total of 9% of the fish exhibited this popeye condition (Table ES-3, same as Figure 5-9B). Some of the preserved fish from the YOY assessment samples were sorted into groups of fish with and without the popeye condition for additional YOY selenium tissue residue analysis and results were compared to the selenium YOY tissue residues (Figure ES-8, same as Figure 5-11B). No dose-response relationship between popeye and selenium concentration was identified, even in fish samples with 100% popeye compared to fish samples with 0% popeye condition (see the two sets of yellow bars on Figure ES-8).

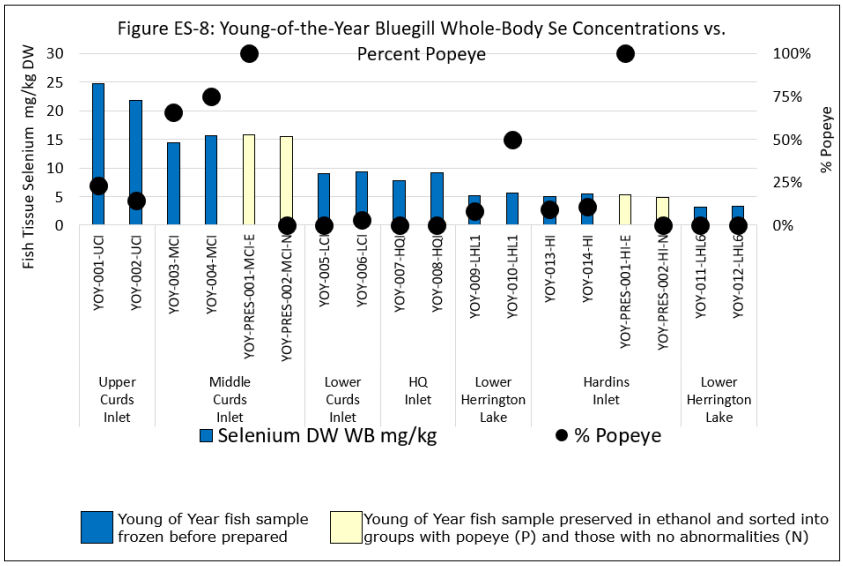


Figure ES- 8: Young-of-the-Year Bluegill Whole-Body Se Concentrations vs. Percent Popeye

Based on the lack of dose-response, and the prevalence of this condition even in areas remote from E.W. Brown Station, other possible sources of popeye were considered. For example, popeye can be

associated with a variety of bacterial, fungal, parasite, or physical stress causes unrelated to selenium. For example, popeye can be a condition found in aquariums and aquiculture. Given the results of a microscopic examination of the YOY fish, parasites were ruled out as a cause, but the other sources of conditions unrelated to selenium could not be ruled out. Furthermore, an evaluation of the size of the fish was conducted as a potential explanation for the popeye condition (Figure ES-9, same as Figure 5-12). Results indicated that smaller fish had a higher likelihood of having popeye condition. Small fish are also susceptible to popeye from physical stress. These findings suggest that the exertion and capture typical of the YOY collection may have contributed to the observed popeye (e.g., Stephens et al. 2002, Hargis 1991; Noor El Deen and Zaki 2012/2013).

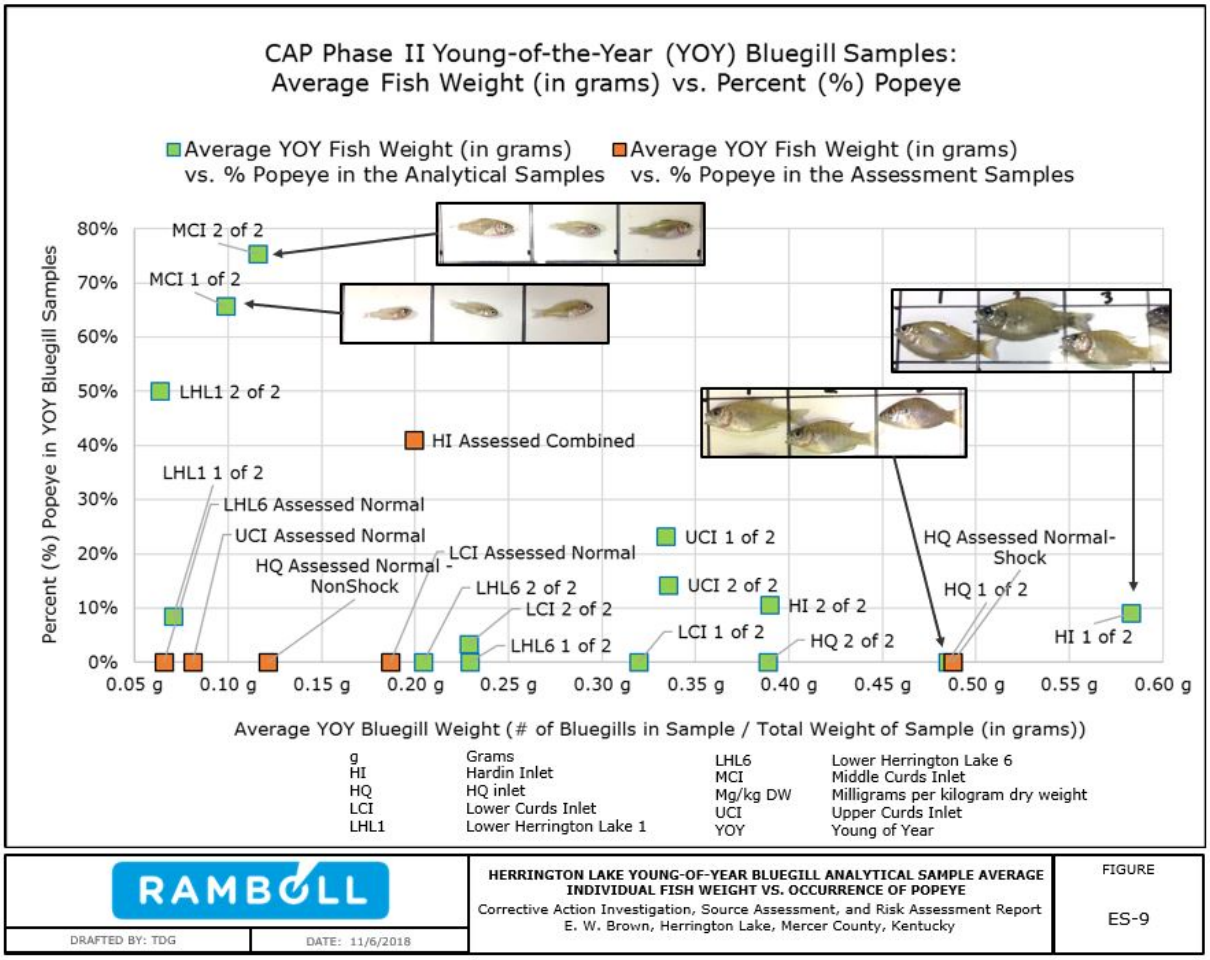


Figure ES- 9. Herrington Lake CAP Phase II Young-of-the-Year (YOY) Bluegill Samples: Average Fish Weight (in grams) vs. Percent (%) Popeye

Several conclusions were reached based on the study of the YOY bluegill:

- The overall presence of teratogenic skeletal, facial, fin, or tail deformities (0.97%) was low, and those observed in Curds Inlet were comparable to those observed at distance well outside the influence of E.W. Brown Station. The observed deformity rate of approximately 1% does not indicate adverse impact to the population of fish in Herrington Lake.

- The skeletal, facial, fin, or tail deformities observed were relatively minor and overall would not likely affect the survival of the fish. No dose-response relationship between selenium concentrations in fish tissues and deformities was established. Moreover, the data from the study of deformities indicated that the low prevalence of deformities would not adversely impact bluegill populations. Bluegill are small home range species known to be among the most sensitive species to selenium and this study evaluated the sensitive YOY life stage for bluegill in areas of Curds Inlet with the highest measured concentrations of selenium in surface water, sediment pore water, and sediment. Therefore, these findings also support the conclusion that other less sensitive fish populations of Herrington Lake would not be adversely impacted by selenium.
- The overall presence of popeye was also low (among all sample types, a total of 9%), and if the popeye was due to physical exertion as some literature suggests may occur, it would be an artificial condition potentially induced by the study itself. Even if not due to exertion, the study showed no dose -response relationship with selenium (Figure ES-8B) and the prevalence in Hardin Inlet (37%) (where sampling did not show the presence of elevated selenium in surface water) exceeded the prevalence in Curds Inlet (0.09% with UCI, MCI, LCI, and HQ Inlet combined) (Table ES-3, same as Figure 5-9B). The prevalence in Hardin Inlet (where sediment concentrations are much lower) also exceeds that of any individual area within HQ Inlet and Curds Inlet, which ranged 0.2% from LCI and HQ Inlet to 25.4% from Middle Curds Inlet (MCI). Hardin Inlet had among the lowest selenium concentrations observed in YOY fish tissues, surface water, and sediment pore water from among the samples collected.

Bluegills were abundant in Herrington Lake. The approximately 4,300 fish evaluated in this assessment (including YOY from the assessment samples and the tissue residue samples) were collected in less than a week of sampling. From the 4,300, approximately 2,700 were collected from within Curds Inlet and HQ Inlet. The Kentucky Department of Fish and Wildlife Resources (KDFWR) does not stock bluegills in Herrington Lake.

These findings, and with the uncertainties already noted, indicate the bluegill population in Herrington Lake is not adversely impacted by selenium. However, certain YOY composite bluegill samples collected from within Curds Inlet did have whole-body selenium levels that exceed the Kentucky criterion for adult whole-body fish. The YOY fish collected were juvenile fish and given the young age (estimated to be within approximately 3 weeks of hatching) and the likelihood that maternal transfer is a source of exposure for young fish, the ovary criterion may be applicable for consideration along with the adult whole-body criterion. The composite samples in the innermost portion of Curds Inlet exceeded the Kentucky adult criterion and the Kentucky ovary criterion. Therefore, some impacts to individual YOY bluegills within Curds Inlet cannot be ruled out. The path forward thus includes recommendations for future monitoring of the YOY bluegill population health.

The ERA also considered the survival, growth, and reproduction of bird and mammal populations using a food web modeling approach with conservative toxicity reference values based on dietary intake. The following ecological receptors were considered in the food web model, as agreed upon in the CAP (Figure ES-10).

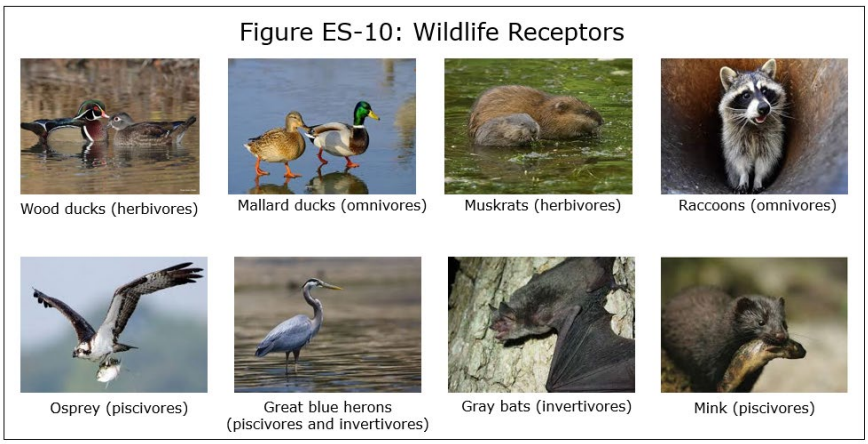


Figure ES-10: Wildlife Receptors

The ERA also considered the river otter as an additional receptor. The ERA food web model indicated that mammal and bird populations are not adversely impacted by CCR-related constituents in the water column or from CCR-related constituents in the sediments in Curds Inlet or elsewhere in Herrington Lake.

The ERA also considered community composition and function for aquatic plants and sediment dwelling organisms. The approach used for this evaluation was the comparison of water, sediment, and sediment pore water concentrations to water and sediment quality criteria appropriate, including specific selenium and arsenic pore water concentrations for sediment dwelling organisms. Based on these comparisons, some isolated potential effects to some organisms in Curds Inlet cannot be definitively ruled out at the spatially limited areas with the highest concentrations of selenium and arsenic in sediment or pore water. Given the limited spatial extent of the highest concentrations exceeding criteria, it is considered unlikely that sediment or sediment pore water poses an unacceptable risk to the plant or sediment dwelling organism community.

6. Recommendations and Path Forward

The Phase I and Phase II investigation results, along with selenium source identification, HHRA, and ERA are sufficient to proceed with the Supplemental Remedy Alternatives Analysis, as identified in the Agreed Order and the CAP. The Phase I investigation included sampling coverage throughout Curds Inlet and within HQ Inlet. The Phase I sampling also included surface water, sediment, aquatic vegetation, and aquatic invertebrate sampling for areas within Lower Herrington Lake, extending upgradient and downgradient from E.W. Brown Station. The Phase I sampling included adult fish tissue sampling for three species of fish within Lower Herrington Lake and approximately 20 miles upgradient of E.W. Brown Station in Middle Herrington Lake. Both large and small home range fish were sampled representing forage fish (bluegill), bottom dwelling omnivorous fish (catfish), and predatory fish (bass) analyzed for consideration of whole-body and fillet tissue results, and a subset of the larger fish ovary tissues were sampled. The Phase II investigation filled data gaps identified in the Phase I sampling program. No data gaps are identified that would prevent proceeding with the Supplemental Remedial Alternatives Analysis.

Potential adverse effects to individual YOY bluegills in inner Curds Inlet could not be ruled out. Uncertainties remain, however, related to the lack of observed dose-response relationship between the YOY bluegill selenium levels and the YOY deformities or popeye condition. As such, future

monitoring of YOY bluegills is recommended. In addition, there is no adult bluegill ovary tissue data to date. The future monitoring of adult bluegill fish, with adult bluegill ovary tissues would provide additional clarifying information if conducted in the same season as YOY bluegill assessment. This monitoring, while considered beneficial to resolve some uncertainties described in the ERA, is not needed to complete the Supplemental Remedial Alternatives Analysis.

KU has already implemented several IRMs to mitigate groundwater impacts at E.W. Brown Station, and control migration of impacted groundwater toward Herrington Lake. In addition to the IRMs conducted pursuant to the GRWAP and discussed in Section 1 of this Corrective Action ISARA Report, there are ongoing projects at E.W. Brown Station to modify operations and wastewater management systems to comply with recently promulgated federal regulations for managing CCR and related coal combustion wastestreams. These include EPA's 2015 Effluent Limitations Guidelines for Steam Electric Coal-fired Utilities (the "ELGs") and the Disposal of Coal Combustion Residuals from Electric Utilities Rule ("CCR Rule"). For certain requirements of these rules, which also are to be addressed pursuant to the CAP II obligations under the Agreed Order, compliance is being achieved through modifications at E.W. Brown Station pursuant to a schedule that will be reviewed and approved by the Cabinet pursuant to the Agreed Order (and set forth in the renewed KPDES permit for the facility).

Key projects include:

- Replace wet handling of CCRs in Auxiliary Pond with dry handling in the Landfill.
- Replace Auxiliary Pond discharge to Curds Inlet (KPDES BRN001 Outfall) by relocating these same process flows to a submerged discharge through a multi-port diffuser located at the main body of Herrington Lake upon issuance of the final renewed KPDES permit (projected for late summer 2019). The diffuser would be anchored to the rock wall and extend into the main body of Herrington Lake. The discharge zone of the diffuser is planned for approximately 40 feet below winter pool. The diffuser will be used for dewatering of the Auxiliary Pond and for plant process wastewater flows currently discharging to the Auxiliary Pond, which will be directed to a new Process Pond that is under construction.
- Provide enhanced physical/chemical treatment of certain wastewaters, including coal pile runoff and toe drain collection system water, with initial system start-up by December 31, 2019.
- Target zero liquid discharge of scrubber (FGD) wastewater but provide auxiliary Process Water System (PWS) treatment system for backup if necessary, with initial system start-up by December 31, 2019.
- Dewater the Auxiliary Pond commencing upon the effective date of the renewed KPDES permit and complete Auxiliary Pond closure by December 31, 2021.

These ongoing projects, which are described in detail in the updated KPDES renewal application, will reduce or eliminate the largest sources of CCR constituent loading to Curds Inlet from E.W. Brown Station by 2020 and will reduce or eliminate these sources from E.W. Brown Station to Herrington Lake entirely within the next two and a half years. These improvements will be considered in the Supplemental Remedial Measures evaluation and Report required by the Agreed Order following the Cabinet's review and approval of the Corrective Action ISARA Report. It is expected that these remedial actions will continue to limit selenium, arsenic, and other CCR-related constituent loading to Herrington Lake, as demonstrated by Auxiliary Pond Outfall KPDES BRN001 monitoring and the mass loading estimates discussed in Section 3 of this report.

Per the CAP, the Supplemental Remedial Alternatives Analysis may include the following elements:

- Identification of Conditions Warranting Supplemental Actions. This involves consideration of the source identification, HHRA, and ERA presented in this Corrective Action ISARA Report. Any supplemental remedial measures considered will include evaluation the performance of interim remedial measures and ongoing projects that are outlined above.
- Definition of Remedial Action Objectives (RAOs).
- Identification of Potentially Applicable Additional Remedial Action Alternatives.
- Evaluation of Supplemental Remedial Alternatives. The evaluation of alternatives will include:
    - Long-term and short-term effectiveness and protectiveness.
    - Risk reduction; the potential for residual risks due to waste remaining after implementation of the remedial measure, type and extent of long-term management required, including monitoring, operation, and maintenance.
    - Short-term risks that might be posed to public health, safety, the environment, and natural resources while implementing any remedial measures.
    - Time until full protection is achieved, potential adverse effects on public health, safety, the environment, or natural resources resulting from exposure to remaining wastes compared to the potential of such adverse effects associated with further corrective measures;
    - Long-term reliability of the engineering and institutional controls, potential need to replace the remedial measure, and compatibility of the remedial measure with other relevant federal, State, and local regulations.
    - Sustainability of the remedial alternatives. As part of the evaluation of the remedial alternatives, the sustainability of the remedial alternatives will be considered, consistent with USEPA's April 2008 Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites (USEPA 2008) and ITRC's November 2011 Green and Sustainable Remediation: A Practical Framework (ITRC 2011).

1. INTRODUCTION

This *Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report* (hereafter referred to as the Corrective Action ISARA Report) is provided to the Kentucky Energy and Environment Cabinet (Cabinet) in accordance with the August 2017 *Corrective Action Plan (CAP) for Herrington Lake* (Ramboll 2017a). The CAP for Herrington Lake was developed and submitted to the Cabinet as part of efforts to resolve the January 11, 2017 Notice of Violation (NOV) received by Kentucky Utilities Company (KU) due to reported detections of selenium in whole-body fish tissue from Herrington Lake at concentrations above Kentucky's water quality standard for protection of aquatic life. To resolve the NOV, KU entered an Agreed Order with the Cabinet on January 30, 2017 that required an investigation of sediment and surface water in Herrington Lake. Specifically, the Agreed Order directs KU to develop and submit for review and approval:

> *"A plan for (1) the further investigation of sediments, surface water quality and biological receptors in Herrington Lake, including an appropriate assessment of human health and ecological risks, (2) an assessment of the sources of selenium impacts, and (3) a consideration of remedial actions, if necessary, to supplement the Groundwater Remedial Action Plan (GWRAP), and a schedule for implementation of such plan for selenium impacts found to be from the E.W. Brown Station."*

The CAP for Herrington Lake was approved by the Cabinet in March 2018 after taking public comment.

It is noted that while the Agreed Order focuses on selenium impacts, the CAP was designed to also address other constituents of potential interest typically present in coal combustion residuals (CCR), including arsenic, mercury, cadmium, boron, lead, zinc, magnesium, and iron, as well as other parameters needed to better understand the aquatic system (e.g., sulfate, total organic carbon, and hardness). There is a focus on selenium in this report because the Kentucky Division of Water collected fish tissue from Herrington Lake in 2016 with reported tissue concentrations exceeding the Kentucky whole-body fish tissue criterion for selenium. There is also a focus on arsenic based on the Phase I and Phase II sediment and pore water results. Three additional metals (cobalt, lithium, and molybdenum) of regulatory interest at E.W. Brown under the CCR Rule are considered in the human health and ecological risk assessments, in Sections 4 and 5, respectively.

1.1 E.W. Brown Location, Herrington Lake, and History

E.W. Brown Generating Station (Hereafter referred to as "E.W. Brown Station") is on the east edge of Mercer County, 3.8 miles northeast of the city of Burgin (Figure 1-1A). E.W. Brown Station is located on the west side of the Herrington Lake portion of the Dix River next to a hydroelectric dam (Dix Dam) built by KU in the 1920s. A coal-fired generating plant has operated at the site since the 1950s, and more recently a combustion turbine generating plant (consisting of seven combustion turbine units that can be fueled by either fuel oil or natural gas) was added to E.W. Brown Station to meet peak demands. In 2016, KU commenced operation of a 10 megawatt (MW) universal solar facility comprised of more than 44,000 solar panels on a 50-acre tract at E.W. Brown Station. Coal Units 1 and 2 were retired in early 2019. A site layout map is provided in Figure 1-1D.

E.W. Brown Station has generated and disposed of CCR since the 1950s. Historically, CCR primarily consisted of bottom ash and fly ash generated from coal combustion. Beginning in 2009, gypsum began to be produced after a scrubber was installed to remove sulfur dioxide from E.W. Brown Station's air emissions. Ash was sluiced to the Main Ash Pond, located directly south of the generating

station. As the Main Ash Pond filled, it was expanded twice, in 1973 and 1989, and at time-of-closure, it measured approximately 114 acres. In 2008, a second pond (referred to as the Auxiliary Pond, or "Auxiliary Pond") was constructed as a temporary settling pond until the Main Ash Pond could be expanded again. In late 2008, the Main Ash Pond was taken out of service, and the sluicing operation was switched to the Auxiliary Pond. Much of the Main Ash Pond was covered with a multi-layered Engineered Cap in preparation for construction of a landfill over the closed Main Ash Pond. This cap, which also serves as the bottom liner of the landfill, is described in Section 3.1.1 of this Corrective Action ISARA Report. Construction of a special waste landfill over the top of the Main Ash Pond was permitted in 2015 and completed in 2016, and this landfill (hereafter referred to as the Landfill) currently receives CCR (including bottom ash, fly ash and gypsum) generated by E.W. Brown Station. Construction of the Landfill atop the Main Ash Pond also served to cap the former pond. Prior to its closing, the Main Ash pond discharged via a permitted KPDES outfall into Curds Inlet. The Auxiliary Pond Outfall KPDES BRN001 is the primary discharge to Curds Inlet. The Main Ash Pond also discharged via KPDES Outfall to Curds Inlet prior to the closure and capping of the Main Ash Pond.

1.1.1 Herrington Lake Study Area Boundaries

Herrington Lake is located within the Dix River watershed (Figures 1-1A, 1-1B, and 1-1C). The lake measures approximately 35 miles long and up to approximately 1,200 feet wide, covering approximately 2,335 acres with approximately 325 miles of shoreline, including numerous open-water regions, embayments, inlets, and coves (Figures 1-1A-C). The main channel of the Dix River portion of the lake is 33 miles from the dam to the headwaters at Highway 52. Approximately two additional miles of the lake are comprised of the Rocky Run embayment just above and east of the dam and the Cane Run embayment southwest of E.W. Brown Station (Figure 1-1A). Dammed and filled with water in the spring of 1925, Herrington Lake is Kentucky's first large-scale impoundment, and is also the deepest lake in Kentucky. The deepest area is near Dix Dam where the water depth reaches 249 feet (76 meters) below water surface (bws) and the average depth of the lake is 78 feet. Because the lake is so deep it has only frozen over twice: Once during the winter of 1936 and once during the winter of 1978. The estimated capacity of the lake is 175,000,000,000 gallons. A short distance below the dam, the Dix River enters the Kentucky River at High Bridge, Kentucky.

There are seven Commonwealth of Kentucky Department of Fish and Wildlife Resources (KDFWR) Fishery Districts. Herrington Lake is located within the Central Fisheries Division (CFD) jurisdiction. KDFWR CFD provides Annual Sportfish Lake Performance Reports for Herrington Lake (KDFWR 2008, 2014, 2016). The CFD described the lake sections in terms of CFD-A and CFD-B Subdivisions (KDFWR 2008). For this CAP, those general areas identified by the CFD for the lake were used to identify three sections of Herrington Lake: Upper, Middle, and Lower Herrington Lake, as illustrated on Figure 1-1C and described below:

- Lower Herrington Lake (LHL): Camp Kennedy @ Highway 152 Crossing to Dix Dam
- Middle Herrington Lake (MHL): Camp Kennedy @ Highway 152 Crossing to Highway 34
- Upper Herrington Lake (UHL): Highway 34 South to Highway 52

The Herrington Lake Study Area consists of these three areas (LHL, MHL, and UHL). At the Cabinet's request, an additional sampling region located in the lower Dix River from Dix Dam downstream to its confluence with the Kentucky River was also included in the Herrington Lake Study Area. Adult fish sampling in the lower Dix River included this larger area, while sampling of the other media was conducted proximal to the Dam spillway.

1.2 Summary of Completed and Planned Remedial Actions

As a condition of the issuance of an operating permit for the Landfill at E.W. Brown Station, KU was required to (1) develop a closure plan for the Main Ash Pond; and (2) develop a remedial action plan to abate groundwater contamination detected in monitored springs and prevent further groundwater contamination. The *Main Ash Pond Closure Plan* (AMEC 2014) was submitted by KU in 2014; this plan describes the final capping of the Main Ash Pond with the construction of the new CCR Landfill over the Main Ash Pond. In addition, as described in the GWRAP, KU has initiated certain remedial actions (referred to as interim remedial measures, or IRMs) that are designed to mitigate the release of constituents of interest into groundwater and limit the migration of impacted groundwater from on-site sources. Based on the findings of the mass loading discussions provided in Section 3 of this Corrective Action ISARA Report, these remedial actions limit contributions of constituents of interest, including selenium, to Herrington Lake, mostly by preventing surface water infiltration and recharge of groundwater in target areas. The remedial actions completed from 2014 to 2016 are summarized in Table 1-1, and include the capping of the Main Ash Pond, installation of the Toe Drain collection system, and repair of the Auxiliary Pond discharge pipeline. In accordance with the GWRAP, ongoing IRM performance monitoring is conducted by KU and is expected to become part of the permanent remedial action for the site, as recognized by the Agreed Order.

In addition to the IRMs conducted pursuant to the GRWAP and discussed in Section 1 of the Corrective Action ISARA Report, there are ongoing projects at E.W. Brown Station to modify operations and wastewater management systems to comply with recently promulgated federal regulations for managing CCR and related coal combustion wastestreams. These include EPA's 2015 Effluent Limitations Guidelines for Steam Electric Coal-fired Utilities (the "ELGs") and the CCR Rule. For certain requirements of these rules, which also are to be addressed pursuant to the CAP II obligations under the Agreed Order, compliance is being achieved through modifications at E.W. Brown Station pursuant to a schedule that will be reviewed and approved by the Cabinet pursuant to the Agreed Order (and set forth in the renewed KPDES permit for the facility).

Key projects include:

- Replace wet handling of CCRs in Auxiliary Pond with dry handling in the Landfill.
- Replace Auxiliary Pond discharge to Curds Inlet (KPDES BRN001 Outfall) by relocating these same process flows to a submerged discharge through a multi-port diffuser located at the main body of Herrington Lake upon issuance of the final renewed KPDES permit (projected for late summer 2019). The diffuser would be anchored to the rock wall and extend into the main body of Herrington Lake. The discharge zone of the diffuser is planned for approximately 40 feet below winter pool. The diffuser will be used for dewatering of the Auxiliary Pond and for plant process wastewater flows currently discharging to the Auxiliary Pond, which will be directed to a new Process Pond that is under construction.
- Provide enhanced physical/chemical treatment of certain wastewaters, including coal pile runoff and toe drain collection system water, with initial system start-up by December 31, 2019.
- Target zero liquid discharge of scrubber (flue gas desulfurization, [FGD]) wastewater but provide Auxiliary Process Water System (PWS) treatment system for backup if necessary, with initial system start-up by December 31, 2019.
- Dewater the Auxiliary Pond commencing upon the effective date of the renewed KPDES permit and complete Auxiliary Pond closure by December 31, 2021.

These ongoing projects, which are described in detail in the updated KPDES renewal application, will reduce or eliminate the largest sources of CCR constituent loading to Curds Inlet from E.W. Brown

Station by 2020 and will reduce or eliminate these sources from E.W. Brown Station to Herrington Lake entirely within the next two and a half years.

1.3 CAP Phase I and II Investigations

The CAP project timeline is illustrated in Figure 1-1E. The CAP Phase I sampling plan was submitted for review to the Cabinet in Aug 2017 (Ramboll 2017a). The Phase II sampling plan was submitted and reviewed by the Cabinet in May 2018. A response to Agency comments on the Phase I Tech Memo, including Section 6, the Phase II Field Sampling Plan (FSP) was completed, submitted, and approved by the Cabinet in June 2018 (Herrington Lake Corrective Action Plan Phase I Technical Memorandum and Phase II Plan, [Ramboll 2018a]). The CAP Phase II results, including the results of the extensive YOY bluegill assessment and laboratory analysis for selenium, were presented to the Cabinet on January 25, 2019.

The Phase I and II sampling was conducted as identified in the CAP (Ramboll 2017a) and in accordance with the following guidance and procedural documents that were reviewed and approved/acknowledged by the Cabinet:

- Quality Assurance Project Plan (QAPP): Herrington Lake, E.W. Brown Station (Ramboll 2017b).
- Standard Operating Procedures (SOP): Fish Sampling and Analysis (Ramboll 2017c).
- SOP: Surface Water Sampling and Analysis (Ramboll 2017d).
- SOP: Sediment Pore Water and Sediment Sampling and Analysis (Ramboll 2017e).
- SOP: Aquatic Vegetation and Aquatic Invertebrate Sampling and Analysis (Ramboll 2017f).
- CAP Phase I Technical Memorandum and Phase II Plan. (Ramboll 2018a).
- QAPP Addendum: Herrington Lake Young-of-the-year (YOY) Fish Assessment (Ramboll 2018b).
- SOP: Young-of-The-Year (YOY) Fish Assessment Sampling and Fish Tissue Sampling (Ramboll 2018c).
- SOP: Selenium Analysis for Young-Of-The-Year (YOY) Preserved Bluegill Whole-Body Tissues (Ramboll 2018d).

1.3.1 Sampling Locations

The Phase I and II sampling included multi-media field sampling and YOY visual assessments to characterize CCR-related environmental chemical constituents in Herrington Lake, with emphasis on regions nearest E.W. Brown Station, including Curds Inlet and HQ Inlet (Ramboll 2017a, 2018a). Phase I and Phase II sampling included a greater density of sampling in Curds Inlet because Curds Inlet is adjacent to E.W. Brown Station and receives a permitted discharge from the Auxiliary Pond, and previously the Main Ash Pond. The CAP Phase I and Phase II efforts augmented data available for Herrington Lake from sampling prior to the CAP efforts (Figure 1-2). The Phase I and Phase II sampling locations are identified, as follows:

- The Phase I sampling locations are illustrated on Figures 1-3A–D.
- The Phase II sampling locations are illustrated on Figure 1-4A–D.

Sampling was more robust within and near Curds Inlet, to provide sufficient data to identify spatial relationships or gradients related to distance from E.W. Brown Station and particularly with spatial distance from Outfall 001 which discharges from the Auxiliary Pond into Curds Inlet. The sampling in and away from Curds Inlet was also provided to support the selenium source identification described in Section 3 of this report.

The Phase I field effort included multi-media sampling from downgradient Dix River and other lake/embayment locations away from Curds Inlet (e.g., Hardin Inlet, Rocky Run Embayment) to allow comparison to lake results at and near Curds Inlets. Phase I sampling also included adult fish sampling from two Middle Herrington Lake (MHL) locations, MHL1 and MHL3, to establish relevant in-watershed reference contaminant levels. The Phase I results informed location and timing choices for the Phase II sampling, focusing on Middle Curds Inlet to further characterize sediment pore water and sediment, particularly near the area within Curds Inlet where the highest concentrations of selenium and arsenic were detected in Phase I. In addition, Phase II sampling provided additional analysis of selenium in adult whole-body fish tissues during June 2018, which was earlier in the spawning season than samples collected in Phase I. Phase II also included a YOY bluegill assessment.

The 2018 YOY bluegill deformities assessment was conducted as a follow up to the YOY assessment conducted in 2016 by Downstream Strategies, which focused solely on approximately 550 fish from Curds Inlet (Downstream Strategies 2016). For the 2018 study, bluegill was the target species because bluegills were available in 2018, bluegill are particularly sensitive to selenium, and bluegill were initially the stated target species in the 2016 YOY study of bass in Curds Inlet conducted by Downstream Strategies. The 2018 YOY bluegill study was a comprehensive study which included the evaluation of approximately 3,600 YOY fish compared to approximately 550 YOY fish in 2016 study. The 2018 YOY study also included three areas within Curds Inlet, one location within HQ Inlet, and three additional areas outside the influence of Auxiliary Pond Outfall KPDES BRN001, allowing a greater understanding of the fishery in Herrington Lake than was available from the 2016 YOY study.

Phase I and II sampling locations included:

- Curds Inlet (CI);
- LHL1 (Rocky Run Embayment);
- LHL2 (Herrington Lake at Dix Dam);
- HQ Inlet (HQ);
- Hardin Inlet (HI);
- LHL3 (Herrington Lake main channel, upstream from CI and LHL2); and
- LHL6 (Herrington Lake near the Sunset Marina near Lake Mile 6).

Phase I sampling also included:

- LHL4 (Herrington Lake main channel, upstream from CI between LHL3 and Hardin Inlet);
- LHL5 (Entrance to Mallard Cove);
- Dix River below Dix Dam (DR); and
- Middle Herrington Lake Mile 10 (MHL1) and Lake Mile 20 (MHL3) (adult-fish sampling reference locations only)
- For purposes of this study, in addition to MHL1 and MHL3, LHL5 and LHL6 are considered in-watershed reference areas that are outside the influence of E.W. Brown Station.

1.3.2 Sample Media

Both Phase I and II included collection of adult fish, surface water (SW), sediment pore water (PW), and sediment (SED). Phase I also included the collection of aquatic invertebrates (AI) and aquatic vegetation (AV). Phase II included the collection and assessment of YOY bluegills (*Lepomis sp.*) (Tables 1-2A–C, Figures 1-4A–D). These sampling efforts are summarized below:

- Adult Fish: Adult fish tissue collected during both the Phase I and II efforts provided year-on-year results for multiple locations in LHL. The Phase II results supplemented the Phase I results to

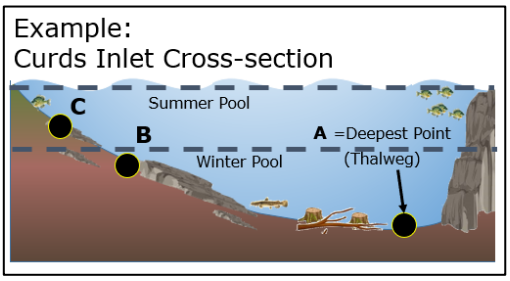
provide additional characterization of whole-body fish selenium levels in Curds Inlet and other lake areas located proximal to E.W. Brown Station (Figures 1-3A–1-4C). Phase I also included two additional adult fish tissue sampling regions located in Middle Herrington Lake (MHL) (Figure 1-3D).

- YOY bluegill: As part of the Phase II effort, A YOY bluegill study was conducted within Curds Inlet, and at other locations within the lake, to examine results related to distance from E.W. Brown Station. The YOY study is discussed in detail in Section 2.1.2 and the results are reported in Table 2-8 and displayed in Figure 1-4D.
- Surface Water: Phase I and II included surface water profiling and sampling from locations concurrent with YOY and adult fish collection (Figures 1-3A–D and 1-4A–D) to help provide insight into constituents in the environment relative to water quality standards.
- Sediment Pore Water and Sediment: Phase I and II included sediment and pore water sample collection from Curds Inlet with limited spatial overlap of samples (i.e. primarily separate sampling transects for each phase) (Figures 1-3A–1-3C and 1-4A–1-4C). Phase I also included sediment sampling from HQ Inlet, LHL1, Dix Dam, LHL3, LHL4, LHL5, LHL6 and the Dix River below the Dix Dam, and pore water sampling from HQ and Hardin Inlets.

  Sediment and pore water sampling locations were located along the surface water sample transects as identified in the CAP (Ramboll 2017a), and specific depths and locations were determined at the time of sampling, based on availability of enough sediment to complete the sample(s). Wherever possible, the sediment sampling targeted depositional areas to characterize general sediment quality for the Inlets as follows:

  - Location **A**: subaqueous, close to the deepest point in the channel (thalweg): In Curds inlet, the water depths of the deepest points along the sampling transects ranged from 10 feet below water surface (ft bws) at Curds NB (NB stands for North Bank), located near the outfalls, to 75–90 ft bws at CI4A. Sample collection at CI4A required specialized commercial diving methods and regulations.
  - Location **B**: subaqueous, below winter pool: In Curds inlet, with the exception of Phase I sampling location CI-4B, which was treated as an "open water" sampling transect and located along the eastern shore near the mouth of Curds Inlet (Figure 1-3C) all other Curds Inlet "B" sampling locations were located near the western shore the western shore, collected from approximately 17–21 ft bws, determined at the time of sampling by in situ assessment of the lake level
  - Location **C**: a location above winter pool elevation (approximately 725 feet) and below summer pool elevation (approximately 740 feet). In Curds inlet, this location was located near the southwestern shore, collected from approximately 3–10ft bws, determined at the time of sampling by in situ assessment of the lake level.

- The illustration on right provides an example of a Curds Inlet Phase I and II sampling transect for sediment and sediment pore water, and for surface water. In the image below, the southern shore of Curds Inlet is shown on the left and the northern shore is shown on the right. For each transect where surface water was sampled, the surface water profiling and sample collection were conducted at the deepest location, 'A', also



referred to as the thalweg. The thalweg, in fluvial geomorphology, refers to the line of lowest elevation within a waterway, which is often corresponds to the middle of a navigable channel of a waterway.

- Aquatic Invertebrates and Aquatic Vegetation: Phase I included the collection of Aquatic Invertebrates and Aquatic Vegetation from the Phase I sampling locations including: Curds Inlet, HQ Inlet, LHL1, LHL2, LHL3, LHL4, LHL5, LHL6 and the Dix River below the Dix Dam (Figures 1-3A–1-3C). All the aquatic invertebrates that were collected are classified as sediment-dwelling (or benthic) invertebrates; no water column invertebrates were collected.
- Analytical methods and field duplicate/QAQC sample location assignments for each of the above collected Phase I and II sample media are summarized in Table 1-3 and 1-4, respectively.

1.3.3 Timing of Phase I and Phase II Sampling per the CAP

The Phase I field effort was completed during the autumn and winter of 2017 as follows:

- October 1–17: Adult fish collection, surface water profiling and sample collection, aquatic vegetation and aquatic invertebrate sampling, sediment collection, and in situ sediment pore water deployment.
- November 1–4: Retrieval of deployed pore water samplers and extraction of pore water samples and the collection of one additional sediment sample from the deep (75–90 feet bws) thalweg near the mouth of Curds Inlet.
- December 10–14: Lake overturn surface water profiling and sample collection.

The Phase II field effort was completed during the summer of 2018 as follows:

- June 14–20: Stratification surface water profiling and sample collection, adult fish collection, sediment collection, and in situ sediment pore water deployment.
- July 16–26: YOY bluegill collection, retrieval of deployed pore water samplers and extraction of pore water samples.

The sampling program design and analytical methods were chosen to ensure the scientific data quality and quantity for use in the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) (Sections 4 and 5 of this report, respectively).

To minimize any potential disruption from sample collection activities to spring fish migration or spawning patterns, or to invertebrate breeding periods, and to ensure optimal plant and aquatic invertebrate productivity, all sampling was completed during lake stratification and early-winter overturn conditions.

1.4 Previous Investigations and Ongoing Environmental Monitoring Programs

Previous investigations of Herrington Lake and E.W. Brown Station are available from a variety of sources. This section summarizes studies that contribute to decisions regarding proposed sampling, including the Groundwater Assessment Report (GWAR) (AMEC 2013), Groundwater Assessment Update (GWAR Update) (AMEC 2015b), CCR Rule groundwater monitoring (40 CFR 257.95(h)(2)), the KPDES Discharge Monitoring Reports and application data, spring sampling data, sediment data (AMEC 2017), and fish tissue data (Kentucky Division of Water [KDOW] 2016a).

1.4.1 Groundwater Assessment Report and Groundwater Assessment Report Update and Ongoing Groundwater Monitoring

The GWAR (AMEC 2013) and the GWAR Update (AMEC 2015b) provide groundwater and spring water quality information that informed the development of this CAP.

As part of the GWAR:

- Baseline monitoring was initiated at springs, identified on Figure 1-2. Five rounds of monitoring were performed at the six springs between January and December of 2012 including Stonewall Spring, Railroad Spring, Webb Spring Complex, Dam Toe Right Spring, Ditch Spring, and Briar Patch Spring. In addition, Beaver Dam Cave Spring, HQ Spring, Hardin Spring, and Rockhouse Spring were sampled.
- Surface water samples were collected from four locations in Curds Inlet and Herrington Lake and E.W. Brown Station water intake. Surface water samples were also collected from the Cedar Branch watershed and compared to the water samples from Herrington Lake.
- A risk assessment was performed for the human health and ecological exposures to groundwater.

The GWAR stated that groundwater flow at the site occurs primarily in fractured bedrock. Extensive hydrogeologic characterization activities were performed in 2011 and 2012, which relied primarily on dye-tracing to confirm groundwater flow paths.

Curds Inlet receives surface water discharges permitted through the KDOW KPDES program. A surface water divide occurs immediately west of Main Ash Pond between the watershed containing the CCR ponds and the Cedar Branch watershed to the west. Dye tracing has confirmed that a groundwater divide is coincident with this surface water divide, and that groundwater does not flow west into the Cedar Branch watershed from the area of the CCR ponds. Dye tracing also confirmed that there is no connection to the north (area of Webb Spring Complex, upstream of the Lower Dix River).

Samples were collected over multiple sampling rounds in 2011, 2012 and early 2013 from 12 springs near the site, including three springs designated as background springs, seven springs and seeps identified by dye tracing as being downgradient from the Main Ash Pond, and two additional springs to the north and northwest. Samples were analyzed for water quality parameters required by the KDWM Solid Waste regulations and guidance for sampling groundwater near coal ash landfills (as specified in specified in 401 KAR 45:160, Section 7.2 (a)). The water quality parameter list contains 23 parameters, including five indicator parameters (pH, SC, COD, TOC, and total dissolved solids) and 18 individual inorganic elements and compounds, mostly metals. Boron, a metalloid or semi-metal, was also required to be monitored. Additional limited sampling was performed of various surface water bodies, including Herrington Lake, Cedar Branch, and their tributaries.

A risk assessment was performed by AMEC in 2013 to further evaluate the potential impacts associated with the ten specific elements or compounds, referred to as constituents of interest. As part of the risk assessment, the conceptual site model (CSM) was refined based on the understanding of groundwater and surface water flow pathways developed in the hydrogeologic characterization of the site, supplemented with literature and site-specific information on surface water hydrology and land use. The potentially affected pathways and the exposure routes associated with them were evaluated in development of the CSM, to identify the most sensitive routes and receptors.

The GWAR Update (AMEC 2015b):

- further evaluated the groundwater flow pathways site-wide, and specifically the hydraulics of the Main Ash Pond and its relationship to the local groundwater flow system;
- provided a more comprehensive review of chemical parameters associated with source waters;
- performed a geochemical evaluation of groundwater; and
- characterized baseline conditions for evaluating future effectiveness of designated remedial actions.

The GWAR Update provided the following information:

- Water quality sampling performed in 2014 included samples collected from potential source waters (pore water within the deep CCR in the Main Ash Pond and the Auxiliary Pond) and analyzed for an expanded parameter list. Water sampled from the Auxiliary Pond discharge was found to be distinct from background water, primarily based on its anionic composition. Background water consists of calcium bicarbonate water of near-neutral to slightly alkaline pH, low chloride concentration, and relatively low dissolved solids content. By contrast, water in the Auxiliary Pond has high dissolved solids content and is dominated by sulfate in its anionic content.
- Water sampled from test wells installed at the bottom of the Main Ash Pond CCR is distinguished from the Auxiliary Pond/GPP water-type based on a higher proportion of chloride to sulfate in its anionic make-up, and dissolved solids content that is higher than in the Auxiliary Pond/GPP water-type. The only groundwater sampling point where this water-type was observed was the Dam Toe Right (CH-040). Samples collected in 2014 from this monitoring point were reported to be a mix of the two water-type sources.
- Redox conditions within the saturated CCR in the Main Ash Pond were reducing and AMEC (2015b) identified that water could become more so as infiltration of aerated water is further reduced, depending on the amount of sulfate (which acts as a reservoir for oxygen) that is present in the CCR. More reducing conditions, if they occur, could limit the solubility of selenium, and reduce concentrations of selenium in the water exiting the Main Ash Pond CCR.

The GWAR and GWAR Update groundwater data, ongoing groundwater monitoring data obtained under the CCR Rule and Landfill permit and spring data were reviewed in preparation of the field sampling program described in Section 2 of this Corrective Action ISARA Report. The groundwater results and the spring results are discussed in Section 3 of this report.

1.4.2 KPDES Monitoring Data and Application Data

The GWAR and GWAR Update discuss monitoring data from KPDES outfalls at E.W. Brown Station. The Discharge Monitoring Reports data indicates concentrations of certain metals have at times been above surface water quality criteria, including selenium and mercury. The GWAR also discusses the whole effluent toxicity (WET) testing performed for effluent from KPDES Outfall 001 on a quarterly basis for acute toxicity from 2009 to 2013. The WET test results indicated that the discharge from KPDES Outfall 001 (Auxiliary Ash Pond) was not exhibiting toxicity to the indicator species following the WET testing protocol.

KPDES application data are also utilized in this Corrective Action ISARA Report for a discussion of CCR-related constituents discharges from permitted outfalls, based upon KPDES Form C application data in 2006, 2014, and 2019.

1.4.3 Herrington Lake Sediment Data

Sediment samples were collected in Curds Inlet in 2017 (AMEC 2017). Sediments in Curds Inlet and Hardin Inlet were analyzed for selenium. The concentrations ranged from less than 1 mg/kg to 16 mg/kg and less than 1 mg/kg to 2 mg/kg, respectively, with the highest concentration of selenium (16 mg/kg), arsenic (350 mg/kg), and total organic carbon (14%) co-located at CI1 in Upper Curds Inlet (Figure 1-2).

The CAP focused on sediment and pore water collection in Curds Inlet and HQ Inlet, and pore water collection from Hardin Inlet. The pore water sampling included selenium and arsenic speciation to examine any possible cycling from sediment to surface water or biota, to better evaluate sediment as a contributing source to the Herrington Lake food web.

1.4.4 Fish Consumption Advisories

The Kentucky Departments for Environmental Protection, Public Health and Fish and Wildlife Resources jointly issue fish consumption advisories to the public when fish are found with trace contaminants of mercury. Kentucky issued a state-wide advisory for mercury in fish, but no Herrington Lake-specific fish consumption advisories are in effect (KEEC 2018).

1.4.5 2016-2018 KDOW Collection of Adult Fish Tissue from Herrington Lake

In May 2016, KDOW collected and analyzed adult fish whole-body and ovary samples from Herrington Lake near Dix dam and from the Rocky Run embayment (Figure 1-2) (KDOW 2017). Tissues were collected from five bluegills (*Lepomis macrochirus*), seven largemouth bass *(Micropterus salmoides)* and one spotted bass (*Micropterus punctulatus*) near Dix Dam and analyzed for selenium. The whole-body selenium results in milligram per kilogram (mg/kg) dry weight [dw]) are as follows:

- Bluegill selenium concentrations ranged from 9.7–11.5 mg/kg.
- Spotted (Kentucky) bass selenium concentration was 10.7 mg/kg.
- Largemouth bass selenium concentrations ranged from 4.9–11.7 mg/kg.

In most cases, the 2016 whole-body selenium concentrations were reported to exceed the 8.6 mg/kg dw KDOW criterion for the protection of aquatic life from chronic impacts.

Although KDOW collected fish from the Rocky Run embayment (referred to as the residential cove by KDOW), the laboratory reports did not include the selenium whole-body fish tissue results for the embayment samples. The largemouth bass ovary samples were collected from near Dix Dam and from Rocky Run. The Dix Dam bass ovary sample selenium concentration was 7.93 mg/kg dw and the selenium levels in the two Rocky Run ovary samples ranged from 11 to11.3 mg/kg. The 2016 KDOW fish tissue data informed the Phase I designs described in the CAP.

In July 2018, KDOW collected and analyzed twenty adult whole-body bluegills, twenty largemouth bass, one channel catfish, and one striped hybrid bass from various locations within Herrington Lake, including from Curds Inlet (bluegill only), HQ Inlet, near Dix Dam, and other locations as specified below (if known).

- Bluegill selenium concentrations ranged from 2.0–7.16 mg/kg dry weight. The highest selenium concentrations in bluegill were detected in Curds Inlet.
- Largemouth bass selenium concentrations ranged from 2.12–5.97 mg/kg dry weight from near Dix Dam and Herrington Lake (exact locations not provided in lab report) respectively.

- The single adult channel catfish (collected from HQ Inlet) had a whole-body selenium concentration of 2.75 mg/kg dw.
- The single adult hybrid striped bass (collected from Herrington Lake, location unknown) had a whole-body selenium concentration of 2.9 mg/kg dw.

In contrast to the 2016 KDOW fish sampling mentioned in Section 1.4.5 of this Corrective Action ISARA Report, none of the July 2018 KDOW fish analyzed had whole body selenium concentrations above the 8.6 mg/kg dw KDOW criterion for the protection of aquatic life from chronic impacts. The July 2018 KDOW results for both the bluegill and largemouth bass are comparable to the Phase I and II adult whole-body bluegill selenium concentrations. All fish data (KDOW 2016/2018 and the Phase I/Phase II results) are discussed further in Section 2 of this Corrective Action ISARA Report.

1.4.6 Adult Small Fish Whole-Body Tissue from the Ash Pond (2009)

United States Fish and Wildlife Service (USFWS) Biologists, May Engineers, Inc. (FMSM) Fisheries Biologists, and an EON Environmental Specialist conducted a study of selenium concentrations in fish tissues from the Main Ash Pond (Stantec 2009). The purpose of the study was to provide a biological assessment related to gray bats that may forage on emergent insects from the Main Ash Pond. Based upon the findings of the study, the opportunistic nature of foraging events at E.W. Brown Station combined with the presence of alternate, high-quality forage opportunities within typical feeding range of local gray bats, the Stantec report concluded that the Main Ash Pond was "*insignificant when compared to all other potential foraging opportunities available to resident gray bats in this population's range.*"

The report also concluded that:

> "a comparison of fish tissue data from KDOW's nearest stream reference site and fish tissue data from the (main) ash pond at E.W. Brown indicates that fish from the reference reach streams contain even higher concentrations of selenium than fish in the (main) ash pond."

Thirty individual fathead minnows (Pimephales promelas) and fifteen individual bluegills were collected from the Main Ash Pond. The following were the composite fish samples collected:

- Three fathead minnow samples (10 fish/composite), ~ 2 ounces [oz]/sample (~50 grams [g]).
- Three bluegill samples (5 fish/composite), ~9oz/sample (~250 g).
- The selenium whole-body results for fish from the ash pond were reported as follows:
- Fathead minnow: 17–18 mg/kg dry weight.
- Bluegill: 14–16 mg/kg dry weight.

1.4.7 2016 YOY Largemouth Bass Study

YOY largemouth bass (*Micropterus salmoides*) bass were collected from Upper, Middle, and Lower Curds Inlet on June 6 and 7, 2016, to form composite sample for teratogenic deformity assessment with approximately 550 fish (Downstream Strategies 2016, Lemly 2018). Approximately 80 additional YOY bass were collected from Upper and Middle Curds Inlet and analyzed for whole-body selenium concentrations (Downstream Strategies 2016, Lemly 2018). Initially the June 2016 study targeted bluegills (*Lepomis macrochirus*) but after finding a limited number of YOY bluegills in Curds Inlet, the target species was switched to largemouth bass since many were found. The YOY bass collected measured approximately 0.5–2.0 inches and were described as "juveniles" (Downstream Strategies 2016).

The deformities assessment was conducted on one composite assessment sample comprised of 548 YOY fish and results were reported as follows:

- Spinal deformity (lordosis, scoliosis) = 49 (9%)
- Craniofacial deformity = 16 (3%)
- Fin deformity = 2 (0.3%)

For the six analytical composite samples, comprised of approximately 80 YOY fish, the selenium whole-body results were reported as follows:

- Upper Curds 5.9–7.0 mg/kg dry weight
- Middle Curds 6.9–8.5 mg/kg dry weight

1.4.8 KY Department of Fish and Wildlife Studies (Fish Community Data)

There are 242 fish species in Kentucky, 226 of which are native (KDFWR 2016). About 40 fish species are important to anglers, with 15 species common to all of Kentucky's major lakes, all of which are human-made impoundments. Three black bass species, the largemouth, smallmouth (*Micropterus dolomieu*), and spotted bass, are Kentucky's most popular game fish. Other popular and widely distributed game fish are crappie (*Poxomis sp.*), catfish (*Ictalurus punctatus*), bluegill, and white (*Morone chrysops*) and hybrid bass (*Morone chrysops x Morone saxatilis*).

Annual largemouth bass population data are available covering the years of 1996–2016 for Herrington Lake. During the years of 2004–2015, KDFWR used standardized sampling methods to collect sport fish species from Herrington Lake by electrofishing or gill netting. Monitored measures included otolith-derived age/growth, catch-rate, mortality, recruitment, length/weight, water temperature, and dissolved oxygen. Angler surveys were also conducted during some study years. The sampling and survey results included species composition, relative abundance, and catch-per-unit-effort (CPUE). The total assessment score for largemouth bass from Herrington Lake range from "good" to "excellent," with exception for the years 2009 and 2011 which were reportedly impacted due to fluctuating water levels during fish spawning seasons.

Performance reports are also available, as follows:

- Black bass: During the springs of 2004–2015, the KDFWR electrofished for black bass in Herrington Lake. Each spring survey included 2.5 hours of sampling from each of the upper, middle, and lower lake sections to produce estimates of species composition relative abundance, and CPUE for largemouth, spotted, and smallmouth bass. Largemouth bass are, by far, the most abundant black bass species in Herrington Lake. Spotted bass, on average, comprised roughly 15% of collected samples. Smallmouth bass are rare in Herrington Lake and none were collected during most years.
- Hybrid striped bass and white bass: During the autumns of 2004–2015 KDFWR gill netted for hybrid striped bass and white bass in Herrington Lake. Sampling duration ranged from 12–18 net-night sampling periods. Overall, the results indicated equal abundance for hybrid striped bass and white bass with both exhibiting excellent growth rates for Herrington Lake. The 2015 white/hybrid bass population assessment for Herrington Lake indicated a "fair" population of hybrid striped bass and a "good" population of white bass. The white bass population was recovering from a June 2013 major die-off.
- White and black crappie: During the springs of 2004–2012 KDFWR electrofished for white and black crappie in Herrington Lake. Each spring survey included 1.5 hours of sampling for each of the upper, middle, and lower lake sections to produce estimates of species composition relative

abundance, and CPUE for largemouth, spotted, and smallmouth bass. Results of the 2004–2012 survey suggest that the white crappie population is increasing in the middle and upper lake sections but in the lower lake, the black crappie is more abundant than white crappie. Based on the annual reports, no crappie surveys were conducted during 2013–2015.

- Bluegill: Bluegills are a forage fish species in Herrington Lake. KDFWR does not stock bluegills in Herrington Lake.

The KDFWR annual reports informed the CAP field sampling program regarding fish species selection (Ramboll 2017a).

1.4.9 Groundwater Monitoring Under CCR Rule

In compliance with the USEPA CCR Rule, 40 C.F.R. Part 257, groundwater is monitored at seven wells at E.W. Brown Station located in proximity to the Auxiliary Pond and the Landfill as part of a required detection monitoring program for these regulated CCR units. These wells have been sampled periodically since October of 2016. Selenium has not been detected to date at any of these wells at concentrations above human health risk-based screening levels. Three metals (cobalt, lithium, and molybdenum) have been detected above groundwater standards specified in the CCR Rule that trigger further monitoring requirements and potential corrective action. The sampling results for these three metals are discussed as part of the HHRA in Section 4. Similarly, lithium, and cobalt and molybdenum detected in the water from HQ and Briar Patch Springs and in the Auxiliary Pond Outfall KPDES BRN001 are discussed in in the ERA in Section 5.

1.5 KDOW Water Quality Standards Criteria for Selenium

The KDOW water quality standards acknowledge that selenium geochemistry is relevant to an understanding of toxicity (KDOW 2016b). The standard states that in natural environments, selenium exists in four oxidation states (KDOW 2013):

- Selenide (-II).
- Elemental Selenium - Se (0).
- Selenite, SeO32- (IV).
- Selenate SeO42- (VI).

Where:

- The two predominant selenium species that constitute total selenium in the water column are selenite and selenate;
- The presence of sulfate in the water column modifies or attenuates the potential acute toxicity effects of selenite; and,
- Toxicity of selenium species is generally as follows: Se-met (selenomethionine, se-amino acids) > SeIV > SeVI.

The primary KDOW chronic water quality standard for selenium is based on adult whole-body tissue concentration for protection of aquatic life.

If fish tissue data are available, fish tissue data shall take precedence over water column data.

- The whole-body fish tissue water quality standard is 8.6 mg/kg total selenium, dry weight.
- A concentration of 5.0 µg/L or greater selenium in the water column shall trigger further sampling and analysis of whole-body fish tissue or alternately of fish egg/ovary tissue.

The USEPA states that when egg/ovary concentrations are measured, the values supersede other values for whole-body, fillet, or water column data. Kentucky has adopted an egg/ovary standard for total selenium of 19.6 mg/kg. The Kentucky standard was not approved by USEPA and it is expected that Kentucky will repeal its egg/ovary standard from its water quality standards. USEPA adopted a recommended egg/ovary criterion for selenium in 2016 (15.1 mg/kg). Throughout this report, both standards are referenced.

1.6 Report Organization

This Corrective Action ISARA Report is submitted in partial fulfilment of obligations under the Agreed Order. Preliminary results of the Phase I investigation and a proposed Phase II Plan were presented to the Cabinet in March 2018 during a meeting between the Cabinet and representatives of KU. The preliminary findings from the Phase II investigation were presented in January 2019 during a meeting between the Cabinet and representatives of KU.

The remainder of this report is organized as follows:

- Section 2 provides a description of Phase I and Phase II sampling locations, methods, and results.
- Section 3 provides a preliminary study of Sources, Loading, and Fate and Transport of metals into and within Herrington Lake.
- Section 4 is the HHRA.
- Section 5 is the ERA.
- Section 6 includes a summary and some preliminary conclusions.
- Section 7 includes recommendations for future study.

This Corrective Action ISARA Report also provides a series of supporting appendices, as follows:

- Appendix A - Geographic coordinates for all sampling locations.
- Appendix B - Digital image logs for all of the sampled media.
- Appendix C - A summary of the surface water profiling results transcribed from the field data sheets (Appendix C1) and figures summarizing fish field-weight and field-length by species (Appendix C2).
- Appendix D – The Phase I and Phase II field data sheets.
- Appendix E - The Kentucky Division of Water (KDOW) Environmental Services Branch (ESB) 2016-2018 fish tissue analytical data reports.
- Appendix F – Phase I/Phase II Complete laboratory reports, including the sample chains of custody and supporting information for the Level II and Level IV laboratory analytical results validation.
- Appendix G – the third-party analytical results Level II and Level IV validation reports.
- Appendix H – HHRA supporting information.
- Appendix I – ERA supporting information.

2. CHEMICAL NATURE AND EXTENT

This section describes the Phase I and Phase II sampling methods and provides reporting data for the Phase I and Phase II field efforts. In addition, this section describes the nature and extent of CCR constituents in Curds Inlet and in other locations throughout Lower Herrington Lake. Phase I and II analytical results for each sampled medium (surface water, sediment pore water, sediment, aquatic invertebrates, and aquatic vegetation), and calculated whole-body results in fish, including adult and YOY fish, are provided in Tables 2-1A through 2-14. This section also discusses the analytical results and key findings, including any potential data gaps to inform Section 7 recommendations for future field sampling of Herrington Lake. The analytical laboratory reports and third-party data validation reports are in Appendices F and G, respectively. This section also reports and briefly discusses the YOY study findings.

2.1 Sampling Methods, Field Data Sheets, and Digital Image Logs

Phase I and Phase II sampling was conducted in accordance with the CAP, QAPP, and the SOPs 2sampling methods, as follows:

- Adult fish sampling methods (Section 2.1.1).
- YOY bluegill sampling methods and field results (Section 2.1.2).
- Surface water profiling and sampling methods (Section 2.1.3).
- Sediment pore water sampling methods (Section 2.1.4).
- Sediment collection methods (Section 2.1.5).
- Aquatic vegetation sampling methods (Section 2.1.6).
- Aquatic invertebrate sampling methods (Section 2.1.7).
- Phase I and Phase II Field Quality Assurance/Quality Control Procedures (Section 2.1.8).

Sample geographic coordinates for the Phase I and II field efforts were recorded using a Trimble® Yuma Global Positioning System (GPS) Tablet for use in a Geographic Information System (GIS). The recorded coordinates are provided in Appendix A. Digital images of samples and image logs are provided in Appendix B for Phase I and Phase II sampling efforts, as follows:

- Appendix B1: General Fishing Methods Digital Image Log
- Appendix B2: Adult Fish Sample Digital Image Log
- Appendix B3: Lake Profiling and Surface Water Collection Digital Image Log
- Appendix B4: Sediment Pore Water Collection and Preparation Digital Image log
- Appendix B5: Sediment Sample Digital Image log
- Appendix B6: Aquatic Invertebrates and Vegetation Sample Digital Image Log
- Attach. I1-5: YOY Bluegill Analytical Samples: Digital Image Log

Phase I and Phase II field water quality parameters are provided in Appendix C. Phase I and II completed field data sheets are provided in Appendix D, as follows:

- Appendix D1: Adult Fish Sample Data Sheets (Phase I and Phase II)
- Appendix D3: Lake Profiling and Surface Water Collection Data Sheets (Phase I Stratification and Overturn and Phase II Stratification)
- Appendix D4: Sediment and Pore Water Sample Collection Data Sheets (Phase II)
- Appendix D5: Aquatic Vegetation Field Data Sheets (Phase I)
- Appendix D6: Aquatic Invertebrates Field Data Sheets (Phase I)

The Phase II YOY fish assessment digital image log is also provided, as discussed in Section 5 of this report.

2.1.1 Adult Fish Sampling Methods

Adult fish sampling included fish tissue collection in accordance with the KDOW fish collection protocols, as applicable for the Herrington Lake Study Area habitats (KDOW 2014; Ramboll 2017c). Both Phase I and II included adult fish sample collection from Lower Herrington Lake (LHL) (Figures 1-3A–C and 1-4A–C). Phase I also included two additional sampling regions within Middle Herrington Lake (MHL) (Figure 1-3D). Adult fish sampling targeted the following trophic levels:

1. Lower trophic level predator/prey fish:bluegill (*Lepomis macrochirus*) and green sunfish (*Lepomis cyanellus*) were collected at Dix River, downstream from Dix Dam, where there were not enough bluegills available.
2. An upper trophic level predator: largemouth bass (*Micropterus salmoides*) and spotted bass (*Micropterus punctulatus*) (also known as Kentucky bass) were collected from Lower and Middle Herrington Lake. One brown trout (*Salmo trutta*) was also collected from the Dix River below Dix Dam.
3. A bottom scavenger/ bottom dwelling ambush predator: channel catfish (*Ictalurus punctatus*) and flathead catfish (*Pylodictis olivaris*) were target species from each of the areas of the lake. Northern hogsuckers and spotted suckers were collected from the Dix River, below Dix Dam, where enough catfish were not available at the time of sampling to complete the sampling requirements.

The adult fish were collected during daylight, using electrofishing, or overnight, using overnight deployed gill nets, opportunistically within the epilimnion (for largemouth bass, bluegill, and catfish) and the metalimnion (catfish only). Samples were collected within the specified 1.5 total days fishing effort per sampling region. Once collected, the adult fish were identified for species, and general physical condition including any physical abnormalities. Such abnormalities were not observed.

During the Phase I effort, significant effort was made to maintain target-species consistency throughout the Study Area; however, local environmental factors including habitat-type variability (e.g. above vs. below Dix Dam), steep near-shore bathymetry (not ideal habitat for bluegills or largemouth bass), and sample region size (e.g. small HQ Inlet) decreased daily catch-per-unit-effort (CPUE) of target species and increased catch-species variability. Wherever enough largemouth bass were not available, Kentucky bass were substituted. The spotted (Kentucky) bass, often mistaken for the largemouth bass, is native to the Mississippi River Basin. The two species are physically similar, but the Kentucky Bass is typically smaller, having a slightly smaller mouth and a circular tooth patch on its tongue. At the Dix River location, downstream from the dam there were not enough catfish available to complete the sample requirements; as such, northern hogsuckers and spotted suckers were substituted. For Phase II, all target species and samples were collected within the 1.5 days effort per adult fish sample.

Once collected and visually assessed, the adult fish were grouped by location and species, then grouped again into composite whole-body samples of 2–5 fish per sample, where sufficient fish numbers were collected. Sample weights and sizes were field-measured and, wherever possible, non-target fish were immediately released back into the lake or river. Adult fish within a composite sample measured a minimum of 75% of the length of the longest group individual. Digital images were recorded of each YOY bluegill prior to the bluegill being wrapped in aluminum foil (dull side against the

sample) and placed into plastic bags. The bags were labelled with project name, sample identification number (ID), species, location, and date-time. The wrapped, bagged, and labeled fish samples were placed in the freezer and freezer temperatures were checked at the beginning and end of every field-sampling day to ensure that the samples remained frozen.

Adult fish ovary samples were collected from bass and catfish by the fisheries biologists in the field, as specified in the CAP.

2.1.2 YOY Bluegill Field Sampling Methods and Field Results

The 2018 YOY bluegill collection was conducted via methods consistent with the 2016 Curds Inlet YOY largemouth bass study (Downstream Strategies 2016; Lemly 2017, 2018). The 2018 YOY study extended well beyond Curds Inlet to evaluate if a gradient of YOY tissue concentrations and/or YOY deformities conditions away from Curds Inlet was detectable. Downstream Strategies (2016) collected approximately 550 YOY largemouth bass from three locations within Curds Inlet and composited them into a single assessment sample. The 2016 study initially targeted bluegills (*Lepomis macrochirus*), but after finding very few, the target species was switched to YOY largemouth bass to reflect the large numbers found in Curds Inlet during summer of 2016. The 2018 YOY study initially targeted largemouth bass and ultimately changed to a YOY study program focused on bluegills as the target species. This change of target species was discussed with the Cabinet in advance of the change from bass to bluegill. Specifically, in a letter from the Cabinet to KU dated July 18, 2018, the Cabinet stated that

> "The Kentucky Department for Environmental Protection (Department) received a letter dated July 18, 2018 from Ramboll Environ on behalf of Kentucky Utilities (KU) which describes the unsuccessful effort to collect bass Young-of-the-Year (YOY) as part of the Phase II sampling of Herrington Lake. Fisheries biologists with the Kentucky Department of Fish and Wildlife Resources were consulted, and they indicated that bass spawning appears to have been unsuccessful at many lakes throughout the Commonwealth this year due to abnormal water temperatures and rainfall. The lake levels at Herrington Lake were down during the spawning season as well due to construction on the Kennedy Bridge, which also could have contributed to the lack of bass YOY available for collection.
>
> Based on the unsuccessful collection efforts for bass YOY, during a conference call on July 12, 2018 KU proposed an alternative YOY study to be performed on bluegills instead of bass. Based on the results of previous studies it has been determined that the bluegill is a species that is equally or more sensitive than bass with respect to selenium. Preliminary observations by Ramboll field staff indicate there are sufficient numbers of bluegill to conduct the study. The Department concurs with the approach to revise the study to collect bluegill YOY if conditions are favorable in Herrington Lake. The sampling and deformities evaluation methods will be the same for bluegill or bass, therefore the procedures in the existing YOY QAPP Addendum and YOY SOP are acceptable without change, provided the documents are updated to reflect the change in species from bass to bluegill."

The Phase II YOY field effort covered 7 distinct YOY sampling regions, included three separate YOY bluegill sampling regions within Curds Inlet that aligned with the Downstream Strategies 2016 YOY bass sampling regions, to investigate any possible gradient away from E.W. Brown Station.

As identified on Figure 1-4D, the YOY bluegills were collected from the following sampling regions:

- Upper Curds Inlet (near the outfalls) (UCI)
- Middle Curds Inlet (near the middle portion of Inlet) (MCI)
- Lower Curds Inlet (near the mouth of the inlet with the lake, near CI4) (LCI)
- HQ Inlet (HQ)
- LHL1 Rocky Run (LHL1)
- Hardin Inlet (HI)
- LHL6 Cove (LHL6)

LHL1, HI, and LHL6 are located approximately a mile or greater from E.W. Brown Station. Efforts were also made to sample an additional region (LHL3 Cove) but those efforts were unsuccessful due to the presence of human activity in the area during the sampling event. Total lengths of the target bluegills ranged 0.75–4 centimeters (cm) (approximately 0.4–2 inches) and all collected YOY bluegills were in the post swim-up juvenile stage. The juvenile bluegills were collected using seine nets, minnow traps, dip nets, and by electrofishing. Overall, most of the 3000+ YOY bluegills were collected by seine netting. In the upper inlets, seine netting presented some practical challenges related to floating and submerged logs, debris, and trash. To address this challenge for Upper Curds Inlet, a modified method of seine net deployment was employed. Like dip netting, the larger seine net was submerged to the bottom and held there until the fish became accustomed to the net and swam over it. The net was then quickly pulled to the surface, trapping hundreds of fish in a relatively brief period of time. Elsewhere, including HQ Inlet, Hardin Inlet, and LHL6, conventional seining methods were suitably productive. Due to difficulties in seining along the deep rock ledge-type shorelines, minnow traps were the primary collection method locations in LCI and outer HQ Inlet with up to 30 concurrently deployed and monitored traps. Opportunistic dip netting also helped complete the LCI assessment sample and was the primary collection method in Rocky Arm (LHL1). Electrofishing was only employed to complete the analytical samples for two locations, HQ Inlet and Hardin Inlet (HI), and only when the other collection methods were not sufficiently productive within the allotted sampling periods. No discernible electrofishing-related physical effects (burns etc.) were observed on any of those fish but as a cautious measure, the electrofished portions of the HQ and HI analytical samples were retained separately from the other samples for laboratory analysis for selenium. In addition, the electrofished samples were not used in the visual assessment for abnormalities. Table 1-2C reports the number of individual fishes collected within each Herrington Lake fish sampling region.

2.1.2.1 YOY bluegill for Assessment of Anatomical Abnormalities

Each of the three Curds Inlet YOY fishing regions provided the minimum assessment sample-size target of 500 bluegills for each sample. The visual assessment samples were preserved in 95% ethanol upon collection, and sent to Richard Lockwood (Ramboll, Nashville Tennessee Aquatic Toxicity Lab) for detailed visual examination under microscope for physical abnormalities including:

- Spinal curvature (kyphosis, lordosis, and scoliosis);
- Craniofacial defects (including mouth, jaw, and gill cover);
- Fin irregularities (missing, misshaped, vestigial);
- Eye abnormalities (including lens cataracts and exophthalmos); and
- Edema (fluid accumulation).

Digital images were captured of all assessed YOY bluegills having physical abnormalities, including a ruler or reference grid to measure sizes. Dr. John Hawke, an independent third party and professor in the Department of Pathobiological Sciences, Aquatic Diagnostic Laboratory at the Louisiana State University School of Veterinary Medicine (LSU), also assessed 25% of the assessed-normal YOY

bluegills and all assessed YOY bluegills exhibiting any physical abnormality. For more detailed information about the Ramboll Aquatic Toxicology Lab and the LSU Department of Pathobiological Sciences see the QAPP Addendum concurrent with the *Phase I Technical Memorandum* (Ramboll 2018a,b).

2.1.2.2 YOY Bluegill Analytical Samples

For each YOY sampling region, two additional tissue samples, each consisting of multiple YOY bluegills to ensure minimum sample weights of 5 grams each (for metals analyses), were also collected and shipped to the analytical laboratory to measure selenium, percent moisture, and percent solids. The analytical samples were frozen for shipment to the lab.

2.1.2.3 Selenium Analysis for YOY Preserved Bluegills

Exophthalmia was observed in some of the YOY fish collected from Middle Curds Inlet (MCI) and Hardin Inlet (HI). A subset of these YOY ethanol-preserved samples were weighed, digitally imaged, and shipped to the laboratory for analysis of selenium as described in the SOP: Selenium Analysis for Young-Of-The-Year (YOY) Preserved Bluegill Whole-Body Tissues, E.W. Brown Station, Mercer County Kentucky (Ramboll 2018c).

The preserved YOY bluegill samples for analysis were sorted into the following groups:

- YOY fish with exophthalmia from Middle Curds Inlet (MCI)
- Normal YOY fish from MCI
- YOY fish with exophthalmia from Hardin Inlet (HI)
- Normal YOY fish from HI

A total of four (N=4) ethanol-preserved YOY bluegill samples were shipped to the laboratory for analysis of the fish tissues and of the relevant residual ethanol. An additional sample of unused ethanol was also analyzed to serve as a blank to confirm that the laboratory grade ethanol prior to any use in the YOY study.

2.1.3 Surface Water Profiling and Sampling Methods

As per the CAP, Lower Herrington Lake surface water profiling and sample collection were conducted during both stratified (Phase I, October 2017, and Phase II, June 2018), and overturn (December 2017) conditions to compare the seasonal results and to provide data to examine any influence of seasonal cycling in Herrington Lake on the surface water metals concentrations. When appended to the Phase I results, the Phase II results also provide year-on-year comparison data for 2017–2018 for Lower Curds Inlet (CI4), HQ Inlet, Rocky Run (LHL1), and LHL6 (near Sunset Marina), while also providing new focused results for the middle Curds Inlet region (new Phase II transects CI2.2 and CI3.1) (Figures 1-3B–C and Figures 1-4B–C).

2.1.3.1 Lake Thermal Stratification and Overturn Sampling Approach and Results

Herrington Lake water levels are available from the United States Geological Survey (USGS) water quality monitoring stations located near Burgin, Kentucky (Station 03286000) and near Dix Dam in Herrington Lake (Station 03286000). Figure 2-1A displays simple linear time-averaged air temperatures for the March / April 2015–2018 spring seasons. These data document the colder conditions in 2018 that affected the timing of local fish spawning. Figure 2-1B illustrates yearly Herrington Lake water levels at Dix Dam for the period of September 2015 to September 2018. These water level data indicate a typical yearly low-flow period spanning November to January, co-occurring with the typical timeframe of the lake overturn limnological cycle which made it a favorable time to

conduct the Phase I overturn surface water sampling. In general terms, lake overturn can cause sediment-at-depth to become (re)suspended and distributed in a lake. Seasonal lake flow trends and limnological cycling were thus relevant to the timing of the Phase I and II surface water sampling, including the December 2017 Phase I overturn surface water sampling described in the CAP (Ramboll 2017a). Section 2.1.3.1 of this Corrective Action ISARA Report provides additional information about lake thermal stratification as it applies to Herrington Lake and to the Phase I and II sampling efforts.

Thermal stratification of a lake refers to varying lake water temperatures related to depth. This seasonal process happens because water density is a function of temperature, with water being most dense at 4 degrees Celsius. The Phase I sampling for Herrington Lake targeted up to three layers of stratification, the epilimnion (upper layer), metalimnion (middle layer), and hypolimnion (deepest layer), wherever stratification was observed. For the shallower well-mixed lake areas that lacked stratification, a single mid-depth water sample was collected. Lake overturn occurs when lake surface temperatures approach deeper water temperature and lake turnover occurs, aided by events such as storms or high winds. Herrington Lake fall overturn occurred in late November 2017 and the Phase I overturn sampling occurred in December 2017.

Knowledge of the Herrington lake stratification and overturn conditions was obtained using water profiling, as described in the Surface Water SOP (Ramboll 2017d). Prior to each of the three surface water sampling events, Exploratory profiling was conducted at select sites to confirm the seasonal status of the lake (stratification vs. overturn). For each surface water sampling transect location in lower Herrington Lake, profiling was conducted just prior to collecting the target surface water sample(s), to provide information about the number of stratified lake layers and to help identify appropriate sample depths for each location. The water profiles were collected using a Yellow Springs Instruments® (YSI®) 650 Multiparameter Display System (MDS) water monitor with an YSI® 6920 V2 Sonde including 200 feet of field cable. The Phase II profiles were also confirmed using a YSI 600xlm Sonde and a Horiba U10 water quality monitoring unit.

Both the YSI® 6920 V2 and 600xlm sondes arrived onsite lab-calibrated and thereafter were calibrated prior to sampling each day. Recorded water quality and lake profile parameters included water depth in feet bws, turbidity (Secchi depth in feet) (Cialdi and Secchi 1865), water temperature (in °C or degrees Celsius), dissolved oxygen (DO), specific conductivity (in millisiemens per centimeter, mS/cm) and acidity (pH). These parameters, considered together with time-of-year, helped determine the lake surface water profile(s) for each sample transect. The surface water samples were co-located with the thalweg sediment samples.

Phase I surface water profiling indicated that, apart from one sampling transect near the mouth of Curds Inlet (CI4 water depth = 75–90 feet bws, a single depth interval was deemed adequate during both stratification and overturn events, for the shallower well-mixed locations within Curds Inlet, HQ and Hardin Inlet, and the Dix River. Surface water sampling from shallow, downstream Dix River targeted a single mid-depth sample along this transect, since the shallow river water also appeared to be well-mixed, likely due to its proximity to flow from the dam. Phase II surface water profiling results were consistent with the Phase I results except that two surface water samples were collected from HQ Inlet as profiling near the mouth of HQ Inlet indicated a cooler, stratified lake layer near the bottom at the thalweg (48–52 feet bws). As such, an additional water sample was collected at 50 feet bws, in addition to the sample already collected at 10 feet bws.

Surface water samples were collected at depth using grab sampling methodology and a Van Dorn-type horizontal water sampler, as identified in the SOP (Ramboll 2017d, Van Dorn 1957). The sampler was lowered to the desired depth and then sent the messenger weight down the tethered line to trigger the caps on the end of the cylindrical sampler to close, sealing in the water at depth. Water samples were collected from the approximate middle of each of the surface water transects. Each sample was placed on ice immediately upon collection prior to shipment to the laboratory. Except for the matrix spike/matrix spike duplicate (MS/MSD) field samples, which require triple the volume of a standard parent sample, the Van Dorn provided enough volume to fill all the laboratory containers with one grab sample.

Depending on the water depth at the time of sampling, the stratification surface water sampling included one sample from each stratified lake layer, the sunlight zone (epilimnion), the mid-depth zone (metalimnion aka thermocline), and the deep-water zone (hypolimnion), to a maximum depth of approximately 100 feet bws. Overturn surface-water sampling included a single water sample from 25 feet bws. For the shallow inlet sampling locations having water depth of less than 25 feet bws, the single winter sample was collected from mid-depth in the water column.

With the exception of the single surface water sample collected from Dix River, Phase I surface water sampling was completed sequentially from downstream to upstream locations starting with location LHL1 (Rocky Run Embayment), LHL2 (Dix Dam), and proceeding to Curds Inlet, and then up the main lake through the open-water sampling locations of LHL3, LHL4, LHL5, and LHL6 (surface water sampling locations displayed in Figures 1-3A–C). Surface water samples were collected for both total and dissolved metals from each location, at each depth. Surface water samples for dissolved metals were filtered through a 0.45 micron (µm) inline filter directly into sample containers. For logistical and field safety reasons, including increased summertime boat traffic and afternoon wind and waves, the Phase II surface water collection started with LHL6 and then progressed to LHL1, LHL3 Cove entrance, HQ Inlet, and CI4.

The DO and temperature profiles from the Phase I and Phase II sampling efforts are illustrated on Figures 2-2A through 2-2D. The profiles indicate both DO and temperature stratification during the stratification-phase sampling. The Phase II DO profiles indicate that oxygen depletion (low DO) occurred at shallower water depths compared to the Phase I stratification-phase profiles. The Phase I overturn profiles (December 2017) for both DO and temperature are more stable and well-mixed compared to the profiles from the two stratification-phase sampling events (October 2017 and June 2018).

2.1.4 Sediment Pore Water Sampling Methods

Phase I sediment pore water sampling targeted Curds Inlet, HQ Inlet, and Hardin Inlet to collect samples for selenium and arsenic speciation. The goal of the Phase II pore water sampling effort was to provide focused results for the middle Curds Inlet region, including four new sampling transects CI2.1, CI2.2, CI3.1, and CI3.2. Pore water samples were collected using duration-deployed passive-diffusive modified Hesslein in-situ interstitial water samplers (hereafter referred to as peepers) (Hesslein 1976). The 5 and 10 milliliter diffusion chambers were filled with deionized water and capped with a 3M™ 0.45 µm semipermeable latex mesh membrane, allowing constituents to diffuse into the chambers, providing time-averaged, estimates of metal concentrations in the sediment pore water. With the combination of the 0.45 µm peeper membrane and the use of a 0.45 µm syringe filter (to extract the pore water from the peeper), all the pore water analytical results are thus dissolved. Before deployment, the casing was decontaminated and thoroughly rinsed with deionized water. Phase

II results also provided data to fill data gaps resulting from the loss of five (of 23) peepers that were not recovered during the Phase I sampling effort, possibly due to fallen debris, seasonal sediment scouring, or natural dredging in Curds Inlet.

The pore water sampling locations were determined along transects and physical location of the peepers was based on the presence of sediment deposits identified by divers at the time of sampling. The peepers were buried horizontally within the upper 6-inch sediment interval of sediment. The pore water sampling locations are identified on Figures 1-3C and 1-4C. Wherever enough soft sediment was available, including at some thalweg locations, the diver hand-pressed the peepers into the soft sediment. The peepers were connected to leader lines and small bright-orange buoys were suspended underwater approximately 2–3 feet above each deployed peeper. A GPS unit confirmed the sample geographic coordinates for each deployed peeper recorded. The peepers were deployed for a minimum of three weeks to allow the pore water in the chambers to equilibrate to the local surroundings.

2.1.4.1 Sampling for Speciated Selenium and Arsenic

Selenium and arsenic exist in multiple oxidation states in the natural environment and form an array of inorganic and organic species through physical, chemical, and biological processes. The primary selenium species are selenite (SeO_3^{2-}, or SeIV), selenate (SeO_4^{2-}or SeVI), and organo-selenide (e.g., selenomethionine or org-Se[II]). The primary arsenic species are arsenite (As^{3+} or As[III]) and arsenate (As^{5+} or As[V]). Understanding selenium and arsenic speciation is critical to understanding its mobility, transformation, and partitioning in the environment. Selenium and arsenic geochemistry are discussed in detail in section 3.3.1 and 3.3.2, respectively.

To preserve the selenium and arsenic speciation-ratios, the divers took great care to retrieve the peepers while preserving them in their native sediment and without exposing them to ambient air. Using a digital camera, the peepers were then photo-documented in their native sediment, gently but thoroughly rinsed with distilled water, then the pore water was extracted from the chambers using sterile syringes, leaving no headspace in the syringe. The pore water was then transferred to the sample containers in an anoxic environment using a specialized laboratory containment bag filled with argon. Since sample containers for speciated selenium required no headspace, the argon bag method ensures that any amount of headspace is filled with inert argon, not air.

2.1.5 Sediment Sampling Methods

Apart from the single sediment sample collected by field biologists from Dix River below Dix Dam, the divers collected all the sediment samples, concurrently with the deployment of the peepers, and from the identified sampling transects (Figures 1-3A and 1-4B). The peepers were placed as near as possible to associated sediment sampling locations, targeting depositional areas as follows:

- Location A: Subaqueous, at or near the deepest point in the channel (thalweg),
- Location B: Subaqueous, at a depth below winter pool (approximately 725 feet above mean sea level [msl]; and
- Location C: A location above winter pool elevation and below summer pool elevation (approximately 740 feet above msl).

Sediment sample locations targeted the 0–6-inch interval of depositional sediment having consistent geochemical composition. The commercial divers collected several grab-type sediment samples from each sampling location to ensure enough sample volume for laboratory analyses for metals and grainsize. The individual sediment grab samples were then homogenized and placed into glass

sampling containers. Sediment lithology (texture, color, etc.) was recorded and digital images were collected of each sample container (Appendix B6).

2.1.6 Aquatic Vegetation Sampling Methods

The Phase I sampling effort included aquatic vegetation (AV). The AV samples were collected using nets, gloved hands, or by simply scooping the vegetation directly into the sampling cylinder. The AV samples were placed in holding containers, on ice, in a cooler, until enough sample mass was achieved at each sampling location, for laboratory analytical analysis. If larger submerged or emergent aquatic vegetation was located within a target area, a sample was collected from that area and this would be included as part of a composite aquatic vegetation sample. The field sampling teams made a conscious effort to minimize any sampling-related disturbances to the aquatic habitat. To meet sample-volume requirements, individual plants were identified at a general level (e.g., periphyton, submerged aquatic vegetation), and then composited. The composited samples were rinsed, pat-dried, and sample weights were recorded. The samples were then wrapped in aluminum foil (dull side against the sample) and placed into labelled plastic zip-top bags. The labels included project name, sample identification, sample date, and time, and the analyses requested. Samples were then placed in one of the two portable laboratory freezers to await shipment to the laboratory for analysis. The aquatic vegetation sample locations are displayed in Figures 1-3A and 1-4A.

2.1.7 Aquatic Invertebrate Sampling Methods

The Phase I aquatic invertebrate sample locations were co-located with the surface water transects within lower Herrington Lake (Figures 1-3A–B). Aquatic invertebrate sample methods included fine-mesh hand netting, limited trap deployment (for crayfish in Curds Inlet and HQ inlet), and opportunistic hand-catch methods throughout each lake-section. Conscious effort was made to minimize any sampling-related disturbance to the aquatic habitat. The invertebrate samples were placed directly into lake water-filled Ziploc bags, then in a cooler having moderately cool temperature with limited direct exposure to the cold ice (to avoid early mortality before the end of the 24-hour [hr] depuration period), until enough sample mass was achieved at each sampling location. The individual invertebrates were then keyed, and field-identified to the lowest practical taxonomic level. Sample weight was then measured and recorded. After the 24-hr depuration period, the live-invertebrates were then wrapped in aluminum foil (dull side against the sample), and placed into a small, plastic zip-top bag. The bags were labelled with project name, sample identification, sample date, and time, and the analyses requested. Samples were then placed in one of the two portable laboratory freezers to await shipment to the laboratory for analysis.

2.1.8 Phase I and Phase II Field Quality Assurance/Quality Control Procedures

Quality assurance and quality control samples were collected during the Phase I and II field investigations included field duplicate samples and equipment blanks, per the Phase I and II QAPPs and SOPs (Ramboll 2017b–f; Ramboll 2018b–d). Sample preparation, and analysis methods for field duplicates (FD) were consistent with that of the parent samples but included the letters "FD" appended to the sample ID. One field duplicate was collected for every 10 parent samples and one equipment blanks (EB) was collected per equipment type and field event, wherever relevant. As a control measure, matrix spike/matrix spike duplicates were performed by the laboratory at a frequency of one for every 20 field samples. Fish tissue split samples were submitted to the Kentucky Environmental Services Branch for chemical analysis. Analytical data were submitted for third-party USEPA Level II and Level IV data validation, as specified in the approved CAP and Phase II Plan. The YOY fish deformities assessment also included a third-party validation by the Louisiana State

University Pathology Laboratory with 100% of fish with anomalies observed and 25% of normal fish evaluated.

2.2 Analytical Results by Medium and Risk-based Screening Levels Considered

The analytical results are graphically presented and described in Figures 2-3A though Figure 2-9H, as described in the discussion of analytical results on a metals specific basis in Section 2.3. This section identifies the tables which present the Phase I and Phase II analytical results by medium. In addition, this section discusses:

- The methods for calculating whole-body fish tissue concentrations (Section 2.2.1)
- The summary of risk-based screening levels (Section 2.2.2)
- The basis of risk-based surface water and pore water screening values (Section 2.2.3)
- The basis of risk-based sediment screening values (Section 2.2.4)
- The basis of fish risk-based screening values for ecological consideration (Section 2.2.5)
- Fish consumption advisories for Herrington Lake (Section 2.2.6)
- The method for estimating human health risk-based concentrations for fish (Section 2.2.7)
- And a discussion of key findings for analytical results by medium as they compare to the risk-based screening levels identified or the spatial patterns in results observed (Section 2.2.8)

The analytical results for each medium that are graphically presented in Section 2.3 in comparison to the risk-based screening levels discussed in this section are reported on a sample-by-sample basis in the following tables in Tables 2-1A through Table 2-6, as follows.

- Table 2-1A: Phase I Adult Bluegill and Green Sunfish Analytical Results (Fillet/Remains, Wet and Dry Weight)
- Table 2-1B: Phase I Adult Bluegill and Green Sunfish Calculated Whole-body Results (Dry Weight Selenium)
- Table 2-1C: Phase I Adult Bluegill and Green Sunfish Calculated Whole-body Results (Wet-weight)
- Table 2-1D: Phase II Adult Bluegill Results (Whole-body, Wet and Dry Weight)
- Table 2-1E: Phase I Adult Bass, Catfish, Trout, and Sucker Analytical Results and Calculated Whole-body Results (Dry Weight Selenium)
- Table 2-1F: Phase I Adult Bass, Catfish, Trout, and Sucker Analytical Results and Calculated Whole-body Results (Wet-weight)
- Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Filet, Remains, and Ovary, Wet and Dry Weight)
- Table 2-1H: Phase II Adult Bass and Catfish Analytical Results (Whole-body, Wet and Dry Weight)
- Table 2-1I: Phase II Young-of-the-Year Bluegill Analytical Results (Whole-body, Wet/Dry Weight)
- Table 2-2A: Phase I Surface Water Analytical Results (Stratification and Overturn)
- Table 2-2B: Phase II Surface Water Analytical Results (Stratification)
- Table 2-3A: Phase I Sediment Pore Water Analytical Results
- Table 2-3B: Phase II Sediment Pore Water Analytical Results
- Table 2-4A: February 2017 Sediment Analytical Results for Curds Inlet and Hardin Inlet
- Table 2-4B: Phase I Sediment Analytical Results
- Table 2-4C: Phase II Sediment Analytical Results
- Table 2-5: Phase I Aquatic Vegetation Analytical Results (Wet and Dry Weight)
- Table 2-6: Phase I Aquatic Invertebrate Analytical Results (Wet and Dry Weight)

The analytical results are summarized by medium with details such as the frequency of detection and range of detected results for the Phase I and Phase II field efforts combined in Tables 2-7A through Table 2-14, as follows:

- Table 2-7A: Adult Sunfish Tissue Results Summary (Whole-Body, Wet/Dry Weight) (Phase I/II)
- Table 2-7B: Adult Sunfish Tissue Results Summary (Fillet, Wet Weight) (Phase I)
- Table 2-7C: Adult Bass Tissue Results Summary (Whole-Body, Wet and Dry Weight) (Phase I/II)
- Table 2-7D: Adult Bass Tissue Results Summary (Fillet, Wet Weight) (Phase I)
- Table 2-7E: Adult Catfish Tissue Results Summary (Whole-Body, Wet/Dry Weight) (Phase I/II)
- Table 2-7F: Adult Catfish Tissue Results Summary (Fillet, Wet Weight) (Phase I)
- Table 2-7G: Adult Trout/Sucker Tissue Results Summary (Whole-Body, Wet/Dry Weight) (Phase I)
- Table 2-7H: Adult Trout and Sucker Tissue Results Summary (Fillet, Wet Weight) (Phase I)
- Table 2-8: YOY Whole-Body Bluegill Tissue Results Summary (Dry Weight) (Phase II)
- Table 2-9: Surface Water: Stratification Results Summary (Phase I and II)
- Table 2-10: Surface Water: Overturn Results Summary (Phase I)
- Table 2-11: Sediment Results Summary (Phase I and II)
- Table 2-12: Sediment Pore Water Results Summary (Phase I and II)
- Table 2-13: Aquatic Vegetation Results Summary (Phase I)
- Table 2-14: Aquatic Invertebrate Results Summary (Phase I)

2.2.1 Adult Whole-Body Fish Tissue Calculation

As per the CAP and the Adult Fish SOP (Ramboll 2017a,c), the collected Phase I adult fish were divided by the analytical laboratory into fillet and remains and, in select cases, the ovaries were extracted in the field. The fillet data were used in the HHRA (Section 4) and the whole-body concentrations were reconstructed by mathematically combining the separate fish-part concentrations for use in the ERA (Section 5). Subsequent paragraphs provide more details on the adult whole-body fish tissue calculations. The Phase II adult fish samples were analyzed as whole-body to provide additional data or the ERA. The KDOW selenium fish tissue standard is measured in whole-body dry-weight so both the Phase I and II selenium results are also reported in dry weight. Risk assessments typically report results in wet-weight so this report also includes wet-weight results. Tables 2-1A thorough 2-1H include the adult Phase I and Phase II, wet weight and dry weight, whole body, fillet data, and ovary data. The calculations used to reconstruct whole-body fish tissue concentrations (WBFC) for use in the ERA (Section 5) combine the fillet, remains, and ovary tissue (wherever relevant) results as described in the Adult Fish SOP as follows:

The general WBFC in mg/kg equation is:

$$WBFC = ([W_F/ W_{WB}] * C_F) + ([W_R/ W_{WB}] * C_R)$$

Where:

C_F = Constituent concentration in fish fillet composite sample (mg/kg)

C_R = Constituent concentration in remains composite sample (mg/kg)

W_{wb} = Weight of the whole fish body (kg)

W_R = Weight of the remains (g), where remains indicate the rest of the fish carcass that was not part of the specifically analyzed fillet or ovary tissues

W_F = Weight of the fillets (g)

WBFC Equation for Bluegills and Green Sunfish

For the bluegills and green sunfish, the fillets were extracted together as one mass because these are small fish. Ovaries were not extracted from either of the sunfish species. This variation of the general WBFC Equation applied to the bluegills and green sunfish analytical results, as follows. The weight of the whole fish body is equal to the weight of the paired-fillet and the remains as follows:

$$WBFC = ([W_F/ (W_F + W_R)] * C_F) + ([W_R/ (W_F + W_R)] * C_R)$$

WBFC Equation for Basses, Catfishes, Trout, and Suckers

For the larger fish where ovary samples were not collected, the fillets were removed by the laboratory and, for practical reasons related to the fillet drying process, lab analysis included one of the two fillets only. The whole-body calculation for these fish uses a fillet estimate that is twice the weight of the single fillet plus the weight of the remains, as follows.

$$WBFC = ([W_F/ (2*W_F + W_R)] * C_F) + ([W_R/ (2*W_F + W_R)] * C_R)$$

WBFC Equation for Basses, Catfishes, Trout, and Suckers – With Ovary Data

To estimate WBFC for the basses, catfishes, trout, and suckers where ovary data were collected, the weight of the whole fish body equals twice the weight of the single filet, plus the weight of the remains, plus the weight of the field-extracted ovaries as follows:

$$WBFC = ([W^F/ (2*W_F + W_R + W_O)] * C_F) + ([W_R/ (2*W_F + W_R + W_O)] * C_R)$$

Where:

W_O = Weight of the ovaries (g)

2.2.2 Risk-Based Screening Levels Used for Consideration of Results

Per the CAP, risk-based screening levels were assembled to provide one basis for evaluating the Phase I and II sampling results. In accordance with the CAP, the below risk-based screening levels are further explained in the human health and ecological risk assessments (Sections 4 and 5), as appropriate, and a preliminary remedy evaluation is provided in Section 6. These risk-based screening levels provide an understanding of the potential significance of Phase I and II detected metals concentrations to support the ecological and human health risk assessments and for the remedy evaluation. Because screening levels are conservative by design, they provide only a preliminary understanding of potential risk; additional information and/or investigation is warranted for those chemicals that exceed the identified screening levels. The human health and ecological risk-based screening levels are provided in Table 4-3 and Tables 5-2 and 5-3, respectively.

2.2.3 Risk-Based Screening Levels for Surface Water and Pore Water

Sources of surface water and pore water screening levels include:

- Kentucky Water Quality Criteria identified in Table 1 of the Kentucky Surface Water Standards 401 Kentucky Administrative Record (KAR) 10:031 Section 6 (KDOW 2016b) including:
  - Ecological acute and chronic water quality criteria.
  - Human health standards for drinking water and consumption of fish.
- USEPA Region 4 Ecological Screening Values, acute and chronic criteria (USEPA 2018b).

- USEPA Freshwater Ambient Water Quality Criteria for Selenium (USEPA 2016a).
- USEPA Regional Screening Levels (RSLs) (USEPA 2018a) for human health for drinking water are used for screening concentrations of constituents in the surface water. In addition, where available, Maximum Contaminant Levels (MCLs) for drinking water are used for screening. Use of screening levels based on drinking water is a health protective means to screen these data because recreational activities would result in lower exposure to surface water. Contact with surface water during recreational activities is discussed further in Section 4. Pore water concentrations are not relevant for human health.

2.2.4 Risk-Based Screening Levels for Sediments

Sediment screening levels include:

Ecological:

- USEPA Region 4 Ecological Screening Values (ESVs) and Refined Screening Values (RSVs) (USEPA 2018b).

No representative screening levels were identified for boron. Boron concentrations in sediment were evaluated through comparison with typical background ranges for boron in sediment provided in (Mason and Dragun 1996). No data are available for Kentucky. Background for Georgia, Washington, Illinois, Kansas, Nebraska, Michigan, Utah, and New Mexico demonstrate that naturally occurring background boron ranges are 10–700 mg/kg (averaging approximately 40 mg/kg).

Human health:

- USEPA RSLs (USEPA 2018a) for human health for exposure to residential soil derived assuming:
    - Exposure to soil 350 days per year for 30 years and based on an excess cancer risk of one in a million ($1x10^{-6}$), also expressed as a non-cancer hazard quotient of 1.
    - This is a highly protective basis for screening and would be expected to be much higher than exposure individuals might have to sediments. More developed sediment-contact exposure estimates are developed and described in the human health risk assessment (Section 4 of this Corrective Action ISARA Report).

2.2.5 Ecological Risk-Based Screening Levels for Fish

Ecological risk-based screening levels for fish include:

- Kentucky water quality criteria. 401 KAR 10:031 (KDOW 2016b) including:
    - Whole-body fish tissue for selenium
    - Ovary tissue for selenium
- The USEPA selenium ovary tissue criterion is also considered (USEPA 2016a)
- Scientific literature, such as Dillon et al. (2010), Beckvar et al. (2005), and additional fish whole-body residue values from Jarvinen and Ankley (1999).

More developed wildlife receptor exposure estimates are developed and described in the ecological risk assessment (Section 5 of this Corrective Action ISARA Report).

2.2.6 Fish Tissue Human Health Consumption Advisories

There are no fish consumption advisories specific to Herrington Lake, but it is subject to a Kentucky statewide advisory for mercury in fish for the following species-groups:

- Predatory fishes (largemouth bass, spotted [Kentucky] bass, and flathead catfish) - women of childbearing age and children 6 years and younger 6 meals per year, all others 1 meal per month.
- Bottom feeders (channel catfish, northern hogsucker, and spotted sucker) and pan fish (bluegills and green sunfish) - women of childbearing age and children 6 years and younger 1 meal per month, all other consumers should eat no more than 1 meal per week (KEEC 2018).

This information is used to estimate human health risk-based concentrations for fish ingestion, as described in Section 2.2.7.

2.2.7 Human Health Risk-Based Concentrations for Fish Ingestion

Risk-based concentrations (RBCs), protective of human receptors consuming fish tissue, were derived as described below, with screening levels summarized in Table 4-3. The RBCs for fish tissue were derived assuming an adult consumes 50 fish meals per year from the lake and that the fish meal size is eight ounces. The number of meals assumed here likely overestimates exposure for many anglers but is used for screening purposes and is consistent with the consumption rate used to develop the Kentucky statewide mercury advisory for pan fish (KEEC 2018). Specifically, the meal per week guideline is the highest consumption rate of the state-wide guidelines for fish consumption in place for mercury. As the assumed consumption rate becomes higher (e.g. 50 meals per year as opposed to 12) the resulting RBCs is a lower, more protective concentration. Thus, use of the assumed 50 meal per year consumption rate is a health protective means to evaluate exposure. This 52-week guideline has been adjusted here to reflect 50 weeks per year of consumption consistent with the standard practice in human health risk assessment considering exposure 350 days per year.

RBCs for fish tissue were derived using the following algorithm provided in USEPA (1989, 2018a) and are reported in Table 4-3:

RBC = (BW * AT * Target Risk) - (INf * FI * EF * ED * CF * (cooking/trimming loss) * (CSF or 1/RFD))

Where:

- RBC = Chronic daily intake in milligrams per kilogram per day (mg/kg-day) calculated with the exposure terms described here (USEPA 1989):
- BW = Body weight (kg). Adult body weight of 80 kg used here (USEPA 2018a)
- AT = Averaging time of 25,550 days (365 days x 70 years) used here for cancer and 365 days x exposure duration used for noncancer (USEPA 2018a).
- Target risk = Cancer: 1 $x10^{-6}$ used for the inorganic arsenic RBC noncancer: Hazard index of 1 used for all others (USEPA 1989).
- INf = Ingestion rate of fish. Assumed to be 50 meals per year consistent with the 350 days per year exposure frequency used in the USEPA RSLs, and very close to the meal per week upper end of meals in the Kentucky advisory for mercury in fish. The 50 meals per year basis is equivalent to 32.2 g/day.
- FI = Fractional intake, which represents the fraction taken from this resource. Assumed to be 100% here or an FI of 1.0.
- EF = Exposure frequency and 350 days per year are used for fish consumption (USEPA 1989, 2018a).

- ED = Exposure duration and 26 years was used for adults (USEPA 2018a).
- CF = Conversion factor or 0.001 mg–g.
- Cooking loss = No cooking loss was assumed here.
- CSF or 1/RfD = Cancer slope factor (CSF) or reference dose (RfD) for noncancer is a chemical specific value taken from USEPA RSL Table 1 (USEPA 2018a).

Fish tissue concentrations are considered in wet weight consistent with HHRA guidance (USEPA 1989, 2018a). Site-specific fish consumption rates are further refined as part of the HHRA.

For methylmercury, the guideline of 0.3 mg/kg (300 µg/kg) in fish tissue identified within Table 1 of 401 KAR 10:031 was used to screen the fish tissue results. The screening value used for lead in fish tissue is based on an advisory for lead in sport fish developed by the Ohio Cooperative Fish Tissue Monitoring Program Sport Fish Tissue Consumption Advisory Program (Ohio 2010) that identifies a lead concentration in fish tissue of 0.375 mg/kg ww or 375 µg/kg derived based on a 1 meal of fish per week and also on the U.S. Food and Drug Administration (USFDA) Provisional Tolerable Daily Intake concentration of 6.0 micrograms per day (µg/day) for lead (USFDA 2017).

2.2.8 Key Findings by Medium

This section provides a medium-specific summary of key findings from the Phase I and II investigations and, for fish tissue, compares results to KDOW analytical results for 2016-2018. Section 2.3 provides further discussion of results on a chemical-specific basis. Analytical laboratory reports are provided in Appendices E and F.

2.2.8.1 Key Findings for Adult Fish

This section discusses the Phase I and II fish tissue results relative to the reported Kentucky 2016 Herrington Lake fish tissue sampling, and to KDOW and USEPA water quality standards and consumption advisories. Herrington Lake is subject to the KDFWR Kentucky statewide advisory for mercury in fish (KEEC 2018) but no other advisories are in effect for the lake.

The Phase I and II adult fish results provided sufficient data to support the following conclusions:

- The concentration of selenium in adult fish tissues (whole-body) collected during Phase I and Phase II are below the Kentucky eco adult whole-body tissue criterion of 8.6 mg/kg dw, and the concentration of selenium in ovary tissues (collected only in Phase I) were also below the Kentucky eco adult ovary criterion (19.3 mg/kg dw) and the USEPA ovary criterion (15.1 mg/kg dw) Figures 2-3A–C). The 2018 KDOW ESB conducted split sample tissue residue analysis for selenium using Phase I fish tissues and selenium results were comparable to the Phase I results (Appendix E2).
- The concentration of selenium in fish fillets from samples collected as part of the Phase I sampling program are less than human health risk-based ingestion values for selenium (Figures 2-3D–E).
- Fish tissues for constituents other than selenium were adequately characterized with Phase I sampling.
    - Fish tissue concentrations for Phase I sampling are also below the screening levels identified from scientific literature for arsenic, cadmium, boron, lead, and zinc for both ecological receptors and human health, where they exist.

- Arsenic speciation in fish tissues demonstrated that inorganic arsenic (the form of arsenic that is potentially toxic to humans) is not present or was present at concentrations lower than the human health criterion for arsenic ingestion in fish tissues.
- Methylmercury (MeHg, the dominant form of mercury in fish tissues) was detected at concentrations less than risk-based screening-levels in Curds Inlet but there were some areas further away from E.W. Brown Station where two fish had measured concentrations above risk-based screening levels. These fillet samples for mercury, do not appear to be related to E.W. Brown Station because they occurred far from E.W. Brown Station Inlet and there were only in two fish. Smaller home range fish, such as bluegill that live in Curds Inlet, did not show elevated mercury. Moreover, the maximum concentrations are less than two-fold above the screening level and are not atypical of mercury concentrations found in fish.
- The 2018 KDOW ESB split sample tissue residue analysis also included other CCR-related constituents using Phase I fish tissues. The 2018 KDOW ESB results for CCR-related constituents were also comparable to the Phase I results (Appendix E3).

- The 2016 KDOW whole body fish tissue selenium concentrations exceeded the KDOW standard for whole-body fish; the ovary results for 2016 did not exceed the KDOW or USEPA ovary criteria (Figure 2-3F1). In contrast to the 2016 KDOW fish tissue results, none of the 2018 KDOW selenium fish tissue concentrations exceeded the KDOW standard for whole-body fish (Figures 2-3F2 and 2-3F3 for bluegill and larger fish, respectively). Figures 2-3F2 and 2-3F3 include more than 40 fish were collected by KDOW in 2018 from locations in Curds Inlet and other locations in Herrington Lake.

2.2.8.2 Key Findings for Surface Water

This section discusses the Phase I and II analytical results for surface water including relevant KDOW and USEPA surface water quality standards. It is important to note that KDOW deleted its acute water column criterion for selenium from its water quality standards in 2016 on the basis that the prior criterion of 20 µg/L was not supported by underlying scientific data. That regulatory action was reviewed and accepted by USEPA Region 4 (USEPA 2017a). There is sufficient information for surface water (stratification and overturn) to support the following conclusions:

- Selenium concentrations in surface water are below the KDOW water quality criteria for stratified lake sampling and overturn sampling with the exception of CI2.2 and CI3.1 during stratification and CI1 during overturn, where selenium was detected at a concentration equal to the KDOW criterion.
- Detected concentrations in surface water are below the KDOW water quality criteria for arsenic, methylmercury, cadmium, lead, and zinc. These results are sufficient to perform the risk assessment and consider remedy evaluations. No additional analyses are needed for these constituents in surface water.
- Because Kentucky does not have water quality criteria for boron, the Phase I and Phase II sampling results for boron in surface water and sediment pore water were compared to human health RSLs for drinking water and the USEPA Region 4 ESV. The Phase I and Phase II boron surface water and pore water results are less than both screening values.

Methylmercury surface water and pore water concentrations did not exceed KDOW ecological or human health criteria. Total mercury concentrations in surface water exceeded the chronic KDOW threshold during the Phase I stratification sampling but both the Phase I overturn and Phase II stratification surface water results for the same region were below the Kentucky ecological chronic and USEPA R4 Chronic criteria. The year-on-year results suggest that the elevated mercury recorded from

Phase I stratification sampling was related to a transient event, including the presence of particulate matter and/or algae in the Phase I stratification water samples. Notably, the KDOW mercury human health criterion (0.051 µg/L) and USEPA R4 wildlife acute and chronic criteria (0.0013 and 0.012 mg/L respectively) are all related to fish consumption, and the Curds Inlet adult fish tissue mercury concentrations, including bluegill which are small home range species, were below the USEPA ecological risk-based screening and Kentucky human health fish ingestion criteria.

2.2.8.3 Key Findings for Sediment Pore Water and Sediment

The sediment pore water and sediment within Curds Inlet and HQ Inlet is well characterized by the Phase I and Phase II sampling. Hardin Inlet is also characterized from Phase I and AMEC 2017 sampling. Sediment is also well characterized at the LHL and Dix River locations identified in the CAP. There is sufficient information for sediment pore water and sediment to support the following conclusions:

- The highest concentrations of selenium and arsenic pore water concentrations detected from Phase I and Phase II sampling are located in Middle Curds Inlet near CI3.1A and CI3A, in the interior of Curds Inlet, predominantly in the "A" sediment series (i.e., the thalweg or "channel" samples). The highest concentrations are bounded by lower concentrations at the sample locations along Transect CI4, which was at the mouth of Curds Inlet. This means that selenium, arsenic, and other CCR-related constituents are well delineated, and this information can be used in the human health and ecological risk assessments provided in Sections 4 and 5 of this report.
- There was a single sediment pore water concentration for cadmium detected at one location in Middle Curds Inlet, CI3B (0.0021 mg/L), which exceeded the KY Eco Chronic Criterion of 0.00037mg/L. This single detection is discussed further in Section 2.3.4 of this report.
- The Phase I and II sediment concentrations for selenium, arsenic, and other CCR-related constituents exceed risk-based screening criteria at one or more locations. For some constituents, like selenium, the detected concentrations exceed screening criteria at most locations, which does not necessarily indicate that sediments pose an unacceptable risk but does reflect the need for further evaluation.

2.2.8.4 Key Findings for Aquatic Invertebrates and Vegetation

The aquatic vegetation and aquatic invertebrate results for selenium, arsenic, mercury, lead, and zinc did not show a consistent trend of higher concentrations of CCR-related constituents within Curds Inlet compared to locations outside Curds Inlet and away from E.W. Brown Station. For constituents such as selenium and arsenic, the concentrations were similar within Curds Inlet and away from Curds Inlet and results for both vegetation and invertebrates were similar (within a factor of 2 or 3). The cadmium concentrations in aquatic vegetation and invertebrates did show a general pattern of decreasing concentrations with increasing distance from the interior of Curds Inlet, with highest cadmium levels for vegetation and invertebrates recorded at middle Curds Inlet location CI3. The higher cadmium concentrations were bounded by lower cadmium concentrations at the transect leaving Curds Inlet. There is sufficient information for aquatic vegetation and aquatic invertebrates to conduct the risk assessments and consider remedy evaluations.

2.3 Analytical Results on a Metal-Specific Basis

This section evaluates the Phase I and II analytical results for each constituent across the sampling media to provide insight into any spatial trends, cycling of metals, or potential sources of metals into Herrington Lake. Each of the metal-specific subsections includes a brief report of the Phase I and II

results along with key findings for each metal. The Phase I and Phase II analytical results are reported separately, in detail, in Tables 2-1A through 2-6. The combined Phase I and Phase II results are summarized in Tables 2-7a through 2-14 by media, for each analyzed constituent, including number of collected samples, number and percent of detections, maximum and average results, and the range of detection limits for each medium as follows:

- Table 2-7A: Adult Bluegill/Green Sunfish Tissue Results Summary (Whole-body, Wet/Dry Weight) (Phase I,II)
- Table 2-7B: Adult Bluegill/Green Sunfish Tissue Results Summary (Fillet, Wet Weight) (Phase I)
- Table 2-7C: Adult Bass Tissue Results Summary (Whole-body, Wet and Dry Weight) (Phase I, II)
- Table 2-7D: Adult Bass Tissue Results Summary (Fillet, Wet Weight) (Phase I)
- Table 2-7E: Adult Catfish Tissue Results Summary (Whole-body, Wet/Dry Weight) (Phase I, II)
- Table 2-7F: Adult Catfish Tissue Results Summary (Fillet, Wet Weight) (Phase I)
- Table 2-7G: Adult Trout/Sucker Tissue Results Summary (Whole-body, Wet/Dry Weight) (Phase I)
- Table 2-7H: Adult Trout and Sucker Tissue Results Summary (Fillet, Wet Weight) (Phase I)
- Table 2-8: YOY Whole-body Bluegill Tissue Results Summary (Dry Weight) (Phase II)
- Table 2-9: Surface Water: Stratification Results Summary (Phase I and II)
- Table 2-10: Surface Water: Overturn Results Summary (Phase I)
- Table 2-11: Sediment Results Summary (Phase I and II)
- Table 2-12: Sediment Pore Water Results Summary (Phase I and II)
- Table 2-13: Aquatic Vegetation Results Summary (Phase I)
- Table 2-14: Aquatic Invertebrate Results Summary (Phase I)

The remainder of this section reports the analytical results, as follows:

- Section 2.3.1: Selenium
- Section 2.3.2: Arsenic
- Section 2.3.3: Mercury and Methylmercury
- Section 2.3.4: Cadmium
- Section 2.3.5: Additional Metals (Boron, Lead, and Zinc) (Phase I and II)

2.3.1 Selenium

The selenium results are ordered by medium and provided in Figures 2-3A–M, and wherever applicable, they include both Phase I and Phase II results. In select cases, selenium results from previous studies (for example, the KDOW 2016 Adult Fish Study) are also included for reference. The selenium figures include:

- Figure 2-3A: Selenium in Whole-Body Fish Tissue: Adult Bluegill and Green Sunfish (Dry Weight) (Phase I and Phase II)
- Figure 2-3B: Selenium in Adult Fish Ovaries: Larger Fish (Dry Weight) (Phase I)
- Figure 2-3C: Selenium in Adult Whole-Body Fish Tissue: Larger Fish (Dry Weight)
- Figure 2-3D: Selenium in Adult Fish Fillet Tissue: Bluegill/Green Sunfish (Wet Weight) (Phase I)
- Figure 2-3E: Selenium in Adult Fillet Tissue: Larger Fish (Wet Weight) (Phase I)
- Figure 2-3F1: Selenium in KDOW May 2016 Adult Fish Study Fish Tissue
- Figure 2-3F2: Selenium in KDEP July 2018 Adult Whole-Body Bluegill Tissue
- Figure 2-3F3: Selenium in KDEP July 2018 Adult Whole-Body Larger Fish Tissue
- Figure 2-3G: Selenium in YOY Whole-body Bluegill Tissue (Phase II YOY Study)
- Figure 2-3H: Selenium in Stratified Surface Water (Phase I and Phase II)
- Figure 2-3I: Selenium in Overturn Surface Water (Phase I)
- Figure 2-3J: Selenium in Sediment Pore Water (Phase I and Phase II)

- Figure 2-3K: Speciated Selenium in Sediment Pore Water (Phase I and Phase II)
- Figure 2-3L: Selenium in Sediment (AMEC February 2017, Phase I and Phase II)
- Figure 2-3M: Selenium in Vegetation and Invertebrates (Phase I)

2.3.1.1 Selenium in Adult Fish

- Selenium results for the Phase I and II adult fish tissue are summarized and displayed in Figures 2-3A–E. Ovary and fillet tissue was extracted from the Phase I adult fish and whole-body estimates were also calculated. The Phase II adult fish were analyzed as whole-body samples.
- The selenium concentrations are highest in Curds Inlet, and lowest in the MHL samples.
- Phase I and II whole-body adult bluegill and sunfish selenium concentrations range from 0.8–7.4 mg/kg dry weight (dw), with concentrations decreasing with increasing distance from E.W. Brown Station (Figure 2-3A). The adult bluegill and sunfish results are below the Kentucky Eco Adult Whole-Body criterion (8.6 mg/kg dw). Average selenium concentration of the collected bluegills and green sunfish is 3.8 mg/kg dw and includes Phase I and Phase II bluegills and green sunfish.
- Phase I adult fish female ovary selenium concentrations range from 3.3–14.5 mg/kg dw; below the KDOW and USEPA ovary criteria of 15.1 and 19.3 mg/kg dw, respectively (Figure 2-3B). The lowest selenium levels were measured in a spotted (Kentucky) bass and a largemouth bass collected from MHL1 and MHL3 (3.3 and 3.95 mg/kg dw, respectively). Phase II fish tissue sampling did not include ovary extraction from females for analysis.
- The Phase I and II adult whole-body larger fish (bass, catfish, trout, and suckers) selenium levels are below the KDOW whole-body fish tissue criterion (8.6 mg/kg dw) (Figure 2-3C). The whole-body levels are relevant to wildlife that may eat the fish.
- The Phase I adult bluegill and sunfish fillet (Figure 2-3D) and larger adult larger fish fillet (bass, catfish, trout, and suckers) (Figure 2-3E) selenium levels are below the human health risk-based concentration (RBC) of 13 mg/kg ww. Phase II adult fish sampling included whole-body fish. The Phase I fillet-specific levels are relevant to human consumption.
- The Phase I and II adult fish results were compared to the results of the 2016 KDOW fish study for samples collected from locations near Dix Dam and from Rocky Run embayment. The 2016 KDOW fish study collected five adult bluegills, seven largemouth bass, and one spotted (Kentucky) bass near Dix Dam for analysis of tissue selenium levels. The 2016 KDOW fish tissue results are provided in Figure 2-3F1. The whole-body selenium results for bluegills ranged 9.7–11.5 mg/kg dw; for the spotted (Kentucky) bass the single reported result was 10.7 mg/kg dw; and for largemouth bass, results ranged from 4.9–11.7 mg/kg dw. These concentrations exceed the KDOW whole-body Eco criterion of 8.6 mg/kg dw. The whole-body fish tissue results from the KDOW May 2016 study are higher than those observed in the Phase I investigation. This variability represents an uncertainty that was further evaluated in the Phase II investigation.

The 2016 KDOW study also included largemouth bass ovary samples collected from the residential cove (Rocky Arm), and from at Dix Dam (Figure 2-3F1). Selenium was detected in the single Dix Dam ovary sample at a concentration of 7.93 mg/kg. Selenium was detected in two residential cove ovary samples at concentrations of 11 and 11.3 mg/kg. None of the ovary samples analyzed by KDOW exceed the KDOW ovary criterion (19.3 mg/kg, dw) or the USEPA criterion (15.1 mg/kg, dw). The KDOW and Phase I ovary sample results are similar. Accordingly, Phase II ovary samples were not warranted, and the Phase II sampling focused on whole-body YOY and adult fish.

2.3.1.2 Selenium in YOY Bluegill-Tissue

A June 2016 young-of-the-year (YOY) study collected and analyzed YOY largemouth bass whole-body composite tissue samples from Curds Inlet (Downstream Strategies 2016). The 2016 YOY bass selenium concentrations ranged from 5.9–8.5 mg/kg dw, similar to the 2017 Phase I Adult fish tissue selenium levels. The 2016 YOY study, however, was only conducted for Curds Inlet, providing no results for other regions in Lower Herrington Lake, including reference areas. A more comprehensive YOY study thus was conducted as part of the 2018 Phase II investigation.

- The 2018 YOY bluegill composite whole-body selenium concentrations ranged from 3.20–24.8 mg/kg dw, from LHL6 and Upper Curds Inlet, respectively, with concentrations decreasing with increasing distance from E.W. Brown Station (Figure 2-3G). Selenium concentrations in the YOY bluegills collected from Curds Inlet and in one of the two HQ Inlet samples (YOY-008-HQ) exceeded the KDOW fish tissue criterion (8.6 mg/kg dw).
- More detailed results and a discussion of the 2018 YOY study, including an assessment of the samples, is included in Section 5 (ERA).

2.3.1.3 Selenium in Surface Water

The surface water selenium results are reported in two groups; Phase I and II stratifications and Phase I overturn. The Phase I and II stratifications total and dissolved selenium surface water results are displayed in Figure 2-3H. The Phase I overturn total and dissolved selenium surface water results are displayed in Figure 2-3I. The surface water selenium levels vary within Curds Inlet, but concentrations generally decrease with increasing distance from E.W. Brown Station, particularly when comparing Curds Inlet to non-Curds Inlet locations.

- The detected total selenium levels for the combined Phase I and II stratification- surface water samples concentrations range from 0.2–5.5 micrograms per liter (µg/L) with the highest values found in middle Curds Inlet (Figure 2-3H).
- Except for two Middle Curds Inlet locations (CI2.2 and CI3.1), the dissolved surface water selenium concentrations were below the Kentucky Eco Chronic Water Quality criterion (0.005 mg/L or 5.0 µg/L). Other Curds Inlet locations exceeded the recommended USEPA Lake (Lentic) 30-day average criterion of 0.0015 mg/L (1.5 µg/L) but were below the Kentucky chronic criterion (0.005 mg/L). Apart from LHL3 Cove, located directly across the main lake channel from Curds Inlet, all other Herrington Lake sampled regions had surface water selenium levels below the EPA Lake (Lentic) 30-day average criterion (Figure 2-3H).
- The overturn surface water total selenium concentrations range from 0.0004–0.0052 mg/L from locations LHL6 (lake mile 6 near Sunset Marina) and Upper Curds Inlet (CI1), respectively (Figure 2-3I). The CI1 result for total selenium marginally exceeded the Kentucky Eco Chronic Water Quality criterion (0.005 mg/L). Seasonality and the effects of overturn mixing on the lake water may help explain the variability between the Phase I and II stratification results and between the stratification and overturn selenium results.
- The Phase I and II surface water samples collected during stratification were lower than the Kentucky human health water quality criterion for selenium (0.17 mg/L) and the USEPA Maximum Contaminant Level (MCL) for selenium (0.050 mg/L).

2.3.1.4 Selenium in Sediment Pore Water

Pore water total selenium concentrations range from 0.0002–0.009 mg/L from locations HI1C and CI1A, respectively and, except for two locations in Curds Inlet, CI1A and CI3B, all Phase I and II pore

water selenium levels are at, or below, the KDOW Eco Chronic surface water criterion of 0.005 mg/L (Figure 2-3J). Speciated selenium in pore water is provided in Figure 2-3K.

2.3.1.5 Selenium in Sediment

Phase I and II sediment selenium concentrations range from 0.4–36.7 mg/kg from locations LHL6B and CI3.1A, respectively (Figure 2-3L) with the highest measured levels from CI3.1A, the Phase II thalweg sampling location within the middle portion of Curds Inlet. Detected concentrations in sediment exceed the 2018 USEPA R4 ESV (0.72 mg/kg) and the USEPA R4 RSV (2.9 mg/ kg). The highest detected selenium concentrations were observed in Curds Inlet and HQ Inlet. Concentrations declined with distance from Curds Inlet. Hardin Inlet had among the lowest selenium sediment concentrations observed from the samples collected, as illustrated on Figure 2-3L. Exceedances of the ESVs and RSVs are further evaluated in the site-specific ecological risk assessment provided in Section 5 of this report. The selenium levels in Phase I and Phase II sediment concentrations are below the USEPA residential RSL for selenium (390 mg/kg) (Section 4 HHRA).

2.3.1.6 Selenium in Aquatic Vegetation and Invertebrates

The Phase I selenium concentrations in AV and AI are reported in Tables 2-13 and 2–14, respectively, and displayed in Figure 2-3M. The Phase I results revealed no apparent pattern of high concentration in, or gradient away from, Curds Inlet or E.W. Brown Station. Accordingly, Phase II sampling focused on other media including sediment and pore water and did not include invertebrates or vegetation. There are no applicable USEPA or KDOW criteria for aquatic invertebrates or aquatic vegetation.

2.3.1.7 Key Findings for Selenium (Phase I and Phase II)

- All Phase I and II adult fish whole-body and ovary tissue selenium levels are below the KDOW fish tissue Eco Chronic criteria of 8.6 mg/kg dw and 19.3 mg/kg dw, respectively (Figures 2-3A–2-3E) and below the human health screening level of 13 mg/kg (Figures 2-3D-2-3E).
- The adult fish selenium levels in bluegill and green sunfish are highest in Curds Inlet, and lowest in Middle Herrington Lake with concentrations decreasing with increasing distance from E.W. Brown Station (Figure 2-3A).
- YOY bluegill selenium levels were highest in Curds Inlet and decreased with increasing distance from E.W. Brown Station (Figure 2-3G).
- The surface water selenium concentrations vary within Curds Inlet, but concentrations generally decreased with increasing distance from E.W. Brown Station, particularly when comparing Curds Inlet to non-Curds Inlet locations. Selenium concentrations in water were less than the Kentucky surface water quality criterion, with limited exception where detections were similar to the criterion within Curds Inlet only. Hardin Inlet had among the lowest selenium surface water concentrations observed from the samples collected.
- The highest detected selenium sediment concentrations were observed in Curds Inlet and HQ Inlet. Concentrations declined with distance from Curds Inlet. Hardin Inlet had among the lowest selenium sediment concentrations observed from the samples collected.
- The majority of detected concentrations of selenium in sediment pore water concentrations did not exceed the Kentucky surface water quality criterion, which is conservative screening tool for pore water as surface water because ESVs are protective of aquatic life including fish and fish which are not directly exposed to sediment pore water. Selenium in pore water exceeded the Kentucky criterion in 2 of the 34 pore water samples, both exceedances were located within Curds Inlet.

Speciated selenium concentrations in pore water exceeded the Kentucky surface water quality criterion in one location in the interior of Curds Inlet. Selenium concentrations in pore water in Hardin Inlet were the lowest of the measured values.

- For aquatic vegetation and aquatic invertebrates, the low selenium results revealed no obvious patterns related to distance from E.W. Brown Station, particularly the wet weight concentration results which were less than a factor of two between highest and lowest concentrations from the locations sampled (Figure 2-3M).

2.3.2 Arsenic

The Phase I and II arsenic results for each medium are displayed in Figures 2-4A–I, as follows:

- Figure 2-4A: Arsenic in Adult Whole-Body Fish tissue (Wet Weight) (Phase I)
- Figure 2-4B: Arsenic in Adult Fish Fillet Tissue: Bluegill and Green Sunfish Inorganic Arsenic (Wet Weight) (Phase I)
- Figure 2-4C: Arsenic in Adult Fish Fillet Tissue: Larger Fish Inorganic Arsenic (Wet Weight) (Phase I)
- Figure 2-4D: Arsenic in Stratified Surface Water (Phase I and Phase II)
- Figure 2-4E: Arsenic in Overturn Surface Water (Phase II)
- Figure 2-4F: Arsenic in Sediment Pore Water (Phase I and Phase II)
- Figure 2-4G: Speciated Arsenic in Sediment Pore Water (Phase I and Phase II)
- Figure 2-4H: Arsenic in Sediment (AMEC February 2017, Phase I and Phase II)
- Figure 2-4I: Arsenic in Vegetation and Invertebrates (Phase I)

2.3.2.1 Arsenic in Adult Fish Tissue

Phase I whole-body adult sunfish, bass, catfish, trout, and sucker arsenic results (in mg/kg, ww and dw) are reported in Tables 2-1A, 2-1C and 2-1F-G and displayed in Figures 2-4A–C. The total arsenic whole-body fish tissue results are less than the published adult and early life-stage (ELS) fish arsenic screening levels (Jarvinen and Ankley 1999). Phase II adult fish analysis focused on selenium only.

The Phase I adult fish tissue samples were also analyzed for speciated arsenic via method 1632A to assess the relative levels of arsenite (AsIII or As3+) and arsenite (AsV or As5+), relevant to the human health exposure assessment (Schoof and Yager 2007). The adult whole-body arsenic results as the sum of AsIII and AsV are provided in Figure 2-4A. The fillet results are provided in Figures 2-4B and 2-4C. Inorganic fish fillet total arsenic results measured directly via Method 1632A are also provided in Figure 2-4B and Figure 2-4C; (note that Method 1632 had lower detection limits than those for arsenate and arsenite).

Specifically:

- The data in Figure 2-4B indicate that inorganic arsenic (from Method 1632A) was detected at low concentrations in three bluegill fillet samples; two from Curds Inlet and one from HQ Inlet. As indicated in Figure 2-4B, in one instance the inorganic arsenic was detected in the bluegill duplicate sample but not the parent sample, in the second instance inorganic arsenic was detected in the sample, but not in the duplicate. Inorganic arsenic from Method 1632A was not detected in the larger fish (bass, catfish, trout, and suckers) (Figure 2-4C).
- The data in Figure 2-4B suggest that inorganic arsenic is rarely detected in fish fillets and, when detected, it is below the risk-based threshold for ingestion of fish.
- The data in Figure 2-4C indicates that inorganic arsenic was undetected in fillets from larger fish.

- Figures 2-4B and 2-4C also provide the human health RBCs for inorganic arsenic relevant to adult fish fillet tissue. Fish tissue concentrations were below the RBC for inorganic arsenic of 0.005 mg/kg ww which was derived assuming 50 meals per year for an adult and with a risk target of 10^{-6}.

2.3.2.2 Arsenic in Surface Water

Phase I and II total and dissolved surface water arsenic levels are provided in Figure 2-4D and Figure 2-4E. Stratification total arsenic detected concentrations in the surface water range from 0.00046–0.00489 mg/L, with the minimum and maximum concentration recorded at LHL3 (80 feet bws) and at CI4 (mouth of Curds Inlet) (70 feet bws), respectively (Figure 2-4D). Overturn total arsenic detected concentrations in the surface water range from 0.00095-0.00548 mg/L with the minimum and maximum recorded from locations LHL6 and CI2, respectively (Figure 2-4E). Arsenic concentrations in surface water samples collected during both stratification and overturn sampling efforts are below the Kentucky human health MCL (0.01 mg/L) and the Kentucky Eco Chronic SWS (0.15 mg/L).

2.3.2.3 Arsenic in Sediment Pore water

The Phase I and II sediment pore water arsenic results (dissolved phase in mg/L) are provided in Table 2-3B and in Figure 2-4F and Figure 2-4G. Arsenic, wherever analyzed by EPA 200.8 and Method 1632A, provided comparable results across methods. Detected concentrations of dissolved arsenic in the pore water range from 0.000515–2.13 mg/L with the minimum and maximum concentration recorded from locations CI2C and CI3.1A, respectively. Detected concentrations of dissolved AsIII in the pore water range from 0.0000322–1.9 mg/L with the minimum and maximum concentration recorded from locations CURDS1 and CI3.1, respectively. Detected concentrations of dissolved AsV in the pore water range 0.000475–0.23 mg/L with the minimum and maximum concentration recorded from locations HI1C and CI3.1, respectively. The concentrations exceed screening levels identified on Figures 2-4F and 2-4G. These exceedances are discussed in more detail, particularly for total and speciated arsenic (arsenite [AsIII or As3+] and arsenate [AsV or As5+]) concentrations in the ERA provided in Section 5 of this report.

2.3.2.4 Arsenic in Sediment

The arsenic concentrations for sediment are provided in Figure 2-4H. Detected arsenic sediment concentrations range from 1.73–448 mg/kg with the minimum and maximum concentration reported for locations LHL6B and CI3A, respectively. CI3A, the thalweg sample, which also had the highest selenium sediment concentration. Arsenic concentrations in sediment in Curds Inlet and elsewhere in the lake exceed the ecological screening value (USEPA R4 ESV) of 9.8 mg/kg as well as the USEPA R4 RSV of 33 mg/kg. For human health, many sampling locations exceeded the USEPA RSL of for residential soil (0.7 mg/kg) with no spatial pattern except that the concentrations are highest in Curds Inlet. Although this RSL is below typical soil background concentrations (Kentucky Guidance for Ambient Background [2004] and USGS 2017), arsenic in sediments is further considered in Section 4, the human health risk assessment.

2.3.2.5 Arsenic in Aquatic Invertebrates and Vegetation

Phase I arsenic concentrations for aquatic invertebrates and aquatic vegetation are provided in Figure 2-4I. No pattern of high arsenic concentrations was found in the invertebrates or aquatic vegetation collected from Curds Inlet or from the other Lower Herrington Lake sampling regions. There are no USEPA or KDOW standards for aquatic invertebrate or aquatic vegetation tissues. Phase II did not include aquatic invertebrate or aquatic vegetation sampling.

2.3.2.6 Key Findings for Arsenic in Phase I and II Sampling

The key findings for arsenic are:

- Phase I sufficiently characterized the fish tissue arsenic concentrations for use in the ERA and HHRA. Phase II sampling thus, did not focus on arsenic in fish tissue.
- The surface water arsenic concentrations were less than the Kentucky water quality criterion at all locations sampled.
- Based on the Phase I results for arsenic in sediment, the Phase II investigation included additional sediment sampling from newly designated transects located in Middle Curds Inlet and from proximal regions outside Curds Inlet to provide year-on-year results. Arsenic concentrations in sediment in Curds Inlet and elsewhere in the lake exceed the USEPA R4 ESV of 9.8 mg/kg. Arsenic levels in the sediment collected from Curds Inlet and HQ Inlet exceed the RSV of 33 mg/kg. For human health, arsenic in sediment at many sampling locations throughout the lake exceeded the USEPA RSL of for residential soil (0.7 mg/kg) with no spatial pattern except that the concentrations are highest in Curds Inlet.
- The highest arsenic (and selenium) detections in sediment and sediment pore water were detected in the Middle Curds Inlet region.
- There are no apparent patterns of arsenic in aquatic vegetation or aquatic invertebrates that indicate site related impacts that require further study.

2.3.3 Mercury and Methylmercury

Phase I and II results for mercury and methylmercury sampling is provided for each medium in Figures 2-5A–L, as listed below. The results for each medium are briefly discussed.

- Figure 2-5A: Methylmercury in Adult Whole-Body Fish Tissue (Wet Weight) (Phase I)
- Figure 2-5B: Methylmercury in Adult Fish Fillet Tissue: Bluegill/Green Sunfish (Wt Wt) (Phase I)
- Figure 2-5C: Methylmercury in Adult Fish Fillet Tissue: Larger fish (Wet Weight) (Phase I)
- Figure 2-5D: Methylmercury in Stratified Surface Water (Phase I and Phase II)
- Figure 2-5E: Methylmercury in Overturn Surface Water (Phase I)
- Figure 2-5F: Dissolved Total Mercury and Dissolved Methylmercury in Pore Water (Phase I, II)
- Figure 2-5G: Total Mercury in Stratified and Overturn Surface Water (Phase I and Phase II)
- Figure 2-5H: Total Mercury in Stratified and Overturn Surface Water (Phase I and Phase II) Expanded Scale
- Figure 2-5I: Total Mercury in Sediment (AMEC February 2017, Phase I, and Phase II)
- Figure 2-5J: Methylmercury in Sediment (AMEC February 2017, Phase I, and Phase II)
- Figure 2-5K: Total Mercury in Vegetation and Invertebrates (Phase I)
- Figure 2-5L: Methylmercury in Vegetation and Invertebrates (Phase I)

2.3.3.1 Methylmercury in Adult Fish Tissue

Phase I adult fish tissue methylmercury levels (mg/kg ww) are provided in Figures 2-5A (fillet and whole-body) and in Figures 2-5B and 2-5C for fish fillets, respectively. The methylmercury concentrations for whole-body bluegill and most of the bass, catfish, trout, and suckers are less than ecological screening levels (Beckvar et al. 2005; Dillon et al. 2010). The methylmercury concentrations for two catfish and one bass sample exceed the lower of the two ecological screening levels. The catfish samples exceeding the lower benchmark were from LHL4 and MHL1. The bass sample with a concentration exceeding the lower benchmark was from LHL5. The Curds Inlet samples and Dix River (below the dam) were lower than both ecological benchmarks. Phase II adult fish

sampling did not include additional methylmercury sampling and focused instead on selenium, percent lipids, and percent moisture.

Relative to the Kentucky human health criterion (300 µg/kg), the Phase I adult fish fillet methylmercury levels were comparable to the relevant whole-body results. Apart from the catfish fillet tissue collected from LHL4 and MHL3, methylmercury levels in the Phase I adult bluegill, bass, trout, suckers, and catfish from other locations are below the human health Kentucky criterion.

2.3.3.2 Mercury and Methylmercury in Surface Water and Sediment Pore Water

Phase I and II stratification and Phase I overturn mercury and methylmercury results for surface water and pore water are provided in Figure 2-5D-H. Figures 2-5D and 2-5E illustrate dissolved and total fractions of methylmercury for stratification and overturn surface water. For pore water, dissolved methylmercury and mercury concentrations are provided in Figure 2-5F. For surface water, the total and dissolved mercury concentrations are provided in Figures 2-5G and 2-5H with greater resolution of lower detected concentrations provided in Figure 2-5H. The Phase I and II pore water and surface water results are, as follows:

- The Phase I and II stratification surface water methylmercury results for total and dissolved methylmercury concentrations are less than the Kentucky and USEPA Region 4 water quality criteria, including the most conservative surface water ESV for aquatic life (0.000028 mg/L) and for human health fish consumption (for total mercury 0.000051 mg/L) (Figure 2-5D).
- The Phase I overturn surface water for dissolved and total methylmercury results do not exceed the USEPA Region 4 surface water chronic ESV for methyl mercury for aquatic life (0.00028 mg/L) or the Kentucky human health criteria for total mercury for consumption of fish (0.000051 mg/L).
- The detected pore water concentrations illustrated in Figure 2-5F for dissolved methylmercury and dissolved mercury concentrations are less than the chronic Kentucky ESV (0.00077 mg/L) for total mercury and the chronic USEPA R4 aquatic life screening value for total methylmercury (0.0000028 mg/L). The screening levels for ingestion of fish for wildlife and human health are not appropriate for pore water.
- Apart from Curds Inlet all Phase I stratification total surface water mercury levels are below the KDOW ecological acute criteria (0.0014 mg/L) and both the Phase I overturn and Phase II stratification surface water results for the same region were below the Kentucky ecological (0.00077 mg/L) (Figures 2-5G and 2-5H). The year-on-year results suggest that the elevated mercury recorded from Phase I stratification sampling was related to a transient event, including the presence of particulate matter and/or algae in the Phase I stratification water samples. Notably, the Kentucky mercury human health (0.000051 mg/L) for fish consumption and USEPA R4 wildlife acute and chronic criteria (0.012 mg/L and 0.0000013 mg/L , respectively) are all related to fish consumption, but all the Curds Inlet adult fish tissue mercury levels were below the USEPA ecological risk-based screening for fish (Figure 2-5A) and the USEPA and Kentucky human health fish ingestion criteria. Four Curds Inlet surface water samples exceeded the Kentucky water quality criterion for human health for fish consumption by less than four-fold and are further discussed in the HHRA.

2.3.3.3 Mercury and Methylmercury in Sediment

Phase I and II and AMEC 2017 sediment total mercury concentrations range from 0.002–0.143 mg/kg with the minimum and maximum concentrations reported from locations CI2.2B and CI4A, respectively; all are less than the ecological screening level (0.18 mg/kg) and the USEPA R4 ESV for

mercury for wildlife (0.17 mg/kg) and below the human health USEPA (2018a) residential soil RSL for inorganic mercury (23 mg/kg) and RSL for methylmercury (8 mg/kg) (Figure 2-5I Table 2-11).

Detected concentrations of methylmercury in the sediment range 0.00004–0.00174 mg/kg with minimum and maximum reported for locations LHL5B and LHL6C, respectively (Figure 2-5J, Table 2-4B, and Table 2-4C). The USEPA R4 screening levels were updated in 2018 and include a methylmercury ESV and RSV of 0.00045 mg/kg and 0.0045 mg/kg, respectively. There was one exceedance of the methylmercury ESV in Curds Inlet, but methylmercury was not detected in most of the Curds Inlet samples. There were also exceedances of the ESV but not the RSV in HQ Inlet, LHL3 and LHL6. Phase I and II sediment methylmercury levels are less than the RSV. The wildlife ESV and RSV are related to the wildlife ingestion of fish. The Phase I methylmercury results for adult fish are discussed above in Section 2.3.3.1.

2.3.3.4 Mercury and Methylmercury in Aquatic Vegetation and Invertebrates

There were no patterns of elevated concentrations of mercury in the invertebrates or aquatic vegetation collected from Curds Inlet compared to the other Lower Herrington Lake sampling regions (Figure 2-5K). Methylmercury was not detected in most of the aquatic vegetation samples, with low wet weight concentrations detected at CI1 and Dix River locations only (Figure 2-5L). There were no patterns of elevated concentrations of methylmercury in the wet or dry weight aquatic invertebrates collected from Curds Inlet compared to the other Lower Herrington Lake sampling regions.

2.3.3.5 Key Findings for Mercury and Methylmercury (Phase I and II)

The key findings for mercury and methylmercury are:

- The Phase I findings for fish tissue sufficiently characterized methylmercury, the predominant mercury form in adult fish tissue, to support the HHRA and ERA.
- Both the Phase I overturn and Phase II stratification surface water levels in Curds Inlet were below the Kentucky ecological and human health criteria, confirming the transience of the elevated Phase I surface water mercury levels found during Phase I stratification sampling.
- The Phase I findings sufficiently characterized mercury and methylmercury levels in the aquatic vegetation and aquatic invertebrates to support the ERA and for future remedy evaluations and data indicate methylmercury was infrequently detected.

2.3.4 Cadmium

The results for the cadmium analysis are provided for each medium, as indicated in Figures 2-6A–H, as follows:

- Figure 2-6A: Cadmium in Adult Whole-Body Fish Tissue (Wet Weight) (Phase I)
- Figure 2-6B: Cadmium in Adult Fish Fillet Data Bluegill and Green Sunfish (Wet Weight) (Phase I)
- Figure 2-6C: Cadmium in Adult Fish Fillet Data Larger Fish (Wet Weight) (Phase I)
- Figure 2-6D: Cadmium in Stratified Surface Water (Phase I and Phase II)
- Figure 2-6E: Cadmium in Overturn Surface Water (Phase I)
- Figure 2-6F: Cadmium in Sediment Pore Water and Sediment (Phase I and Phase II)
- Figure 2-6G: Cadmium in Sediment (Phase I and Phase II)
- Figure 2-6H: Cadmium in Vegetation and Invertebrates (Phase I)

2.3.4.1 Cadmium in Adult Fish Tissue

The Phase I adult-fish whole-body and fillet cadmium levels are below the KDOW ecological criteria and human health RBCs based on consumption of 50 meals per year. The whole-body fish tissue cadmium levels were highest in Curds Inlet, with concentrations decreasing with increasing distance from E.W. Brown Station (Figure 2-6A). This observed pattern is less apparent in the Phase I adult fish fillet results (Figure 2-6B-C). Based on Phase I findings, Phase II fish sampling focused on Selenium in whole-body fish tissue, not including cadmium.

2.3.4.2 Cadmium in Surface Water

Cadmium results in stratified and overturn water are displayed in Figures 2-6D and 2-6E, respectively. Similar to the selenium results, the Phase I overturn surface water cadmium concentrations (Figure 2-6E) exceed the Phase I and II stratification levels (Figure 2-6D). Except for one middle Curds Inlet sampling location (CI2, 0.000377 mg/L) which slightly exceeds the KDOW chronic ecological criteria (0.000370 mg/L) (Figure 2-6E), the surface water cadmium levels measured from all three surface water sampling events are below the KDOW human health (0.005 mg/kg) and chronic ecological criteria (Figure 2-6D-E).

2.3.4.3 Cadmium in Sediment Pore Water and Sediment

All Phase I and II sediment pore water cadmium levels are below the KDOW ecological criteria (0.00038 mg/L, based on site-specific hardness [see Table 5.2]) except for at one middle Curds Inlet sampling location (CI3B, 0.00204 mg/L) (Figure 2-6F). All sediment cadmium levels are below the USEPA human health residential RSL and below the USEPA region 4 RSV (5 mg/kg) at all locations except CI1A and CI2.1A (10.1 and 7.76 mg/kg, respectively) (Figure 2-6G). Some of the sediment cadmium levels from Curds Inlet and HQ Inlet exceed the USEPA Region 4 ESV and two samples in Curds Inlet exceed the USEPA Region 4 RSV.

2.3.4.4 Cadmium in Aquatic Vegetation and Invertebrates

For both the aquatic vegetation and aquatic invertebrates, cadmium levels follow the general pattern of decreasing concentrations with increasing distance from the interior of Curds Inlet, with highest cadmium levels for vegetation and invertebrates recorded at middle Curds Inlet location CI3 (Figure 2-6H).

2.3.4.5 Key Findings for Cadmium (Phase I and II)

The key findings for cadmium are:

- Cadmium is sufficiently characterized from Phase I and II surface water, sediment pore water, sediment, aquatic vegetation, and aquatic invertebrate results to conduct the risk assessments and for preliminary remedy evaluation.
- The one exceedance at middle Curds Inlet sampling location (CI3B, 0.00204 mg/L) (Figure 2-6F) for sediment pore water is possibly due to debris contamination of the flexible diffusive membrane part of the pore water sampler. A similar result for lead at this one location (discussed in Section 2.3.5) and not at any other locations suggests that debris may have infiltrated one or more of the cavities of the pore water sampler.
- Although there are some sediment exceedances when compared to the USEPA R4 ESV, all sediment cadmium levels are below the USEPA human health residential RSL (71 mg/kg) and below the USEPA region 4 RSV (5 mg/kg) at all locations except CI1A and CI2.1A (10.1 and 7.76 mg/kg, respectively) (Figure 2-6G).

- Cadmium concentrations in the aquatic vegetation and aquatic invertebrates follow the general pattern of decreasing concentrations with increasing distance from E.W. Brown Station, with highest cadmium levels also recorded at middle Curds Inlet location CI3 (Figure 2-6H).

2.3.5 Additional Metals (Boron, Lead, and Zinc) (Phase I and II)

Boron, lead, and zinc Phase I and II results for each medium are provided in Figures 2-7A–H, Figures 2-8A-H and Figures 2-9A-H as listed below, and results are reported and discussed.

- Figure 2-7A: Boron in Adult Whole-Body Fish Tissue (Wet Weight) (Phase I)
- Figure 2-7B: Boron in Adult Fish Fillet Tissue: Bluegill and Green Sunfish (Wet Weight) (Phase I)
- Figure 2-7C: Boron in Adult Fish Fillet Tissue: Larger Fish (Wet Weight) (Phase I)
- Figure 2-7D: Boron in Stratified Surface Water (Phase I and Phase II)
- Figure 2-7E: Boron in Overturn Surface Water (Phase I)
- Figure 2-7F: Boron in Sediment Pore water
- Figure 2-7G: Boron in Sediment (Phase I and Phase II)
- Figure 2-7H: Boron in Vegetation and Invertebrates (Phase I)
- Figure 2-8A: Lead in Adult Whole-Body Fish Tissue (Wet Weight) (Phase I)
- Figure 2-8B: Lead in Adult Fish Fillet Tissue: Bluegill and Green Sunfish (Wet Weight) (Phase I)
- Figure 2-8C: Lead in Adult Fish Fillet Tissue: Larger Fish (Wet Weight) (Phase I)
- Figure 2-8D: Lead in Stratified Surface Water (Phase I and Phase II)
- Figure 2-8E: Lead in Overturn Surface Water (Phase I)
- Figure 2-8F: Lead in Sediment Pore water (Phase I and II)
- Figure 2-8G: Lead in Sediment (AMEC February 2017, Phase I and Phase II)
- Figure 2-8H: Lead in Vegetation and invertebrates (Phase I)
- Figure 2-9A: Zinc in Adult Whole-Body Fish Tissue (Wet Weight) (Phase I)
- Figure 2-9B: Zinc in Adult Fish Fillet Tissue: Bluegill, Green Sunfish (Wet Weight) (Phase I)
- Figure 2-9C: Zinc in Adult Fish Fillet Tissue: Larger Fish (Wet Weight) (Phase I)
- Figure 2-9D: Zinc in Stratified Surface Water (Phase I and Phase II)
- Figure 2-9E: Zinc in Overturn Surface Water (Phase I)
- Figure 2-9F: Zinc in Sediment Pore Water (Phase I and Phase II)
- Figure 2-9G: Zinc in Sediment (AMEC February 2017, Phase I, and Phase II)
- Figure 2-9H: Zinc in Vegetation and Invertebrates (Phase I)

2.3.5.1 Boron, Lead, and Zinc Results (Phase I and II)

The detected concentrations of boron, lead, and zinc in fish tissue (whole-body and fillet), surface water, sediment pore water, sediment, aquatic vegetation and aquatic invertebrates are at or below Kentucky and USEPA ecological and human health criteria and risk-based screening levels, where such criteria exist with the exception of boron and zinc in sediment (Figures 2-7A–H, Figures 2-8A-H and Figures 2-9A-H). Boron and zinc concentrations in sediment at some locations in Curds Inlet exceeded relevant ESVs, as follows:

- All Phase I and II sediment boron levels are magnitudes below the screening level for residential soil (16,000 mg/kg) (Figure 2-7G).
- The Phase I and II sediment boron concentrations range 2.95–72.3 mg/kg with the minimum and maximum concentrations recorded from locations CI4B and CI1A, respectively (Figure 2-7G, Table 2-11).
- Phase I results from three Curds Inlet locations (CI1A, CI2.1, and CI4A) and one HQ Inlet Location (HQ1A) are greater than the average of the average background sediment boron levels listed in

Mason and Dragun (1996) (40 mg/kg) but are below the corresponding average of maximum background boron levels. (117 mg/kg) (Figure 2-7G).

- Sediment lead results for Phases I and II were at or below the USEPA R4 ESV (35.8 mg/kg) apart from one location (CI1C) sampled in Phase I, one location (CI2.2C) sampled in Phase 2 (38.3 mg/kg and 37.1 mg/kg, respectively), and one location sampled in Hardin Inlet by AMEC (37 mg/kg).
- Phase I and II zinc sediment concentrations range 10.9–245 mg/kg with minimum and maximum recorded from locations LHL6B and CI1A, respectively (Figure 2-9G, Table 2-11). The Phase I zinc sediment result from CI1A (245 mg/kg), and from other Curds Inlet locations, exceeds the USEPA Region 4 ESV (121 mg/kg) but all are less than the USEPA Region 4 RSV (459 mg/kg) and greater than a magnitude below the USEPA RSL for residential soil (23,000 mg/kg).

2.3.5.2 Key Findings for Boron, Lead, and Zinc (Phase I and II)

The Phase I and II results for boron, lead, and zinc in surface water, sediment pore water, sediment, aquatic vegetation, and aquatic invertebrates provide sufficient information to conduct the risk assessments and for the remedy evaluations.

2.3.5.3 Key Finding for Additional Metals (Magnesium and Iron) (Phase I and II)

Magnesium and iron were also sampled in surface water, sediment pore water, sediment, aquatic vegetation, and aquatic invertebrates. Magnesium and iron were analyzed in Phase I and Phase II investigations as CCR-related constituents, but these are also naturally occurring constituents. The data for these metals are provided in the Section 2 tables (results are not graphically presented). The Phase I and II results are also adequate to conduct the human health and ecological risk assessments and for the remedy evaluations.

3. CHEMICAL FATE AND SOURCE IDENTIFICATION IN HERRINGTON LAKE

This section provides an analysis of chemical source identification and fate in Herrington Lake using data from the Phase I and Phase II investigations (surface water, sediment, and sediment pore water) along with groundwater monitoring data, KPDES outfall data, spring monitoring data, and data from the Toe Drain collection system. This discussion is based on a conceptual understanding of E.W. Brown potential source contributions to Herrington Lake. The CCR-related constituents of greatest potential interest for this investigation are selenium and arsenic. The conceptual model for source identification is provided in Figures 3-1A–G, as follows:

- Figure 3-1A provides a site overview
- Figure 3-1B provides a view of the E.W. Brown Landfill (that serves as a cap for the Main Ash Pond), the Toe Drain collection system and Auxiliary Pond Outfall KPDES BRN001.
- Figure 3-1C through 3-1H provides conceptual information to inform the discussion of the Landfill, groundwater monitoring wells, groundwater conditions such as the groundwater divide and piezometric water levels, and a detailed cross section view of the Toe Drain collection system is provided.
- Figure 3-1I illustrates Curds Inlet with a cross section example of the channel.
- Figure 3-1J describes Curds Inlet with focus on the coal pile drainage.
- Figure 3-1K illustrates Curds Inlet, HQ Inlet, springs, KPDES outfalls, and groundwater monitoring wells, for consideration of groundwater and springs as potential sources of CCR related constituents to Curds Inlet.
- Figure 3-1L identifies the Phase I and Phase II sampling stations within Curds Inlet and HQ Inlet to illustrate the dense coverage of sampling now available for these areas.
- Figure 3-1M illustrates the Lower Herrington Lake area, including sampling locations LHL5 and LHL6; both located well upgradient of the influence of the E.W. Brown Station and therefore providing reference conditions.

This section provides a detailed discussion of the geochemical relationships for selenium and arsenic, using the conceptual understanding of selenium and arsenic as well as Phase I and Phase II investigation sampling data for surface water, sediment, and sediment pore water. Boron is also discussed, as literature studies have demonstrated that boron can be used as a tracer for leaching of CCR-related constituents (e.g. Quast et al. 2006; Ruhl et al. 2014). The relationships between selenium, arsenic, and boron are presented in graphical form.

This section also provides a discussion of mass loading of selenium and arsenic to Herrington Lake from each of the following:

- Auxiliary Pond KPDES Outfall BRN001
- Springs and groundwater flow
- Sediment flux
- Estimated upgradient lake wide mass loading conditions based on conditions at LHL5 and LHL6

Mass loading estimates are provided for two time periods, from before and after the completion of IRMs described in Section 1 of this report. IRMs include installation of a Toe Drain collection system below the Former Main Ash Pond, construction of an Engineered Cap over the Main Ash Pond, and repair of Auxiliary Pond discharge pipe. Mass loading results are provided in a relative manner using standardized units so that the sources can be directly compared. Specifically, estimated mass

loadings from sediment to the water column are compared to estimates of mass loadings from the Auxiliary Pond KPDES BRN001 outfall, springs, and seeps. Groundwater data are also discussed in terms of the concentrations observed at and mass loading estimated from the E.W. Brown Station monitoring well locations between the upland sources and Herrington Lake. This analysis of relative source contributions also considers upgradient concentrations of selenium and arsenic within Herrington Lake, using data from samples collected during Phase I and Phase II efforts. The approaches used allow a relative comparison from each source with an order of magnitude level of accuracy for comparative purposes. The estimated values presented as mass loading allow comparisons but are not exact values.

The remainder of this Section is provided as follows:

- Section 3.1 provides a discussion of potential sources of CCR-related constituents:
  - Section 3.1.1. describes the conceptual source identification model for the E.W. Brown Station and Herrington Lake
  - Section 3.1.2 identifies other KPDES permitted dischargers identified in Herrington Lake
- Section 3.2 briefly discusses selenium and arsenic geochemistry and naturally occurring sources.
- Section 3.3 discusses the nature of selenium and arsenic in Herrington Lake using the Phase I and Phase II data, with boron as a marker for CCR-related constituents.
- Section 3.4 provides selenium and arsenic mass loading estimates for a discussion of source identification.
- Section 3.4 discusses key findings for this chemical source identification and fate discussion for Herrington Lake.

3.1 Potential Sources of CCR-related Constituents in Herrington Lake

The potential sources of CCR-related constituents in Herrington Lake are described using a conceptual source identification model for the E.W. Brown Plant and Herrington Lake (Section 3.1.1) and a brief discussion of selenium and arsenic geochemistry and naturally occurring sources (Section 3.1.2).

3.1.1 Conceptual model for source identification for the E.W. Brown Station and Herrington Lake

The conceptual model for source identification for the E.W. Brown Station and Herrington Lake is illustrated on Figures 3-1A–M. Each of the key source areas is identified on these figures and briefly described in this section.

- **Landfill and former Main Ash Pond:** The E.W. Brown Station has generated and disposed of CCR since the 1950s. Ash was sluiced to the Main Ash Pond, located directly south of the generating station. As the Main Ash Pond filled, it was expanded twice, in 1973 and 1989, and at time-of-closure, it measured approximately 114 acres. In 2008, a second pond (referred to as the Auxiliary Pond, or "Auxiliary Pond") was constructed as a temporary settling pond until the Main Ash Pond could be expanded again. Until it was taken out of service, the Main Ash Pond discharged to Curds Inlet through a permitted KPDES Outfall. In late 2008, the Main Ash Pond was taken out of service, and the sluicing operation was switched to the Auxiliary Pond. Much of the Main Ash Pond was covered with a multi-layered Engineered Cap in preparation for construction of a landfill over the closed Main Ash Pond (Figures 3-1A and Figure 3-1B). The Landfill liner provides a cap for the Main Ash Pond. The multi-layered Engineered Cap was

constructed between the former Main Ash Pond and the Landfill, as illustrated on Figure 3-1H. The multi-layered system is comprised of the following (layered from the surface of the former Main Ash Pond):

- A drainage layer on top of the Main Ash Pond.
- A geocomposite drainage net underdrain centered under leachate collection swales.
- A compacted clay layer.
- A cushioned geotextile (Type II).
- A linear low-density polyethylene (LLDP) flexible membrane liner.
- An 18-inch drainage media leachate collection layer.

- **Water Collection Systems:** There are three water collection systems associated with the former Main Ash Pond and the Landfill: (1) the Abutment Drain collection system, (2) the Landfill leachate collection system, and (3) the Toe Drain collection system. The Abutment Drain collection system captures water with CCR-related constituents from the former Main Ash Pond. This system was installed in 2014. The water from the Abutment Drain collection system is pumped to the new Process Pond. The Landfill leachate collection system is also pumped to the new Process Pond.

  The Toe Drain collection system, completed in 2016, captures groundwater flow from within and below the Main Ash Pond and pumps that groundwater to the Auxiliary Pond. The Toe Drain also captures water from springs (Dam Toe Right, Dam Toe Middle, and Dam Toe Left) and seepage from the former Main Ash Pond and pumps the flow from these springs to the Auxiliary Pond. The Toe Drain collection system was designed to collect flow from the springs previously in the area of the Toe Drain via a spring box. In addition, the Toe Drain collection system design includes connection to existing Toe Drain seepage piping, has perforated underdrains pipe along the bedrock surface, and has stone fill to facilitate collection of water. The water collected in the Toe Drain collection system is pumped to the Auxiliary Pond. Figures 3-1C through 3-1H show the geologic view of the Landfill with a cross section through the Landfill approximately perpendicular to the dam face and crossing through the Toe Drain System (Figures 3-1D and 3-1H). The approximate original ground surface prior to building the ash pond is shown, and the vertical thickness of the Ash Pond, and vertical thickness of the landfill are shown (Figure 3-1H). It is possible that there is seepage from the Main Ash Pond that is not captured by the Toe Drain collection system. However, the bottom of the pumping chamber, which is at an elevation of approximately 730 feet asl, is topographically lower than the base of the ash in the Main Ash Pond, and therefore would be expected to capture flow from the Main Ash Pond as it dewaters. Furthermore, pore water sampling in Curds Inlet conducted in Phase I and Phase II sampling in accordance with the CAP and Phase II Plan supports a conclusion that groundwater upwelling is not a source of CCR-related constituents to Curds Inlet. Therefore, if any groundwater with CCR-related constituents does not get captured by the Toe Drain collection system, it would be *de minimis*.

  A view of Curds Inlet and the coal pile is provided in Figure 3-1J. Runoff from the coal pile does not flow to Curds Inlet along the northern bank. Rather, drainage from the coal pile is collected in the coal pile runoff and settling pond and is pumped to the Auxiliary Pond where it is discharged to Curds Inlet via KPDES Outfall BRN001.

- **KPDES Permitted Outfalls:** The Auxiliary Pond KPDES Outfall BRN001 is the primary source of CCR-related constituents into Curds Inlet. This outfall discharges from the Auxiliary Pond to the uppermost portion of Curds Inlet. The Auxiliary Pond, which went into service in 2008, receives scrubber wastewater, other process wastewaters, and historically has been used for ash transport

water. The Auxiliary Pond KPDES Outfall BRN001 is the primary wastewater outfall for E.W. Brown Station. Prior to its closure, the Main Ash Pond discharged directly to Curds Inlet via the KPDES permitted outfall BRN001.

There are three additional KPDES permitted outfalls, BRN002, BRN003, and BRN005. BRN005 is permitted for cooling water intake. Cooling water extracted from the lake via KPDES BRN005 discharges to Curds Inlet via KPDES Outfall BRN003 (open water flow) and BRN002 (piped water flow). Following the retirement of Unit 2 in February 2019, BRN002 no longer discharges cooling water.

- **Springs:** Ditch Spring, Beaver Dam Cave Spring, and the South Abutment Spring formerly flowed to Curds Inlet (Figures 3-1A, 3-1B, 3-1I, 3-1K, 3-1F). These springs have been observed to have no flow since the completion of the IRMs (e.g., capping of the Main Ash Pond). The springs Dam Toe Right, Dam Toe Middle, and Dam Toe Left formerly flowed to Curds Inlet but the flow from these springs is now captured by the Toe Drain collection system and channeled to the Auxiliary Pond. Two springs, Beaver Dam Spring and HQ Spring, flow into HQ Inlet. The CCR-related constituents detected in the springs are discussed in this section. There was one additional transient spring identified in inner Curds Inlet before the installation of the Toe Drain (North Curd Sink, identified on Figures 3-1B and 3-1L, proximate to the Toe Drain). This spring was only observed and sampled on a single sampling event in 2015 when lake levels were low (before the Toe Drain was installed).

  There is a quarry pond that was constructed as an IRM in 2016 (Table 1-1). The quarry pond does not collect CCR-related waste streams. The quarry surface was covered with topsoil and vegetated to minimize erosion. There is a drainage channel from the quarry pond to KPDES Outfall BRN001 that does not discharge except in condition of excessive rainfall (Figures 3-1K and 3-1L).

- **Groundwater:** Groundwater monitoring wells nearest Herrington Lake and Curds Inlet are MW-009, MW-011, MW-010 near the Auxiliary Pond, MW-112, MW-113, and MW-114 near the central and northern end of the Landfill, and MW-106 near the southern boundary of the Landfill (Figures 3-1A, 3-1B, 3-1C). In general, groundwater follows topography and flows toward the lake. There is a groundwater basin divide illustrated on Figure 3-1C. The screened well depths are and piezometric water level measurements from June 2018 are shown on Figures 3-1D and 3-1F, respectively. MW-116 is the groundwater monitoring well furthest south and is between E.W. Brown Station Auxiliary Pond and Hardin Inlet (Figure 3-1E).

- **Sediment and Sediment Pore Water:** Flux from CCR-related constituents from sediments to the water column within Curds Inlet or HQ Inlet could potentially occur. The Phase I and Phase II investigations included the collection of sediment and sediment pore water as discussed in Section 2 of this report and illustrated on Figure 3-1L. A view of Curds Inlet is provided on Figure 3-1I with an inset cross section example of Curds Inlet where Phase I and Phase II samples were collected. As illustrated on the diagram: samples designated with "A" reflect the thalweg samples, samples designated "B" were below winter pool lake levels, samples designated "C" were collected during summer pool conditions and can be exposed during winter pool lake levels. The Curds Inlet example cross section in Figure 3-1I also illustrates the steep northeastern channel bank and compare to the more gradual (and less rocky) opposite bank. During Phase I and Phase II sampling, divers noted large woody debris (logs and stumps) that drag across the banks as lake levels rise and fall. These forces can break down the channel banks over time releasing naturally-occurring constituents into the channel. The potential flux of CCR-related constituents from sediment to the water column is included in the estimates of mass loading discussed in this

section. The sediment pore water sampling also provides insight into whether there is groundwater upwelling in Curds Inlet.

- **Upgradient Areas**: A wider view of the E.W. Brown Station, Curds Inlet, HQ Inlet and Herrington Lake are provided on Figure 3-1M. Figure 3-1M also displays sampling Locations LHL5 and LHL6, located approximately 1.8 and 3 miles upstream from Curds Inlet, respectively, but still within the Lower Herrington Lake study area. LHL5 and LHL6 are considered reference areas for the evaluation of lake-wide concentrations upgradient of the influence of the E.W. Brown Station. Figures 3-2A and 3-2B identify the permitted dischargers within the Herrington Lake watershed, discussed further in Section 3.1.2.

3.1.2 Other KPDES Permitted Dischargers Identified in Herrington Lake

As part of an initial assessment of potential selenium sources in Herrington Lake, a search of dischargers within the Dix River watershed was conducted. Specifically, sources of selenium were assessed using publicly available data from USEPA's Envirofacts Multisystem Search Engine, a tool which integrates information from a variety of databases containing data on facilities that are required to report activities to a state or federal system (USEPA 2017b,c). Databases included in the Envirofacts Multisystem search include (but are not limited to) the Toxics Release Inventory, Superfund Enterprise Management System, Facility Registry Service, and the Integrated Compliance Information Search. Specific information regarding National Pollutant Discharge Elimination System and KPDES facilities were obtained from USEPA's Permit Compliance System database. The locations of the KPDES facilities are identified in the Herrington Lake Corrective Action Plan (Ramboll 2017a). These permitted dischargers include facilities such as sewage treatment, manufacturing, crushed stone and concrete mixing, waste management, and roofing. The receiving waters include Herrington Lake and waterbodies that flow to Herrington Lake. The permitted dischargers in the Herrington Lake watershed are illustrated on Figures 3-2A and 3-2B, with a listing of the dischargers in Table 3-1.

3.1.3 Selenium and Arsenic Naturally Occurring Sources

The CCR constituents of greatest potential interest for this investigation are selenium and arsenic. According to Agency for Toxic Substances and Disease Registry (ATSDR 2003), selenium is ubiquitous in the environment, being released from both natural and anthropogenic sources. The principal releases of selenium into the environment from human activities result from the combustion of coal. Other anthropogenic emission sources of atmospheric selenium include oil combustion facilities, selenium refining factories, base metal smelting and refining factories, mining and milling operations, end-product manufacturers (for example, some semiconductor manufacturers), as well as incineration of rubber tires, paper, and municipal waste. Selenium was also used in the glass industry, as a nutritional feed additive for poultry and livestock and as an accelerator and vulcanizing agent in rubber production. Selenium was used as a catalyst in the preparation of pharmaceuticals including niacin and cortisone, as an ingredient in antidandruff shampoos (selenium sulfide), and as a constituent of fungicides (selenium sulfide). Sewage treatment plants are another source of selenium release to water. ATSDR (2003) reported that in the past, selenium was used in pesticide products, but because of stability in soils and subsequent contamination of food crops, its use in pesticide products is restricted.

Arsenic is naturally occurring in rocks and soil at concentrations reflecting the underlying geology in the region. Higher concentrations are typically associated with sulfide ores (e.g. arsenopyrite) as well as igneous and sedimentary rocks (USEPA 2005). Arsenic is also found in coals (Barringer and Reilly 2013). Arsenic levels in soil may also be attributed to anthropogenic activities. Prior to 1970s,

arsenic was primarily used to produce agricultural pesticides; but since the 1980s and up until about 2003, the primary use of arsenic has been in the application of chromated copper arsenate (CCA) for wood preservation. Since 2003, there has been a voluntary reduction in the use of CCA (Barringer and Reilly 2013). Elevated levels of arsenic in soil are often associated with mining and processing of ores, pesticide/herbicide manufacturing facilities and agricultural lands (USEPA 2005; Barringer and Reilly 2013). Arsenic has also been used in glass production.

The Cabinet does not publish selenium and arsenic background concentrations for surface water or sediment, but the Cabinet does publish background concentration ranges for selenium and arsenic in soil for the state of Kentucky, as summarized in the Kentucky Guidance for Ambient Background Assessment (Kentucky Natural Resources and Environmental Protection Cabinet 2004, Table 2 of that report). As indicated in the Kentucky 2004 report, the summary statistics represent from 400 to 800 samples and the data were "collected from areas generally considered to be outside of the influence of site activities but were potentially impacted by regional or urban activity. Therefore, these samples represent "ambient," as opposed to "natural," background."

Soil concentrations for selenium and arsenic as identified in the Kentucky 2004 report are provided below and all constituents are provided in Table 3-2A. Naturally occurring background soil concentrations are relevant because they provide some insight into the naturally occurring rock formations that form Herrington Lake and ambient soils that can naturally erode from soil to form lake sediments over time.

- The mean concentration of selenium in naturally occurring soils of Kentucky is 0.94 mg/kg, with a 95% upper confidence limit on the mean of 0.99 mg/kg, and a 95th percentile of 2.1 mg/kg.
- The mean concentration of arsenic in naturally occurring soils of Kentucky is 8.9 mg/kg, with a 95% upper confidence limit on the mean of 9.4 mg/kg, and a 95th percentile of 21.2 mg/kg.

The United States Geological Survey (USGS 2017) document entitled *Critical Mineral Resources of the United States—Economic and Environmental Geology and Prospects for Future Supply*, Chapter Q for selenium, provides recent data on soil chemistry in the conterminous United States including data in the 0-5 cm depth, which represents the top two inches of soil. The background soils discussions in USGS (2017) for arsenic rely on USGS data reported in Smith et al. (2014). The USGS background data for Kentucky is comprised of 64 samples. These data are provided in Table 3-2B of this report and are consistent with the Kentucky ambient soils data. Background selenium and arsenic concentration maps provided in USGS (2017) and Smith et al. (2014) are repeated in Figures 3-3A and 3-3B of this Corrective Action ISARA Report. As indicated in Figures 3-3A and 3-3B, the E.W. Brown Station is within an area in Kentucky identified as having selenium and arsenic above the 90th percentile.

3.2 Geochemistry of Selenium and Arsenic

A brief description of the geochemistry controlling selenium and arsenic fate in Herrington Lake surface water and sediments is provided in Figure 3-3C.

3.2.1 Selenium Geochemistry

A preliminary conceptual model of the selenium geochemistry cycle in the Herrington Lake aquatic environment is provided in Figure 3-3C, illustrating cycling of selenium in surface water and sediments through primary producers, consumers, and carnivores. The selenium geochemical cycle involves three major processes in aquatic systems: abiotic and biotic transformations among various selenium

species; deposition and resuspension of particulate phases; and trophic transfer involving algae, plants, and animals. Understanding selenium speciation in surface water, sediments and within the food web is critical to understanding its mobility, transformation, partitioning in the environment. (Chapman et al. 2010)

As indicated in Figure 3-3C, selenium can exist in four different oxidation states:

- Se^{4+} or Se(IV) - typically present as selenite ion SeO_3^{2-},
- Se^{6+} or Se(VI) - typically present as selenate ion SeO_4^{2-},
- Se or Se(0) - present as elemental selenium, and
- Se^{2-} or Se(-II) - typically present as organo-selenide (*e.g*. selenomethionine) or metal selenides.

Selenium in coal ash is initially present as Se(IV) and Se(0) (Liu et al. 2013); however, in coal ash, inorganic forms of Se(IV) and Se(VI) are most likely to be present (Schwartz et al. 2016). Because Se(IV) tends to bind more strongly to sediment phases (oxyhydroxides, organic matter and clays), under highly oxidized conditions, the more thermodynamically stable Se(VI) is often present at higher concentrations than Se(IV) (Masscheleyn et al. 1991; Schwartz et al. 2016; Vriens et al. 2016).

Under more reducing conditions, selenium solubility is controlled by formation of sparingly soluble elemental selenium and metal selenide compounds (Masscheleyn et al. 1991; Ruhl et al. 2012; Schwartz et al. 2016). Biological processes are also important in determining the forms of selenium that may be present. Microorganisms are capable of a range of transformation processes including reduction, methylation, oxidation, and demethylation of selenium (Eswayah et al. 2016).

Microbially-mediated transformation of selenium to more reduced forms facilitates selenium uptake and subsequent incorporation into higher trophic levels (Riedel et al. 1996). Se(IV), and to a lesser degree Se(VI), can be taken up directly by phytoplankton, bacteria, and microalgae to form volatile dimethylselenide and non-volatile organic selenium compounds (e.g. selenomethionine, selenocysteine). These organo-selenium compounds may eventually become concentrated in biogenic particulates (e.g. phytoplankton detritus) and participate in deposition and resuspension processes along with other sorbed and mineralized selenium species. Once deposited in sediments, insoluble elemental and reduced selenium species may be sequestered in sediments or re-oxidized and released back into the food chain via bioturbation and other sediment mixing processes (Chapman et al. 2010).

Potential factors affecting the bioavailability of selenium in Herrington Lake sediments include the fact that Herrington Lake is very deep in portions of the lake nearest the dam and the E.W. Brown Station. The depth of the lake limits the limnologic cycle of lake turnover, and thus, limits the amount of selenium input into the food web from sediments (i.e., sediment suspension, resuspension, and selenium uptake into plants from sediments at depth). Sediments at depth which do not cycle or have limited cycling due the limnological stratification also tend to sequester selenium due to the relatively anaerobic environment. Under more reducing conditions, selenium tends to sorb to iron oxides and oxyhydroxides and becomes less bioavailable.

3.2.2 Arsenic Geochemistry

Arsenic can exist in four oxidation states As^{5+} or As(V), As^{3+} or As(III), As^0 or As(0) and As^{3-} or As(-III), as indicated in Figure 3-3C. Arsenic derived from coal ash exists mainly as As(V); however, in natural waters it is mostly found in inorganic form as oxyanions of As(III) and As(V) (Smedley and Kinniburgh 2002). Organic forms produced by biological activity may also exist. The two main forms of

organic arsenic are dimethylarsenic acid (DMAA) and monomethylarsonic acid (MMAA). In both DMAA and MMAA, arsenic is present as As(V).

In solution, oxyanions of As(V) will be present as the negatively charged $H_2AsO_4^-$ or $HAsO_4^{2-}$. Both species readily bind to positively charged iron oxyhydroxide surfaces. The As(V) oxyanion tends to sorb more strongly to mineral phases compared to the reduced As(III) form because As(III) in solution is most likely to be present as the neutral H_3AsO_3 species (Raven et al. 1998; Schwartz et. al. 2016).

Thus, unlike selenium which is immobilized under reducing conditions, arsenic solubility increases substantially under reducing conditions. Post-depositional mobilization of arsenic to the surface can result in elevated concentrations in surface sediments and immediately overlying surface waters (Cummings et al. 1999). In addition to chemical redox reactions in which equilibrium is achieved slowly, biological activity can also result in more rapid redox changes via dissimilatory reduction (respiration) or reductive dissolution of iron. Iron-reducing bacteria are capable of indirectly mobilizing adsorbed arsenic via reductive dissolution of iron oxyhydroxides (Lagner and Inskeep 2000; Tadanier et al. 2005). Arsenic is also released via chemical reduction of iron oxyhydroxides (Masscheleyn et al. 1991).

Thus, relative concentrations of As(III) and As(V) can vary depending upon redox conditions as well as biological activity. Whereas, redox equilibrium is achieved slowly under normal conditions biological activity can result in the rapid oxidation of As(III) to As(V) (Smedley and Kinniburgh 2002). The relative rates of microbially mediated As(V) reduction and As(III) oxidation can have a significant effect on arsenic cycling in natural systems (Jones et al. 2000).

3.3 Fate of Selenium and Arsenic Using Phase I and Phase II Data

As indicated in Section 2, arsenic and selenium have been measured in surface water, sediment and sediment pore water samples collected in various areas of Herrington Lake. Sediment pore water data include speciated results for both arsenic and selenium. These data have been summarized in Section 2. The sediment and pore water samples were collected along transects targeting sediment depositional areas as follows:

- Location A Sediments: Subaqueous, close to the deepest point in the channel (thalweg),
- Location B Sediments: Subaqueous, at a depth below winter pool (approximately 725 feet above mean sea level [msl]; and,
- Location C Sediments: A location above winter pool elevation and below summer pool elevation (approximately 740 feet above msl).

The speciated arsenic and selenium concentrations in pore water samples collected along transects in Curds Inlet show characteristic differences in redox conditions between the deepest Location A sediments and shallower Location B and C sediments. Chemical relationships between arsenic, selenium, and boron (as a potential tracer) in surface water, sediment and pore water are investigated for surface water (Section 3.3.1), sediment pore water (Section 3.3.2), and sediment (Section 3.3.3). Selenium and arsenic in the Auxiliary Pond KDPES Outfall BRN001 have shown reductions in mass via this outfall over time (Figures 3-4A and 3-4B, respectively).

3.3.1 Surface Water

Selenium was detected in surface water samples at concentrations ranging from non-detect (< 1.0)–5.4 µg/L. Arsenic was detected at similar levels with concentrations ranging from 0.46–5.48 µg/L. A plot of total selenium versus total arsenic detected in surface water samples is displayed in Figure 3-5A. The correlation coefficient (r^2 = 0.28) indicates a weak correlation between arsenic and selenium in Herrington Lake surface water samples.

The highest selenium concentrations were detected in shallow water (< 15 feet) in Curds Inlet. In contrast, four of the six highest arsenic concentrations were detected at depths of 50–70 ft. bws in Curds and HQ Inlets. These data are consistent with sediments playing a larger role with respect to arsenic loadings in Herrington Lake. Potential mass flux from sediments represent only a minor contribution to overall selenium mass loadings; however, for arsenic, potential mass flux from sediments may be more significant.

Boron has been investigated in the past as a general groundwater tracer and as a tracer for leaching of CCR (e.g. Quast et al. 2006; Ruhl et al. 2014). Total selenium and arsenic in surface water are plotted versus total boron in Figure 3-6A and 3-6B. There is a strong correlation (r^2 = 0.90) between boron and selenium in surface water which demonstrates a CCR source for the selenium. The correlation between boron and arsenic in surface water is weaker (r^2 = 0.32) but still suggests that the source of arsenic is related to CCR. The strong correlation between boron and selenium is considered further in Section 3.4 to understand potential sources of selenium in Herrington Lake.

3.3.2 Sediment Pore Water

As indicated in Section 2.3.1.4, the speciation of selenium in sediment pore water samples collected from Curds Inlet, HQ Inlet and Hardin Inlet is presented in Tables 2-3A and 2-3B, and Figure 2-3K. As indicated in Figure 2-3K the highest selenium pore water concentrations were detected in sediments nearest the KPDES BRN001 outfall to Curds Inlet; and selenate was the dominant form of selenium detected. Pore water selenium concentrations followed a general pattern of decreasing concentrations with distance downgradient in Curds Inlet and speciated forms were mostly not detected in deeper, thalweg (Location A) sediment samples (e.g. CURDS2A, CI2.1A, CI2.2A, CI3A, CI3.1A).

A plot of total selenium versus total arsenic in sediment pore water by sediment location type (i.e. "A", "B" or "C" sediments as defined above) is presented in Figure 3-7. The highest pore water arsenic concentrations are clearly associated with the deeper (A) sediments. Arsenic speciation in pore water (Figure 2-4G) indicates a preponderance of As(III) over As(V) in "A" sediments suggesting that these deeper thalweg locations are characterized by more reducing-like conditions. As indicated in Section 3.3.2, arsenic solubility increases substantially under reducing conditions accounting for much higher pore water arsenic concentrations associated with deeper "A" sediment locations.

With few exceptions, pore water selenium concentrations associated with "A" sediments are low – generally less than 0.002 mg/L. Under more reducing conditions, selenium tends to sorb to iron oxides and oxyhydroxides and becomes less bioavailable. Because sediment redox was not measured, it cannot be concluded that all "A" locations are characterized by reducing conditions – or that all "B" and "C" locations represent oxidizing conditions. The data presented in Figure 3-6 suggest that some "A" sediment locations (e.g. CI1A and CI1A DUP nearest the BRN001 outfall) are characterized by oxidizing conditions; and some "B" sediment locations (e.g. CI3.1B and CI3.2B) exhibit more reducing like character. However, all "C" sediment locations do appear to be characterized by oxidizing conditions.

The relationship between total selenium and total boron in pore water is plotted by sediment location type in Figure 3-6A. Under more oxidizing conditions, there is a clear relationship between selenium and boron as indicated for the "C" sediment locations. However, because selenium tends to drop out of solution under reducing conditions, there is no clear relationship between selenium and boron at "A" and "B" locations.

The relationship between total arsenic and total boron in pore water is plotted by sediment location type in Figure 3-6B. There is a weak relationship between arsenic and boron under oxidizing or reducing conditions.

3.3.3 Sediments

Pore water selenium concentrations are plotted against sediment selenium concentrations by sediment location type in Figure 3-8A. There is no apparent relationship between selenium in pore water and selenium in sediment under both oxidizing and reducing conditions (see Figure 3-8A). These data show that pore water selenium concentrations are not determined by sediment selenium levels and suggest that sediment is not the controlling source of selenium in pore water. The selenium concentrations in sediment and sediment pore water are illustration on a map of Curds Inlet in Figure 3-8B.

Pore water arsenic concentrations are plotted against sediment arsenic concentrations by sediment location type in Figure 3-9A. Although the overall correlation is weak (r^2 = 0.47; largely dictated by more reducing A sediments), there is a clear association between higher sediment concentration and higher pore water concentrations in reducing sediments. The selenium concentrations in sediment and sediment pore water are illustration on a map of Curds Inlet in Figure 3-9B.

3.3.4 The Selenium and Boron Relationship Further Evaluated

The association between boron and selenium in surface water and oxidizing pore waters is one line of evidence that can be used to evaluate potential sources of selenium in Herrington Lake.

- Total selenium is plotted against total boron in surface water, oxidizing pore water ("C" sediment locations) and spring (HQ Spring and Briar Patch Spring) samples in Figure 3-10A. The overlap between surface water and oxidizing "C" pore water samples is consistent with surface water as the source of pore water selenium concentrations detected in oxidizing "C" sediments.

Although higher selenium and boron levels are observed in samples collected from HQ and Briar Patch Springs compared to surface water and pore water levels; the relationship between boron and selenium largely remains. These data are consistent with HQ Spring and Briar Patch Spring acting as sources of selenium to Herrington Lake. The springs may be influenced by seepage from the Main Ash Pond or the Auxiliary Pond. The IRMs completed to date have improved conditions in the springs.

- Predicted boron levels have been calculated using the measured selenium from Auxiliary Pond KPDES BRN001 based on a linear best fit to the data presented in Figure 3-10B. The Auxiliary Pond KPDES BRN001 discharge is a permitted source of selenium to Herrington Lake, and the association between boron and selenium (i.e. selenium/boron signature) is expected to follow the selenium/boron signature observed in surface water. Selenium concentrations (and predicted boron levels) in the Auxiliary Pond KPDES BRN001 discharge are higher than concentrations detected in sediment pore water, surface water and springs. Several measured selenium and boron data points are also available from the 2019 Auxiliary Pond KPDES Permit Application Form

C. Those data are summarized on Figure 3-10C. As can be seen on Figure 3-10C, the measured selenium and boron results are consistent with the predicted results.

- Selenium has been detected in groundwater at MW-106 at concentrations ranging from 0.0057–0.021 mg/L (n = 10, detected between October 2016 and June 2018). MW-106 is located west of HQ and Briar Patch Springs between the Main Pond and Auxiliary Pond. Selenium and boron levels detected at MW-106 are plotted along with data collected for surface water, springs and "C" sediment pore water in Figure 3-10C. The selenium/boron signature in groundwater collected at MW-106 differs from the selenium boron signature observed in surface water and sediment pore water but is similar to the signature observed for several of the samples collected from Briar Patch Spring.
- At other monitoring wells located east of the CCR ponds (i.e. MW-110, MW-111, MW-112, and MW-113) selenium was not detected at a detection limit of 0.005 mg/L except on one occasion at MW-111. Boron concentrations ranged from 0.63 to 6.5 mg/L. These concentrations coincide with data collected from the Toe Drain Sump. While there is some overlap with surface water and sediment pore water data, particularly at low boron levels, the data suggest that groundwater detected at perimeter monitoring wells MW-110, MW-111, MW-112 and MW-113 and from the Toe Drain Sump is not a significant source of selenium to Herrington Lake. There was one additional transient spring identified in inner Curds Inlet before the installation of the Toe Drain (North Curd Sink, identified on Figures 3-1B and 3-1F, proximate to the Toe Drain). This spring is not spatially identified on Figure 3-10A-C because it was only observed and sampled on a single sampling event in 2015 when lake levels were low (before the Toe Drain was installed). The concentrations of selenium and boron were 0.0088 mg/L and 8.06 mg/L, respectively. These concentrations, if plotted on Figure 3-10C, align with the Toe Drain sump data.

The relationship between boron and selenium is strong, as discussed. Boron is further illustrated in Figure 3-10D for sediment and pore water, as was done for selenium and arsenic in Figures 3-8B and 3-9B, respectively. Boron was not detected at significant concentrations in the sediment or pore water, as illustrated in Figure 3-10D. The highest sediment concentrations are in the interior of Curds Inlet where KPDES BRN001 discharges. This supports a conclusion that the BRN001 outfall is the primary source of selenium to the water column of Curds Inlet. A comparison between selenium and boron in sediment, sediment pore water, the springs, the Toe Drain collection system, and the groundwater monitoring wells demonstrates a relationship between selenium and boron across each of the sample media, suggesting an ash source. The source evaluation of selenium demonstrates decreasing selenium levels with increasing distance from the E.W. Brown Station.

3.4 Selenium and Arsenic Mass Loading and Herrington Lake Source Identification

A mass loading comparison of relative contributions from selected sources of selenium and arsenic to Herrington Lake before and after implementation of the IRMs is provided. Mass loading results are provided in a relative manner using standardized units so that the sources can be directly compared. Specifically, estimated mass loadings from sediment to the water column are compared to estimates of mass loadings from the Auxiliary Pond KPDES BRN001 outfall, springs, and seeps. Groundwater data are also discussed in terms of the concentrations observed at and mass loading estimated from the E.W. Brown Station monitoring well locations between the upland source areas and Herrington Lake. This analysis of relative source contributions also considers upgradient concentrations of selenium and arsenic within Herrington Lake, using data from samples collected during Phase I and Phase II efforts. The approaches used allow a relative comparison from each source with an order of

magnitude level of accuracy for comparative purposes. The estimated values presented as mass loading allow comparisons but are not exact values. Contributions from the following sources are considered:

- Auxiliary Pond KPDES Outfall BRN001
- Springs,
- Groundwater,
- Sediment flux from sediments to the water column, and
- Estimated upgradient lake wide mass loading conditions based on conditions at LHL5 and LHL6.

3.4.1 Selenium Mass Loading Estimates

3.4.1.1 Estimate of Selenium Mass Loading from Auxiliary Pond KPDES Outfall BRN001

The mass of selenium entering Herrington Lake via Auxiliary Pond KPDES Outfall BRN001 discharge to Curds Inlet is estimated in Table 3-3A and is illustrated on Figure 3-4A. Mass loading estimates are based on quarterly selenium concentrations reported in KPDES 001 discharge monitoring reports and quarterly average flow rates. For the monitoring period of Q1 2015–Q3 2018, selenium concentrations ranged from ND–0.053 mg/L measured in Q4 and Q1 of 2016, respectively. Quarterly average flow rates ranged from 3.2–8.4 million gallons per day (MGD). As indicated in Table 3-3A, corresponding selenium mass loading estimates range from approximately 250–1000 g/day with an overall average loading estimate of 620 g/day before the implementation of IRMs and ranged from approximately 95-750 g/day with an average of approximately 360 g/day after implementation of the IRMs.

The data indicate a trend of decreasing mass loading and decreasing flow rate over the past three years (Figure 3-4A). The estimate of selenium mass loading from KPDES BRN001 is compared to other sources on Figure 3-11A.

3.4.1.2 Estimate of Selenium Mass Loading from Springs and Groundwater

Springs

The mass loading of selenium from springs at the E.W. Brown Station was estimated based on the groundwater flow model developed by AMEC (2013) from dye trace studies conducted in 2011 and 2012. As documented by these studies, faulting, fractures and local solutioning (karst) are present in the bedrock, and dyes were injected into karst bedrock features close to the Landfill (former Main Pond) and monitored in seeps and springs. Dyes were detected downgradient of the Landfill and Auxiliary Ponds including seeps at the toe of the Former Main Ash Pond embankment (locations Dam Toe Right, Middle, Left (CH-040, CH-041 and CH-042), Ditch Spring (CH-044), Beaver Dam Cave Spring (CH-045), Briar Patch Spring (CH-057) and HQ Spring (CH-046) (Table 3-3B).

The tracer tests indicated that a groundwater divide exists on site separating groundwater infiltration and discharge in one area from groundwater infiltration and discharge in another area. The groundwater divide from the tracer testing is shown on Figure 3-1C and runs through groundwater well MW-111. The tracer test results showed that the groundwater discharged from Briar Patch Spring and HQ Spring is from a different area of the site than the water discharged at Ditch Spring, South Abutment Seep, Beaver Dam Cave Spring, Dam Toe Middle, Dam Toe Left, Dam Toe Right. The tracer test and measurements from the springs are primarily measuring the impacts from groundwater flow through large conduits formed in the karst bedrock. Smaller fractures in the bedrock also transmit groundwater and there is exchange between the water in the smaller fractures and the water in the larger conduits.

Figure 3-1D shows a cross section along the line A-A' in Figure 3-1C. The cross-section depicts monitoring wells, borings, springs, subsurface geology and land surface topography.

- On the right side of Figure 3-1D is Hardin Inlet, showing surface water level from June 19, 2018. Also shown is the summer time pool elevation (740 feet als) and the winter time pool elevation (725 feet als) of Herrington Lake.
- Surface topography in the figure is adjusted based on well specific survey data and the well to well elevations.
- Wells and springs that are not on the cross-section line are projected onto the line, but their elevation is correct. HQ Spring and Briar Patch Spring appear as if they are below the land surface on the figure, however their position has been projected 261 feet and 498 feet east, indicating the water which originates to form these springs flow through the hillside, all illustrated by this cross section (Figure 3-1D). The South Abutment Seep, Beaver Dam Cave Spring and Ditch Spring appear at or above land surface.
- The location and elevation of the Toe Drain collection system is shown on the Figure 3-1D as well. It is possible that there is seepage from the Main Ash Pond that is not captured by the Toe Drain collection system. However, the bottom of the pumping chamber, which is at an elevation of approximately 730 feet asl, is topographically lower than the base of the ash in the Main Ash Pond, and therefore would be expected to capture flow from the Main Ash Pond as it dewaters (Figure 3-1H). Well MW-217 (Figure 3-1C) is located down gradient and at an elevation lower than the Toe Drain collection system. Monitoring conducted in February 2019 pursuant to assessment monitoring under the CCR Rule at that well indicated non-detect for arsenic and a selenium concentration (0.0066 mg/L) that is below groundwater protection standards (Table 3-4B). Furthermore, pore water sampling in Curds Inlet conducted in Phase I and Phase II sampling in accordance with the CAP and Phase II Plan supports a conclusion that groundwater upwelling is not a source of CCR-related constituents to Curds Inlet. Therefore, if any groundwater with CCR-related constituents does not get captured by the Toe Drain collection system, it would be *de minimis*. The Toe Drain captures groundwater via perforated pipe, and Dam Toe Spring discharge via inlet pipe. The installation of the Toe Drain collection system has significantly affected the discharge from the South Abutment Seep, Beaver Dam Cave Spring and Ditch Spring which have been mostly dry since installation.
- On Figure 3-1D, according to the results of the tracer tests, groundwater to the right (South) of MW-111 is from a different source area compared to groundwater to the left (North) of MW-111.

Selenium mass loading estimates from springs were based on flow measurements made by AMEC during 2011–2014 and selenium concentrations detected in samples collected in 2012–2013 prior to implementation of IRMs. Based on these data, estimated selenium mass loadings to Herrington Lake from seeps and springs downgradient of the Main Ash Pond and Auxiliary Ponds (circa 2012) ranged from approximately 87.6-593 g/day, with an average of approximately 421 g/day (Table 3-3B).

As indicated in Table 3-3B, the two largest sources of selenium from springs and seeps originate from HQ Spring (CH-046) and Briar Patch Spring (CH-057) with estimated selenium mass loadings of 54–240 g/day and 30–290 grams/day, respectively. Combined, Dam Toe Right, Middle, and Left (CH-040, CH-041 and CH-042), Ditch Spring (CH-044), and Beaver Dam Cave Spring (CH-045) produced a rounded estimate of selenium mass loading of approximately 3.6–63 g/day. More recent concentration and flow rate data collected from June 2017–October 2018 indicate that selenium mass loading from these two springs have decreased significantly because the flow from the springs was reduced after

the implementation of the IRMs. Selenium mass loadings from Briar Patch Spring decreased to 0.2–54 g/day with an average of approximately 6.4 g/day (n=24, Table 3-3C); and selenium mass loadings from HQ Spring decreased to approximately 1.4–9.4 g/day, with an average of approximately 3.5 g/day (n=4, Table 3-3C). February 2019 sampling of the groundwater pursuant to assessment monitoring under the CCR Rule at MW-218 which is sampling groundwater at an elevation below HQ and Briar Patch Spring, indicates that deeper groundwater (below the springs) is not impacted with selenium which showed non-detect at this location (Table 3-4B).

These data suggest that recent efforts to minimize seepage from coal ash storage ponds have been effective at reducing selenium mass loading to Herrington Lake from seeps and springs. The estimate of selenium mass loading from the springs is compared to other sources on Figure 3-11A (before implementation of IRMs) and 3-11B (after implementation of IRMs).

The transient spring identified in inner Curds Inlet before the installation of the Toe Drain collection system (North Curd Sink) is not included in the mass loading estimates because it was only observed and sampled on a single sampling event in 2015 when lake levels were low (before the Toe Drain was installed) and flow rates are not available. However, as mentioned, the concentration of selenium was 0.0088 mg/L, which is lower than selenium concentrations for the springs identified on Table 3-3B.

Groundwater

Mass loading of selenium from site groundwater to Herrington Lake can be estimated using groundwater concentration data from monitoring wells located near the lake (identified on Figures 3-1A, 3-1C and Table 3-4A) and groundwater flux estimates. Selenium was not detected in groundwater at the majority of locations (with detection limits of 0.005 mg/L equal to the Kentucky surface water criterion of 0.005 mg/L; see Table 3-4B). Selenium was detected in groundwater at MW-106 at concentrations ranging from 0.006–0.021 mg/L (detected between October 2016 and June 2018; see Tables 3-4A and 3-4B). MW-106 is located west of HQ and Briar Patch Springs between the Main Pond and Auxiliary Pond (see Figure 3-1A and 3-1C). At other monitoring wells located east of the CCR ponds (i.e. MW-109, MW-110, MW-111, MW-112, MW-113 and MW-114) selenium was not detected except on one occasion at MW-111 in October of 2016. Selenium was not detected at MW-111, in the ten sampling events following October 2016. These data suggest that any selenium contribution from groundwater is likely to be insignificant compared to other sources. However, the potential input from groundwater is considered further below.

The bedrock contains karst features and smaller rock fractures that provide pathways for groundwater flow directly to the lake. The mass loading of selenium to Herrington Lake from fractured bedrock groundwater near the KU facility was estimated based on the groundwater mass discharge calculation methodology described in *Use and Measurement of Mass Flux and Mass Discharge* (ITRC 2010). Conceptually, this methodology treats the groundwater flow and transport as an average flux over a large area.

The groundwater discharge, Q over a discharge area is computed as:

$$Q = K \times i \times A \quad (3\text{-}1)$$

Where:

Q: groundwater discharge (ft^3/day)

K: hydraulic conductivity (ft/day)
i: hydraulic gradient (unitless)
A: cross-sectional area of geologic unit (ft^2)

To account for variability across the discharge area, the area was segmented as shown on Figure 3-1E and the groundwater discharge was calculated separately for each segment. The discharge area is comprised of segments represented by wells MW-114, MW-113, MW-112, MW-111, MW-110, MW-109 and MW-116. MW-106 was not used because, as indicated on Figure 3-1E, MW-109, MW-110, and MW-111 are between MW-106 and the lake. The wells between the upland sources and Herrington Lake are used for flux estimates. For each segment a value for hydraulic conductivity, *K*, was assigned based on Specific Capacity tests at each well along the transect reported by in the *First Annual Groundwater Monitoring and Corrective Action Report* (AMEC 2018a). Hydraulic gradient, *i*, was developed from the potentiometric surface map for June 2018 (AMEC 2019) as depicted on Figure 3-1F. The discharge area for each segment, *A*, was estimated from the cross section with depth as shown in Figure 3-1G. Thickness of the representative saturated aquifer is assumed to continue down to an elevation of 710 feet amsl, and, following topography, deeper in the vicinity of Hardin Inlet. These calculated discharge areas are significantly below the monitoring well screens, and significantly below lake level (725 to 740 feet amsl). Groundwater below this elevation is unlikely to be related to operations at the site.

The groundwater flow through each segment is shown in Table 3-4C. The segment that contains the Toe Drain collection system is Segment 3 represented by MW-112. The calculated groundwater flow through Segment 3 is approximately 400,000 L/day, that compares to the water captured at the Toe Drain collection system which is approximately 1,900,000 L/day (based on operational records from May 2017 to March 2019). Water captured by the Toe Drain collection system includes water from the springs Dam Toe Middle, Dam Toe Left and Dam Toe Right, and the groundwater captured by the perforated pipe leading to the Toe Drain collection system.

The segment that contains HQ Spring and Briar Patch Spring is Segment 4 which is represented by MW-111. The calculated groundwater flow through Segment 4 is 11,000 L/day, that is compared to the combined discharge of the springs of 2,200,000 L/day – 16,000,000 L/day. Segments 1, 5 and 7 had wells that indicated very high hydraulic conductivity. Due to the methodology used for the calculation, this analysis assumes that the high conductivity is present everywhere in the segment, for very high hydraulic conductivities this assumption may result in an overestimation of the water discharged from these segments.

In addition to providing the methodology for computing groundwater discharge estimates, ITRC (2010) also describes the calculation of mass discharge/flux, which multiplies the groundwater discharge by the contaminant concentration, as shown below:

$$F = c \times K \times i \times A \quad (3\text{-}2)$$

Where:

F: Flux (mg/day)
c: Concentration of contaminant (mg/L)
K: hydraulic conductivity (ft/day)
i: hydraulic gradient (unitless)
A: cross-sectional area of geologic unit (ft^2)
Note: conversion factors were applied as needed to match the units in the calculations.

The hydraulic conductivity, hydraulic gradient, and geometric area of cross-section for the flux calculation are identical to those in the groundwater discharge calculation discussed above. The flux of selenium from groundwater is calculated as a range of values based on the selenium concentrations at monitoring wells in two timeframes, one timeframe before the completion of IRMs (i.e., 2012-2013) and one timeframe from after completion of the IRMs (i.e., May 2017 through June 2018, 5 sampling events). A comparison of selenium mass loading before and after the completion of IRMs is provided on Figures 3-11A (before implementation of IRMs) and 3-11B (after implementation of IRMs).

In this analysis:

- Monitoring wells with no detections for selenium for all events (with a detection limit of 0.005 mg/L) between time October 2016 to June 2018 are assigned a concentration of 0.0 mg/L.
- Monitoring wells with at least one selenium detection at any point between October 2016 and June 2018 are assigned half detection limit for all non-detect values.

The reported high flux value is based on the maximum selenium concentration measured at each monitoring well. The reported low flux value is based on the minimum selenium concentration measured at each monitoring well.

The loading of selenium from groundwater in Segment 4 is estimated to be 0.03 g/day based on one detection of selenium at MW-111 in 2016 (Table 3-4C, the range and average are all 0.03 g/day because the estimate is based on a timeframe when selenium was not detected). Segment 4 contains HQ Spring and Briar Patch Spring. As discussed above, from June 2017–October 2018 selenium mass loadings from Briar Patch Spring ranged from approximately 0.2–54 g/day, with an average of approximately 6.4 g/day; and selenium mass loadings from HQ Spring ranged from approximately 1.4–9.4 g/day, with an average of approximately 3.5 g/day (Table 3-3C).

The monitoring well MW-116 is the groundwater monitoring well furthest south and is the closest well to Hardin Inlet (Segment 7, Figure 3-1E). Selenium was not detected in MW-116 during any sampling event. This demonstrates that there is no apparent migration of CCR-related constituents via groundwater to Hardin Inlet.

3.4.1.3 Diffusive Flux of Selenium from Sediments

Contaminated sediments in Curds and HQ Inlets were also investigated as a potential source of selenium to the water column via flux from sediment. The flux rate of selenium across the sediment-water interface is driven by the concentration gradient across the interface. When selenium concentrations above and below the sediment-water interface are equivalent, there is no concentration gradient and there is no net transfer of selenium. If concentrations of selenium in surface water are higher than the concentration of selenium in pore water, the net flux of selenium is into the sediment. However, if pore water selenium concentrations are higher than surface water concentrations, there will be a net flux of selenium from the sediment into the overlying surface water.

An upper bound estimate of the net flux of selenium from sediment can be calculated from the following equation assuming that surface water concentrations are zero (i.e. there is a net flux of selenium out of the sediment).

$$F = \frac{C \cdot D \cdot A}{L} \quad (3\text{-}3)$$

where:

F	=	flux rate of selenium (grams/second)
C	=	pore water selenium concentration (0.0025 grams/meter^3)
D	=	selenate diffusion coefficient (7 x 10^{-10} meters^2/second; Sato et al. 1996)
A	=	area of contaminated sediment (20,300 meters^2; estimated from GIS)
L	=	diffusion length (0.00035 m; Wang et al. 2012)

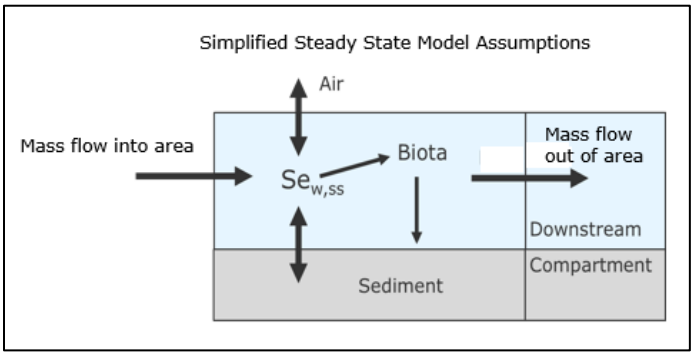
Ramboll measured pore water selenium concentrations in sediment samples collected from Curds Inlet. The average concentration of selenium detected in sediment pore water samples collected from Curds Inlet is 0.0025 g/m^3. The area of potentially emitting sediment encompassing these sediment locations is estimated to be approximately 20,300 m^2. This area (estimated from GIS) extends from the KPDES BRN001 outfall to Study Area transect 4 which includes sample location CI4. After applying literature estimates for the selenate diffusion coefficient and a typical diffusion length, the calculated mass flux is 0.00020 g/second or approximately 9 g/day as described in equation 3-4 and reported in Table 3-5.

$$Flux = \frac{\left(\frac{0.0025\ g}{m^3}\right) \cdot \left(\frac{7\ x\ 10^{-10}\ m^2}{s}\right) \cdot (20{,}300\ m^2)}{0.00035\ m} = \frac{0.00010\ g}{s} \approx \frac{9\ g}{day} \quad (3\text{-}4)$$

At an estimated flux rate of 9 grams/day, the relative contribution from contaminated sediments in Curds Inlet is relatively minor compared to estimated loadings from other sources. Although this estimate is an upper-bound diffusive flux rate (because it assumes overlying surface water concentrations are zero), it does not consider potential contribution from resuspension of particulate phases via bioturbation and physical mixing processes. If contribution from resuspension of particulate phases via bioturbation and physical mixing doubles the estimate, that would yield approximately 18 g/day. The estimate of selenium mass loading from KPDES BRN001 is compared to other sources on Figure 3-11A (before implementation of IRMs) and 3-11B (after implementation of IRMs). The selenium mass loading estimates for flux from Curds Inlet sediment to the water of Curds Inlet reflected in Figures 3-11A and 3-11B are assumed to be equal because the IRMs did not directly change sediment conditions.

3.4.1.4 Lake Wide Upgradient Mass Loading Estimate for Selenium Mass Loading

Phase I and Phase II Herrington Lake sample locations LHL5 and LHL6 are approximately 1.8 to 3 miles upgradient of Curds Inlet (Figure 3-1M). The estimate of the selenium mass loading at these upgradient locations was derived based on the simplifying assumption that the lake has reached steady-state conditions and the concentrations measured could be used to estimate a mass loading from upgradient sources. Under steady state conditions, the underlying assumption is that the mass of selenium entering any given area is equal to the mass leaving any given area when the overall lake flow is considered. The lake is equal to the mass of selenium exiting the lake. If the lake is divided into two compartments – one that is upgradient from Curds Inlet and one that is downgradient from Curds Inlet – then the mass loading in the upstream



compartment can be estimated from the mass of selenium leaving that compartment if steady state conditions are assumed.

The literature suggests that fully mixed lakes approach steady-state conditions within six (6) hydraulic residence times (Varekamp 2003). Stratified lakes can also approach this steady-state condition in a similar timeframe with an oscillating pattern of concentration versus time (Varekamp 2003). While the dynamic nature of Herrington Lake may prevent achievement of true steady-state conditions, the following calculations provide a simple approximation of the baseline mass loading of selenium to Herrington Lake that can be used to evaluate relative contributions from other sources.

It is assumed for this purpose that the concentrations of selenium at LHL5 and LHL6 are at steady-state conditions, where the mass of selenium detected at LHL5 and LHL6 reflect upgradient lake wide conditions from natural sources and anthropogenic influences.

The mass of selenium at the upstream compartment is equal to the steady-state concentration of selenium in surface water ($Se_{w,ss}$) at the boundary of the upstream compartment multiplied by the flow of water through the compartment. This calculation represents a lower bound estimate of selenium mass loading because it assumes that the net transfer to air and sediment is negligible. If, for example, there was a net transfer to sediment, then selenium mass loadings would have to be even greater than what is calculated from the flow of water out of the compartment.

The average concentration of dissolved selenium detected during Phase I and Phase II sampling events at locations LHL5 and LHL6, which are assumed to be in the upgradient compartment outside the influence of the E.W. Brown Station permitted outfalls (Figure 3-1M), is 0.00037 mg/L. This is within the range of background concentrations for selenium in freshwater (0.0001–0.0004 mg/L) reported by the U.S. Department of the Interior (USDOI 1998) and is the value used for estimating the mass of selenium leaving the upgradient compartment.

The USGS (2000) provides an estimate of the volume of water (254,000 acre-feet equal to approximately 3.1 x 10^8 m^3), and an estimate of the hydraulic residence time (344 days), in Herrington Lake. These data can be used to calculate an average flow through the lake of 911,000 m^3/day (approximately 370 ft^3/s). Because the KU facility is located at the downstream end of the lake, the average flow through the lake should approximate the average flow through the upgradient compartment.

Multiplying the steady state concentration of selenium (0.00037 mg/L = 0.00037 g/m^3) by the estimated average flow through the lake of 911,000 m^3/day yields a net mass of selenium leaving the upgradient compartment of 340 g/day (equation 3-5).

$$\frac{911{,}000\ m^3}{day}\ x\ \frac{0.00037\ g}{m^3}\ =\ \frac{340\ g}{day} \qquad (3\text{-}5)$$

AMEC (2015a) cites USEPA (1977) for an alternative estimate of the mean flow through the lake of 593 ft^3/s or 1.45 x 10^6 m^3/day. At this flow rate, the mass of selenium leaving the upgradient compartment is estimated at 540 g/day (equation 3-6).

$$\frac{1{,}450{,}000\ m^3}{day}\ x\ \frac{0.00037\ g}{m^3}\ =\ \frac{540\ g}{day} \qquad (3\text{-}6)$$

Using this steady state approach, a lower bound estimate of the selenium loading to Herrington Lake from other sources upgradient of the E.W. Brown Station is estimated to be on the order of 340–540 g/day (Table 3-6) and illustrated on Figures 3-11A (before implementation of IRMs) and 3-11B (after implementation of IRMs). The selenium mass loading estimates for selenium from upgradient lake-wide reference is the same estimate shown on Figures 3-11A and 3-11B because the IRMs did not change upgradient conditions.

3.4.2 Arsenic Mass Loading Estimates

Mass loading estimates were also derived for arsenic following the methodology described in Section 3.4.1.

3.4.2.1 Estimate of Arsenic Mass Loading from KPDES BRN001

The mass of arsenic entering Herrington Lake via KPDES BRN001 discharge to Curds Inlet is estimated in Table 3-3A. Mass loading estimates are based on quarterly arsenic concentrations reported in KPDES 001 discharge monitoring reports and quarterly average flow rates. For the monitoring period of Q1 2015–Q3 2018, arsenic concentrations ranged from ND–0.0135 mg/L measured in Q4 2015 and Q1 2017, respectively. Quarterly average flow rates ranged from 3.2–8.4 MGD. As indicated in Table 3-3A, corresponding arsenic mass loading estimates range from approximately 95–790 g/day, with an average of approximately 400 g/day before implementation of the IRMs and ranged from approximately 48-210 g/day, with an average of approximately 140 g/day after implementation of the IRMs.

The data indicate a trend in decreasing mass loading and decreasing flow rate over the past three years (Figure 3-4B). Based on data submitted for Q1 2015–Q3 2018, the average mass of arsenic entering Herrington Lake via the KPDES 001 discharge appears to be less than the estimated mass loading of arsenic from upgradient sources. Arsenic mass loading from KPDES BRN001 is compared to loading from other sources on Table 3-7 and Figure 3-11C before implementation of the IRMs and 3-11B after implementation of the IRMs.

3.4.2.2 Estimate of Arsenic Mass Loading from Springs and Groundwater

Springs

The mass loading of arsenic from springs and seeps at the E.W. Brown Station was performed similar to that described for selenium. The mass loading was estimated based on the conceptual groundwater flow model developed by AMEC (2015a) from dye trace studies conducted during the years of 2011–2012. Arsenic mass loading estimates were based on spring flow measurements made by AMEC in 2011–2014 and arsenic concentrations detected in samples collected in 2012–2013, reflecting a timeframe before completion of the IRMs. Based on these data, estimated arsenic mass loadings to Herrington Lake from seeps and springs downgradient of the Main and Auxiliary Ponds (circa 2012) ranged 118.9–1,560 g/day, with an average of estimate of approximately 540 g/day (Table 3-3B).

As indicated in Table 3-3B, the four largest sources of arsenic originate from Dam Toe Right (CH-040) Dam Toe Middle (CH-041), Dam Toe Left (CH-042) and Briar Patch Spring (CH-057) with estimated arsenic mass loadings before implementation of the IRMs of approximately:

- Dam Toe Right 20–98 g/day (estimated average of approximately 60 g/day)
- Dam Toe Middle 31–860 g/day (estimated average of approximately 285 g/day);
- Dam Toe Left 27–270 g/day (estimated average of approximately 95 g/day);
- Briar Patch Spring 30–260 g/day (estimated average of approximately 40 g/day).

The former flows from Dam Toe Right, Middle, and Left are now being collected and transferred to the Auxiliary Pond (completed April 2016). As a result, estimated arsenic mass loadings to the lake from springs and seeps have decreased significantly. More recent data, in 2017 and 2018 after completion of the IRMs, indicate the two largest sources of arsenic from springs and seeps now originate from Briar Patch Spring and HQ Spring. Concentration and flow rate data collected from June 2017–October 2018 indicate that arsenic mass loadings from Briar Patch Spring decreased to 0.3–23 g/day, with an average of approximately 4.1 g/day (n=24); and estimated arsenic mass loadings from HQ Spring range from approximately 0.87–13 g/day, with an average of approximately 4.6 g/day (n=4), as summarized on Table 3-3C.These data indicate that remediation efforts to minimize seepage from former Main Ash Pond, to collect water via the Toe Drain collection system, and repair of the Auxiliary Pond pipes among the IRMs mentioned in Table 1-1 have been effective at reducing arsenic mass loading to Herrington Lake from springs and seeps. Arsenic mass loading from the springs is compared to loading from other sources on Table 3-7 and Figure 3-11C before implementation of the IRMs and 3-11D after implementation of the IRMs.

The transient North Curd Sink is also not spatially identified and is not included in the mass loading estimates for arsenic because, as noted for selenium, it was only observed and sampled on a single sampling event in 2015 when lake levels were low (before the Toe Drain was installed) and flow rates are not available. The arsenic concentration measured in the North Curd Sink was 0.264 mg/L, is similar to the arsenic concentration from the Dam Toe Springs (0.72 mg/L) prior to the completion of IRMs (Table 3-3B).

Groundwater

Mass loading of arsenic from site groundwater to Herrington Lake can be estimated using groundwater concentration data from monitoring wells located near the lake (identified on Figures 3-1A, 3-1C and Table 3-4A) and groundwater flux estimates. Arsenic concentrations in groundwater are presented in Table 3-4B. Arsenic was detected in groundwater at MW-106 at concentrations ranging from 0.01–0.07 mg/L (detected between October 2016 and June 2018; see Table 3-4B. MW-106 is located west of HQ and Briar Patch Springs between the Main Pond and Auxiliary Pond (see Figure 3-1A and 3-1C). At other monitoring wells located nearest the lake (i.e. running south to north MW-109, MW-110, MW-111, MW-112, MW-113 and MW-114) arsenic was detected at concentrations of 0.0053–0.011 mg/L in MW-109 east of the auxiliary pond; not detected at a detection limit of 0.005 mg/L in MW-110 and MW-111; detected at concentration ranged from 0.006–0.047 mg/L in MW-112 and 0.005–0.012 mg/L in MW-113; and not detected at a detection limit of 0.005 mg/L in MW-114. These detection limits and detections are well below the Kentucky chronic ecological water quality standard of 0.15 mg/L. These data suggest that arsenic loading to the lake via groundwater would be lower than water quality criteria protective of aquatic life.

The mass loading of arsenic from fractured bedrock groundwater is calculated as a range of values based on the concentrations at monitoring wells from May 2017 through June 2018 (5 sampling events). The process followed is the same as outlined in Section 3.4.1.4.

In this analysis:

- Monitoring wells non-detect for arsenic for all events (October 2016 to June 2018) are assigned a concentration of 0.0 mg/L
- Monitoring wells with at least one arsenic detection are assigned half detection limit for all non-detect values.

The reported high flux value is based on the maximum arsenic concentration measured at each monitoring well. The reported low flux value is based on the minimum arsenic concentration measured at each monitoring well range from approximately 3.2 g/day to 19.1 g/day, with an average of approximately 8.6 g/day). The mass flux calculations and results for arsenic are presented on Table 3-4C and in Figure 3-11C before implementation of the IRMs and 3-11D after implementation of the IRMs.

The mass loading of arsenic from groundwater in Segment 4 is estimated to be 0.0 g/day since there have been no detections of arsenic in MW-111. Segment 4 contains HQ Spring and Briar Patch Spring. As discussed above, from June 2017–October 2018 arsenic mass loadings from Briar Patch Spring ranged from approximately 0.3–23 g/day with an average of approximately 4.1 g/day; and arsenic mass loadings from HQ Spring ranged from approximately 0.87–13 g/day, with an average of approximately 4.6 g/day (Table 3-3C).

Flux of arsenic from groundwater toward the lake was determined by arsenic concentrations at three wells along the transect (MW-113, MW-112 and MW-109). Each well had detections of arsenic with MW-112 having arsenic detections as high as 47 µg/L. According to the groundwater mass loading calculations, the segment represented by MW-112 has the largest groundwater flux of these three segments. Therefore, the high estimate for arsenic is primarily a result of groundwater flux calculated at this segment. This segment includes the Toe Drain collection system. Total arsenic estimated flux from the groundwater pathway ranges from approximately 3.2 g/day to 19 g/day, with an average of approximately 8.6 g/day. These estimated arsenic inputs are small relative to those from other sources summarized in Section 3.4.2.

The monitoring well MW-116 is the groundwater monitoring well furthest south and is a well closest Hardin Inlet (Segment 7, Figure 3-1E). Arsenic was not detected in MW-116 during any sampling event. This demonstrates that there is no apparent migration of CCR-related constituents via groundwater to Hardin Inlet.

3.4.2.3 Diffusive Flux of Arsenic from Sediments

Contaminated sediments in Curds Inlet was also investigated as a potential source of arsenic to Herrington Lake. The flux rate of arsenic across the sediment-water interface is driven by the concentration gradient across the interface. The overall average pore water arsenic concentration detected in Curds Inlet is 0.018 mg/L (detected using EPA Method 200.8) (Table 2-12). However, this average is largely controlled by pore water arsenic concentrations detected in deeper, more reducing-like thalweg sediments where the highest concentrations were detected (Tables 2-3A–B, Section 3.3.3).

Unlike selenium where the variation in pore water concentrations is small, there is about a 75-fold difference between the average pore water arsenic concentration detected in the ten highest (average = 0.45 mg/L) and the ten lowest (average=0.006 mg/L) pore water arsenic concentrations. For selenium, this difference is only about 4-fold. The spatial distributions of pore water selenium and arsenic concentrations are presented in Figures 3-8A, 3-8B, 3-9A, and 3-9B.

Using the average concentration of arsenic in sediment pore water (0.18 g/m^3) diffusing over an area of 20,300 m^2 (total Phase I and II sampling area within Curds Inlet estimated using a GIS) and applying literature estimates for arsenic diffusion coefficient (9 x 10^{-10} m^2/s; Tanaka et al. 2013) and a typical diffusion length of 0.00035 m as in equation 3-3, the calculated mass flux is 0.0094 g/s or approximately 800 g/day as described in equation 3-7 and reported in Table 3-6.

$$Flux = \frac{\left(\frac{0.18\ g}{m^3}\right) \cdot \left(\frac{9\ x\ 10^{-10}\ m^2}{s}\right) \cdot (20{,}300\ m^2)}{0.00035\ m} = \frac{0.0094\ g}{s} \approx \frac{800\ g}{day} \quad (3\text{-}7)$$

Equation 3-7 overestimates arsenic flux, therefore, equation 3-8 is also considered. Equation 3-7 is considered an overestimate because only the more reducing (thalweg) sediments likely contribute to arsenic flux from sediment to the water of Curds Inlet (see Figure 3-9B). Equation 3-7 assumes the thalweg (i.e., more reducing sediment) is 33% (roughly one third) of the sediment area. Using GIS, it is assumed that the thalweg fraction of the sediments for Curds Inlet is approximately 20% of the area (i.e., the approximate area with more reducing sediment conditions). The 20% area is characterized by an average pore water arsenic concentration of 0.45 mg/L (the average of the top ten measurements). The remaining sediments (80%) are characterized by more oxidizing conditions with an average pore water arsenic concentration of 0.018 mg/L (average of all other measurements). Equation 3-8 displays the calculation of the g/day mass loading of arsenic with the assumptions of 20% reducing sediments of Curds Inlet, with approximately 470 g/day, as shown in Figures 3-11C and 3-11D. The sediment flux values presented on Figures 3-11C and 3-11D are assumed to be equal because the IRMs did not directly change sediment conditions.

$$Reducing\ Sediment\ Flux = \left(\frac{\left(\frac{0.45\ g}{m^3}\right) \cdot \left(\frac{9\ x\ 10^{-10}\ m^2}{s}\right) \cdot (20{,}300\ m^2)}{0.00035\ m} \right) \cdot 0.2 = \frac{0.0047 g}{s} \approx \frac{406\ g}{day}$$

$$+$$

$$Rest\ of\ Curds\ Inlet\ Flux = \left(\frac{\left(\frac{0.018\ g}{m^3}\right) \cdot \left(\frac{9\ x\ 10^{-10}\ m^2}{s}\right) \cdot (20{,}300\ m^2)}{0.00035\ m} \right) \cdot 0.8 = \frac{0.00074 g}{s} \approx \frac{65\ g}{day}$$

$$\approx 470\ \text{g/day} \quad (3\text{-}8)$$

The summary of estimates below shows the range of results that could be calculated using the fraction of more reducing sediment conditions from 5–35%. With this approach, arsenic mass loading estimates from sediments range 180–760 g/day providing a range of the uncertainty in the estimate provided in equation 3-8.

Fraction of Reducing Sediments	Estimated Arsenic Mass Loading (g/day)
5%	180
10%	280
15%	370
20%	470
25%	570
30%	670
35%	760

3.4.2.4 Estimate of Arsenic Mass Loading from Upgradient Sources

As was described for selenium, surface water concentrations of arsenic detected at LHL5 and LHL6 were used to estimate mass loading of arsenic from upgradient sources assuming steady state conditions. The average concentration of dissolved arsenic in surface water detected at LHL5 and LHL6 during Phase I and Phase II sampling events was 0.00087 mg/L (Table 3-6). Assuming this value represents a steady state concentration in the lake upgradient of Curds Inlet, a lower bound estimate of the baseline loading of arsenic to Herrington Lake from other sources upgradient of the KU outfalls is estimated to be on the order of 790–1300 grams/day, with an average of approximately 1050 g/day as indicated below and on Table 3-6 and Figure 3-11C and 3-11D. The mass loading estimates for arsenic from upgradient lake-wide reference is the same estimate shown on Figures 3-11C and 3-11D because the IRMs did not directly change upgradient conditions.

Multiplying the assumed steady state concentration of arsenic (0.00087 mg/L = 0.00087 g/m^3) by the average flow through the lake of 911,000 m^3/day (as calculated in Section 3.4.1.4) yields a net mass of arsenic leaving the upgradient compartment of 790 g/day.

$$\frac{911{,}000\ m^3}{day}\ x\ \frac{0.00087\ g}{m^3}\ =\ \frac{790\ g}{day} \qquad (3\text{-}9)$$

Assuming a higher flow rate of 1.45 x 10^6 m^3/day (Section 3.4.1.4; USEPA 1977), the mass of arsenic leaving the upgradient compartment is estimated at 1,300 g/day.

$$\frac{1{,}450{,}000\ m^3}{day}\ x\ \frac{0.00087\ g}{m^3}\ =\ \frac{1{,}300\ g}{day} \qquad (3\text{-}10)$$

These calculations are intended to provide an order of magnitude estimate of potential arsenic loadings to Herrington Lake from upgradient sources.

3.4.2.5 Potential Mass Loading from Atmospheric Deposition or Coal Pile Runoff

Potential mass loading from atmospheric deposition from fugitive coal ash dust emissions is assumed to be limited because the E.W. Brown Station did not historically handle dry ash. CCR was wet handled through piping to the Main Ash Pond and the Auxiliary Pond. Regular dust control measures are implemented at the E.W. Brown Station to limit fugitive dust emissions. Measures included watering of traffic ways, limiting the area of open excavation/grading areas, and providing temporary cover for soil stockpiles. Therefore, atmospheric deposition from fugitive dust from the E.W. Brown Station is not a likely source of CCR-constituents to the lake. Stack emissions of CCR constituents in fine particulate matter would not be expected to result in appreciable deposition in the near field.

Air emission data for arsenic, selenium and mercury air emissions for 2009 and 2017 from the E.W. Brown Station are provided below. These pollutant emissions were reduced significantly in 2010 with the installation of a 99+% sulfur dioxide (SO_2) scrubber.

E.W. Brown Station Toxic Release Inventory Air Emissions 2009 and 2017			
Constituent	**2009 Emissions (lbs)**	**2017 Emissions (lbs)**	**% change**
Mercury	123.00	5.00	-96%
Arsenic	433.00	33.00	-92%
Selenium	1,907.00	450.00	-76%

FGD installed in 2010, Selenium non-reportable in 2009, Arsenic and selenium non-reportable in 2017

Runoff from the coal pile does not flow to Curds Inlet along the northern bank. Rather, drainage from the coal pile is collected in the coal pile runoff and settling pond and is pumped to the Auxiliary Pond where it is discharged to Curds Inlet via Auxiliary Pond KPDES Outfall BRN001.

3.5 CSM Summary and Key Findings for Chemical Fate & Source Identification in Herrington Lake

Selenium and arsenic mass loading to Herrington Lake by source is illustrated in Figures 3-11A through 3-11D based on the estimates described in Sections 3.4.2.1 through 3.4.2.4. The mass loading calculations provided in this section are based on simplifying assumptions and are intended to provide order-of-magnitude estimates for comparing the relative contributions from selected sources. Average mass loading estimates are presented. These graphics allow the relative comparison of selenium and arsenic mass loading from identified sources into the Herrington Lake before and after implementation of the IRMs. IRMs that limited the flow of CCR-related constituents were completed in 2016. The IRMs, among others identified in Table 1-1, include the capping of the Main Ash Pond, installation of the Toe Drain collection system, and repair of the Auxiliary Pond discharge pipeline. Figures 3-11A through 3-11D provide a comparison of conditions (i.e., mass loading) before and after implementation of the IRMs so that the contributions from multiple sources can be generally compared. Each graphic provides estimates of mass loading from:

- Auxiliary Pond Outfall KPDES BRN001,
- Springs,
- Groundwater,
- Flux from sediments, and
- Lake-wide upgradient mass loading.

The key findings are described as follows:

- The primary input of CCR-related constituents to Curds Inlet is from the Auxiliary Pond KPDES Outfall BRN001. The estimated discharge of selenium from the Auxiliary Pond KPDES Outfall BRN001 is slightly lower after the implementation of the IRMs.
- Springs currently contribute CCR-related constituents to the lake. Ditch Spring, Beaver Dam Cave Spring, and the South Abutment Spring formerly flowed to Curds Inlet but have mostly been dry since the installation IRMs. Briar Patch Spring and HQ Spring continue to flow into HQ Inlet after the implementation of IRMs, but flow and thus mass load is reduced for Briar Patch and HQ Springs after the capping of the Main Ash Pond and repair of the Auxiliary Pond discharge pipeline.

- The Groundwater Sampling and Analysis Report (AMEC 2018b) concludes that the groundwater impacts identified from the CCR compliance monitoring are attributable to the Main Ash Pond, and not to the Landfill constructed on top of the Main Ash Pond. The data discussed in this Corrective Action ISARA Report show that selenium mass loading from groundwater is expected to be *de minimis.* Selenium was only detected in one well located near the lake (MW-111, October 2016) and selenium and was not detected in the groundwater from MW-111 in the following 10 sampling events. The flux of arsenic from groundwater toward the lake was determined by arsenic concentrations at three wells along the transect. MW-113, MW-112 and MW-109 each had detections of arsenic with MW-112 having the highest arsenic detections and mass loading. This segment includes the Toe Drain collection system. Comparatively, the arsenic mass loading from groundwater is small relative to those from other sources.

  Monitoring well MW-116 is the groundwater monitoring well furthest south and is closest to Hardin Inlet (Segment 7, Figure 3-1E). Elevated CCR-related constituents were not detected in MW-116 during any sampling event, which is consistent with the established easterly flow direction. This demonstrates that there is no apparent migration of CCR-related constituents via groundwater to Hardin Inlet.

- The Toe Drain captures groundwater flow from within and below the Main Ash Pond and pumps that groundwater to the Auxiliary Pond. The Toe Drain also captures water from springs (Dam Toe Right, Dam Toe Middle, and Dam Toe Left) and pumps the flow from these springs to the Auxiliary Pond. The springs (Dam Toe Right, Middle, and Left) are captured by the Toe Drain collection system. It is possible that there is seepage from the Main Ash Pond that is not captured by the Toe Drain collection system. However, the bottom of the pumping chamber, which is at an elevation of approximately 730 feet asl, is topographically lower than the base of the ash in the Main Ash Pond, and therefore would be expected to capture flow from the Main Ash Pond as it dewaters. Sampling from monitoring well MW-217 which is both down gradient of and at an elevation lower than the Toe Drain does not indicate the presence of significant arsenic or selenium in groundwater at elevations below the Toe Drain. Furthermore, pore water sampling in Curds Inlet conducted in Phase I and Phase II sampling in accordance with the CAP and Phase II Plan supports a conclusion that groundwater upwelling is not a source of CCR-related constituents to Curds Inlet. Therefore, if any groundwater with CCR-related constituents does not get captured by the Toe Drain collection system, it would be *de minimis*.

- The mass loading of selenium and arsenic from sediment is shown on Figures 3-11A through 3-11D. The estimates of flux from sediment to the water in Curds Inlet includes consideration of sediment geochemistry. The results showed:

  - Selenium flux from sediments to water is orders of magnitude lower than selenium mass loading from the Auxiliary Pond Outfall KPDES BRN001.
  - Selenium flux from sediment is also below the lake-wide upgradient estimates of mass load.
  - Arsenic flux from sediment to the water in Curds Inlet is potentially similar to the arsenic load from spring water collected in the Toe Drain collection system but it is within the range estimated for the lake-wide upgradient mass loading.
  - The estimated loading from arsenic sediments to the water column in Curds Inlet (via pore water flux) is comparable estimated mass loading from KPDES BRN001 in 2017-2018 and the Toe Drain collection system. In addition, the flux from sediment is comparable to the lake wide upgradient mass loading as estimated using Phase I and Phase II data from LHL5 and LHL6. Arsenic is closely considered in the human health and ecological risk assessments.

  - The amount of selenium and arsenic in pore water was consistent with flux from sediment and does not indicate mass loading from groundwater upwelling in Curds Inlet.

- Atmospheric deposition of CCR constituents in particulate emissions from the E.W. Brown Station is not a likely source of CCR-constituents to the lake.
- Runoff from the coal pile does not flow to Curds Inlet along the northern bank. Rather, drainage from the coal pile is collected in the coal pile runoff and settling pond and is pumped to the Auxiliary Pond where it is discharged to Curds Inlet via Auxiliary Pond KPDES Outfall BRN001.

4. HUMAN HEALTH RISK ASSESSMENT

This section provides the Human Health Risk Assessment as provided in the Agreed Order to address any threat or potential threat to human health associated with management and storage of CCR at E.W. Brown Station. Accordingly, the approach applied here is based on the final HHRA Work Plan described in the CAP. The purpose of the baseline HHRA is to present an assessment of the theoretical human health risks associated with potential exposure to CCR-related COPCs at the site. The HHRA findings will be used to evaluate the need for further characterization and whether steps should be taken to mitigate risks.

4.1 Steps of the HHRA

The initial step of the HHRA was development of the CSM as described in the CAP, which identifies potential exposure pathways by which human receptors may contact site media. The exposure pathways for human receptors are described in Section 4.1.1 and complete exposure pathways are quantitatively evaluated here using site data.

The HHRA includes the following four steps identified in USEPA guidance (USEPA 1989):

- **Step 1 – Identification of Contaminants of Potential Concern (COPCs)**, through screening site data for constituents in surface water, sediment, and fish tissue in comparison with risk-based concentrations (RBCs) described in 2.2. The methods used to screen site data and the COPCs identified are described in this HHRA (Section 4.3)**.** As indicated there, the only COPC identified for further evaluation was arsenic in sediments.
- **Step 2 – Exposure Assessment.** This section presents exposure estimates for all complete exposure pathways and provides the technical rational for the following: grouping of data for site media; deriving exposure point concentrations for those media; identifying algorithms and exposure assumptions for all complete exposure pathways (Section 4.4).
- **Step 3 - Toxicity Assessment.** This section presents the toxicological data and appropriate USEPA-recommended toxicity values for all COPCs for use in the HHRA (Section 4.5).
- **Step 4 - Risk Characterization.** This section integrates findings from the prior three steps by combining exposure and toxicity assessments to derive cancer risk estimates and noncancer hazard indices for all COPCs in complete exposure pathways. This section also includes an Uncertainty Assessment that discusses the uncertainties inherent in conducting a HHRA and considers whether identified uncertainties over or underestimate risks (Section 4.6).

4.1.1 Potential Human Receptors and Exposure Pathways

The potential for people to contact CCR-related constituents in environmental media depends on site use and the resulting potential exposure pathways. Herrington Lake is a popular recreational lake used for boating, swimming, and fishing. It is stocked with fish and contains bluegill, catfish, crappie, hybrid striped bass, largemouth bass, spotted bass and white bass. As such, fish consumption is a primary pathway for people to be exposed to site CCR-related COPCs. Thus, the most likely human receptors are those who visit the lake for recreation and whom may also consume fish recreationally caught from the lake.

Use of groundwater in the vicinity of E.W. Brown Station as drinking water was ruled out in the GWAR based on data gathered in a Water User Survey performed in 2011 indicating no complete pathways

for use of groundwater as drinking water (AMEC 2013). As described in AMEC (2013) the Lake Village Water Association (LVWA) supplies drinking water in the Study Area using water drawn from both the Harrodsburg and Danville municipal supplies. The intake for the Danville supply is in Herrington Lake several miles upstream from E.W. Brown Station. The intake for the Harrodsburg supply is in the Kentucky River just downstream of the confluence with Cedar Branch at Shaker Landing, which is downstream from E.W. Brown Station. AMEC (2013) reviewed water quality data obtained through an Open Records Request to KDOW for the Harrodsburg water treatment plant from 2008 through 2012. There were no exceedances of MCLs or secondary MCLs in treated water.

On this basis, AMEC (2013) stated that "no potable water users have been identified that could potentially be impacted by the groundwater discharges from E.W. Brown Station, and therefore potential exposure pathways involving drinking water are considered incomplete." At request of the Cabinet, reviews were conducted in 2018 and 2019 to identify whether there were domestic drinking water wells within a mile of E.W. Brown Station and this analysis is summarized in Section 4.2 and detailed in Appendix H. In addition, as noted in Section 3, the on-site monitoring well network confirms that groundwater flow from beneath E.W. Brown Station is eastward toward Herrington Lake. As indicated in Section 4.2, and Appendix H, no domestic wells are located within a mile of the facility. Metals of interest in the CCR Rule (arsenic, selenium, cobalt, lithium, and molybdenum) that were detected in onsite groundwater wells are discussed in the Section 4.6.5 Uncertainties in the HHRA. However, because the onsite groundwater and onsite monitoring wells are not used as drinking water sources, nor will they be used for this purpose in the future, they are not considered further here as a drinking water source.

As described in AMEC (2013) the Lake Village Water Association (LVWA) supplies drinking water in the study area using water drawn from both the Harrodsburg and Danville municipal supplies. Both of these intakes are far from E.W. Brown Station: the Danville intake is several miles upstream and the Harrodsburg supply is far downstream in the Kentucky River. Because Herrington Lake serves as a drinking water supply in areas remote from E.W. Brown Station, lake surface water quality data are considered here in comparison with MCLs, or risk-based concentrations protective of residential water consumers. In addition, recreational visitors contact surface water in Herrington Lake while boating or swimming and this exposure pathway is evaluated in the HHRA.

Sediments are known to have selenium and arsenic at concentrations greater than those in naturally occurring background soil in Curds Inlet and HQ Inlet near E.W. Brown Station. Most sediments are under water far too deep to be accessed during wading or swimming. However, there is a hypothetical possibility that recreational visitors may contact COPCs in shallower sediments while visiting the lake in vicinity of E.W. Brown Station.

In summary the following exposure pathways are proposed for further evaluation in the HHRA, as described in Section 3 of the CAP:

- Ingestion of fish containing COPCs by recreational anglers and/or by their relatives or acquaintances
- Ingestion and dermal contact with COPCs in lake water by residential consumers using it as drinking water.
- Ingestion and dermal contact with COPCs in sediment by recreational visitors to shallow lake areas.
- Incidental ingestion of, or dermal contact with, surface water by recreational visitors.

4.1.2 Guidance Documents for HHRA

The HHRA was conducted consistent with guidance on the conduct of HHRA provided by the Cabinet (2017)[1] and by the USEPA and with the approved HHRA Work Plan in the CAP (Ramboll 2017a). Applicable USEPA guidance includes, but is not limited to, the following:

- Kentucky Risk Assessment Guidance (KRAG 2002) Prepared by the Kentucky Natural Resources and Environmental Protection Cabinet
- Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part A) (USEPA 1989).
- Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part B) Development of Risk-Based Preliminary Remediation Goals (USEPA 1991a).
- Supplemental Guidance to RAGS: Calculating the Concentration Term (USEPA 1992a)
- Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites (USEPA 2002).
- Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53 (USEPA 2003a)
- Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessments) (USEPA 2004)
- Exposure Factors Handbook (USEPA 2011)
- Statistical software ProUCL 5.1.00 for environmental applications for data sets with and without non-detected observations (USEPA 2017d)
- Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. (USEPA 2014b)
- RSLs (USEPA 2018a) Revision date October 3, 2018.
- Angler Attitudes and Behavior Associated with Ohio River Health Advisories (Knuth et al. 1993.
- Human Health Fish Consumption Risk Assessment for the Tri-State Geographic Initiative; Kenova Cluster (Kenova Cluster 1998).

4.2 Updated Well and Spring Survey

Two recent surveys were conducted to evaluate whether there are any domestic drinking water wells that could be influenced by the site: A 2018 electronic search of the Kentucky Groundwater Data Repository; and a January 11, 2019 public records request to KDEP for water supply well reports filed between 2011 and January of 2019 for the vicinity around the site. These are each described here with additional detail provided in Appendix H.

4.2.1 Updated Well and Spring Survey

KU conducted an electronic search of the Kentucky Groundwater Data Repository in 2014 as part of an application for the special waste landfill permit issued by the Kentucky Division of Waste Management on July 31, 2014 (Permit 084-00010). At the time, the well records indicated that there were no wells or springs in the repository that were used for domestic water supply.

In February 2, 2018 KU performed an updated electronic search of the Kentucky Groundwater Data Repository to identify whether additional wells or springs had been added to the record since the time of the 2014 well search. The 2018 search focused on a "Search Radius" of 2 miles, with a center point (near the center of the landfill) of Latitude 37.787 degrees and a Longitude of -84.721 degrees. The search identified 13 springs and 19 wells, some of which were located at distances of greater than 2

[1] Available at: http://www.lrc.ky.gov/kar/401/100/030.htm

miles from the site. Wells and springs are identified within the Kentucky Groundwater Data Repository by an 8-digit identifying number, called an Assembled Kentucky Ground Water (AKGWA) number. The findings of this survey are summarized in Table 4-1, and 4-2 and are summarized in detail in Appendix H.

Table 4-1 provides a summary of the 19 wells identified. As indicated there and detailed in Appendix H, no wells were identified as being of concern. Of the 19 wells identified, four were plugged and thus no longer useable, 10 were onsite monitoring wells at the facility, and the remaining five wells were greater than a mile from the site.

Table 4-2 provides a summary of the springs identified and as indicated there, of the 13 springs in the survey none were identified as being of concern. Six of the springs had been previously identified in the survey done for the Landfill permit application and were found to not be of concern and the remaining seven springs were more than a mile from the site.

For these reasons, none of these wells or springs were identified as a potential human health concern.

4.2.2 Public Records Request for Water Supply Wells Conducted in 2019

In addition to the electronic records searches conducted in 2014 and 2018, a public records request was sent by Mary Sorenson of Ramboll to Public Records Branch Kentucky Department for Environmental Protection on January 11, 2019. The request stated the following:

> "I request to inspect the following document(s): Pursuant to the Kentucky Open Record Act, I am requesting copies of all water supply well driller reports filed with KDOW pursuant to 401 KAR 6:310 Section 1 for the period from January 1, 2011 to the present for Mercer County, Kentucky. If possible, I would prefer only receiving the water supply well driller reports for property located within two miles of the EW Brown Power Plant (AI No. 3148) in Mercer County. The latitude and longitude of the search radius are Latitude 37.787 degrees and the Longitude is minus 84.721 degrees."

Ms. Sorensen's request was forwarded from the Division of Information Services to the Kentucky Geological Survey. The Kentucky Geological Survey conducted a search of the wells and springs in the requested area. These are summarized in Appendix H2, and Table H-2. As indicated there, all wells had been previously identified in the 2018 survey and there were no domestic wells within a mile of the facility. In addition, all springs were previously identified except for two inactive springs.

4.3 Data Analysis and Identification of COPCs

The goal of this HHRA is to evaluate fish tissue, sediment, and surface water data to identify any COPCs that could potentially pose a risk for human receptors at the Herrington Lake Study Area. The Study Area is comprised of Herrington Lake, several embayments, and the lower Dix River. The Study Area data were compared to RBCs to identify COPCs and to derive risk estimates based on exposure scenarios intended to represent current or hypothetical potential future Study Area uses and exposures.

Section 2 of this report provides a summary of RBCs that were assembled to provide one basis for evaluating the Phase I and Phase II sampling results. In this HHRA, the human health RBCs are used to identify COPCs in all Study Area media except pore water, which does not have relevant human exposure pathways and the screening levels are summarized in Table 4-3. In this section, the basis of

the screening levels for each media is reiterated. Where the maximum concentration of a constituent exceeds the respective screening level, that constituent is identified as a COPC. The following sections describe the identification of COPCs for fish fillets, surface water and sediments.

4.3.1 Screening of Fish Fillet Data for COPCs

This section summarizes the screening conducted in Section 2.4 above for Phase I and Phase II fish tissue results relative to risk-based concentrations derived to protect anglers who consume up to 50 meals a year of fish from Herrington Lake. As indicated in Section 2.3.5, the screening levels for fish tissues were based on 50 meals per year consistent with the least stringent of the fish consumption advisories for mercury in fish in Kentucky. The 50 meal per year assumed consumption rate equates to 31 grams per day, which is higher than the national fish consumption rate of 22 grams per day used by USEPA in setting the ambient water quality criteria based on human consumption of fish. USEPA indicated that the 22 g/day consumption rate was the 90th percentile consumption rate of fish and shellfish from inland and nearshore waters for the U.S. adult population 21 years of age and older, based on NHANES data from 2003–2010 (USEPA 2014a). The consumption rate used in this screening of 31 g/day represents a health protective assumption that may overestimate risks for consumers particularly because it is assumed that all fish eaten are taken from Herrington Lake (as opposed to other lakes or the grocery store).

Summaries of the wet weight fish fillet data relative to the screening levels are provided in Table 4-4 for bluegills and green sunfish and in Table 4-5 for the remaining fish. These tables also list the figures where these data are displayed and labelled. As indicated in Tables 4-4 and 4-5, data for selenium, arsenic, boron, cadmium, lead, mercury, and zinc are available in bluegill, sunfish, bass, catfish, trout, and sucker from Dix River and the following Herrington Lake locations: Lower Curds Inlet, Lower Herrington Lake, Middle Curds Inlet, Hardin Inlet, HQ Inlet, Middle Herrington Lake and Lower Herrington Lake). Considering the fillet data relative to the risk-based concentrations results in the following conclusions:

- The concentrations of selenium in fish fillets are less than human health risk-based ingestion values for selenium (Figures 2-3D–E).
- Fish tissue concentrations for arsenic, cadmium, boron, lead, and zinc are also below the human health screening levels.
    - Arsenic speciation in fish tissues demonstrated that inorganic arsenic (the form of arsenic that is potentially toxic to humans) is not present or was present at concentrations lower than the human health standard for arsenic ingestion in fish tissues (Figures 2-4B–C).
- The only fish tissue concentrations that exceeded the human health screening levels are concentrations of methylmercury in fish tissue observed in areas of the lake away from E.W. Brown Station. Specifically, two flathead catfish samples had elevated concentrations, one sample from Middle Herrington Lake (427 µg/kg) and another in Lower Herrington Lake (379 µg/kg) (Table 4-5, Figure 2-5C).

Thus, considering all the fillet data analyses, only methylmercury in two fish exceeded the risk-based screening levels derived to be protective of consumption of up to 50 meals per year. These fillet samples for mercury, do not appear to be Study Area-related because they occur far from E.W. Brown Station Inlet and are only in two fish. Moreover, the maximum concentrations are less than two-fold above the screening level and are not atypical of mercury concentrations found in fish. Given these considerations, no COPCS were identified for fish fillets and fish consumption is not considered further in this HHRA.

4.3.2 Human Health Screening Levels for Sediments

As described in Section 2.3.2 sediment screening levels for human health include:

- USEPA RSLs (USEPA 2018a) for human health for exposure to residential soil derived assuming:
    - Exposure to soil 350 days per year for 30 years and based on an excess cancer risk of 1 in one million or $1x10^{-6}$ or a non-cancer hazard quotient of 1.
    - This is a highly protective basis for screening and would be expected to be much higher than exposure individuals might have to sediments. More representative exposure assumptions for sediment contact are described in the exposure assessment section.

Table 4-6 summarizes the Phase I and II results for sediment (sample depths ranged 10–80 ft bws), on a metal-by-metal basis, and compares the results to the corresponding residential soil RSLs. Many of the deeper sediment samples were collected from locations that are not feasibly accessible to human recreators. For the secondary screening for human exposure to arsenic in sediment (Table 4-7), a maximum sample depth of 24 feet bws was used based on the following criteria:

- Herrington Lake surface water levels are managed, with seasonal targets of 740 asl (summer pool) and 725 asl (winter pool).
- Within-season lake water depths can intermittently vary by up to approximately 20 feet (Figure 2-1B). However, recreational season levels would not be expected to drop below 725 asl (winter pool).
- Recreators might access the sediment while wading in up to 4 feet of water at any time of the year
- For example, a summer stratification-phase sediment sample collected from 24 ft bws could be in as little as 4 ft bws during winter, (i.e. 4 ft bws winter depth + 20 ft to summer depth at that same location = 24 ft bws).
- A summer stratification-phase sediment sample collected from 15ft bws could also be intermittently exposed, particularly during the lowest winter lake-levels.

Overall, this approach is realistic but also conservative, because during summer months, when most recreation and potential contact with sediment occurs, many of the included deeper locations are not practically accessible by recreators.

As indicated in both Tables 4-6 and 4-7, only arsenic is present in sediment samples at concentrations greater than the risk-based screening level of 0.68 mg/kg based on residential soils and a $1x10^{-6}$ cancer risk level. It is notable that this screening level is lower than the state-wide mean concentration of arsenic in soils as designated by the State of Kentucky, which range 0.059–55.5 mg/kg, with an average of 8.9 mg/kg (KRAG, Table G-1 of the Kentucky Risk Assessment Guidance, 2002). Arsenic concentrations in sediment exceed the screening level at some locations within each area sampled, including locations outside the influence of E.W. Brown Station (Figure 2-4H). Because no background sediment concentrations have been established specifically for Herrington Lake and because concentrations are highest in Curds Inlet, arsenic in sediments is identified as a COPC and is further evaluated in the HHRA.

Additivity was also considered in this screening by comparing maximum concentrations to 0.1 of the screening level. Specifically, as reported in Table 4-4, the maximum concentrations detected for arsenic exceeds the screening levels. Lead and iron were present at concentrations less than their respective screening levels, but greater than 0.1 of the screening levels. Considering the target endpoints of iron (gastrointestinal [USEPA 2006]) and lead (neurobehavioral [USEPA 2018a]), these are not considered to be a concern for aggregate risks.

4.3.3 Screening of Surface Water Data for COPCs

As described in Section 2.3.1, surface water data were compared with the following human health screening levels:

- Kentucky Water Quality Criteria identified in Table 1 of the Kentucky Surface water standards 401 KAR 10:031 Section 6 (KDOW 2016b) including:
  - Human health standards for drinking water and consumption of fish.
- USEPA RSLs (USEPA 2018a) for human health for drinking water are used for consideration of the surface water.

Table 4-8: Surface Water Screening for Human Receptors summarizes the screening for human health receptors. As indicated there only total mercury and iron are present in water samples at concentrations greater than their respective Kentucky Criteria. In addition, arsenic in surface water is greater than the RSL, but not greater than the Kentucky Criteria. Pore water concentrations are not relevant for human health.

As indicated in Section 2.4.3.2, total methylmercury concentrations in surface water from stratification and overturn sampling are presented in Figures 2-5D and Figure 2-5E, respectively and total mercury concentrations in surface water from stratification and overturn sampling are presented in Figure 2-5G, with greater resolution of lower detected concentrations presented in Figure 5-3H. The data indicate the following:

- The total and dissolved mercury concentrations in overturn water samples do not exceed Kentucky ecological or human health criteria.
- However, the total and dissolved mercury concentrations in the stratified surface water samples from Curds Inlet exceeded Kentucky human health criteria, as presented in Figures 2-5G-H. The elevated mercury observed during stratified sampling but not during overturn sampling indicates a transient condition in the inner portion of Curds Inlet.
- Also, it is noted that the Kentucky human health water quality standard for mercury of 0.000051 mg/L is for fish consumption and as discussed previously, mercury concentrations in fish tissues from Curds Inlet are below the USEPA and Kentucky human health fish ingestion standards. In addition, four samples exceeded the MCL with the highest concentration exceeding the MCL by less than four-fold.
- Two samples of iron in surface water were present at concentrations greater than the Kentucky criteria for human health; one from station CI2 located in Curds Inlet and one from HQ inlet.

The four water samples that exceeded the MCL for mercury and the two iron samples that are greater than their respective screening levels are considered further here. The four mercury samples from the Curds Inlet stratification sampling cannot be considered representative of drinking water concentrations because the elevated concentrations were only found during Phase I stratification sampling event and not detected in overturn or Phase II stratification sampling. Although concentrations were temporarily higher than the MCL, exposure during recreational activities is not expected to be a concern because recreational exposures would be for a shorter duration and would involve limited ingestion of water. Specifically, the MCL is intended to be protective of consumption of 2 liters of water a day for 350 days per year, but recreational exposure during swimming or playing in the interior of Curds Inlet would result in much less ingestion of water and would be much less frequent, i.e. 65 days or less per year, as described for the sediment evaluation, and the amount of surface water consumed would be much less than 2 liters per day for those 65 days. Given these considerations, mercury in surface water is not considered further here.

Considering the two iron samples present at concentrations greater than the Kentucky criteria for human health of 0.3 mg/L. The Kentucky criteria for iron is a secondary water quality standard intended to protect against rusty color; sediment; metallic taste; reddish or orange staining rather than adverse health effects and neither of these iron detections were present at concentrations greater than the USEPA (2018a) health-based RSL for drinking water for iron of 14 mg/L. Given that these exceedances only occur at this location and that Curds Inlet and HQ Inlet are not sources of drinking water, iron is not considered further in the HHRA.

4.4 Exposure Assessment

Exposure assessment is the process of identifying human populations that could potentially contact COPCs in Study Area media; in this case fish tissue, and to a lesser extent, surface water, sediment, and air, and of estimating the potential magnitude, frequency, duration, and route(s) of exposure(s). As identified in the USEPA guidance, reasonable maximum exposure (RME) estimates are derived here for COPCs in Study Area media. Because this assessment intends to not underestimate exposures or risks, many health protective assumptions are proposed here to avoid underestimating potential exposure. As such, these estimates likely overestimate exposures and risks for most individuals.

As described in Section 4.3.2, only one COPC was identified: arsenic in Study Area sediments. Potential exposure pathways are the incidental ingestion and dermal contact with arsenic in sediments by lake users.

The methods used to estimate exposure through ingestion and dermal contact with arsenic in sediments are described here and summarized in Table 4-9: Exposure Estimates for Recreational Visitors' Ingestion and Dermal Contact with Arsenic in Sediments. Exposure to arsenic in Study Area sediments was evaluated here through the following general algorithm described in Equation 4-1 and identified in USEPA (1989, 2018a):

Equation 4-1:

$$\mathrm{CDI} = ((\mathrm{Cs} \times \mathrm{EF} \times \mathrm{ED} \times \mathrm{FI} \times \mathrm{CF} \times ((\mathrm{INs} \times \mathrm{ABSo}) + (\mathrm{SA} \times \mathrm{ABSd} \times \mathrm{AF}))/(\mathrm{AT} \times \mathrm{BW}))$$

Where:

CDI	=	Chronic daily intake (mg/kg-day)
Cs	=	Arsenic exposure point concentration in soil or sediment (mg/kg)
EF	=	Exposure Frequency - recreational area (days / year)
ED	=	Exposure duration (years)
FI	=	Fractional intake accounting for time spent in a part of the Study Area (fraction)
Ins	=	Soil or sediment ingestion rate (mg/day)
ABSo	=	Oral absorption (bioavailability) (unitless)
SA	=	Dermal surface area (cm^2)
ABSd	=	Dermal absorption (unitless)
AF	=	Adherence factor for soil or sediment (mg/cm^2)
CF	=	Conversion factor mg-kg (unitless)
BW	=	Body weight (kg)
AT	=	Averaging time: For non-cancer effects (ATn): = 365 days/year x Exposure duration) For cancer effects (ATc)= 365 days/year x 70-year average lifetime = 25,550 days

Exposure values applied in this HHRA are described in the following sections and are summarized in Table 4-9. The approach is consistent with EPA guidance and most terms are standard default exposure terms identified in USEPA (2011) and USEPA (2018a) except as indicated.

Cs – Concentration of arsenic in sediments. As described in Section 4.3.2, sediments that are present under water depths of 24 feet or less were considering in the HHRA. This depth was considered relevant to account for the average variability of water depths of approximately 20 feet and a four-foot depth of water considered representative for people who wade or swim in affected areas. Sediment data were divided into areas for further consideration including the following: Upper Herrington Lake; Curds Inlet (Upper, Middle, and Lower); outside Curds Inlet; Hardin Inlet, HQ Inlet; Middle Herrington Lake; Lower Herrington Lake (Table 4-10). Where there were enough samples in the depth range of interest exposure point concentrations for arsenic in sediments were derived based on the 95% upper confidence limit (UCL) on the mean, consistent with USEPA guidance (USEPA 1989, 2015) for the RME calculations.

The UCLs were calculated using ProUCL software (USEPA 2015). ProUCL calculates UCLs using numerous alternative methods, including both parametric and nonparametric methods. Parametric methods assume that the data are consistent with a standard statistical distribution, such as normal, log-normal, or gamma. Nonparametric methods do not require any assumptions about the distribution. Because of the difficulty of reliably testing whether an environmental dataset fits one of the standard statistical distributions, nonparametric methods are often preferred, particularly when the dataset contains non-detects. Therefore, UCLs will be calculated using the Kaplan-Meier (KM) bias-corrected accelerated (BCA) bootstrap method. The KM BCA bootstrap method is robust enough to handle any typical environmental dataset, except in cases for which there are less than 6 detected values (USEPA 2009).

Exposure point concentrations for arsenic in sediments, either UCLs or maximum concentrations for areas considered are summarized in Table 4-10.

EF - Exposure Frequency. Exposure frequency represents the number of days per year that an individual may contact Study Area media, for example, Herrington Lake sediment. The USEPA does not have a standard default exposure frequency for recreational users, and instead risk assessments can consider factors including climate, accessibility, and the attractiveness of an area to derive an exposure frequency that is representative and health-protective. Climate data were considered here to develop an exposure frequency. Data compiled by the US weather service[2] indicate that, on average, Lexington, Kentucky experiences average daily low temperatures above 50 degrees for five months (roughly equivalent to 21.7 weeks) per year. The number of days having an average low temperature of greater than 50 degrees is a reasonable universe of possible days, since cooler weather generally means people spend less time swimming in the lake or playing in wet areas. For this assessment, it was also assumed that an older child or adult might swim and contact sediments for three days per week during the warm swimming period (i.e., 65 days per year). This represents each weekend and one more weekday each week. Since a young child is unlikely to use the area alone, a 33-use-per year exposure frequency estimate is therefore assumed, or that that they visit half as often as older children and adults. These assumptions represent the upper-estimate of number-of-days that young children may be brought to the area with an older child or adult (Table 4-9). Considering climate and the location and potentially limited accessibility to some sediment areas, the following exposure frequencies for human contact with surface sediments are thus proposed:

[2] https://www.usclimatedata.com/climate/lexington/kentucky/united-states/usky1079

- 65 days per year for older children and adults
- 33 days per year for a child under the age of 6.

ED - Exposure Duration. Exposure duration is the number of years an individual might be exposed at a setting. Standard default exposure durations are proposed for use in the RME estimates including a 6-year exposure for a child, a ten-year exposure frequency for an older child, a 16-year exposure for an adult (USEPA 2011, 2018a).

FI- Fractional Intake. Fractional intake accounts for the fraction of time that exposure occurs within a given area (USEPA 1989). Sediments were considered within sub-parts of the Study Area including: Upper Herrington Lake; Curds Inlet (Upper, Middle, and Lower); outside Curds Inlet; Hardin Inlet, HQ Inlet; Middle Herrington Lake; Lower Herrington Lake (Table 4-10). The areas within Curds Inlet were considered within Upper, Middle, and Lower regions because concentrations differ within these areas. However, Curds Inlet is relatively inaccessible and each of the Curds Inlet sub-areas is small. To better reflect time spent within these three parts of Curds Inlet, a fractional intake of 0.33 was applied to the Upper, Middle, and Lower Curds Inlet areas in risk estimates. Remaining sub-parts of the Study Area are larger and were considered with a fractional intake of 1.

INs – Ingestion rate for sediment. Incidental ingestion of soil/dust by adults and children is thought to occur as a result of mouthing hands, objects, and surfaces, e.g., food, toys, cigarettes, etc., that have soil or dust on them. Although there are no studies evaluating sediment ingestion, risk assessments typically assume that direct contact with sediments may also result in incidental ingestion. Sediment ingestion is expected to be higher in young children because children's hand-to-mouth behavior is more frequent, and because on a body weight basis the amount of soil or dust ingested is greater than in either older children or adults.

In this assessment, the standard default soil ingestion rates for young children of 200 mg/day and for older children and adults including workers of 100 mg/day are used in the RME estimates (USEPA 2011, 2018a).

ABSo – Oral absorption (bioavailability) for Arsenic. Oral bioavailability is an estimate of the degree of absorption of ingested arsenic tin the gastrointestinal tract of the body. Where oral absorption is lower from the media under consideration (e.g., sediment) than it was in the study used to derive a toxicity value, a relative bioavailability adjustment (RBA) can be made. For this assessment an RBA of 0.6 has been applied consistent with the generic RBA used by the USEPA in the RSL tables. In describing the 0.6 RBA value USEPA 2018a states:

> "The default value represents the 95th percentile of many arsenic soil samples, and it is expected that the site-specific RBA will be less than 0.6 at most sites, which means that the default should be protective for screening ".

Because this value is considered protective for use in screening, it is also use in this baseline risk assessment.

SA – Surface area of skin (cm^2). To estimate the potential for exposure through dermal contact, assumptions are made about the surface area of skin in contact with Study Area soil or sediments. USEPA standard default assumptions are proposed for assumed surface areas for use in the RME scenario. For children aged 0 to less than 6 years old, a surface area of 2,373 cm^2 was applied, which was derived by USEPA and represents a weighted average of mean values for head, hands, forearms,

lower legs, and feet (forearm and lower leg-specific data used when available, ratios for nearest available age group used elsewhere) (USEPA 2011 see especially Tables 7-2 and 7-8; USEPA 2018a).

For children ages 6–16 and adults, a surface area of 6,032 cm^2 was used, which was derived by USEPA and represents a weighted average of mean values for head, hands, forearms, lower legs, and feet (male and female, 21+ years) (forearm and lower leg-specific data used for males and female lower leg; ratio of male forearm to arm applied to female arm data (USEPA 2011, Tables 7-2 and 7-12; and USEPA 2018a).

ABSd – Dermal absorption of Arsenic. Dermal absorption is an estimate of the amount of a contaminant that is absorbed through the skin. The USEPA standard assumption regarding dermal absorption of arsenic from soil of 0.03 (Exhibit 3-4 of USEPA 2004) was applied in this HHRA.

AF – Skin-Soil Adherence. The skin-to-soil adherence factor quantifies the mass of soil that adheres to the hands during outdoor activities in units of mg soil per cm^2 skin surface area (mg/cm^2). Soil adherence used here include the USEPA (2014b) default soil to skin adherence factors of 0.2 mg/cm^2 for a young child, 0.07 mg/cm^2 for teens, and adults.

BW – Body weight. Body weight is considered in risk assessment because both the toxicity values and the exposure estimates are evaluated on a per-kilogram of body weight basis. For this reason, exposures in young children are often of more concern because their exposure may be higher on a per kilogram basis. The body weights used in this assessment are consistent with USEPA (2011, 2018a) including 15 kg for a young child under the age of 6 and 80 kg for adults. The body weight for teens was assumed to be 43 kg consistent with KRAGs (2002).

4.5 Toxicity Assessment

The toxicity assessment quantitatively evaluates the hazards associated with COPCs identified in Study Area media, i.e., arsenic in sediments. In this toxicity assessment, toxicity values were assembled for arsenic to evaluate the relevant exposure pathways including oral ingestion and dermal contact with skin. Toxicity values for oral exposure include reference doses for evaluation of noncancer endpoints and carcinogenic slope factors for cancer endpoints. Toxicity values for oral exposure are also used to estimate dermal contact after considering dermal absorption from the skin.

The hierarchy identified in the USEPA (2003a) Human Health Toxicity Values in Superfund Risk Assessments was applied to select toxicity values for use in the risk assessment. The 2003a USEPA hierarchy has first level reliance on the USEPA Integrated Risk Information System (IRIS) tables (USEPA 2017e), served as the primary basis for toxicity values in the HHRA which are reported in Tables 4-11 and 4-12).

4.5.1 Cancer Toxicity Assessment

Cancer risks for inorganic arsenic are based on the USEPA IRIS cancer slope factor (CSF) of 1.5 $(mg/kg\text{-}day)^{-1}$ derived based on studies of human populations who developed cancers following ingestion of high levels of inorganic arsenic in drinking water (USEPA 1995a). Specifically, USEPA derived the CSF based on data from a cross-sectional study of 40,000 Taiwanese exposed to naturally occurring arsenic in drinking water who were found to have a significant excess in skin cancer prevalence (Tseng et al. 1968; Tseng 1977). USEPA identifies some limitations in this study stating:

> "Although this study demonstrated an association between arsenic exposure and development of skin cancer, it has several weaknesses and uncertainties, including poor nutritional status of the exposed populations, their genetic susceptibility, and their exposure to inorganic arsenic from non-water sources, that limit the study's usefulness in risk estimation. Dietary inorganic arsenic was not considered nor was the potential confounding by contaminants other than arsenic in drinking water. There may have been bias of examiners in the original study since no skin cancer or preneoplastic lesions were seen in 7500 controls; prevalence rates rather than mortality rates are the endpoint; and furthermore there is concern of the applicability of extrapolating data from Taiwanese to the U.S. population because of different background rates of cancer, possibly genetically determined, and differences in diet other than arsenic (e.g., low protein and fat and high carbohydrate) (U.S. EPA, 1988)."

Table 4-11 summarizes the CSF for arsenic used in this HHRA. Because nearly all of these uncertainties would tend to overestimate risks, this CSF is expected to be a highly health protective means to consider cancer risks.

4.5.2 Non-Cancer Toxicity Assessment

To evaluate effects other than cancer this assessment applied the oral reference dose (RfD) of 0.0003 mg/kg-day derived based on the no observed adverse effect level (NOAEL) of 0.0008 mg/kg-day estimated from a population in Taiwan exposed to arsenic in drinking water (USEPA 1991b). Individuals exposed at higher concentrations developed adverse cardiovascular and skin (dermal) conditions. USEPA derived the RfD through application of an uncertainty factor of 3 intended to account for "both the lack of data to preclude reproductive toxicity as a critical effect and to account for some uncertainty in whether the NOAEL of the critical study accounts for all sensitive individuals." (USEPA 1991b). The oral RfD for arsenic is summarized in Table 4-12.

4.6 Risk Characterization

In risk characterization, quantitative exposure estimations are combined with toxicity factors to produce numerical estimates of potential human health risk. Noncancer health hazards and cancer risk estimates were derived using methods identified in USEPA guidance (USEPA 1989, 2014b). Table 4-11 provides a summary of excess lifetime cancer risk estimates and hazard quotients for arsenic in sediments.

4.6.1 Cancer Risk Method

Cancer risk estimates for arsenic were calculated by multiplying the lifetime average daily intake estimate for arsenic in sediments by the arsenic carcinogenic slope factor (Equation 4-2).

Equation 4-2: Excess lifetime cancer risk (ELCR)=(CDI×CSF)
where:

ELCR = a unitless probability (e.g., 1×10^{-5} or one in 100,000) of an individual developing cancer;
CDI = chronic daily intake averaged over 70 years (mg/kg-day); and
CSF = Cancer slope factor expressed in $(mg/kg\text{-}day)^{-1}$.

Within CERCLA (U.S. House of Representatives, 1980), incremental excess cancer risk levels for site-related contaminants are evaluated relative to the target range of 1×10^{-4}–1×10^{-6} (one-in-10,000 to one-in-a-million) identified in the National Contingency Plan (NCP, 40 CFR Part 300.430). Estimated excess cancer risk levels less than 1×10^{-6} are considered insignificant, while estimated cancer risk

levels greater than 1×10^{-4} generally require further characterization, although they may not necessarily require remedial action or other risk reduction measures. Excess risk estimates can also be considered relative to the 'background' rate for cancer in the U.S. Specifically, the American Cancer Society (ACS 2018) estimates that the existing lifetime risk of developing any invasive form of cancer without any known exposure is one-in-three (3×10^{-1}) (ACS 2018).

4.6.2 Excess Cancer Risk Estimates

Excess lifetime cancer risk estimates for arsenic for recreational visitors exposed sediments are summarized in Table 4-13. As indicated there, the following risks were estimated:

- No excess cancer risk estimates for arsenic were greater than one in 10,000 (1×10^{-4}). Thus, all estimates were within the target range often considered to be acceptable by regulatory agencies.
- Excess lifetime cancer risk estimates for arsenic ranged from 2×10^{-6} to 1×10^{-5} with the highest estimates found in Middle and Lower Curds Inlet, and in HQ Inlet.

4.6.3 Calculation of Potential Non-Cancer Hazards

Non-cancer effects were calculated as the ratio of the estimated daily intake of a chemical to the corresponding RfD. The estimate of potential non-cancer risks for arsenic was derived as a Hazard Quotient (HQ) based on the oral RfD (USEPA 1991b). Where the average daily dose is lower than the RfD, the HQ is less than one (1). Where an HQ exposure is less than one, no adverse effects would be expected. However, because of the potential for overestimation related to both the exposure estimates and the derivation of RfDs, an HQ greater than one does not necessarily indicate that harm will occur.

The USEPA Regional Removal Management Level (RML) (USEPA 2018c) identified an HQ of 3 as an acceptable upper bound level for screening hazards associated with individual constituents stating:

> "However, an HQ of 3 is generally considered a reasonable risk level for RMLs for non-carcinogenic chemicals based on the discussion of uncertainty included in EPA's definition of the non-carcinogenic Reference Dose (RfD) and Reference Concentration (RfC). EPA defines the RfD and RfC as: "…an estimate (with uncertainty spanning perhaps an order of magnitude) of daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime." It is unknown for any particular chemical where the RfD/RfC may fall within the order of magnitude range of uncertainty. As a science policy choice, OSWER places the RfD/RfC in the middle of a factor of ten uncertainty range; with a factor of three above and below (i.e., 0.3 to 3). As stated previously, action generally is not warranted at a site where the non-carcinogenic HQ is less than 1; whereas, action may be warranted where the non-carcinogenic HQ exceeds 1. Again, as a science policy choice to aid in prioritizing actions that may warrant the use of removal authority, an HQ of 3 was selected as the upper, target risk level for calculating non-cancer RMLs." (USEPA 2018c).

4.6.4 Non-Cancer Hazard Quotients

Table 4-13 summarizes non-cancer hazard quotients (HQs) for recreational visitors and as indicated there, all HQs were calculated to be below 1.0, which indicates that no adverse effects would be expected.

4.6.5 Uncertainties in the HHRA

Potential for uncertainty within the risk assessment process is typically considered when evaluating the risk assessment results. Uncertainty is inherent in the quantitative risk assessment process due to its use of environmental sampling results, assumptions regarding exposure, and quantitative representations of chemical toxicity based on toxicity studies in animals. Typical uncertainty sources in HHRAs relate to the sampling data, the exposure frequency estimates, and the toxicity values used to estimate risk(s). In the case of Herrington Lake, robust Phase I and II multi-media sampling results are available to evaluate human health risks including:

- Comprehensive fish fillet data were available and evaluated using human health-protective assumptions. The analyses determined that metals concentrations in the fish tissue are within acceptable levels for human consumption.
- Comprehensive surface water concentration data were available and evaluated using the assumption that the water is all used as drinking water. These analyses determined that the metals levels in the surface water do not pose a human health risk.
- Robust sediment concentration data were available and evaluated for recreational visitors' potential exposure to arsenic through direct contact with sediment.
- Conservative health protective assumptions were applied to each of the remaining sources of uncertainty, and as a result, exposure and risks are likely overestimated for most individuals. Specific examples include:
    - Inclusion of sediments under 24 or less feet of water likely overestimates the potential for most recreational visitors to contact sediments.
    - Risk estimates for recreational visitors assumed children under the age of six would visit Study Area areas 33 times a year and older children and adults could visit 65 times, which probably overestimates risks for most individuals;
    - The health protective nature of both the cancer slope factors and reference concentrations used in the assessment are likely to overestimate risks for most, if not all, Study Area users.

The numerous aspects of the HHRA that tend to overestimate risks can be considered when evaluating the findings of the assessment.

An additional uncertainty was considered in the HHRA. Metals of interest in the CCR Rule (arsenic, cobalt, lithium, and molybdenum) have been detected in onsite monitoring wells at concentrations greater than their respective MCL (arsenic), or the groundwater protection standards identified in the CCR Rule (40 CFR 257.95(h)(1)). Arsenic concentrations in onsite monitoring wells are screening levels for residential drinking water. Arsenic concentrations in onsite groundwater wells exceed the MCL of 0.010 mg/L with the greatest elevation identified at 0.047 mg/l in MW 112 (Table 3-4B). None of the selenium concentrations in onsite groundwater monitoring wells exceeded the MCL of 0.050 mg/l (Table 3-4B).

The CCR Rule human health ground water protection standards for cobalt, lithium, and molybdenum, which do not have MCLs, are USEPA RSLs (USEPA 2018a) for drinking water (cobalt, lithium, and molybdenum). Data for cobalt, lithium, and molybdenum are considered from onsite groundwater monitoring wells available for 2016, 2017, and 2018 (AMEC 2019). These data are compared to screening levels in Table New 4-1. As indicated in Table New 4-1:

- Cobalt concentrations exceed the RSLs slightly in MW 114, molybdenum exceeds slightly in MW 112 and lithium exceeds in all wells except MW 114 (Table 4-14).
- The greatest elevations were found for lithium at concentrations less than 10-fold higher than the screening level (Table 4-14).

However, because the onsite groundwater and onsite monitoring wells are not used as drinking water sources, nor will they be used for this purpose in the future, the finding of these constituents in onsite groundwater wells does not pose a risk.

4.7 HHRA Conclusions

A human health risk assessment was conducted to evaluate the CCR-related constituents detected in water, sediment and fish tissue. Comprehensive reviews were conducted in 2018 and 2019 to identify domestic drinking water wells and none were found within a mile of E.W. Brown Station. Health protective assumptions were applied to select RBCs that were used to identify COPCs in Study Area media. No COPCs were identified for surface water based on the conservative assumption that surface water is used as residential drinking water. No COPCs were identified for fish tissue assuming consumption of 50 meals per year. Screening-level analysis of sediment concentrations identified arsenic as a COPC in sediments. Site-specific human health risk estimates were derived for recreational visitor's exposure to arsenic in sediments for areas under 24 or less feet of water. Health protective assumptions were applied to estimate exposure for hypothetical recreational visitors including young children, older children and adults whom might visit the areas (i.e. Upper Herrington Lake; Curds Inlet; outside Curds Inlet; Hardin Inlet, HQ Inlet; Middle Herrington Lake; Lower Herrington Lake) as often as 33 days per year for the young child and 65 days per year for adults.

Calculated excess lifetime cancer risk estimates were less than the upper end of USEPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$. No hazard quotients were greater than 1 indicating no adverse effects would be expected for recreational visitors that may be in contact with sediments.

5. ECOLOGICAL RISK ASSESSMENT

This section provides the ERA as provided in the Agreed Order to address any threat or potential threat to human health associated with management and storage of CCR at E.W. Brown Station. The overall goal of this ERA is to assess the potential for ecological risks of selenium and other CCR-related constituents of potential ecological concern (COPECs) within the Herrington Lake Study Area. The ERA approach is consistent with the ERA approach described in the approved CAP after taking public comment. Pertinent data and information for this ERA were collected during the Phase I and II sampling conducted in accordance with guidance and documents (e.g., QAPP, SOPs) approved by the Cabinet. This ERA will contribute to further remedial decision-making for the Study Area.

5.1 Technical Approach for the ERA

The ERA approach is consistent with relevant ERA guidance provided by the Cabinet (2017) and USEPA, as follows:

- Kentucky Risk Assessment Guidance (KRAG 2002) Prepared by the Kentucky Natural Resources and Environmental Protection Cabinet
- Framework for Ecological Risk Assessment (USEPA 1992b)
- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (USEPA 1997a)
- Guidelines for Ecological Risk Assessment (USEPA 1998)
- ECO Update: The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments (USEPA 2001)
- Supplemental Guidance to ERAGS: Region 4, Ecological Risk Assessment (USEPA 2018b)
- Generic Ecological Assessment Endpoints for Ecological Risk Assessment: Second Edition with Generic Ecosystem Services Endpoints Added (USEPA 2016b)

The ERA follows the USEPA (1997a) eight-step ERA process, as illustrated on Figure 5-1. Steps 1 and 2 comprise the screening-level ERA (SLERA). The SLERA provides a conservative estimate of the maximum potential ecological risks and incorporates uncertainty in a precautionary (i.e., conservative) manner. The overall goal of the SLERA is to determine whether (1) there is a high probability that there are no significant ecological risks; or (2) there is a need for additional evaluation of potential risks (USEPA 1997a, 2000a). At this point in the process, a scientific management decision point (SMDP) may be implemented which includes reporting of results to stakeholders. If potentially adverse effects are identified, the iterative risk assessment process continues with Steps 3 through 8 or a BERA.

The second tier of the screening process offers an opportunity to consider additional information, such as alternative benchmarks, factors that limit bioavailability (or availability for uptake), and/or additional toxicological information, to further evaluate the potential for COPECs to adversely affect target organisms. This second tier is referred to as Step 3A of the baseline ERA, or baseline ecological risk assessment (BERA). According to USEPA (2000a) "Problem Formulation [i.e., Step 3] is commonly thought of in two parts: Step 3A and Step 3B…Step 3A serves to introduce information to refine the risk estimates from steps one and two."

A BERA provides an opportunity for iterative refinement of potential risks identified in the SLERA but are typically more complex than SLERAs and incorporate more realistic exposure and effects information. Following the BERA, there is another opportunity for a scientific management decision point, which is communicated to the stakeholders.

This ERA for the Herrington Lake Study Area includes Steps 1 (SLERA) though 3A (BERA). Three major elements are included in an ERA: problem formulation, analysis of exposure and ecological effects, and risk calculation. Progression from the SLERA to the BERA (Step 3A) involves iterative consideration and refinement of these major elements, as necessary. Supporting information for this ERA are provided in Appendix H.

5.2 Screening-Level Problem Formulation

The screening-level problem formulation integrates available information to provide the foundation for the ERA, establishing the goals, scope, and focus of the assessment. Ultimately the problem formulation will clarify what is known about potential ecological resources within the Study Area and synthesize what is known about or predicted for a given site to develop a CSM that will guide the ERA process. The screening-level problem formulation phase and preliminary CSM development typically requires describing or defining the following:

- Study Area (see Section 1.1)
- Environmental setting (Section 5.2.1)
- Potentially exposed ecological receptors (Section 5.2.2)
- Potentially complete exposure pathways (Section 5.2.3)
- Preliminary assessment and measurement endpoints (Section 5.2.4)
- A CSM (Section 5.2.5)

5.2.1 Environmental Setting

Herrington Lake is a freshwater reservoir formed in the 1920s by the construction of the Dix River Dam for hydroelectric power. It is the deepest lake in Kentucky, reaching depths of approximately 250 feet or more, with variable depths for summer pool and winter pool. The banks of the lake are generally comprised of naturally occurring stratified rock forming steep drop-offs in many areas. The shoreline is dominated by a dense layer of deciduous trees with a smaller proportion of evergreens. The understory consists of small, woody shrubs and trees and non-woody vegetation (e.g., herbs, grasses).

The lake supports aquatic-feeding wildlife such as ducks, raccoons, muskrat, mink, river otters, herons, and osprey. There are over 200 species of fish native to Kentucky in Herrington Lake. Fish species present in Herrington Lake include bluegill, green sunfish, largemouth bass, spotted (Kentucky) bass, channel catfish and flathead catfish. Largemouth and spotted bass are Kentucky's most popular game fish. Striped bass and largemouth bass were stocked in Herrington Lake in 2016 and 2017 by the Kentucky Division of Fish and Wildlife, as follows:

- In 2017, Herrington Lake was stocked with 40,112 (16.6 fish/acre) largemouth bass (4.1–4.7 in).
- In 2016, Herrington Lake was stocked with 53,748 (22.3 fish/acre; 1.2–1.8 in) hybrid striped bass in June 2016. The hybrid striped bass stocking was divided into 26,349 reciprocal cross hybrids and 27,399 original cross hybrids.

Bluegills are not stocked in Herrington Lake by the Kentucky Division of Fish and Wildlife. Bluegills are abundant in Herrington Lake, as is described further in this ERA. According to the 2010 Lake and Tailwater Survey, bluegills were the fourth most sought-after fish group at Herrington Lake in 2010. Panfish are collected by tens of thousands by anglers, such as approximately 21,000 fish caught in 2010 and approximately 46,000 caught in 2004.

The Study Area is comprised of Herrington Lake, several embayments, and the lower Dix River. Water flow and level in Dix River is regulated by the dam. Lower Dix River is approximately 40–70 feet wide, interspersed with shallow areas of 2 feet or less and deep pools and runs of several feet deep. Portions of Lower Dix River are bordered by tall cliffs. A spillway enters the river from the east approximately a half mile from the dam. These varied habitats within the lake support a variety of algae, plants, and invertebrates, which serve as the base of the food web for the lake. The upper layers of the lake, where sunlight penetrates, supports algae and a variety of floating (e.g., duckweed), submerged and emergent aquatic plants. Vegetation is generally concentrated along the shallower shoreline, among the submerged rocks or woody debris. Invertebrates inhabit the water column, as well as the sediment (benthic or sediment-dwelling). Benthic invertebrates include crayfish and larval-stage flies, such as mayflies, damselflies, stoneflies, and dobsonflies. Fish are the dominant species in terms of biomass of the lake.

Similar to Herrington Lake, aquatic-feeding wildlife (e.g., ducks, raccoons, muskrat, mink, river otters, etc.) would be expected to inhabit Dix River below the dam. The fish species in Dix River reflect colder water conditions compared to the lake, such as trout. Dix river also supports algae, aquatic plants, and invertebrates, although the species may differ slightly due to the differences in aquatic habitat. Several areas of emergent vegetation are present in the shallow shoals of the river. Crayfish and larval-stage flies are also present.

5.2.2 Potential Ecological Receptors

In this subsection, potential ecological receptors are identified based on the environmental setting (Section 5.2.1) and a review of pertinent information, such as Federal and state special status species.

5.2.2.1 Threatened and Endangered Species

The Herrington Lake Study Area is located in Garrard County (to the east) and Mercer County (to the west) in Kentucky. According to the Kentucky Department of Fish & Wildlife Resources (KDFWR)[3], four species are Federally listed as endangered within Garrard and Mercer counties (Table 5-1). Two species, a bivalve (Clubshell; *Pleurobema clava*) and a bat (Gray myotis; *Myotis grisescens*) are endangered in Garrard County. Two species, a bird (Interior least tern; *Sternula antillarum athalassos*) and a bat (Gray myotis) are endangered in Mercer County. The KDFWR also lists 3 bird, 1 bivalve, 1 insect, 2 mammal, and 1 reptile species as endangered, threatened, or special concern in Garrard County, and 1 amphibian, 23 bird, 2 insect, and 3 mammal species as endangered, threatened, or special concern in Mercer County (Table 5-1).

5.2.2.2 Receptors of Interest

Most healthy aquatic ecosystems support a variety of organisms that are potential ecological receptors of chemical exposures, including plants, aquatic invertebrates, benthic invertebrates, fish, birds, and mammals. It is not feasible to complete risk calculations for all species potentially exposed. Such an effort would also be duplicative because of the similarity of exposure patterns among closely related species and those with similar feeding guilds or functional groups. For these reasons, representative receptors of interest (ROIs) are selected. These ROIs are representative of entire classes of organisms (i.e., functional groups). Selection criteria for ROIs include sensitivity, exposure potential, expected presence at the Site, ecological relevance, trophic level, feeding habits, and the availability of life history information. The rationale for selecting each ROI is discussed below.

[3] Available at http://app.fw.ky.gov/speciesinfo/speciesinfo.asp. Accessed on March 24, 2017.

- *Fish*. The fish community lives in constant and direct contact with surface water. Exposures are also possible via sediment and the food web (i.e., secondary consumers), particularly for bioaccumulative constituents (i.e., those constituents with a potential to accumulate in tissue[4]). The fish community often dominates the aquatic ecosystem, in terms of biomass, and fish serve as a prey base for piscivorous (or fish-eating) wildlife.
- *Wildlife*. Birds and mammals are exposed to constituents in surface water, surface sediment, and sediment pore water primarily through prey ingestion. As higher trophic level species, birds and mammals are susceptible to compounds that bioaccumulate through the food web. Individual foraging strategies and choices of prey may also promote incidental sediment ingestion.
- *Aquatic vegetation*. The aquatic plant community lives in constant and direct contact with surface water. Plants serve as a prey base for higher trophic level organisms and cycling of nutrients and other constituents into the food web, as well as essential habitat for many animal species.
- *Invertebrates*. The aquatic and benthic invertebrate community lives in constant and direct contact with surface water and/or sediment and sediment pore water. Invertebrates have vital functions within the ecosystem, including serving as a prey base for higher trophic level organisms and cycling of nutrients and other constituents into the food web.

5.2.3 Potentially Complete Exposure Pathways

Once COPECs are present in surface water, sediment pore water, or sediment, a variety of organisms may be exposed to them via different pathways. An exposure pathway describes the specific mechanism(s) by which a receptor may be exposed to a chemical present in an environmental medium. A complete exposure pathway is one in which constituents can be traced or are expected to travel from the source to a receptor (USEPA 1997a). Therefore, a complete exposure pathway has five parts:

- A source of chemical constituents
- A transport mechanism of the chemical(s) from the source (such as runoff or groundwater constituent mass loading)
- A point of exposure (surface water, pore water, or sediment in a lake or river)
- A receptor(s) (such as a community of benthic invertebrates)
- A route of exposure through which the receptor takes up the chemical (such as a receptor touching, drinking, or eating contaminated sediment)

The exposure pathway is complete and potentially capable of causing unacceptable risks only when all five parts are present.

Both direct and indirect exposure pathways may exist for plants, invertebrates, and fish in the Herrington Lake Study Area and for birds and mammals that utilize the lake. Biota potentially act as both a receptor and a secondary source of chemical contamination. Possible exposure routes include inhalation, dermal contact, ingestion through diet, and ingestion of surface water and/or sediment. Aquatic plants and invertebrates are potentially exposed to chemicals in surface water through direct contact. Benthic invertebrates (e.g., crayfish, insect larvae) are potentially exposed to constituents in sediment through direct contact between sediment pore water (i.e., the interstitial water within the sediment) and structures, such as gills and setae, and ingestion of sediment. Fish may be potentially exposed via gill transfer from water, water and/or sediment ingestion, prey ingestion, or dermal contact with surface water and/or sediment pore water. Wildlife are potentially exposed via inhalation,

[4] According to log Kow values and USEPA (2000e).

dermal contact, and ingestion of aquatic prey, drinking water, and incidental sediment. Although inhalation and dermal exposures occur, these routes are poorly characterized for most wildlife species. Ingestion of prey is assumed to dominate wildlife exposure. Since some constituents bioaccumulate throughout the food web, concentrations of constituents in prey may be elevated relative to concentrations in surface water, sediment, or pore water.

5.2.4 Preliminary Assessment and Measurement Endpoints

Assessment endpoints are the explicit expression of ecological entities (e.g., mammal populations) and attributes (e.g., reproductive ability) to be protected (USEPA 1997a, 2003b). The selection of assessment endpoints depends on knowledge about the receiving environment, constituents released (including ecotoxicological properties and concentrations that cause adverse impacts), and the values that will drive risk management decision-making (Suter et al. 1995). According to USEPA (1997a),

> "for the SLERA, assessment endpoints are any adverse effects on ecological receptors, where receptors are plant and animal populations and communities, habitats, and sensitive environments. Many of the ecotoxicity screening values are based on generic assessment endpoints (e.g., protection of aquatic populations or communities from changes in structure or function) and are assumed to be widely applicable to sites around the United States."

The specific preliminary assessment endpoints considered for this SLERA are:

- Survival, growth, and reproduction of fish populations
- Survival, growth, and reproduction of aquatic-feeding bird and mammal populations
- Protection and maintenance of aquatic vegetation and water-column invertebrate community structure and function
- Protection and maintenance of benthic invertebrate community structure and function

"Population" refers to a group of interbreeding individuals of a single species, occurring within a geographic area (Barnthouse et al. 2008; USEPA 1999). As described by Barnthouse et al. (2008), "regulations, policies, directives, and guidance documents frequently discuss the need for ERAs to consider risks to populations, not simply to individual organisms or organism-level attributes. The reason for this [need] is that, from a management perspective, the population-level attributes such as abundance, persistence, age and composition can be more relevant than are the health or persistence of individual organisms." "Community structure and function" refers to the types and diversity of species present and their ecological roles (for example, serving as prey for wildlife). The focus of this ERA on populations and communities is consistent with USEPA's Generic Ecological Assessment Endpoints for Ecological Risk Assessment (2016b) and the USEPA Ecological Risk Assessment and Management Principles (1999).

Because direct measurement of assessment endpoints is often difficult or impossible, measurement endpoints are used to provide the information necessary to evaluate whether the values associated with the assessment endpoint are being protected. A measurement endpoint is defined as a measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint and is a measure of biological effects. More than one measurement endpoint may be selected for a given assessment endpoint. For this screening-level ERA, measurement endpoints are simply defined as the comparison of maximum chemical concentrations in surface water, sediment pore water, and surface sediment to relevant ecotoxicity screening levels.

5.2.5 Ecological Conceptual Site Model

A CSM is a planning tool used for identifying chemical sources, potential receptors, and complete exposure pathways on which to focus the ERA. This CSM describes the network of relationships between constituents released from past and ongoing activities at the E.W. Brown Station and the receptors that may be exposed to the constituents through pathways such as ingestion of food or water. The CSM examines the range of potential exposure pathways and identifies those that are present and may be important for ecological receptors; it eliminates those pathways that are incomplete and therefore do not pose a risk. The ecological CSM for the Herrington Lake Study Area is presented in Figures 5-2A–C.

5.3 Screening-Level Ecological Risk Assessment

The analysis phase of the ERA involves the characterization of relationships between exposures and effects. This characterization involves identification of appropriate exposure estimates for the assessment and measurement endpoints identified in the problem formulation. Characterization also involves the identification of appropriate estimates of potential adverse impacts or ecological effects for the constituents.

The risk characterization phase of the ERA involves the integration of results from the analysis phase to develop an estimate of the potential risk posed to the ecological entities included in the assessment endpoints, as identified in the problem formulation phase. The risk estimate is be characterized in terms of the significance of any adverse effects.

This SLERA integrates information provided in the screening-level problem formulation (Section 5.2) and is comprised of the screening-level exposure assessment (Section 5.3.1), screening-level effects characterization (Section 5.3.2), and screening-level risk calculations (Section 5.3.3).

5.3.1 Screening-Level Exposure Assessment

Environmental samples collected from the Herrington Lake Study Area in 2017 (Phase I) and 2018 (Phase II) were used in the screening evaluation of potential ecological risks. The Phase I sampling effort collected surface water, sediment pore water, surface sediment, aquatic vegetation, benthic invertebrates, and adult fish, consistent with the CAP Phase I Sampling Plan. The Phase II sampling effort collected surface water, sediment pore water, surface sediment, adult fish, and YOY bluegills, consistent with the Phase II FSP. For this SLERA, surface water, pore water, and sediment data are evaluated to determine the preliminary COPECs to be carried forward into Step 3A of the BERA. Biota tissue (vegetation, invertebrates, and fish) data will be evaluated in the BERA.

For the ERA, the following areas within the Herrington Lake Study Area are identified (see Section 1 for further description of each area).

- Curds Inlet
  - Upper Curds Inlet
  - Middle Curds Inlet
  - Lower Curds Inlet
- HQ Inlet
- Hardin Inlet

- Lower Herrington Lake (LHL4, LHL5, LHL6)
  - Rocky Run Embayment (LHL1)
  - Near Dix Dam (LHL2)
  - Outside Curds Inlet (LHL3)
  - Dix River
- Middle Herrington Lake (MHL1 and MHL3)

This ERA also considers Briar Patch Spring, HQ Spring, and the Auxiliary Pond Outfall KPDES BRN001.

A Reference Area that is outside the influence of Curds Inlet is identified and discussed in this ERA for comparison to Curds Inlet conditions. This area includes LHL5 and LHL6, within Lower Herrington Lake, and MHL1 and MHL3, within Middle Herrington Lake. Only fish data were collected from MHL1 and MHL3; these data are considered in the Step 3A of the BERA.

Summary statistics (i.e., minimum and maximum detected concentrations, arithmetic mean of detected concentrations, and frequency of detection) are determined for constituents in surface water, pore water, and surface sediment for each of the areas above. Surface water data includes stratification and overturn sampling results, as well as dissolved phase and total recoverable metal concentrations. Exposure estimates used in this SLERA are the maximum concentrations of constituents detected in surface water, pore water, and sediment.

5.3.2 Screening-Level Effects Characterization

The screening-level ecological effects evaluation involves the identification of appropriate ecotoxicity screening levels for detected constituents in each environmental medium. ESVs are chemical concentrations in environmental media below which there is negligible risk to receptors exposed to those media (USEPA 2000a). The ESVs used in the selection of preliminary COPECs were purposefully chosen to ensure that the process is inherently conservative, by focusing on values that reflect adverse effects in individual organisms. This means that a larger number of constituents may be identified as COPECs than are likely to pose significant risks of population-level effects. Although the first of USEPA's (1999) risk management principles is to reduce risks to levels that will result in recovery and maintenance of healthy local populations and communities of biota, SLERAs typically focus on individual-level effects to ensure the conservatism of the outcome.

Potential ESVs are described in Section 2.2.2. The selected ESVs for use in this SLERA for surface water and pore water are presented in Table 5-2 and for sediment in Table 5-3. For surface water and pore water, Kentucky water quality criteria are selected preferentially, where available. Otherwise, USEPA Region 4 surface water ESVs are used. For sediment, USEPA Region 4 freshwater ESVs are used. Screening-level ESVs are based on chronic criteria (i.e., the lowest and most conservative). For hardness-dependent criteria (cadmium, lead, and zinc), site-specific hardness (mean of 156 mg/L as calcium carbonate [$CaCO_3$]) was used to calculate the appropriate ESV.

5.3.3 Screening-Level Risk Characterization

The screening-level risk characterization involves the calculation of HQs, which, for the SLERA, are the ratio of the maximum exposure estimate with the ESV identified in the screening-level ecological effects characterization. The unitless HQs are considered a measurement endpoint that can provide understanding of potential ecological risks. An HQ equal to or less than a value of 1 (to one significant figure) indicates that adverse impacts are considered unlikely depending on the basis of TRV (which is discussed as it pertains to potential adverse effects). An HQ greater than 1 is an indication that further

evaluation is necessary to evaluate the potential for adverse impacts (Kentucky Natural Resources and Environmental Protection Cabinet 2002). Therefore, those constituents in surface water, pore water, and sediment with hazard quotients greater than 1 are carried forward as preliminary COPECs into the BERA. In addition, those constituents for which no screening values exist are carried forward as preliminary COPECs.

The results of the surface water, pore water, and sediment ecological screening are provided in Tables 5-4, 5-5, and 5-6, respectively. Exhibit-1 summarizes the preliminary COPECs by media:

Exhibit 5-1: Surface Water, Sediment, and Pore Water COPEC Summary

	Surface Water	Sediment	Pore Water	Preliminary COPEC?
Selenium	✓	✓	✓	Yes
Arsenic	---	✓	✓	Yes
Mercury	✓	---	---	Yes
Methylmercury	---	✓	---	Yes
Cadmium	---	✓	✓	Yes
Boron	---	No Criteria	---	Yes
Iron	---	✓	✓	Yes
Lead	---	---	---	No
Magnesium	---	No Criteria	---	Yes
Zinc	---	✓	---	Yes

The springs (Briar Patch Spring, HQ Spring, and Auxiliary Pond Outfall BRN001) are considered as well for cobalt, molybdenum, and lithium.

The preliminary COPECs identified above are carried forward into Step 3A of a BERA (Section 5.4), including refinement of the COPECs, exposure, effects, and risk characterization. Additional chemical-specific information (e.g., background concentrations, published toxicity data) and realistic exposure assumptions are considered in the refined screening evaluation (Step 3A of the BERA). Although lead was not identified as a preliminary COPEC in the screening assessment, lead is conservatively retained as a bioaccumulative chemical for evaluation of potential adverse effects to wildlife in the BERA.

5.4 Baseline Ecological Risk Assessment: Step 3A

As described in Section 5.1, Step 3A of the ERA process is an opportunity for iterative refinement of potential risks using methods similar to those used in Steps 1 and 2 (USEPA 2000a, 2001). Specifically, Step 3A of the BERA considers background concentrations, alternative ecotoxicological benchmarks, reference concentrations, more representative exposure estimates, bioavailability, and additional toxicological information to further evaluate the potential for constituents to adversely affect aquatic organisms and aquatic-feeding wildlife. Step 3A of the BERA more fully describes which COPECs in which media and which locations may have the potential to adversely affect ecological receptors.

This section is organized as follows:

- Refinement of identified preliminary COPECs (Section 5.4.1)
- Refined problem formulation (Section 5.4.2)
- Refined exposure estimates (Section 5.4.3)
- Refined effects characterization (Section 5.4.4)
- Refined risk calculations (Section 5.4.5)

5.4.1 Refinement of Identified Preliminary COPECs

This section of the BERA further evaluates several of the preliminary COPECs identified in the SLERA and establishes the list of COPECs that will be the focus of the BERA evaluation. Exhibit 1 lists the preliminary COPECs retained for further evaluation. Of these, all were retained for the BERA with the exception of boron, iron, and magnesium, as explained in the following sections. .

5.4.1.1 Boron

Boron concentrations in surface water and pore water do not exceed the surface water ESV. Because no ESV exists to evaluate boron in sediment, background concentrations are considered for comparison. As discussed in Sections 2.2.4 and 2.3.5.1, detected boron concentrations from two locations in Curds Inlet (CI1A and CI4A) and one location in HQ Inlet (HQ1A) exceed the average background sediment boron levels listed in Mason and Dragun (1996) for several U.S. states (see Figure 2-7G). However, mean boron sediment concentrations from Curds Inlet and HQ Inlet are below the Mason and Dragun (1996) average background sediment concentrations. All detected boron concentrations in sediment are below the average of the maximum background boron levels listed in Mason and Dragun (1996; Figure 2-7G). In addition, mean concentrations of boron within the Study Area sediment range 3.4–26 mg/kg, with the mean in-watershed reference concentration of boron at 10.6 mg/kg (Table 5-6). Although boron was measured in fish, plant, and invertebrate tissue, no ecological risk-based criteria exist to evaluate potential toxicity (see Figures 2-7A, 2-7B, 2-7C, and 2-7H).

Detected pore water concentrations of boron do not exceed the respective ESV. Therefore, boron is unlikely to adversely affect benthic invertebrates in the Study Area. Boron does not bioaccumulate (USEPA 2000b). Therefore, boron does not pose a risk to aquatic or benthic organisms and is not considered further in this ERA due to the following:

- Maximum detected concentrations of boron in surface water do not exceed the ESV;
- Detected boron concentrations in sediment within the Study Area generally do not exceed the average background sediment levels reported in literature;
- Detected boron concentrations in sediment do not exceed the maximum background sediment levels reported in literature;

- Maximum detected concentrations of boron in pore water do not exceed the ESV;
- Pore water concentrations provide the best line of evidence to determine potential toxicity to benthic invertebrates; and
- Boron does not bioaccumulate in the food web.

5.4.1.2 Iron

Iron concentrations in surface water do not exceed the surface water ESV, but iron concentrations in pore water and sediment do exceed the ESV at several locations in Curds Inlet, Dix Dam, Hardin Inlet, and HQ Inlet (Tables 5-5 and 5-6, respectively). The average iron concentrations in sediment were observed at the various areas considered in the ERA, as follows:

- Curds Inlet average concentration of 35,100 mg/kg
- Dix Dam (LHL2) average concentration of 31,200 mg/kg
- Dix River average concentration of 29,600 mg/kg
- Hardin Inlet average concentration of 29,000 mg/kg
- HQ Inlet average concentration of 22,700 mg/kg
- LHL3 average concentration of 12,000 mg/kg
- LHL4 average concentration of 14,800 mg/kg
- LHL5 and LHL6 Reference average concentration of 16,300 mg/kg
- Rocky Run Embayment (LHL1) average concentration of 17,300 mg/kg

The average iron concentration in Curds Inlet sediment is approximately 2 times greater than that observed in the reference area (LHL5 and LHL6) and Rocky Run Embayment (LHL1). The USEPA Region 4 ESV for iron is 20,000 mg/kg and the refined screening value (RSV) is 40,000 mg/kg, based on an Ontario Ministry of the Environment (1993) report that is based on a bracket of background values. The Ontario Ministry of the Environment study also notes that the average background observed during that study was 31,200 mg/kg. The 20,000 mg/kg and 40,000 mg/kg values do not reflect studies of adverse effects in sediment dwelling organisms. Furthermore, the average concentrations of iron in each of the areas evaluated are below the USEPA RSV of 40,000 mg/kg.

Iron was detected in pore water at each of the locations where samples were collected (Table 5-5). The maximum detection of iron in pore water was from location CI3A near the location with the maximum sediment concentration (CI3B). The maximum HQ for iron in pore water is 8. The average pore water concentrations (1.46 mg/L) only slightly exceed the USEPA Region 4 ESV (1 mg/L). The ESV is used as a screening level for all aquatic organisms and only sediment dwelling organisms are directly exposed to pore water. The ESV is based on the National Recommended Water Quality Criteria and cross references the USEPA 1986 Water Quality Criteria document. The 1986 document acknowledges that iron is the fourth most abundant element in the earth's crust. Iron is also an essential nutrient for plants and animals. And USEPA (1986) states that "iron can exist in natural organometallic or humic compounds and colloidal forms." And some environments "may contain iron concentrations of several mg/L in the presence or absence of dissolved oxygen, but this iron form has little effect on aquatic." The detected iron in pore water exceeded the ESV by a factor of 3 are primarily the thalweg.

For the following reasons, iron is not considered further in this ERA.

- Maximum detected concentrations of iron in surface water do not exceed the ESV;
- Iron is naturally-occurring and ubiquitous in the environment;
- At the neutral pH levels within the Study Area surface water, iron would exist in a relatively insoluble form, which limits the bioavailability of iron to aquatic organisms;

- Iron would likely form insoluble metal sulfide complexes due to relatively high sulfide content in sediment, further limiting the bioavailability of iron to organisms;
- The pore water exceeds the ESV but the ESV is for all aquatic organisms, including fish, and only sediment dwelling organisms are exposed to pore water. The areas within Curds Inlet where iron in pore water exceeds the ESV are primarily in the thalweg in the areas nearest CI3A where the highest detections of iron were observed in sediment, and
- Iron does not bioaccumulate in the food web.

5.4.1.3 Magnesium

Magnesium concentrations in surface water and pore water do not exceed the surface water ESV; no ESV exists to evaluate magnesium in sediment. Similar to iron, magnesium is a naturally-occurring inorganic, ubiquitous in the environment and contributes to the natural hardness of water. Magnesium is also an essential nutrient required for normal body functioning in organisms. Within the Study Area, maximum detected magnesium concentrations in sediment are lower in all areas (1,620–18,200 mg/kg) compared to the Reference Area (23,600 mg/kg) (Table 5-6). Magnesium does not bioaccumulate (USEPA 2000b). Therefore, adverse effects of magnesium to ecological receptors in the Study Area are unlikely (as summarized below), and magnesium does not warrant further evaluation in this ERA.

- Maximum detected concentrations of magnesium in surface water do not exceed the ESV;
- Magnesium is naturally-occurring, ubiquitous in the environment, and an essential nutrient for organisms;
- Sediment concentrations of magnesium in the Reference Area were higher than all other portions of the Study Area;
- Pore water concentrations provide the best line of evidence to determine potential toxicity to benthic invertebrates, and maximum detected concentrations of magnesium in pore water do not exceed the ESV; and
- Magnesium does not bioaccumulate in the food web.

5.4.1.4 COPECs for BERA Evaluation

Based on the initial refinement process, the ERA process focuses on the evaluation on the following COPECs:

- Selenium
- Arsenic
- Mercury
- Methylmercury
- Cadmium
- Lead (wildlife only)
- Zinc

The identified COPECs are the constituents that require further evaluation to understand the likelihood of adverse effects from these COPECs within the Study Area.

5.4.2 Refined Problem Formulation

As the ERA process progresses to a BERA, the problem formulation is refined, based on specific and relevant information that more explicitly defines the site-specific ERA. In the following sections, ecological receptors for aquatic-feeding wildlife (Section 5.4.2.1) and measurement endpoints (Section 5.4.2.2) are defined.

5.4.2.1 Refined Receptors of Interest

Potential ROIs for the Herrington Lake Study Area, identified in Section 5.2.2.2, include aquatic vegetation, aquatic and benthic invertebrates, fish, and aquatic-feeding wildlife. For wildlife, food web modeling is used to evaluate potential adverse impacts of COPECs. However, food web modeling cannot be feasibly conducted for all species that might be present within the Study Area; therefore, ROIs are those selected to represent the range of aquatic-feeding wildlife species that could be exposed. The following aquatic-feeding bird and mammal ROIs are evaluated in this ERA:

- *Mallard (Anas platyrhynchos)*. Mallards represent the omnivorous bird feeding guild for aquatic systems. Mallards are among the more common species in this feeding guild within the Study Area. Given their tolerance for a broad range of habitats, either wintering or breeding populations are expected to use the Study Area. Exposure of mallards to constituents may be enhanced by their foraging strategy, "dabbling," in which they stir up sediment with their bills in an effort to locate prey. Incidental sediment ingestion may occur as a result.
- *Wood duck (Aix sponsa)*. Herbivorous birds are represented by the wood duck. The wood duck is a common bird of lakes, ponds, marshes, and along rivers and streams. Although breeding and young wood ducks feed on insects, crustaceans and other invertebrates, adults primarily feed on plant matter (Kaufman 1996; Drobney and Fredrickson 1979).
- *Great blue heron (Ardea herodias)*. Great blue herons are evaluated as a representative of the feeding guild of invertivorous/piscivorous birds. Great blue herons consume a variety of invertebrates, particularly crustaceans, as well as fish. The proportion of invertebrates and fish in the diet is based on availability, which can change seasonally. Great blue herons generally consume fish up to 300 millimeters (mm) in length. Great blue herons nest in colonies, usually building prominent nests in standing dead snags in still waterbodies. No such colonies have been observed within the Study Area.
- *Osprey (Pandion haliaetus)*. Compared to great blue herons, osprey consume slightly larger fish (greater than 250 mm in length) and are also considered in this ERA as a representative of the piscivorous bird feeding guild. Despite being the continent's only raptor that eats almost exclusively live fish, osprey have colonized a broad array of habitats.
- *Muskrat (Ondatra zibethicus)*. The herbivorous mammal feeding guild is represented by the muskrat. Compared to other herbivorous mammals, the potential for exposure to muskrats is enhanced by the location of their den sites (i.e., along stream banks), limited territory sizes, and foraging preferences. Muskrats prefer roots and basal portions of aquatic plants, often digging for food in the bottoms of lakes and ponds (Bailey 1937; Dozier 1953; Hanson et al. 1989 as cited in USEPA 1993a). This feeding strategy may promote incidental sediment ingestion.
- *Raccoon (Procyon lotor)*. Raccoons represent the feeding guild of omnivorous mammals. The raccoon has been reported to be the most abundant and widespread medium-sized omnivore in North America (USEPA 1993a) and has been observed within the Study Area. Raccoons also tend to be more closely associated with aquatic systems than other mammalian omnivores, although they feed opportunistically from both aquatic and terrestrial sources. Raccoons are common in urban, suburban, and agricultural areas.
- *Gray bat (Myotis grisescens)*. The gray bat serves as a representative of invertivorous mammals in this ERA. Gray bats feed opportunistically, focusing primarily on emerging aquatic insects, such as mayflies and caddisflies, when available, but also feeding on flying terrestrial insects, such as moths, flies, or beetles (University of Michigan 2019). Their relatively high metabolic rate increases prey consumption and thereby, increases their exposure potential. Gray bats have been

documented foraging near Herrington Lake (Stantec 2009). They inhabit caves and migrate between winter and summer hibernacula. Gray bats are a sensitive species (see Section 5.2.2.1) for the Study Area.

- *Mink (Mustela vison)*. Carnivorous mammals are represented by mink. Mink are top-level carnivores (i.e., species at the top of the aquatic food web) that feed on fish, small mammals, birds, eggs, frogs, and macroinvertebrates. For this ERA, mink is conservatively assigned to the piscivorous feeding guild. Large territory sizes and opportunistic feeding habits may mitigate the exposure potential of mink. Landform characteristics preferred by mink include irregular shorelines with brushy or wooded cover, as opposed to open, exposed banks (Allen 1986).
- River Otter (*Lontra canadensis*). North American river otters are evaluated in this SLERA as another representative of the piscivorous mammal feeding guild. Otters represent a top-level predator and, as such, would have a higher exposure to bioaccumulative constituents at the top of the food web. They are closely associated with aquatic ecosystems. Otters are known to exist in Herrington Lake and they have a potentially higher potential for exposure than mink.

5.4.2.2 Refined Assessment and Measurement Endpoints

In this subsection, each assessment endpoint, presented in Section 5.2.4 of the SLERA, is paired with at least one refined measurement endpoint for evaluation in this BERA. In cases where multiple measurement endpoints are evaluated for one assessment endpoint (e.g., fish communities), a weight-of-evidence approach is employed in the risk evaluation. The refined assessment and measurement endpoints for this BERA are provided in Exhibit 5-2.

Exhibit 5-2: Summary of Assessment and Measurement Endpoints

Assessment Endpoint	Measurement Endpoint
Protection and maintenance of aquatic vegetation and water-column invertebrate community structure and function	• Comparison of surface water concentrations against water quality criteria
Protection and maintenance of benthic invertebrate community structure and function	• Comparison of sediment concentrations against sediment quality criteria • Evaluation of spiked sediment studies • Comparison of sediment pore water concentrations against water quality criteria
Survival, growth, and reproduction of fish populations	• Comparison of surface water concentrations against water quality criteria • Comparison of fish tissue concentrations against protective fish concentrations • Evaluation of YOY bluegill study
Survival, growth, and reproduction of aquatic-feeding bird and mammal populations	• Comparison of calculated daily dietary intakes against chemical-specific toxicity reference values for birds and mammals

5.4.3 Refined Exposure Estimates

Following Section 5.4.1, selenium, arsenic, mercury, methylmercury, cadmium, lead (wildlife only), and zinc are identified as COPECs. The following sections support the refined exposure assessment of COPECs for aquatic wildlife (fish, vegetation, and invertebrates) and aquatic-feeding wildlife. Only COPECs identified by the USEPA (2000b) as bioaccumulative are evaluated for their potential effects to wildlife.

In this refined assessment, exposure is based on surface water (Table 5-4), pore water (Table 5-5), sediment (Table 5-6), and biota tissue (see Section 2 tables) data. Fish exposure estimates included the adult and YOY bluegill samples collected and analyzed using the fish sampling and analysis SOPs (Ramboll 2017c and 2018c). Exposure is considered for (1) the Study Area as a whole (Site-Wide); (2) Curds Inlet only; (3) the Study Area without Curds Inlet (Site without Curds Inlet); and (4) the in-watershed Reference Area (LHL5, LHL6, MHL1, MHL3). Evaluating these larger subareas facilitates calculation of a 95% UCL on the mean (using ProUCL software), which is a more meaningful and realistic exposure metric than relying on maximum chemical concentrations. The 95% UCL serves as the exposure point concentration (EPC), where applicable in this refined assessment. These subareas also accommodate the evaluation of plants, water-column invertebrates, fish, and wildlife receptors that have larger exposure potential (e.g., surface water that is constantly moving and mixing) or have larger home range sizes, and thus, exposure areas. Because benthic invertebrates are more limited in their mobility, exposure is considered on a more localized basis for these receptors.

5.4.3.1 Aquatic Wildlife: Fish, Aquatic Plants, and Aquatic/Sediment Dwelling Invertebrates

Exposure for fish is based on several lines of evidence. First, EPCs are developed for both total and dissolved COPEC concentrations in surface water[5] collected from the Herrington Lake Study Area. The EPCs (95% UCL concentrations) of all COPECs in surface water (total and dissolved phases) are presented in Tables 5-7A, 5-7B, and 5-7C for Site-Wide, Curds Inlet, and Site without Curds Inlet, respectively, and Table 5-8 (Reference Area). Second, COPECs were measured in adult fish samples collected from the Study Area (Tables 2-1A–H), as well as ovaries from bass and catfish samples, when available (Table 2-1G). Third, COPECs were also measured in the YOY bluegills collected from the Study Area (Table 2-1I).

Exposure for aquatic plants and water-column invertebrates is based primarily on consideration of both total and dissolved COPEC concentrations in surface water[6] collected from the Herrington Lake Study Area. The EPCs (95% UCL concentrations) of all COPECs in surface water (total and dissolved phases) are presented in Tables 5-7A, 5-7B, and 5-7C for Site-Wide, Curds Inlet, and Site without Curds Inlet, respectively, and Table 5-8 (Reference Area). In addition, COPECs were measured in plant samples collected from the Study Area (Table 2-5).

The benthic invertebrate exposure evaluation considers COPEC concentrations in surface sediment and sediment pore water collected from the Herrington Lake Study Area. Due to their limited mobility, exposure is considered on a more limited, sample-specific basis. Therefore, the EPCs of COPECs in sediment are presented in Table 5-6. The EPCs for pore water are presented in Table 5-5. In addition, COPECs were measured in site-specific benthic invertebrate samples (Table 2-6).

[5] Surface water data includes both overturn and stratification sampling results.

[6] Surface water data includes both overturn and stratification sampling results.

5.4.3.2 Aquatic-Feeding Wildlife

For wildlife, several metals identified as COPECs have the potential to bioaccumulate (USEPA 2000b). Because diet is a dominant route of exposure to these bioaccumulative compounds and, therefore, drives potential risk (Moore et al. 1997, 1999), such exposures are the primary focus of this wildlife risk characterization. Exposure to these COPECs are evaluated by estimating the dietary intake (DI) of COPECs for representative avian and mammalian species and comparing these estimates to literature-derived doses, below which adverse effects on survival or reproduction are unlikely.

For each receptor, DI was calculated using the generalized equation:

$$Exposure\ (DI) = \left[\frac{(IR_{water} \times\ C_{water}) + (IR_{sediment} \times C_{sediment}) + (IR_{food} \times \sum(FIR_{food\ item} \times C_{food\ item}))}{BW}\right] \times AUF$$

where:

Exposure (DI) =	Dietary intake (oral intake of constituent in diet (mg/kg-d) (calculated)
IR_{water} =	Ingestion rate of surface water (kg weight of water/individual/day) (literature)
C_{water} =	Concentration of constituent in surface water (mg chemical/L water) (measured)
$IR_{sediment}$ =	Ingestion rate of sediment (kg weight of sediment/individual/day) (literature)
$C_{sediment}$ =	Concentration of constituent in sediment (mg chemical/kg sediment) (measured)
IR_{food} =	Ingestion rate of food/prey items (kg fresh weight of food/individual/day) (literature)
$FIR_{food\ item}$ =	Fractional ingestion rate of a food item (unitless percentage) (literature)
$C_{food\ item}$ =	Concentration of constituent in a food item (mg/kg fresh weight) (measured for plants, invertebrates and fish)
BW =	Body weight (kg) (literature)
AUF =	Area use factor (unitless percentage) (literature)

Measured concentrations of surface water, sediment, and site-specific plant, invertebrate, and adult fish tissue input used in the food web model are provided in Tables 5-9A, 5-9B, and 5-9C for Site-Wide, Curds Inlet, and Site without Curds Inlet, respectively. Surface water data includes dissolved and total overturn and stratification results; however, only the total phase is used in the food web model. Because water-column invertebrates were not collected from the Study Area, site-specific benthic invertebrate tissue data are used as a surrogate for aquatic invertebrates in the food web model. Site-specific data offers a more realistic exposure assessment than using literature-derived bioaccumulation factors (BAFs) to estimate water-column invertebrate concentrations from surface water data.

Muskrat are a common prey item for mink. Tissue concentrations of COPECs in muskrat were conservatively estimated using BAFs for small mammals derived from the literature. Specifically, soil to small mammal uptake factors were used as a surrogate for sediment to small mammal BAFs. The 95% UCL concentrations of COPECs in sediment were multiplied by applicable BAFs to estimate COPEC

concentrations in the small mammal (or muskrat) portion of the mink's diet. The estimated prey concentrations were adjusted to represent wet weight concentrations from dry weight sediment data, assuming a moisture content of 68% in biota tissue (USEPA 1999). The applicable BAFs and estimated prey (muskrat) concentrations are provided in Tables 5-10A, 5-10B, and 5-10C for Site-Wide, Curds Inlet, and Site without Curds Inlet, respectively.

The exposure parameters or inputs for the receptor-specific dietary exposure models are identified and summarized in Table 5-11 for each wildlife receptor. Factors include incidental water and sediment ingestion rates, food ingestion rates, prey preferences (percent dietary composition), body weight, and foraging range. Exposure parameters for wildlife receptors were drawn from USEPA's (1993a) Wildlife Exposure Factors Handbook, if available. All wildlife receptors were assumed to drink surface water (incidental ingestion). Sediment ingestion rates were applied for those wildlife receptors whose feeding strategy promotes incidental sediment ingestion (i.e., mallard, wood duck, great blue heron, raccoon, mink, river otter, and muskrat). Sediment ingestion was considered negligible for the osprey (as a piscivore) and the gray bat (as an aerial insectivore), as they do not forage in the sediment directly. Receptor-specific food ingestion rates were used for osprey, great blue heron, mink, and muskrat (USEPA 1993a). USEPA (1993a) did not provide receptor-specific food ingestion rates for mallard, wood duck, raccoon, gray bat, or river otter. For these receptors, food ingestion rates were calculated using an allometric equation for either birds or mammals, as described in USEPA (1993a), and an 80% moisture content to convert from dry weight to wet weight.

Mink consume fish and small mammals (USEPA 1993a). The small mammal exposure is assumed when the water level is lower during winter pool and mammals may be exposed to Herrington Lake sediment. This is a conservative estimate of exposure given the water depths of Herrington Lake. Gray bats ingest aquatic insects that have a larval stage in water and emerge as flying insects. Bats are not included in USEPA 1993a so additional scientific literature was used to estimate dietary exposure parameters, as indicated in Table 5-11. For example, gray bats are known to consume mayflies (Kentucky Bat Working Group 2019). The percentage of aquatic invertebrates in the diet assumed for the gray bat was conservatively estimated as 75% of the invertebrate tissue collected during Phase I because the collected invertebrate samples included mayflies but also included crayfish, which do not emerge into flying insects. Additionally, as sediment-dwelling invertebrates emerge from an aquatic system, studies show that the body burden of metals are reduced as the emergent insects molt or shed their exoskeleton to emerge as flying insects (Krantzberg and Stokes1988; Rienhold et al. 1999; Cid et al. 2010; Wesner et al. 2017; Kraus et al. 2019).

The AUFs account for site-specific exposure frequency and are applied when the foraging area of a wildlife receptor is larger than the area being assessed. AUFs account for mobile wildlife receptors obtaining at least a portion of their food outside the Study Area. Because the Study Area (including the Reference Area) encompasses a relatively large area and would include the foraging area of most, if not all, wildlife receptors, AUFs are only applied for the Curds Inlet exposure scenario in this ERA for each of the wildlife receptors as identified in Table 5-11 ("Behavioral Use AUF"). An AUF of 1 indicates that a wildlife receptor would obtain 100% of their diet from an area. An AUF of less than 1 (e.g., 0.4), assumes that a wildlife receptor would obtain 40% of their diet from an area. Because the gray bat forages opportunistically from available resources, including both aquatic and terrestrial prey (USFWS 1997; Harriman 2003), an AUF of 0.5 is applied for the gray bat for the Study Area to account for the portion of diet obtained from terrestrial riparian areas. Terrestrial food sources are only applicable in the dietary exposure estimates for the bats.

The calculation of DI for wildlife receptors is reported in Tables 5-12A, 5-12B, and 5-12C for Site-Wide, Curds Inlet, and Site without Curds Inlet, respectively, and Table 5-13 for reference data.

5.4.4 Refined Effects Characterization

The methodologies used to assess ecological exposures in this BERA are discussed below for aquatic plants, invertebrates, fish, and aquatic-feeding wildlife. The effects characterization involves critical body residues (CRBs) for fish and toxicity reference values (TRVs) for mammals and birds. The TRVs are related to the HQs (the ratio of exposure to effects).

5.4.4.1 Fish

Several lines of evidence are used to evaluate fish in this ERA. First, the selected ESVs used to assess potential risk to fish from COPECs in surface water are the water quality ESVs presented in Table 5-2. Second, risk-based screening levels or CBRs are compared to adult fish and ovary tissue concentrations. CBRs are concentrations of a chemical bioaccumulated in an aquatic organism that corresponds to a defined measure of toxicity (e.g., mortality). For this ERA, they are expressed as concentrations of COPECs in whole-body or ovary fish tissue and are drawn from the available literature for bioaccumulating COPECs. CBRs represent threshold tissue concentrations where concentrations in excess of the CBR could potentially result in adverse biological effects to the exposed fish (not consumers of fish). CBRs used in this ERA are presented in Table 5-14, and the sources are discussed below.

For selenium, Kentucky has developed CBRs in whole-body fish tissue and ovary tissue (KDOW 2016b). In addition, the USEPA ovary tissue level for selenium is also considered (USEPA 2016a). For other COPECs, except for mercury, the Jarvinen and Ankley database (1999) and U.S. Army Corps of Engineers (USACE) Environmental Residue Effects Database (ERED) were the primary sources of CBRs. For methylmercury, a value of 0.2 mg/kg wet weight reported by Beckvar et al. (2005) for early life stage fish was used as a highly conservative, and therefore, protective, CBR. This value can be considered a no observed adverse effect level (NOAEL) or a level below which no adverse effects are likely. For comparison, a CBR of 0.77 mg/kg wet weight was used for general (representative) fish.

5.4.4.2 Aquatic-Feeding Wildlife

The effects assessment for wildlife is based on TRVs that relate ingested dietary dose to potential ecotoxicological endpoints. TRVs are literature-derived doses, below which adverse effects are unlikely (e.g., Sample et al. 1996). USEPA guidance documents (USEPA 1997a, 1999) emphasize using data from studies examining changes in growth, reproduction, and survival endpoints to determine TRVs, because these endpoints are more directly interpretable with respect to potential adverse impacts on wildlife populations.

NOAEL TRVs are indicative of doses of COPECs that have had no deleterious effects on a wildlife receptor. NOAELs are commonly reported endpoints that are generally most appropriate for use in calculating screening-level risk, because SLERAs are intentionally and inherently conservative. Alternative metrics—such as the lowest observed adverse effect level (LOAEL)—are more appropriate for BERAs, where the goal is to predict risks as accurately as possible. LOAEL TRVs are the minimum doses of constituents where deleterious effects are observable in laboratory studies. Realistically, the dose level at which an individual ecological receptor may experience some potential adverse effects likely occurs between the NOAEL and LOAELs. Therefore, both NOAELs and LOAELs are used in this ERA for Herrington Lake. Also, the basis of TRVs and their relevance to HQs is also discussed as part of the risk characterization.

Selected TRVs are presented in Table 5-15. The basis of the selenium bird and mammal TRVs are discussed below.

Avian Selenium TRV
The USEPA (2007) identified 1,734 studies with possible toxicity data for either birds or mammals. Of these studies, 1,534 were rejected for use. Of the remaining studies, 69 contained data for birds. USEPA (2007) identified a NOAEL TRV of 0.29 mg selenium/kg bw/day, which is equal to the highest bounded NOAEL lower than the lowest bounded LOAEL for studies with reproduction, growth, or survival as endpoints. This TRV identified in USEPA (2007) is from a study by El-Begearmi and Combs (1982) that evaluated survival juvenile chickens fed selenium for two weeks.

For the LOAEL TRV, reproductive toxicity data were extracted from seven mallard studies (Heinz et al. 1987; Heinz et al. 1989; Heinz and Hoffman 1996; Heinz and Hoffman 1998; Hoffman and Heinz 1988; Stanley et al. 1994; Stanley et al. 1996). All of the studies except Hoffman and Heinz (1988) reported data for offspring production (number of surviving ducklings produced per pair). Some of the data on offspring production are subject to uncertainty. For example, Heinz et al. (1989) observed that mallards exposed to the highest dose group (2.46 mg/kg-day) avoided the food during the study, which likely contributed to the observed reproductive effect due to lack of nutrition. Also, relatively low control hatchability was observed in Heinz and Hoffman (1996) (41.3%) and Heinz and Hoffman (1998) (44.2%). Dose-response analysis was conducted for offspring production based on the combined data from these studies (except Hoffman and Heinz 1988), despite the above uncertainties. The EC20 and EC50 for selenium effects on production of mallard offspring are 0.64 and 0.92 mg/kg-day, respectively. Thus, 0.64 mg/kg-day is identified as the LOAEL TRV.

Mammal Selenium TRV
The USEPA (2007) identified 1,734 studies with possible toxicity data for either birds or mammals. Of these studies, 1,534 were rejected for use. Of the remaining studies, 132 contained data for mammals. USEPA (2007) identified a NOAEL TRV of 0.143 mg selenium/kg bw/day, which is equal to the highest bounded NOAEL lower than the lowest bounded LOAEL for studies with reproduction, growth, or survival as endpoints. This TRV is from a study by Mahan and Moxon (1984) that evaluated growth in juvenile pigs fed selenium for four weeks. The LOAEL TRV of 0.215 mg selenium/kg-bw/day is also identified from this study.

5.4.4.3 Aquatic Vegetation and Water-Column Invertebrates

The selected ESVs used to assess potential risk of surface water to aquatic plants and water-column invertebrates are the water quality ESVs presented in Table 5-2. There are no specific criteria for the comparison to COPECs measured in site-specific plant tissue samples. These data are discussed qualitatively.

5.4.4.4 Benthic Invertebrates

Initially, the selected ESVs used to assess potential risk to benthic invertebrates from COPECs in pore water and sediment are the water and sediment quality ESVs presented in Tables 5-2 and 5-3, respectively. Additional criteria for selected COPECs are considered, as necessary. There are no specific criteria for the comparison to COPECs measured in site-specific benthic invertebrate tissue samples. These data are discussed qualitatively.

5.4.5 Refined Risk Characterization

Potential adverse effects to aquatic plants, invertebrates, fish, and wildlife from COPECs in surface water, pore water, and sediment, as appropriate, are evaluated in this section of the BERA. Similar to the screening-level risk characterization, HQs are calculated to understand potential ecological risks. However, in the refined risk characterization for all ecological receptors except for benthic invertebrates (which have limited mobility and are evaluated on a sample-specific basis), HQs are the ratio of reasonable exposure estimates (e.g., 95% UCLs) identified in the refined exposure estimates (Section 5.4.3) with RSVs identified in the refined effects characterization (Section 5.4.4). HQs equal to or less than 1 (rounded to one significant figure) are predicted to be below levels associated with adverse effects and are discussed. HQs greater than 1 indicate further evaluation may be necessary and are also discussed. HQs reflect potential exposures for individual organisms, therefore HQs are also discussed in terms of potential wildlife populations.

5.4.5.1 Fish

Similar to benthic invertebrates, the refined risk characterization for fish includes several lines of evidence.

Evaluation of YOY Bluegill

The YOY bluegill study was conducted during the Phase II assessment, with YOY fish collected from July 20–26, 2018. The sampling and procedures followed the YOY QAPP Addendum and SOPs for collection, assessment, and tissue residue analyses (Ramboll 2018a,b,c,d). The 2018 YOY bluegill deformities assessment for Herrington Lake was conducted as a follow up to a YOY bass deformities assessment conducted in 2016. Bluegills were identified as the target species because bluegills were available in 2018, bluegills are particularly sensitive to selenium, and bluegills were initially the stated target species in the 2016 YOY study of bass in Curds Inlet. The 2018 YOY bluegill study included the evaluation of approximately 3,600 YOY fish compared to approximately 550 YOY fish in 2016, which makes the 2018 YOY study more comprehensive. The 2018 YOY study also included three areas within Curds Inlet, one location within HQ Inlet, and three additional areas outside the influence of Auxiliary Pond Outfall BRN001, allowing a greater understanding of the fishery in and near Curds Inlet than was available from the 2016 YOY study. The collection approach is presented in the QAPP Addendum and SOPs provided to the Cabinet:

- QAPP Addendum: Herrington Lake Young-of-the-year (YOY) Fish Assessment (Ramboll 2018b).
- SOP: Young-of-The-Year (YOY) Fish Assessment Sampling and Fish Tissue Sampling (Ramboll 2018c).
- SOP: Selenium Analysis for Young-Of-The-Year (YOY) Preserved Bluegill Whole-Body Tissues (Ramboll 2018d).
- YOY assessment supporting information is provided in Appendix I1.

YOY bluegill tissue residue samples and assessment samples were collected from sampling regions including illustrated on Figure 5-3:

- Upper Curds Inlet (UCI, portion of Curds Inlet closest to E.W. Brown outfalls)
- Middle Curds Inlet (MCI, middle portion of Curds Inlet)
- Lower Curds Inlet (LCI, at the mouth of Curds Inlet)
- HQ Inlet
- LHL1 Rocky Run
- LHL6 Cove (Lake Mile 6 near Sunset Marina)
- Hardin Inlet (added as an alternate site)

A LHL3 Cove located across from Curds Inlet was initially planned as part of the YOY assessment but later abandoned due to insufficient numbers of YOY bluegills due to recreational activity in the area during the sampling effort.

Due to potential for field misidentification of juvenile centrarchids, all YOY fish that appeared to be bluegills within the targeted size range were collected and retained for analysis. Non-target fish were released. Upon collection of the target YOY bluegills from a seine haul, dip net, trap run, or electrofishing run, the fish were transferred alive to temporary holding containers (aka "livewells"). A field count was made, and a based on the number collected, a determination was made to retain a portion of the catch for tissue residue analysis.

- Collections at UCI, MCI, and LHL1 yielded the requisite 500+ specimens in within a few hours with no need for trapping and electrofishing. The tissue sample was taken from the collective pool of 500+ fish.
- Multiple sampling-days and methods were required to collect the YOY bluegills from LCI, HQI, HI, and LHL6. The tissue samples were retained from the largest single day tally for the respective sampling locations.
- The YOY bluegills collected for detailed visual assessment were preserved in 95% denatured alcohol, while fish retained for tissue residue analysis were individually digitally imaged, composited, and frozen prior to shipment to the analytical laboratory.
- The YOY samples were maintained via chain of custody and transported by ground to the Ramboll, Nashville ecotoxicology laboratory for the YOY assessment. A third-party validation of the YOY fish assessment was conducted. This included review of 100% of the fish with any abnormalities (or possible abnormalities) and 25% of the normal fish to confirm that fish with subtle abnormalities were not overlooked.

The YOY bluegills were assessed for the following deformities:

- Spinal curvature (kyphosis, lordosis, scoliosis)
- Craniofacial defects (including mouth, jaw, and gill cover)
- Fin irregularities (missing, misshaped, vestigial)
- Eye abnormalities (including lens cataracts)
- Edema (fluid accumulation)

To help develop a baseline size and health condition for sites with lower selenium conditions, the YOY bluegills collected from LHL1 and LHL6 Cove were assessed first. To effectively and efficiently assess hundreds of fish from each of the YOY sites, smaller groups of 25 bluegills were taken from their ethanol preservative-filled sample containers and placed in a 5.5 cm clear plastic culture dish for detailed visual examination at 10–80X magnification using a Leica S8APO dissecting stereo microscope (Figure 5-4). For each YOY bluegill, both sides and the dorsal view were examined in every viewing lot until the entire sample was assessed. Digital-imaging and sample documentation of the assessed fish was conducted using an AmScope QX 800 digital microscope camera for the YOY digital image log and excel spreadsheet data forms that are provided in Appendix I1. Both sides and the dorsal view of each deformed fish were digitally imaged, and 25% of the assessed-normal fish were also similarly digitally imaged (Appendix I1).

YOY bluegills were collected to inspect for deformities (approximately 3,600 fish) and for analysis of tissue residues (approximately 700 additional fish) for a total of approximately 4,300 YOY bluegill. An example of the normal fish identified in the YOY study from each of the study areas is identified in

Figure 5-5. The assessment activities were documented in a log book and results were transferred to the YOY-Specific Group and Individual Health Examination data sheets (Appendix I1).

A summary of the skeletal, facial, fin, and tail deformities is provided on Figure 5-6. High resolution digital images of each fish identified with the deformities on Figure 5-6 is provided in Figures 5-7A through 5-7H. The 2018 YOY assessment demonstrated that nearly all of fish did not have skeletal, facial, fin, or tail teratogenic deformities (Figure 5-6). The digital images indicted that some of the deformities noted were subtle and possibly do not reflect a severity of conditions that would suggest the survival of the individual YOY fish was limited. Of the more than 3,600 collected YOY bluegills, only 35 of them (0.97%) had deformities. The observed rates in Curds Inlet and HQ Inlet (0.38–0.83%) were less than observed at the sampling location located outside of the influence of Curds Inlet. The observed deformity rates at LHL1 and Hardin Inlet, were 2.1% and 0.96%, respectively. The deformity rate at LHL6, located approximately 2 miles upgradient from Curds Inlet, was 0.66%, which is comparable to Curds Inlet. These rates of skeletal, facial, fin, or tail teratogenic deformities are considered low and do not reflect deformities rates that would adversely impact the population of fish in Herrington Lake.

The YOY bluegill whole-body tissue selenium levels were elevated within Curds Inlet with decreasing concentrations moving away from Curds Inlet (Figure 5-8A). The YOY bluegills collected from Upper Curds Inlet, nearest the Auxiliary Pond Outfall KPDES Outfall BRN001, had whole-body selenium levels that exceeded both the Kentucky adult whole-body and the ovary criteria as well as the USEPA ovary criteria. The YOY tissue selenium levels were compared to the rates of skeletal, facial, fin, or tail teratogenic deformities to evaluate whether a dose-response relationship was observed (Figure 5-8B). As indicated, a dose-response relationship is not evident. If selenium was causing the observed deformities, then there should have been higher selenium in the tissues of fish with the observed deformities.

During the YOY deformities assessment, however, a condition was noticed in approximately 5% of the 3,600 fish evaluated in the assessment (Figure 5-9A). The condition, called exophthalmia, is more commonly referred to as “popeye”. Popeye can be associated with selenium toxicity at high concentrations, so a detailed examination of the fish was conducted to see if there was a dose-response that was related to selenium. Because popeye was noticed in the 3,600 YOY assessment samples, digital images of the approximately 700 YOY fish sent for tissue residue analysis were more closely examined. A summary of the fish with popeye from each of the locations and each of the sample types (tissue residue or assessment) is identified in Figure 5-9B. The percent of fish with popeye was compared to tissue concentrations, again to evaluate whether a dose-response relationship was observed (Figure 5-10A). As indicated, a dose-response relationship is not evident. A comparison of deformities and popeye with tissue concentrations were also considered (Figure 5-10B). Again, a dose-response is not evident. If selenium was causing the observed popeye condition, then there should have been higher selenium in the tissues of fish with the observed popeye. The pattern was not observed, suggesting that selenium was not the cause of the popeye condition.

Considering the YOY assessment samples and YOY tissue residue samples, a total of 9% of the fish showed this popeye condition (Figure 5-9B). The incidence of popeye in this 2018 assessment samples ranging from zero incidence in UCI, LCI, and LHL6 assessment samples to 41% incidence in the HI assessment sample with average popeye for Curds Inlet ranging from 0.2% to 25.4% when the 3,600 assessed fish and the digital images from the tissue residue samples were considered (Figure 5-

9B). Some of the preserved fish from the YOY assessment samples were sorted into groups of fish with and without the popeye condition for additional YOY selenium tissue residue analysis and results were compared to the selenium YOY tissue residues (Figure 5-11A and 5-11B). Again, no dose-response relationship between popeye and selenium concentration was identified, even in fish samples with 100% popeye compared to fish samples with 0% popeye condition.

Based on the lack of dose-response, and the prevalence of this condition even in areas well outside the influence of E.W. Brown Station (e.g., Hardin Inlet), the 2016 YOY study was considered and other sources of popeye were considered. Popeye was not reported in the YOY bass in Curds Inlet of Herrington Lake, KY (Lemly 2018). The causes of popeye are diverse and not specifically related to selenium toxicity/teratogenicity. These non-toxicological causes include:

- Infectious agents such as:
  - Bacterial: Aeromoniasis, pseudumoniasis, flavobacterium, vibriosis
  - Viral: Infectious pancreatic necrosis
  - Fungal: Ichthyosporidium
  - Parasitic: Trematodes and cysts in the orbit (though this was ruled out from microscopic examination)
- Hormonal or nutritional issues:
  - Thyroid
  - Pantothenic acid deficiency
  - Niacin deficiency
  - Folic acid deficiency
  - Vitamins A and/or E deficiency
- Physio-chemical issues:
  - Gas bubble disease (supersaturated nitrogen or oxygen gas conditions in conjunction with high temperatures)
  - Physical trauma, stress, or exertion.
  - The varied causes of popeye justifies separating the spinal, facial, fin, and tail deformities from the popeye condition and is consistent with observation by Lemly from fish collected in 2016 that reported no incidence of popeye in bass collected in Herrington Lake.

An evaluation of the size of the fish was conducted as a potential explanation for the popeye condition (Figure 5-12). Results indicate that smaller YOY bluegills had a higher likelihood of having popeye condition. Small fish are also susceptible to popeye from physical stress. These findings suggest that the exertion and capture typical of the YOY collection may have contributed to the observed popeye (e.g., Stephens et al. 2002, Hargis 1991; Noor El Deen and Zaki 2012/2013).

Overall, no dose-response relationship between selenium concentrations in fish tissues and deformities was established. Moreover, the data from the study of deformities indicated that the low prevalence of deformities would not adversely impact bluegill populations. Bluegills were abundant in Herrington Lake. The approximately 4,300 fish evaluated in this assessment (including YOY from the assessment samples and the tissue residue samples) were collected in less than a week of sampling. Of the 4,300 fish, approximately 2,700 were collected from Curds Inlet and HQ Inlet. The KDFWR does not stock bluegills in Herrington Lake.

Evaluation of Critical Body Residues in Adult Fish

More than 200 individual adult fish were collected to form 77 composite samples (2–5 fish per sample) including bluegills, largemouth and spotted (Kentucky) bass, channel catfish, flathead catfish brown trout, northern hogsucker, spotted sucker, and green sunfish. The detected concentrations of selenium in the adult fish whole-body and ovary tissues (in mg/kg dry weight) are illustrated on Figures 2-3A–C. None of the Phase I or Phase II adult fish samples exceed the relevant Kentucky criteria for selenium. The YOY whole-body bluegill composite tissue sample results are discussed in the previous section.

An evaluation of the critical body residues for fish tissues are summarized as HQs in table (Table 5-14) and HQs are less than the threshold value of 1. The fish tissue concentrations are compared to risk-based criteria on a fish-by-fish basis, as is described in Section 2. The only detections of constituents other than selenium that exceed any of the identified risk-based criteria is methylmercury in catfish, which only slightly exceed the Beckvar et al. value of 0.2 mg/kg. The locations where catfish were detected at highest concentrations were LHL4, LHL5, and MHL1. The results do not exceed the Dillon et al. risk-based criterion of 0.77 mg/kg. Although catfish have large home ranges, the pattern of whole-body tissue concentrations does not suggest that there are significant influences from E.W. Brown Station, particularly because smaller home range fish, such as bluegill, did not show elevated patterns of mercury near the E.W. Brown Station.

Evaluation of Surface Water for Fish

The refined evaluation of surface water for fish uses the same methods and results as used for aquatic plants and water-column invertebrates. For the Site-Wide evaluation, only total mercury has an HQ greater than 1 (i.e., HQ=2); there are no HQs greater than 1 for dissolved COPECs (Table 5-7A). Within Curds Inlet, total mercury has an HQ of 4, and dissolved mercury has an HQ of 0.8 (Table 5-7B). For the Site without Curds Inlet, no total or dissolved HQs exceed 1 (Table 5-7C). Reference Area HQs are well below 1 for all COPECs (see Tables 5-7A–C).

5.4.5.2 Aquatic-Feeding Wildlife

Wildlife HQs are calculated by dividing the estimated dose of a COPEC to each wildlife receptor by the corresponding TRV to yield a quotient. HQs were estimated considering exposures for Site-Wide (Table 5-16A), Curds Inlet Only (Table 5-16B), or Site without Curds Inlet (Table 5-16C) for 4 species of birds and 5 species of mammals representing the range of trophic levels and feeding guilds typical of wildlife species that inhabit Herrington Lake. Therefore, the conclusions drawn for the wildlife species evaluated can be generalized to reflect conclusions for the broad range of bird and mammals feeding in the lake. Based on the dietary food web models and HQ estimates, it is unlikely that the bird and mammal populations of Herrington Lake will be adversely affected by COPECs from the E.W. Brown Station because:

- NOAEL and LOAEL HQs do not exceed the value of 1 for the nine wildlife receptors evaluated, using Curds Inlet data and considering that Curds Inlet is a portion of the home range for the wildlife evaluated (Table 5-16B). This is the most logical scenario of consideration with regard to exposures from the E.W. Brown Station given the proximity to the KDPES Outfall BRN001, the higher concentrations of selenium and arsenic seen in sediments of Curds Inlet, and the natural behavior of wildlife in the lake environment.
- The LOAEL HQs do not exceed the value of 1 for the nine wildlife receptors evaluated under the Site-Wide exposure scenario (Tables 5-16A, 5-16B, and 5-16C). This indicates that individual birds and mammals are not predicted to experience adverse effects based on observable

laboratory studies on bird and mammal survival, growth, or reproduction, using TRVs from the USEPA Ecological Soil Screening Levels compilations. When individual birds and mammals are not expected to be adversely impacted, the bird and mammal populations are not expected to be adversely impacted.

- HQs marginally exceeding a value of 1 were for NOAEL (i.e., no effects to individuals) for the river otter considering Site-Wide exposure scenario (NOAEL HQ of 2 for selenium) and the muskrat considering Reference Area exposure scenario (NOAEL HQ of 2 for selenium) (i.e., LHL5, LHL6). These are considered biased toward an overestimate of exposure because:
    - The river otters are assumed to consume primarily fish, but the USEPA (1993a) indicates they are opportunistic and will feed on a variety of prey depending on availability and ease of capture, including crustaceans (especially crayfish), aquatic insects (e.g., stonefly nymphs, aquatic beetles), amphibians, insects, birds (e.g., ducks), mammals (e.g., young beavers), and turtles.
    - Muskrat are assumed to eat 100% vegetation based on the vegetation sampled in the Phase I Herrington Lake investigation. The Phase I vegetation included submerged aquatic vegetation that required divers in some areas to collect. Although otters dive to forage for vegetation, USEPA (1993a) indicates that marsh grasses, sedges, bulrushes, and cattails can be important muskrat foods and muskrats feed on bank vegetation. USEPA (1993a) also indicates that muskrats consume crayfish, fish, frogs, turtles, young birds, and molluscs.

5.4.5.3 Aquatic Vegetation and Water-Column Invertebrates

For the refined Site-Wide evaluation of COPECs in surface water and potential effects to aquatic plants and invertebrates, only total mercury has an HQ greater than 1 (i.e., HQ=2); there are no HQs greater than 1 for dissolved COPECs (Table 5-7A). Within Curds Inlet, total mercury has an HQ of 4, and dissolved mercury has an HQ of 0.8 (Table 5-7B). For the Site without Curds Inlet, no total or dissolved HQs exceed 1 (Table 5-7C). Reference Area HQs are well below 1 for all COPECs (see Tables 5-7A, 5-7B, or 5-7C).

One line of evidence used in the evaluation of COPECs for aquatic plants and invertebrates is consideration of total metals versus dissolved metals analyses. The use of dissolved metals concentrations has been shown to more accurately predict aquatic toxicity than total metals analyses, because they better reflect the metal concentrations that are bioavailable to aquatic organisms. Furthermore, dissolved metals are the basis of Kentucky and USEPA water quality criteria. For these reasons, dissolved metal analyses provide the most appropriate means of assessing risks to aquatic organisms (Bergman and Dorward-King 1997; USEPA 1985, 1993b, 1995b; Prothro 1993). No HQs for dissolved COPEC concentrations exceed 1, including mercury, within the Study Area.

Another line of evidence on which to evaluate potential adverse effects of mercury to aquatic plants and water-column invertebrates is the forms of mercury present. Total mercury includes the measurement of several forms of mercury, with toxicity dependent on the form available. Generally, methylmercury is much more toxic than inorganic mercury, but methylmercury typically comprises less than 3%, and often much less than 1%, of total mercury in soil (Davis et al. 1997; USEPA 1997b). The highest HQ for methylmercury in all areas is 0.3 (total), therefore methylmercury is not likely to pose a risk to aquatic organisms.

Finally, mercury and methylmercury were measured in plant tissue collected from the Study Area. Water-column invertebrates were not collected. Mercury was detected in all plant tissue samples

(Figure 2-5K), but methylmercury was not detected in most of E.W. Brown Station samples (Figure 2-5L). There are no specific criteria for comparison to these data. The mercury concentrations in the site-specific vegetation samples show no pattern of elevated concentrations within Curds Inlet.

Therefore, the evaluation of COPECs in surface water indicates that toxicity to aquatic plants and water-column invertebrates within the Herrington Lake Study Area is unlikely for all COPECs.

5.4.5.4 Benthic Invertebrates

The refined evaluation for benthic invertebrates includes several lines of evidence.

Evaluation of Sediment and Pore Water for Benthic Invertebrates

Because sediment and sediment pore water are intimately related, these two lines of evidence are discussed together in this section. Also, benthic invertebrates have limited mobility, so exposure is considered on a sample-specific basis.

First, sediment and sediment pore water concentrations for all COPECs are compared to ESVs in the following figures from Section 2 of this report (summarized in Exhibit 5-3 for easy reference):

Exhibit 5-3: Summary of Figures to Reference for Sediment and Pore Water Results by Metal

	Sediment	Pore Water
Selenium	Figure 2-3L	Figure 2-3J
Arsenic	Figure 2-4H	Figure 2-4F
Mercury	Figure 2-5I	Figure 2-5F
Methylmercury	Figure 2-5J	Figure 2-5F
Cadmium	Figure 2-6G	Figure 2-6F
Lead	Figure 2-8G	Figure 2-8F
Zinc	Figure 2-9G	Figure 2-9F

In sediment, all COPECs exceed the ESV in one or more sample locations. In sediment pore water, only selenium, arsenic, and cadmium exceed the ESV in at least one sample location. Each COPEC is discussed in more detail below. The Phase I and Phase II sediment data showed that detected concentrations of selenium and arsenic exceeded ESVs in most of the locations from Herrington Lake, including locations well away from the influence of E.W. Brown Station. Therefore, RSVs and alternative, protective criteria that are relevant for Herrington Lake are considered. The selenium and arsenic detected in sediment and sediment pore water concentrations are illustrated in relation to ESVs, RSVs, and additional criteria focused on sediment dwelling organisms in Figures 5-13A through 5-13E.

Selenium

Selenium concentrations in sediment exceed the ESV at almost all locations (88%) within the Study Area (Figure 2-3L). According to USEPA (Region 4), "since the ESVs are based on conservative endpoints and sensitive ecological effects data, they represent a preliminary screening of site chemical concentrations to determine if there is a need to conduct further investigations at the site. ESVs are not recommended as remediation levels." USEPA (Region 4) also provides refined screening values, or RSVs, that are based on alternative criteria, less conservative values, or LOAELs. USEPA RSVs offer a more realistic benchmark on which to compare. Figure 5-13A shows that 39% of sampling locations have selenium sediment concentrations exceeding the USEPA Region 4 RSV, therefore, the basis of the RSVs is also considered in detail, as follows:

- The current sediment ESV and RSV for selenium from USEPA Region 4 are based on values used for hazard assessment in the Netherlands (Crommentujin et al. 1997; 2000), which can be meaningful for screening purposes but are not necessarily appropriate for all locations, including Herrington Lake. The Netherlands values (i.e., Dutch Standards) were derived using equilibrium partitioning from water, which is also done in the United States. However, these Dutch standards have been rescinded in the Netherlands. The Government of the Netherlands (2019) now default to European Union regulations which derive screening values (predicted no-effect concentrations or PNECs) by evaluating available toxicity data and applying appropriate assessment factors to address uncertainty; criteria are not listed, they must be derived based on appropriate data. Given that the Netherlands no longer use the values and that they were appropriately considered for screening purposes as USEPA states, additional criteria are considered.
- USEPA only recently (March 2018) revised the ESV/RSV for selenium. Previously, the ESV and RSV were 11 mg/kg and 20 mg/kg, respectively, and were based on data from Washington, Oregon, and Idaho (Washington State Department of Ecology 2013). Washington State Department of Ecology (2013) still provides reference to these sediment screening values. Specifically, the Washington Department of Ecology ESV was determined from studies using a chronic 28-day growth endpoint with the amphipod, *Hyalella azteca*, and the RSV was determined from studies using an acute 10-day growth endpoint with the midge, *Chironomus dilutus,* and a chronic 28-day mortality endpoint with *Hyalella Azteca* (Washington State Department of Ecology 2011). These are species expected to be present in Herrington Lake. Washington State derived a "no adverse effects level" (11 mg/kg), that showed no differences from reference/control in any endpoint and a "minor adverse effects level" (20 mg/kg) that showed a difference from the reference/control in only one of the test endpoints (Washington State Department of Ecology 2011; 2013). Both effects levels were defined and developed in terms of impact to the benthic community as a whole, not to individual species.

The Phase I and Phase II selenium sediment concentrations are provided on Figure 5-13A, including the Washington Department of Ecology ESV and RSV. Fourteen sediment sample locations in Curds Inlet and HQ Inlet have selenium concentrations that exceed the Washington ESV (no effects value), and four sediment samples from two locations in Curds Inlet (CI3A and CI3.1A) exceed the Washington RSV (minor effects value). The spatial distribution of selenium concentrations within Curds Inlet, using inverse distance weighting interpolation, is illustrated in Figure 3-8B. The two areas near locations CI3A and CI3.1A show the highest concentrations of selenium in sediment. This comparison indicates that some unacceptable risks to individual benthic organisms from selenium in sediment from Curds Inlet may exist. It is not likely that these conditions adversely impact the sediment dwelling organism community.

Selenium concentrations in pore water can have a closer relationship with toxicity for sediment dwelling organisms compared to sediment selenium concentrations due to bioavailability. Two locations, both located in Curds Inlet, had total selenium concentrations in pore water that exceed the ESV (Figure 2-3J, Figure 5-13C). Because not all forms of selenium are considered toxic but screening values for total selenium are often based on the assumption that it is entirely present in its most toxic form, Phase I and II pore water analysis included speciated selenium to determine the speciation ratios of selenate and selenite (Figure 5-13D) to compare to the KY ecological chronic criterion, which was used in the ERA as the ESV. Only selenate at location, CI1A, exceeds the ESV. The spatial distribution of selenium in Curds Inlet pore water is presented in Figure 3-8A. The USEPA Region 4 provides specific chronic criteria for both selenite (0.028 mg/L) and selenate (0.009 mg/L). The detected concentrations in pore water from Herrington Lake are below the USEPA criteria (Figure 5-13D), supporting the conclusion that selenium in pore water is not adversely affecting benthic invertebrates in the Study Area. Additional risk-based criteria from the USEPA ECOTOX database supports this finding as well. The USEPA ECOTOX data are provided in Appendix I2 and are illustrated on Figure 5-13D. These results support the conclusion that selenium in sediment pore water does not pose an unacceptable risk to sediment dwelling organisms or plants.

Arsenic

Similar to selenium, arsenic concentrations in sediment exceed the selected ESV in almost all locations (86%) and the RSV in approximately one half (49%) of all locations within the Study Area (Figure 2-4H, Figure 5-13B). When measured in pore water, arsenic concentrations exceed the USEPA Region 4 chronic ESV at several locations within Curds Inlet (Figure 2-4F, Figure 5-13E). The spatial distributions of sediment and pore water arsenic concentrations, using inverse distance weighting, are presented in Figure 3-9B. As was described in Section 3, there is a clear association between higher sediment concentration and higher pore water concentrations in reducing sediments of Curds Inlet. This association is also apparent in Figure 3-9A.

Arsenic bioavailability is affected by the interaction of several factors, including pH, redox potential, and the concentrations of sulfide, iron, and manganese (Drever 1997; Baumann and Fisher 2011). Arsenic is mobilized at oxic-anoxic boundaries and in sulfide-poor reducing environments. Arsenic exists in oxygenated sediment in primarily two forms, arsenite (III; dominant form) and arsenate (V; more toxic and bioavailable form) and readily converts between these forms depending on the ambient redox conditions. Arsenic is most bioavailable in reducing environments at low pH and least bioavailable under oxic conditions (Drever 1997, Harrison 2007).

Speciated arsenic was measured in pore water samples. Figure 5-13E compares the concentrations of arsenic, arsenite, and arsenate in pore water to the USEPA Region 4 ESV and additional risk-based criteria based on the USEPA ECOTOX database (data are provided in Appendix I2 of this Corrective Action ISARA Report). Arsenic, arsenite, and arsenate exceeds the ESV in a few locations within Curds Inlet. Based on these findings, some isolated areas may exist with potential impacts to sediment dwelling organisms, along the thalweg locations only. It is not likely that these conditions adversely impact the sediment dwelling organism community.

Mercury and Methylmercury

Detected concentrations of mercury in sediment do not exceed the selected ESV (0.18 mg/kg) for mercury in sediment (Figure 2-5I). Methylmercury was detected relatively infrequently in sediment and exceeds the selected ESV for methylmercury (0.45 µg/kg) in a few locations in Curds Inlet, HQ Inlet, LHL1, LHL3, and LHL6 (Figure 2-5J). There is no particular pattern of elevated methylmercury in

sediments within Curds Inlet. Furthermore, methylmercury concentrations are much lower than the RSV for all locations (Figure 2-5J).

Mercury and methylmercury were detected in approximately one half of the pore water samples analyzed. No detected concentration of mercury or methylmercury in sediment pore water exceed the respective ESVs (Figure 2-5F). Because pore water concentrations indicate potential toxicity to benthic invertebrates much closer than whole sediment concentrations, it is unlikely that mercury or methylmercury is adversely affecting benthic invertebrates in the Study Area.

Cadmium
Cadmium concentrations in sediment exceed the selected ESV at several locations within Curds Inlet and one location in HQ Inlet (Figure 2-6G). However, only two locations (CI1A and CI2.1A) have cadmium sediment concentrations that exceed the RSV (Figure 2-6G). The highest concentrations of cadmium in sediment is observed at CI1A at the interior of Curds Inlet.

Detected cadmium concentrations in pore water do not exceed the Kentucky chronic ESV, except for location CI3B (Figure 2-6F). The highest concentration in pore water at location CI3B is markedly different than another other location. The elevated CI3B is not co-located with elevated cadmium in sediment. Based on these two considerations, this one exceedance may possibly be due to debris contamination of the flexible diffusive membrane portion of the pore water sampler. A similar high anomalous concentration at the same location was detected for lead. Based on the evaluation of pore water data, cadmium is unlikely to adversely affect benthic invertebrates in the Study Area.

Lead
Lead concentrations in sediment for all locations but one, a duplicate sample at CI1C, do not exceed the selected sediment ESV (Figure 2-8F). The one exceedance (38 mg/kg) is slight (ESV of 36 mg/kg). For pore water, detected concentrations of lead are at least an order of magnitude lower than the water ESV (Figure 2-8E). Similar to cadmium, the detected concentration of lead at location CI3B was much higher than all other detected pore water concentrations, indicating a possible anomalous result due to potential debris contamination of the pore water sampler. Lead is unlikely to adversely affect benthic invertebrates in the Study Area.

Zinc
Only a few locations with detected zinc concentrations in sediment exceed the sediment ESV, but no locations exceed the sediment RSV (Figure 2-9G). For pore water, no detected concentrations of zinc exceed the water ESV (Figure 2-9F). The zinc pore water concentration at one location, CURDS2A, is an order of magnitude higher than other zinc concentrations in the Study Area. It is unknown why the zinc concentration at this location is higher. Zinc is unlikely to adversely affect benthic invertebrates in the Study Area.

Evaluation of Site-Specific Benthic Invertebrate Tissue Results

Concentrations of COPECs measured in invertebrates collected from the Study Area are displayed in Figure 2-3M (selenium), Figure 2-4I (arsenic), Figure 2-5K (mercury), Figure 2-5L (methylmercury), Figure 2-6H (cadmium), Figure 2-8G (lead), and Figure 2-9H (zinc). Because there are no applicable criteria by which to evaluate tissue concentrations in invertebrates, patterns of tissue concentrations of COPECs were examined with respect to Curds Inlet are summarized below.

- Selenium, arsenic, mercury, methylmercury, lead, and zinc tissue results for benthic invertebrates showed no apparent pattern of high concentration in, or gradient away from, Curds Inlet.
- Cadmium levels in benthic invertebrate tissue follow the general pattern of decreasing concentrations with increasing distance from The Plant, with the highest cadmium levels recorded in middle Curds Inlet, location CI3.

5.5 Uncertainty Analysis

Quantifying uncertainty is part of the ERA process. The most relevant uncertainties associated with the Herrington Lake ERA are summarized in Table 5-17. The source of the popeye is uncertain. No apparent dose-response relationship supports the presence of popeye in the YOY bluegills related to their tissue selenium levels. But the occurrence of popeye in wild fish populations has numerous other known causes, including from physical and/or environmental stressors, including increased water-temperature, super-saturated dissolved oxygens levels, or physical stress caused by limited but unavoidable handling during the collection of very small fish Both adult and ovary tissue criteria were used for comparison to tissue residues in the YOY fish because the collected YOY bluegills were very small (1–3.5 cm length). Uncertainty remains as to which criterion (adult fish or ovary tissues) best reflects an indication of adverse impacts to YOY bluegills. The adult bass and catfish ovary tissues did not indicate selenium concentrations that exceeded the Kentucky ovary tissue criterion. There are, however, no adult bluegill ovary tissue results to compare in this ERA.

5.6 Consideration of Additional Constituents for CCR Rule

Additional ecological screening was conducted for cobalt, lithium, and molybdenum, which are additional metals of regulatory interest at E.W. Brown under the CCR Rule. Data for Briar Patch Spring, and HQ Spring are compared to risk-based Region 4 ESVs (USEPA 2018b) for surface water in Table 5-18. No detected concentration of cobalt, lithium, or molybdenum exceed the USEPA R4 ESVs in springs. The Outfall data are also provided for cobalt and molybdenum (Table 5-19). Again, the detected concentrations do not exceed ecological risk-based criteria.

5.7 ERA Conclusions

The source of the popeye remains an uncertainty in the ERA but several conclusions were reached based on the study of the bluegill:

- The adult fish tissue selenium concentrations in adult fish and fish ovary samples were below the Kentucky water quality standards for fish tissues. The selenium in tissue residue analysis for YOY fish tissue indicates concentrations that exceed Kentucky water quality standards within Curds Inlet. Therefore, some impacts to individual YOY fish based on selenium tissue burdens within Curds Inlet cannot be ruled out, with highest exposures observed at the innermost portion of Curds Inlet, nearest Auxiliary Pond Outfall BRN001.
- Moreover, the overall presence of teratogenic skeletal, facial, fin, or tail deformities were low (approximately 1% of the approximately 3,600 fish evaluated), and those observed in Curds Inlet

were comparable to those observed at distance well outside the influence of Auxiliary Pond Outfall BRN001 and Curds Inlet. No dose-response relationship between selenium concentrations in fish tissues and deformities was established. Moreover, the data from the study of deformities indicated that the low prevalence of deformities would not adversely impact bluegill populations. This low percentage (approximately 1%) is in a range of negligible effect to the bluegill population, the sensitive species to selenium, and species with small home range.

- The skeletal, facial, fin, or tail deformities observed were relatively minor and overall would not likely affect the survival of the fish. This Corrective Action ISARA Report displays digital images of each fish with a deformity and provides the full assessment reporting datasheets.
- A condition known as popeye was also observed in the YOY fish. The overall presence of the popeye was also low (among all sample types, a total of 9%), and if the popeye was due to physical exertion as some literature suggests may occur, it would be an artificial condition potentially induced by the study itself. Even if not due to exertion, there is not a dose-response relationship with selenium and the prevalence in Hardin Inlet (37%) exceeded the prevalence in Curds Inlet (0.09% with UCI, MCI, LCI, and HQ Inlet combined). The prevalence in Hardin Inlet also exceeds any individual area within Curds or HQ Inlet, which range from 0.2% (LHL and HQ Inlet) to 24.5% (MCI). As was mentioned in Section 3, Hardin Inlet had among the lowest selenium concentrations observed in YOY fish, surface water, sediment pore water, and sediment from the samples collected. Elevated CCR-related constituents were not detected in the monitoring well between E.W. Brown Station and Hardin Inlet during any sampling event, which is consistent with the established easterly groundwater flow direction. This demonstrates that there is no apparent migration of CCR-related constituents via groundwater to Hardin Inlet.
- In addition, bluegills were abundant in Herrington Lake. The approximately 4,300 fish evaluated in this assessment (including YOY from the assessment samples and the tissue residue samples) were collected in less than a week of sampling. Of the 4,300 fish, approximately 2,700 of them were collected from Curds Inlet and HQ Inlet. The Kentucky Department of Fish and Wildlife Resources (KDFWR) does not stock bluegills in Herrington Lake.
- Based on these findings, and with the uncertainties already noted, the bluegill population in Herrington Lake is not adversely impacted by selenium loading from E.W. Brown Station. Because bluegill are small home range species known to be among the most sensitive species to selenium and because this study evaluated the sensitive YOY life stage for bluegill in areas with the highest measured concentrations of selenium in surface water, sediment pore water, and sediment, these findings also support the conclusion that other less sensitive fish populations would not be adversely impacted by selenium. However, certain YOY composite bluegill samples collected from within Curds Inlet did have whole-body selenium levels that exceed the Kentucky criterion for adult whole-body fish. The YOY fish collected were juvenile fish and given the young age (estimated to be within approximately 3 weeks of hatching) and the likelihood of maternal transfer is a source of exposure for young fish, the ovary criterion may be applicable for consideration along with the adult whole-body criterion. The composite samples in the innermost portion of Curds Inlet exceeded the Kentucky adult criterion and the Kentucky ovary criterion. Therefore, some impacts to individual YOY bluegills within Curds Inlet cannot be ruled out. The path forward thus includes recommendations for future monitoring of the YOY bluegill population health.

In addition to the ERA of fish populations, the ERA also considered the survival, growth, and reproduction of bird and mammal populations using a food web modeling approach with conservative toxicity reference values based on dietary intake. The ERA food web model indicated that mammal and bird populations are not adversely impacted by CCR-related constituents that are discharged in

Auxiliary Pond Outfall BRN001 or from CCR-related constituents in the sediments in Curds Inlet or elsewhere in Herrington Lake.

The ERA also considered community composition and function for aquatic plants and sediment dwelling organisms. The approach used for this evaluation was the comparison of water, sediment, and sediment pore water concentrations to the appropriate water and sediment quality criteria, including specific selenium and arsenic pore water concentrations for sediment dwelling organisms. Based on these comparisons, some isolated potential effects to some organisms in Curds Inlet cannot be definitively ruled out at the spatially limited areas with the highest concentrations of selenium and arsenic in sediment or pore water. Given the limited spatial extent of the highest concentrations exceeding criteria, it is considered unlikely that sediment or sediment pore water poses an unacceptable risk to the plant or sediment dwelling organism community. .

6. SUMMARY AND CONCLUSIONS

The summary and conclusions for the chemical nature and extent, the source identification, HHRA, and ERA are briefly summarized. Section 7 identifies the recommendations and path forward based on these findings.

6.1 Chemical Nature and Extent

Detailed findings in section 2 of the chemical nature and extent of contamination in the lake can be summarized with the following key findings:

Fish Tissue: The Phase I and Phase II analytical results for fish provided sufficient data to support the following conclusions:

- All Phase I and II adult fish selenium levels are below the KDOW fish tissue Eco Chronic criterion and below the human health screening level.
    - The adult fish bluegill and green sunfish selenium levels are highest in Curds Inlet, and lowest in Middle Herrington Lake with concentrations decreasing with increasing distance from E.W. Brown Station.
    - The KDOW ESB conducted split sample tissue residue analysis for selenium using Phase I fish tissues and selenium results were comparable to the Phase I results.
    - The Phase II YOY bluegill selenium levels were highest in Curds Inlet and decreased with increasing distance from E.W. Brown Station.
- Fish tissues for constituents other than selenium were adequately characterized with Phase I sampling and are also below the screening level benchmarks identified from scientific literature for arsenic, cadmium, boron, lead, and zinc for both ecological receptors and human-health, where they exist. The KDOW ESB split sample tissue residue analysis for constituents other than selenium were comparable to the Phase I results.
- The 2016 KDOW whole body fish tissue selenium concentrations exceeded the KDOW standard for whole-body fish; the ovary results for 2016 did not exceed the KDOW or USEPA ovary criteria. In contrast to the 2016 KDOW fish tissue results, none of the 2018 KDOW selenium fish tissue concentrations exceeded the KDOW standard for whole-body fish, with more than 40 fish collected by KDOW in Curds Inlet and other locations in Herrington Lake.
- Arsenic speciation in fish tissues demonstrated that inorganic arsenic (the form of arsenic that is potentially toxic to humans) is not present or was present at concentrations lower than the human-health standard for arsenic ingestion in fish tissues.
- Methylmercury (MeHg, the dominant form of mercury in fish tissues) was detected below human health risk-based screening-levels in Curds Inlet, but there were two catfish in areas away from E.W. Brown Station with concentrations greater than risk-based screening levels based on consumption of 50 meals per year:
    - One of the two catfish was collected from LHL4, approximately 3 miles upgradient from E.W. Brown Station and the second was from MHL1, approximately 10 miles upgradient from E.W. Brown Station.
    - These mercury concentrations in the catfish are not considered to be due to discharges from E.W. Brown station into Curds Inlet because small home range bluegill fish did not indicate a pattern of elevated mercury concentrations in Curds Inlet.

Surface Water: The Phase I and Phase II analytical results for surface water provided sufficient data to support the following conclusions:

- A concentration gradient was observed with higher selenium concentrations in the inner portions of Curds Inlet and decreasing concentrations away from the Auxiliary Pond Outfall BRN001 discharge location. There were selenium concentrations in surface water from Curds Inlet that slightly exceeded the Kentucky chronic water quality criterion; however, the criterion recognizes that fish tissue is the controlling standard. Apart from Curds Inlet, the other Herrington Lake sampled regions had surface water selenium levels below the Kentucky and USEPA chronic criteria.
- Detected surface water concentrations are below the Kentucky chronic water quality standards for arsenic, methylmercury, cadmium, lead, and zinc.
- Total and dissolved mercury in surface water was detected at elevated concentrations in the Phase I stratified sampling, but both the Phase I overturn and Phase II stratification surface water levels in Curds Inlet were below the Kentucky ecological and human health criteria, confirming the transience of the elevated Phase I surface water mercury levels.

Sediment Pore Water: There is sufficient information for sediment pore water to support the following conclusions:

- Selenium, arsenic, and cadmium in pore water were detected at concentrations that exceeded the Kentucky ecological criteria or screening values in localized areas within Curds Inlet and were below the Kentucky standards elsewhere within Curds Inlet.
- Other CCR-related constituents in sediment pore water were detected at concentrations lower than the Kentucky water quality standards in Phase I, which is a conservative comparison because the water quality standards protect fish and other aquatic wildlife, not all of which inhabit pore water.

Sediments: There is sufficient information for sediments to support the following conclusions:

- Detected concentrations of selenium and arsenic in sediment exceeded USEPA Region 4 ESVs at many locations, including areas outside the influence of E.W. Brown Station.
- Other CCR-related constituents had one or more locations that exceeded USEPA Region 4 ESVs but did not exceed USEPA Region 4 RSVs.

Aquatic Vegetation and Invertebrates: There is sufficient information for aquatic vegetation and aquatic invertebrates to support the following conclusions:

- There are no specific criteria for comparison to these data. Concentrations of the constituents evaluated show comparable results around the lake locations sampled with no particular distinct patterns of the most elevated concentrations being specific to Curds Inlet. The only exception to this was seen for cadmium where the highest concentrations were seen in the central portion of Curds Inlet. The higher cadmium concentrations were bounded by lower cadmium concentrations at the transect leaving Curds Inlet.

6.2 Chemical Fate and Source Identification for Herrington Lake

Section 3 identified sources and transport mechanisms for CCR-related constituents from E.W. Brown Station to Herrington Lake, with the Auxiliary Pond Outfall KPDES BRN001 being the primary source identified. The geochemistry of selenium and arsenic was evaluated, and the results observed in Curds Inlet are consistent with expectations based on geochemistry of oxidizing and reducing sediments. Selenium is strongly correlated with boron, confirming the contribution of CCR-related

contribution. Arsenic was less strongly correlated with boron, but still suggests a CCR-related source. Also, the sediments from Curds Inlet may be a source of arsenic to the water of Curds Inlet via flux.

The selenium source identification includes consideration of the relationship between selenium and boron because literature studies have demonstrated that boron can be used as a tracer for leaching of CCR-related constituents. The relationships for selenium and boron are evaluated for the sediments and pore water from Phase I and Phase II investigations. In addition, the relationship for sediment, sediment pore water from the springs, the Toe Drain collection system, and groundwater monitoring wells are compared. The comparison suggests a consistent relationship between selenium and boron across each of the sample types, suggesting a consistent ash source, with decreasing selenium concentrations, with distance from Curds Inlet. Contour mapping of selenium, boron, and arsenic concentrations within Curds Inlet based on Phase I and Phase II sediment and sediment pore water is provided.

Selenium and arsenic mass loading to Herrington Lake by source is illustrated in Figures 3-11A through 3-11D based on the estimates described in Sections 3.4.2.1 through 3.4.2.4. The mass loading calculations provided in those sections are based on simplifying assumptions and are intended to provide order-of-magnitude estimates for comparing the relative contributions from selected sources. These average mass loading graphics allow the relative comparison of selenium and arsenic mass loading from identified sources into Herrington Lake before and after implementation of the IRMs. IRMs were completed in 2016 that limited the flow of CCR-related constituents. The IRMs, among others identified in Table 1-1 and described in Section 1, include the capping of the Main Ash Pond, installation of the Toe Drain collection system, and repair of the Auxiliary Pond discharge pipeline. In addition, a Toe Drain collection system was installed. Figures 3-11A through 3-11D provide a comparison of conditions (i.e., mass loading) before and after implementation of the IRMs so that the contributions from multiple sources can be generally compared. Each graphic provides estimates of mass loading from:

- Auxiliary Pond Outfall KPDES BRN001,
- Springs,
- Groundwater,
- Flux from sediments, and
- Lake-wide upgradient mass loading.

The key findings are described as follows:

- The primary input of CCR-related constituents to Curds Inlet is from the Auxiliary Pond KPDES Outfall BRN001. The estimated discharge of selenium from the Auxiliary Pond KPDES Outfall BRN001 is slightly lower after the implementation of the IRMs.
- Springs currently contribute CCR-related constituents to the lake. Ditch Spring, Beaver Dam Cave Spring, and the South Abutment Spring formerly flowed to Curds Inlet but have mostly been dry since the installation IRMs. Briar Patch Spring and HQ Spring continue to flow into HQ Inlet after the implementation of IRMs, but flow and thus mass load is reduced for Briar Patch and HQ Springs after the capping of the Main Ash Pond and repair of the Auxiliary Pond discharge pipeline.
- The Groundwater Sampling and Analysis Report (AMEC 2018b) concludes that the groundwater impacts identified from the CCR compliance monitoring are attributable to the Main Ash Pond, and not to the Landfill constructed on top of the Main Ash Pond. The data discussed in this Corrective Action ISARA Report show that selenium mass loading from groundwater is expected to be *de minimis.* Selenium was only detected in one well located near the lake (MW-111, October 2016)

and selenium and was not detected in the groundwater from MW-111 in the following 10 sampling events. The flux of arsenic from groundwater toward the lake was determined by arsenic concentrations at three wells along the transect. MW-113, MW-112 and MW-109 each had detections of arsenic with MW-112 having the highest arsenic detections and mass loading. This segment includes the Toe Drain collection system. Comparatively, the arsenic mass loading from groundwater is small relative to those from other sources.

Monitoring well MW-116 is the groundwater monitoring well furthest south and is closest to Hardin Inlet. Elevated CCR-related constituents were not detected in MW-116 during any sampling event, which is consistent with the established easterly flow direction. This demonstrates that there is no apparent migration of CCR-related constituents via groundwater to Hardin Inlet.

- The Toe Drain captures groundwater flow from within and below the Main Ash Pond and pumps that groundwater to the Auxiliary Pond. The Toe Drain also captures water from springs (Dam Toe Right, Dam Toe Middle, and Dam Toe Left) and pumps the flow from these springs to the Auxiliary Pond. The springs (Dam Toe Right, Middle, and Left) are captured by the Toe Drain collection system. It is possible that there is seepage from the Main Ash Pond that is not captured by the Toe Drain collection system. However, the bottom of the pumping chamber, which is at an elevation of approximately 730 feet asl, is topographically lower than the base of the ash in the Main Ash Pond, and therefore would be expected to capture flow from the Main Ash Pond as it dewaters. Furthermore, pore water sampling in Curds Inlet conducted in Phase I and Phase II sampling in accordance with the CAP and Phase II Plan supports a conclusion that groundwater upwelling is not a source of CCR-related constituents to Curds Inlet. Therefore, if any groundwater with CCR-related constituents does not get captured by the Toe Drain collection system, it would be *de minimis*.
- The mass loading of selenium and arsenic from sediment is shown on Figures 3-11A through 3-11D. The estimates of flux from sediment to the water in Curds Inlet includes consideration of sediment geochemistry. The results showed:
    - Selenium flux from sediments to water is orders of magnitude lower than selenium mass loading from the Auxiliary Pond Outfall KPDES BRN001.
    - Selenium flux from sediment is also below the lake-wide upgradient estimates of mass load.
    - Arsenic flux from sediment to the water in Curds Inlet is potentially similar to the arsenic load from spring water collected in the Toe Drain collection system but it is within the range estimated for the lake-wide upgradient mass loading.
    - The estimated loading from arsenic sediments to the water column in Curds Inlet (via pore water flux) is comparable estimated mass loading from KPDES BRN001 in 2017-2018 and the Toe Drain collection system. In addition, the flux from sediment is comparable to the lake wide upgradient mass loading as estimated using Phase I and Phase II data from LHL5 and LHL6. Arsenic is closely considered in the human health and ecological risk assessments.
    - The amount of selenium and arsenic in pore water was consistent with flux from sediment and does not indicate mass loading from groundwater upwelling in Curds Inlet.
- Atmospheric deposition of CCR constituents in particulate emissions from the E.W. Brown Station is not a likely source of CCR-constituents to the lake.
- Runoff from the coal pile does not flow to Curds Inlet along the northern bank. Rather, drainage from the coal pile is collected in the coal pile runoff and settling pond and is pumped to the Auxiliary Pond where it is discharged to Curds Inlet via Auxiliary Pond KPDES Outfall BRN001.

6.3 Human Health Risk Assessment

- A human health risk assessment was conducted to evaluate the CCR-related constituents detected in water, sediment and fish tissue.
- Health protective assumptions were applied to select risk-based screening levels that were used to identify COPCs in Study Area media.
    - No COPCs were identified for water based on the assumption that surface water is used as residential drinking water.
    - No COPCs were identified for fish tissue assuming consumption of 50 meals per year.
    - Selenium was not identified as a COPC in any medium and thus no adverse effects on human health would be expected associated with exposure to selenium in the study area.
    - Screening level analysis of sediment concentrations identified arsenic as a COPC in sediments.
- Human health risk estimates for arsenic in sediment were within levels generally considered acceptable by regulatory agencies.
    - Site-specific human health risk estimates were derived for recreational visitor's exposure to arsenic in sediments for areas under 24 or less feet of water during winter pool.
    - Health protective assumptions were applied to estimate exposure for hypothetical recreational visitors including young children, older children and adults whom might visit the areas as often as 33 days per year for the young child and 65 days per year for adults.
    - Calculated excess lifetime cancer risk estimates for arsenic were less than the upper end of USEPA's target risk range from $1x10^{-6}$ to $1x10^{-4}$.
    - No hazard quotients for any constituents, including arsenic and selenium, were greater than 1 indicating no adverse effects would be expected for recreational visitors that may be in contact with sediments.

6.4 Ecological Risk Assessment

- The Phase I and Phase II adult fish whole-body selenium concentrations were below the Kentucky criteria (8.6 mg/kg dw). The Phase I adult ovary tissues were below the Kentucky and USEPA ovary criteria (19.4 mg/kg and 15.2 mg/kg respectively). The Phase II YOY bluegill whole-body selenium levels at the three sampled regions within Curds Inlet exceed the Kentucky criterion for adult whole-body fish tissue and impacts to individual YOY bluegills in Curds Inlet cannot be ruled out. The highest levels were recorded in Upper Curds Inlet, located adjacent to the Auxiliary Pond Outfall KPDES BRN001 outfall.
- The 2018 YOY assessment demonstrated that nearly all of the fish did not have skeletal, facial, fin, or tail teratogenic deformities. Overall, only 35 of the more than 3,600 fish had some deformity, which is 0.97% of the fish. The rates in Curds and HQ Inlets (0.38–0.83%) were less than the rates observed outside the influence of Curds Inlet, with an observed occurrence at LHL1 of 2.1% and Hardin Inlet at 0.96%. The rate of occurrence at LHL6, approximately 2 miles upgradient from Curds Inlet was 0.66%, within a comparable range to that observed in Curds Inlet (outside the influence of E.W. Brown Station). These rates of skeletal, facial, fin, or tail teratogenic deformities do not indicate adverse impact to the population of fish in Herrington Lake. Furthermore, bluegill are small home range species known to be among the most sensitive species to selenium. Because this study evaluated the sensitive YOY life stage for bluegill in areas with the highest measured concentrations of selenium in surface water, sediment pore water, and sediment, these

findings also support the conclusion that other less sensitive fish populations would not be adversely impacted by selenium.

- During the YOY deformities assessment, a condition was noticed in approximately 5% of the 3,600 fish evaluated in the assessment. The condition, called exophthalmia, is more commonly referred to as "popeye". Popeye can be associated with selenium toxicity at high concentrations, so a detailed examination of the fish was conducted to see if there was a dose-response that was related to selenium. Because popeye was noticed in some of the YOY assessment samples, the digital images of the approximately 700 YOY fish sent for tissue residue analysis were more closely examined. Considering the YOY assessment samples and YOY tissue residue samples, a total of 9% of the fish exhibited this popeye condition. Some of the preserved fish from the YOY assessment samples were sorted into groups of fish with and without the popeye condition for additional YOY selenium tissue residue analysis, and results were compared to the selenium YOY tissue residues. No dose-response relationship between popeye and selenium concentration was identified, even in fish samples with 100% popeye compared to fish samples with 0% popeye condition. If selenium was the cause of the popeye, a higher body residue of selenium should be seen in fish with popeye compared to fish with no popeye.
- Based on the lack of dose-response, and the prevalence of this condition even in areas remote from E.W. Brown Station, other possible sources of popeye were considered. For example, popeye can be associated with a variety of bacterial, fungal, parasite, or physical stress causes unrelated to selenium. For example, popeye can be a condition found in aquariums and aquiculture. Given the results of a microscopic examination of the YOY fish, parasites were ruled out as a cause, but the other sources of conditions unrelated to selenium could not be ruled out. Furthermore, an evaluation of the size of the fish was conducted as a potential explanation for the popeye condition (Figure ES-9, same as Figure 5-12). Results indicated that smaller fish had a higher likelihood of having popeye condition. Small fish are also susceptible to popeye from physical stress. These findings suggest that the exertion and capture typical of the YOY collection may have contributed to the observed popeye.
- Several conclusions were reached based on the study of the YOY bluegill:
    - The overall presence of teratogenic skeletal, facial, fin, or tail deformities (0.97%) was low, and those observed in Curds Inlet were comparable to those observed at distance well outside the influence of Auxiliary Pond Outfall KPDES BRN001 and E.W. Brown Station. This low percentage does not indicate adverse impact to the population of fish in Herrington Lake.
    - The skeletal, facial, fin, or tail deformities observed were relatively minor and overall would not likely affect the survival of the fish.
    - The overall presence of popeye was also low (among all sample types, a total of 9%), and if the popeye was due to physical exertion as some literature suggests may occur, it would be an artificial condition potentially induced by the study itself. Even if not due to exertion, the study showed no dose-response relationship with selenium and the prevalence in Hardin Inlet (37%) (where sampling did not show the presence of elevated selenium in surface water and sediment) exceeded the prevalence in Curds Inlet (0.09% with UCI, MCI, LCI, and HQ Inlet combined) (Table ES-3, same as Figure 5-9B). The prevalence in Hardin Inlet also exceeds that of any individual area within HQ Inlet and Curds Inlet, which ranged 0.2% from LCI and HQ Inlet to 25.4% from Middle Curds Inlet (MCI). The prevalence in Hardin Inlet (where selenium concentrations are among the lowest measured for YOY fish tissues, surface water, sediment, and sediment pore water) also exceeds that of any individual area within HQ Inlet

and Curds Inlet, which ranged 0.2% from LCI and HQ Inlet to 25.4% from Middle Curds Inlet (MCI).

  - In addition, bluegills were abundant in Herrington Lake. The approximately 4,300 fish evaluated in this assessment (including YOY from the assessment samples and the tissue residue samples) were collected in less than a week of sampling. Of the 4,300 fish, approximately 2,700 of them were collected from Curds Inlet and HQ Inlet. The Kentucky Department of Fish and Wildlife Resources (KDFWR) does not stock bluegills in Herrington Lake.
  - These findings, and with the uncertainties already noted, indicate the bluegill population in Herrington Lake is not adversely impacted by selenium. However, certain YOY composite bluegill samples collected from within Curds Inlet did have whole-body selenium levels that exceed the Kentucky criterion for adult whole-body fish. The YOY fish collected were juvenile fish and given the young age (estimated to be within approximately 3 weeks of hatching) and the likelihood of maternal transfer is a source of exposure for young fish, the ovary criterion may be applicable for consideration along with the adult whole-body criterion. The composite samples in the innermost portion of Curds Inlet exceeded the Kentucky adult criterion and the Kentucky ovary criterion. Therefore, some impacts to individual YOY bluegills within Curds Inlet cannot be ruled out. The path forward thus includes recommendations for future monitoring of the YOY bluegill population health.

- The ERA also considered the survival, growth, and reproduction of bird and mammal populations using a food web modeling approach with conservative toxicity reference values based on dietary intake. The ERA food web model indicated that mammal and bird populations are not adversely impacted by CCR-related constituents that are discharged in Auxiliary Pond Outfall KPDES BRN001 or from CCR-related constituents in the sediments in Curds Inlet or elsewhere in Herrington Lake.
- The ERA also considered community composition and function for aquatic plants and sediment dwelling organisms. The approach used for this evaluation was the comparison of water, sediment, and sediment pore water concentrations to water and sediment quality criteria appropriate, including specific selenium and arsenic pore water concentrations for sediment dwelling organisms. Based on these comparisons, some isolated potential effects to some organisms in Curds Inlet cannot be definitively ruled out at the spatially limited areas with the highest concentrations of selenium and arsenic in sediment or pore water. Given the limited spatial extent of the highest concentrations exceeding criteria, it is considered unlikely that sediment or sediment pore water poses an unacceptable risk to the plant or sediment dwelling organism community.

7. RECOMMENDATIONS AND PATH FORWARD

This ISARA Report describes the Phase I and Phase II investigation results, along with selenium source identification, HHRA, and ERA. This report concludes that conditions in the lake do not pose an unacceptable risk to human health but some possible adverse effects to ecological receptors in Curds Inlet cannot be definitively ruled out, particularly for individual YOY bluegill in the interior of Curds Inlet. There is sufficient information at this time to proceed with the Supplemental Remedy Alternatives Analysis, as identified in the Agreed Order and the CAP. The FS should focus on Curds Inlet. The Phase I investigation included sampling coverage throughout Curds Inlet and within HQ Inlet. The Phase I sampling also included surface water, sediment, aquatic vegetation, and aquatic invertebrate sampling for areas within Lower Herrington Lake, extending upgradient and downgradient from Curds Inlet. The Phase I sampling included adult fish tissue sampling for three species of fish within Lower Herrington Lake and 20 miles upgradient of E.W. Brown Station and of Curds Inlet in Middle Herrington Lake. Both large and small home range fish were sampled representing forage fish (bluegill), bottom dwelling omnivorous fish (catfish), and predatory fish (bass) analyzed for consideration of whole-body and fillet tissue results, and a subset of the larger fish ovary tissues were sampled. The Phase II investigation filled data gaps identified in the Phase I sampling program. No data gaps are identified that would prevent proceeding with the Supplemental Remedial Alternatives Analysis.

Potential adverse effects to individual YOY bluegills could not be ruled out in the interior of Curds Inlet, but there were uncertainties with the YOY results because there was a lack of dose-response observed between selenium in fish and the YOY deformities or popeye condition. As such, future monitoring of the YOY bluegill in Curds Inlet is recommended. In addition, there is no adult bluegill ovary tissue data to date. The future monitoring of adult bluegill fish, with bluegill ovary tissues would provide additional clarifying information if conducted in the same season as YOY bluegill assessment. This monitoring, while considered beneficial to resolve some uncertainties described in the ERA, is not needed to complete the Supplemental Remedial Alternatives Analysis.

KU implemented several IRMs to mitigate groundwater impacts at E.W. Brown Station, and control migration of impacted groundwater toward Herrington Lake (e.g., the capping of the Main Ash Pond, installation of the Toe Drain collection system, and repair of the Auxiliary Pond discharge pipeline). In addition to the interim remedial measures conducted pursuant to the GRWAP and discussed in Section 1 of the Corrective Action ISARA Report, there are ongoing projects at E.W. Brown Station to modify operations and wastewater management systems to comply with recently promulgated federal regulations for managing CCR and related coal combustion wastestreams. These include EPA's 2015 ELGs and the CCR Rule. For certain requirements of these rules, which also are to be addressed pursuant to the CAP II obligations under the Agreed Order, compliance is being achieved through modifications at E.W. Brown Station pursuant to a schedule that will be reviewed and approved by the Cabinet pursuant to the Agreed Order (and also set forth in the renewed KPDES permit for the facility).

Key projects include:

- Replace wet handling of CCRs in Auxiliary Pond with dry handling in the Landfill.
- Replace Auxiliary Pond discharge to Curds Inlet (KPDES BRN001 Outfall) by relocating these same process flows to a submerged discharge through a multi-port diffuser located at the main body of Herrington Lake upon issuance of the final renewed KPDES permit (projected for late summer 2019). The diffuser would be anchored to the rock wall and extend into the main body of Herrington Lake. The discharge zone of the diffuser is planned for approximately 40 feet below

winter pool. The diffuser will be used for dewatering of the Auxiliary Pond and for plant process wastewater flows currently discharging to the Auxiliary Pond, which will be directed to a new Process Pond that is under construction.

- Provide enhanced physical/chemical treatment of certain wastewaters, including coal pile runoff and toe drain collection system water, with initial system start-up by December 31, 2019.
- Target zero liquid discharge of scrubber (FGD) wastewater but provide a PWS treatment system for backup if necessary, with initial system start-up by December 31, 2019.
- Dewater the Auxiliary Pond commencing upon the effective date of the renewed KPDES permit and complete Auxiliary Pond closure by December 31, 2021.

These ongoing projects, which are described in detail in the updated KPDES renewal application (May 2019), will reduce or eliminate the largest sources of CCR constituent loading to Curds Inlet from E.W. Brown Station by 2020 and will reduce or eliminate these sources from E.W. Brown Station to Herrington Lake entirely within the next two and a half years. These improvements will be considered in the Supplemental Remedial Measures evaluation and Report required by the Agreed Order following the Cabinet's review and approval of the Corrective Action ISARA Report.

The Supplemental Remedial Alternatives Analysis may include the following elements, as identified in the approved CAP.

- *Identification of Conditions Warranting Supplemental Actions.* A fundamental goal in a remedial action program is to control or eliminate unacceptable risks to human health and the environment. The identification of conditions in Curds Inlet warranting evaluation of supplemental remedial actions will consider the results of the source identification, HHRA, and ERA presented in this Corrective Action ISARA Report. The supplemental remedial measures considered for Curds Inlet will consider the GWRAP performance. In addition, consideration of future improvements and the expected reductions in pollutant loadings from the control of Auxiliary Pond Outfall KPDES BRN001 will be considered, when approved by the Cabinet.
- *Definition of Remedial Action Objectives (RAOs).* RAOs are intended to provide a general description of what the remedial measures is expected to accomplish and help focus the development of the remedial alternatives in the remedial alternatives analysis. RAOs are typically derived from the CSM and address the significant exposure pathways identified in the risk assessment.
- *Identification of Potentially Applicable Additional Remedial Action Alternatives.* The remedial alternatives analysis does not necessarily have to address all potential remedies, rather, USEPA advises that the analysis be focused on realistic remedies and tailored to the extent, nature and complexity of releases and contamination at a given facility (USEPA 1996). Identification of potentially applicable alternatives will consider the following:
    - Protection of human health and the environment. Proposed remedies must be protective of human health and the environment through active (e.g., source control, media cleanup, containment) and/or protective (e.g., institutional controls, deed restrictions) means.
    - Performance, reliability and ease of implementation, potential impacts of remedial measures including at a minimum safety, effects, cross-media effects, and control of any probable residual contamination
    - Time to begin and complete
    - Cost/benefit
    - State and local permits or other public health or environmental requirements that may affect the remedy implementation

- *Evaluation of Remedial Alternatives*. A comparative analysis of remedial alternatives will be performed to identify the alternative that provides the best combination of the following performance attributes considering ongoing remedial measures from the GWRAP and future planned remedial measures for Auxiliary Pond Outfall KPDES BRN001. The evaluation of alternatives will include:
  - Long-term and short-term effectiveness and protectiveness.
  - Risk reduction; the potential for residual risks due to waste remaining after implementation of the remedial measure, type and extent of long-term management required, including monitoring, operation, and maintenance.
  - Short-term risks that might be posed to public health, safety, the environment, and natural resources while implementing the remedial measure, including any potential threats to human health and the environment that may be associated with excavation, transportation, and redisposal of wastes.
  - Time until full protection is achieved, potential adverse effects on public health, safety, the environment, or natural resources resulting from exposure to remaining wastes compared to the potential of such adverse effects associated with further corrective measures;
  - Long-term reliability of the engineering and institutional controls, potential need to replace the remedial measure, and compatibility of the remedial measure with other relevant federal, State, and local regulations.
  - Sustainability. As part of the evaluation of the remedial alternatives, the sustainability of the remedial alternatives will be considered, consistent with USEPA's April 2008 *Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites* (USEPA 2008) and ITRC's November 2011 *Green and Sustainable Remediation: A Practical Framework* (ITRC 2011). Specifically, alternatives meeting the above-defined evaluation criteria that are expected to require an overall lower level of manpower, energy and/or materials consumption to achieve the same level of protectiveness will be identified. In selecting a remedial action, it is important to understand the potential benefits (i.e., gains in ecosystem service value) and costs (i.e., losses in ecosystem service value) associated with the implementation of various remedial alternatives and their relationship to predicted ecosystem service injury that is suggested by a risk assessment. The overall goal of the comparative analysis will be to evaluate the identified alternatives in terms of their ability to manage risks, benefits, and trade-offs between the alternatives.

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TABLES

Table 1-1: E.W. Brown Station Summary of Completed Interim Remedial Measures
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	IRM Description	Schedule of Implementation
Gypsum Processing Plant (GPP)	Installed a liner for the Gypsum Pond and the area draining to the pond (55,600 SF total) to prevent infiltration of gypsum-impacted water in the area of the GPP Liner system consists of the following, from bottom to top: 4 inches of dense graded aggregate (DGA) over grade (rough rock surface) – to support membrane 60-mil LLDPE flexible membrane liner between two geotextile layers 6-inch fabric form concrete mat	Completed: Late 2015
West Quarry (non-Coal Cumbustion Residue (CCR))	Drained accumulated storm water Filled the quarry with inert structural fill (i.e., soil and rock) Graded surface to promote drainage Covered surface with topsoil and vegetated to minimize erosion	Completed: April 2016
Auxiliary Pond Discharge Pipeline	Replaced existing sections of the HDPE pipeline and manholes (based on 2014 evaluation by AMEC) Reduced the number of manholes Tightness tested system on completion.	Completed: November 2016
Main Pond	Final Capping of Existing CCR Installation of the cap will be phased so that it is integrated into construction of the new lined landfill over the top of the covered existing CCR See Main Ash Pond Closure Plan (AMEC 2014) for final design details	Phases I, II, and III of the capping work is complete
	Abutment Drain Collection[1] Installed pumping station to capture the north abutment drain discharge and transfer it to the Auxiliary Pond[1]	Complete: July 2014
	Toe Drain Collection[1] Installed collection system for discharges at the toe of the Main Pond Dam and to transfer them to the Auxiliary Pond[1] Constructed a cut-off wall across the valley downstream of the toe	Completed: April 2016

Notes:

CCR Coal Combustion Residue

DGA Down Graded Aggregate

GPP Gypsum Processing Plant

HDPE High Density Polyethylene Pipe

IRM Interim Remedial Measure

LLDPE Linear Low-Density Polyethylene

1. Transfer of discharges to the Auxiliary Pond is intended as a short-term IRM. Once the design and construction of a new wastewater treatment unit for certain wastewater streams from the plant are completed to comply with newly promulgated effluent limitation guidelines, water pumped from the toe of the dam will likely be treated with other remaining wastewater streams (AMEC 2015a) as necessary to comply with Kentucky Pollution Discharge Elimination System [KPDES] discharge requirements).

Table 1-2A: Number of Adult Fish Samples by Location to Characterize Conditions in Lower and Middle Herrington Lake (Phase I, II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

PHASE I

Fish Sampling Region	Bluegill and Green Sunfish Sample 1 of 2	Bluegill and Green Sunfish Sample 2 of 2	Bass Sample 1 of 2	Bass and Brown Trout Sample 2 of 2	Bass and Trout Ovary	Catfish and Sucker Sample 1 of 2	Catfish and Sucker Sample 2 of 2	Catfish and Sucker Ovary
CI (Curds Inlet)	BG (4)	BG (3)	LMB (2)	LMB (3)	1	CHCF (2)	FHCF (2)	1
HQ1 (HQ Inlet)	BG (3)	BG (4)	NS	NS	NS	NS	NS	NS
LHL1 (Rocky Run)	BG (3)	BG (4)	LMB (2)	LMB (2)	1	CHCF (1)	FHCF (1)	0
LHL2 (Dix Dam)	BG (3)	BG (5)	LMB (3)	KYB (4)	1	CHCF (1)	FHCF (1)	0
LHL3	BG (3)	BG (4)	KYB (3)	KYB (3)	2	CHCF (1)	CHCF (2)	1
LHL4	BG (4)	BG (4)	KYB (2)	LMB (2)	2	CHCF (1)	FHCF (1)	0
LHL5 (Entrance to Mallard Cove / Cane Run)	BG (3)	BG (4)	LMB (3)	LMB (3)	1	CHCF (2)	CHCF (3)	1
LHL6	BG (3)	BG (3)	KYB (3)	LMB (2)	2	CHCF (2)	CHCF (2)	1
MHL1	BG (4)	BG (4)	LMB (2)	KYB (2)	1	FHCF (2)	FHCF (1)	1
MHL3	BG (3)	BG (4)	LMB (2)	LMB (3)	1	CHCF (2)	CHCF (2)	1
DR (Dix River)	GS (3), BG(2)	GS (4)	LMB (1)	BT (1)	2	SS (2)	HS (2)	1

PHASE II

Adult Fish				YOY Sunfish			
Adult Fish Sampling Region	Bluegill and Green Sunfish Sample 1 of 1	Bass Sample 1 of 1	Catfish Sample 1 of 1	YOY Fish Sampling Region	YOY Sunfish Analytical Sample 1 of 2	YOY Sunfish Analytical Sample 2 of 2	YOY Sunfish Deformity Sample
(Curds Inlet)	BG (4)	LMB (4)	FHCF (2)	UCI (Upper Curds Inlet)	69[a]	49[a]	624
				MCI (Middle Curds Inlet)	108	69	674
				LCI (Lower Curds Inlet)	31	29	524
HQ1 (HQ Inlet)	BG (4)	NS		HQ1 (HQ Inlet)	19	26	486
LHL1 (Rocky Run)	BG (4)	LMB (3)	FHCF (3)	LHL1 (Rocky Run)	83	100	524
LHL2 Dix Dam	BG (5)	LMB (3)	FHCF (2)	LHL2 Dix Dam	NS		
LHL3 Cove	BG (2)	NS		LHL3 Cove	NS		
HI (Hardin Inlet)	NS			HI (Hardin Inlet)	11	19	209
LHL6 Cove	BG (5)	LMB (3)	FHCF (4)	LHL6 Cove	31	47	607

Notes:
LMB: Largemouth Bass
CHCF: Channel Catfish
FHCF: Flathead Catfish
BG: Bluegill
BT: Brown Trout
GS: Green Sunfish
SS: Spotted Sucker
HS: Northern Hogsucker

} These four substitute species were collected at Dix River only

(X): Indicates the number of fish that comprise the composite sample
NS: Not Sampled
a: An undisclosed number of these YOY were taken from the analytical sample to create a composite field duplicate at the lab.

Table 1-2A Continued:
Total Number of Adult Fish Individuals and Composite Samples Collected During Phase I & II Sampling

Species	Number of Fish Collected	Total Number of Samples
Bluegill	98	27
Green sunfish	7	2
Largemouth bass	43	17
Channel catfish	21	12
Kentucky (Spotted) bass	17	6
Flathead catfish	19	10
Spotted sucker	2	1
Northern hogsucker	2	1
Brown trout	1	1
Total:	210	77
Pan fish:	105	29
Larger fish:	105	48

Table 1-2B: Number of Samples for Surface Water, Sediment Pore Water, Sediment, Aquatic Vegetation, and Aquatic Invertebrates by Location (Phase I and II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Regions ↓	Herrington Lake Areas		Phase I Stratification					Phase I Overturn	Phase II Stratification		
	Sampling Location ID	Location Description	Pore water	Sediment	Aquatic Vegetation	Aquatic Invertebrates	Surface Water[a]	Surface Water[b]	Pore water	Sediment	Surface Water[a]
Curds Inlet, Lower Herrington Lake	Curds NB	Upper Curds Inlet	1	grain-size only	—				—		
	Curds 1		1	1							
	CI-1		1	5[c]	1	1	2[c]	1	3[c]	—	
	Curds 2	Middle Curds Inlet	3	grain-size only	—						
	CI-2		2	4[c]	1	1	2[c]	1	1	—	[d]
	CI-2.1		—						2	3	[d]
	CI-2.2								2	4[c]	1
	CI-3		1	3	1	2[c]	2[c]	1	3[c]	4[c]	[d]
	CI-3.1		—						3[c]	3	1
	CI-3.2								2	3	[d]
	CI-4	Lower / Mouth of Curds Inlet	—	4[c,e]	2[c]	1	2[e]	2[c]	2	3[c,e]	3[c]
Lower Herrington Lake Outside Curds Inlet	HQ	HQ Inlet	3[c]	3	1	1	1	1	—		2[e]
	HI	Hardin Inlet	4[c,d]	grain-size only	—		1	1[e]	—		
	LHL-1	Rocky Run Embayment	—	2	1	2[c]	2	1	—		2
	LHL-2	Dix Dam		2	1	1	3	1	—		[d]
	LHL-3	Lower Herrington Lake Main Channel		2	1	1	3	1	—		2
	LHL-4			2	1	1[e]	3	1	—		
	LHL-5	Entrance to Mallard Cove / Cane Run		2	1	1	3	1			
	LHL-6	Lower Herrington Lake Main Channel		2	1	1	3	1	—		4[c]
Dix River Below Dix Dam	DR	Dix River Below Dix Dam	—	1	1	1	1	—	—		
Total for Each Sample Medium =			16[c,d]	33[c,e]	13[c]	14[c,e]	28[c,e]	13[c,e]	18[c]	20[c,e]	15[c,d,e]

Notes:

Each surface water sample included one field-filtered and one non-filtered set of containers, each constituting a

a : Surface water sampling during summer stratification involved one sample for each stratified surface water layer.

b: Surface water sampling during overturn involved one sample at 25 ft. BWS (As per the 2017 REH CAP).

c:Sample counts include field duplicates but do not include MS/MSD or field equipment blanks.

d: Surface water profiling; no surface water samples were collected

e: Additional MS/MSD samples were collected but not incuded in this sample count.

CI: Curds Inlet

DR: Dix River

LHL: Lower Herrington Lake

— : Not Sampled

Table 1-2C: Summary of Young-of-the-Year Bluegill Samples Collected including Sampling Methods for each YOY Bluegill Collection Region
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

YOY Regions	YOY Sub-Regions	YOY Sunfish 2018 Collection Date	Total Number of YOY Sunfish Collected[a]	Tissue Sample Processing / Shipping Date	Tissue Analytical Sample ID	Number of Sunfish in Tissue Sample	Primary Sample Collection Method
Curds Inlet	Upper Curds Inlet (UCI)	July 17	1150+	July 20	YOY-001-UCI	118	Modified Seine Net[b]
					YOY-001-UCI-MS		
					YOY-001-UCI-MSD		
					YOY-002-UCI		
					YOY-001-UCIDUP		
	Middle Curds Inlet (MCI)	July 20	851	July 21	YOY-003-MCI	177	Seine Net
					YOY-004-MCI		
				November 27	YOY-Pres-001-MCI-E	93	
					YOY-Pres-002-MCI-N	150	
	Lower Curds Inlet (LCI)	July 17–26	585	July 23	YOY-005-LCI	61	Minnow Traps, Dip Net
					YOY-006-LCI	61	
Lower Herrington Lake Outside of Curds Inlet	HQ Inlet	July 17–26	531	July 25	YOY-007-HQI	45	Seine Net, Minnow Trap, Dip Net, Electrofish[c]
					YOY-008-HQI	45	
	LHL1 (Rocky Fork)	July 22	707	July 22	YOY-009-LHL1	183	Dip Net
					YOY-010-LHL1	183	
	LHL3 Cove	July 17–25	33	Insufficient sample size from this small cove for assessment or for a tissue sample			Seine Net, Minnow Traps, Dip Net, Electrofish
	LHL6 Cove	July 23–24	685	July 25	YOY-011-LHL6	78	Seine Net, Minnow Traps
					YOY-012-LHL6	78	
	Hardin Inlet (HI)	July 17,26	239	July 25	YOY-013-HI	30	Seine Net, Electrofish[b]
					YOY-014-HI	30	
				November 27	YOY-Pres-001-HI-E	86	
					YOY-Pres-002-HI-N	50	

Notes:

a Reflects total arrived and counted in Assessment sample + counts of fish separated/documented for tissue analysis Some additional crushed and non target fish not included in total counts.

b For Upper Curds Inlet (UCI) dues to fallen debris and trash, a modified seine method was used where the net was deployed similar to a large dip net

c All electrofish YOY sunfish were stored separate from YOY fish collected by other methods and were used only for the analytical samples, not for the visual assessment samples. The electrofished YOY sunfish showed no visible effects due to collection.

YOY Young-of-the-Year
LHL Lower Herrington Lake

Table 1-3: Laboratory Analytical Methods for All Sample Media (Phase I and II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Test	Methods	Surface Water	Sediment	Pore Water[a]	Aquatic Vegetation	Aquatic Invertebrates	Adult Fish Tissue	YOY Fish
Total Metals (selenium, arsenic, cadmium, lead, zinc, iron, boron, and magnesium)	USEPA 200.8 and 6010/6020, 7742	I,II	I,II	--	I	I	I,II[b]	--
Dissolved Metals (selenium, arsenic, cadmium, lead, zinc, iron, boron, and magnesium)	USEPA 200.8, 200.7, and 6010/6021	I,II	--	I,II	--	--	--	--
Mercury	USEPA 7470,EPA 7471, 1631	I,II[c]	I,II	I,II	I	I	I	--
Methylmercury	USEPA 1630, USEPA 1631E, Lab SOP	I,II	I,II	I,II	I	I	I	--
Selenium	USEPA 6020A	--	--	--	--	--	--	II
Sulfate	USEPA 300.0	I	I	I	--	--	--	--
Total Organic Carbon (TOC)	SW 9060	I	I	--	--	--	--	--
Dissolved Organic Carbon (DOC)	SW 9060	I	--	I	--	--	--	--
Hardness	2340C	I	--	--	--	--	--	--
Percent Solids	SM 2540G, E160.3, ZFZDRY	--	I,II	--	I	I	I,II	II
Percent Lipids	Lab SOP, NOAA Lipid	--	--	--	--	I	I,II	--
Percent Moisture	ASTM D2216, Lab SOP	--	I	--	I	I	I,II	--
Speciated selenium	HPLC with ICP-MS	--	--	I,II	--	--	--	--
Speciated arsenic	1632A	--	--	I,II	--	--	I	--
Sediment grain size	Grain size	--	I	--	--	--	--	--

Notes:
USEPA United States Environmental Protection Agency
HPLC High Performance Liquid Chromatography
ICP-MS Inductively Coupled Plasma/Mass Spectrometry
SOP Standard Operating Procedure
YOY Young-of-the-Year
I Phase I
II Phase II
a See Index for detailed pore water methods
b Phase II Fish Results include Whole-body Selenium only

Table 1-4: Parent, Field Duplicate, and MS/MSD Sample Relationships (Phase I and II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Phase	Sample Matrix	Sample Location	Parent Sample	QC / Ovary Sample ID	Type
Phase I	Adult Fish	CI	FF-001(BG)-CI-171004	FF-001(BG)-CI-171004-FD	Field duplicate
Phase I	Adult Fish	CI	FWB-001(BG)-CI-171004	FWB-001(BG)-CI-171004-FD	Field duplicate
Phase I	Adult Fish	CI	FF-002(BG)-CI-171004	FF-002(BG)-CI-171004-FD	Field duplicate
Phase I	Adult Fish	CI	FWB-002(BG)-CI-171004	FWB-002(BG)-CI-171004-FD	Field duplicate
Phase I	Adult Fish	CI	FF-002(LMB)-CI-171004	FF-002(LMB)-CI-171004-FD	Field duplicate
Phase I	Adult Fish	CI	FWB-002(LMB)-CI-171004	FWB-002(LMB)-CI-171004-FD	Field duplicate
Phase I	Adult Fish	CI	FWB-001(LMB)-CI-171004	FO-001(LMB)-CI-171004	Ovary sample
Phase I	Adult Fish	CI	FWB-001(FHC)-CI-171013	FO-001(FHC)-CI-171013	Ovary sample
Phase I	Adult Fish	HQ	FF-002(BG)-HQ-171004	FF-002(BG)-HQ-171004-FD	Field duplicate
Phase I	Adult Fish	HQ	FWB-002(BG)-HQ-171004	FWB-002(BG)-HQ-171004-FD	Field duplicate
Phase I	Adult Fish	LHL1	FWB-001(LMB)-LHL1-171005	FO-001(LMB)-LHL1-171005	Ovary sample
Phase I	Adult Fish	LHL2	FF-001(LMB)-LHL2-171005	FF-001(LMB)-LHL2-171005-FD	Field duplicate
Phase I	Adult Fish	LHL2	FWB-001(LMB)-LHL2-171005	FWB-001(LMB)-LHL2-171005-FD	Field duplicate
Phase I	Adult Fish	LHL2	FWB-001(KB)-LHL2-171005	FO-001(KB)-LHL2-171005	Ovary sample
Phase I	Adult Fish	LHL3	FF-001(CC)-LHL3-171005	FF-001(CC)-LHL3-171005-FD	Field duplicate
Phase I	Adult Fish	LHL3	FWB-001(CC)-LHL3-171005	FWB-001(CC)-LHL3-171005-FD	Field duplicate
Phase I	Adult Fish	LHL3	FWB-001(KB)-LHL3-171003	FO-001(KB)-LHL3-171003	Ovary sample
Phase I	Adult Fish	LHL3	FWB-002(KB)-LHL3-171004	FO-002(KB)-LHL3-171004	Ovary sample
Phase I	Adult Fish	LHL3	FWB-002(CC)-LHL3-171016	FO-002(CC)-LHL3-171016	Ovary sample
Phase I	Adult Fish	LHL4	FWB-001(LMB)-LHL4-171003	FO-001(LMB)-LHL4-171003	Ovary sample
Phase I	Adult Fish	LHL4	FWB-001(KB)-LHL4-171003	FO-001(KB)-LHL4-171003	Ovary sample
Phase I	Adult Fish	LHL5	FF-002(BG)-LHL5-171011	FF-002(BG)-LHL5-171011-MS FF-002(BG)-LHL5-171011-MSD	MS/MSD
Phase I	Adult Fish	LHL5	FWB-002(BG)-LHL5-171011	FWB-002(BG)-LHL5-171011-MS FWB-002(BG)-LHL5-171011-MSD	MS/MSD
Phase I	Adult Fish	LHL5	FWB-001(LMB)-LHL5-171007	FO-001(LMB)-LHL5-171007	Ovary sample
Phase I	Adult Fish	LHL5	FWB-001(CC)-LHL5-171007	FO-001(CC)-LHL5-171007	Ovary sample
Phase I	Adult Fish	LHL6	FF-002(CC)-LHL6-171007	FF-002(CC)-LHL6-171007-MS FF-002(CC)-LHL6-171007-MSD	MS/MSD
Phase I	Adult Fish	LHL6	FWB-002(CC)-LHL6-171007	FWB-002(CC)-LHL6-171007-MS FWB-002(CC)-LHL6-171007-MSD	MS/MSD
Phase I	Adult Fish	LHL6	FF-002(LMB)-LHL6-171011	FF-002(LMB)-LHL6-171011-MS FF-002(LMB)-LHL6-171011-MSD	MS/MSD
Phase I	Adult Fish	LHL6	FWB-002(LMB)-LHL6-171011	FWB-002(LMB)-LHL6-171011-MS FWB-002(LMB)-LHL6-171011-MSD	MS/MSD
Phase I	Adult Fish	LHL6	FWB-001(LMB)-LHL6-171011	FO-001(LMB)-LHL6-171011	Ovary sample
Phase I	Adult Fish	LHL6	FWB-001(KB)-LHL6-171007	FO-001(KB)-LHL6-171007	Ovary sample
Phase I	Adult Fish	LHL6	FWB-001(CC)-LHL6-171007	FO-001(CC)-LHL6-171007	Ovary sample
Phase I	Adult Fish	MHL1	FWB-001(KB)-MHL1-171014	FO-001(KB)-MHL1-171014	Ovary sample
Phase I	Adult Fish	MHL1	FWB-001(FHC)-MHL1-171014	FO-001(FHC)-MHL1-171014	Ovary sample
Phase I	Adult Fish	MHL3	FF-002(BG)-MHL3-171014	FF-002(BG)-MHL3-171014-MS FF-002(BG)-MHL3-171014-MSD	MS/MSD
Phase I	Adult Fish	MHL3	FWB-002(BG)-MHL3-171014	FWB-002(BG)-MHL3-171014-MS FWB-002(BG)-MHL3-171014-MSD	MS/MSD
Phase I	Adult Fish	MHL3	FWB-001(LMB)-MHL3-171014	FO-001(LMB)-MHL3-171014	Ovary sample
Phase I	Adult Fish	MHL3	FWB-001(CC)-MHL3-171014	FO-001(CC)-MHL3-171014	Ovary sample
Phase I	Adult Fish	DR	FWB-001(LMB)-DR-171016	FO-001(LMB)-DR-171016	Ovary sample
Phase I	Adult Fish	DR	FWB-001(BT)-DR-171016	FO-001(BT)-DR-171016	Ovary sample
Phase I	Adult Fish	DR	FWB-001(HS)-DR-171016	FO-001(HS)-DR-171016	Ovary sample
Phase I	Surface water	CI1	SW-001(5)-CI1-171014	DUP-01-171014	Field duplicate
Phase I	Surface water	CI2	SW-001(10)-CI2-171014	DUP-02-171014	Field duplicate
Phase I	Surface water	CI3	SW-001(10)-CI3-171014	DUP-03-171014	Field duplicate
Phase I	Surface water	CI4	SW-001(25)-CI4-171212	DUP-01-171212	Field duplicate
Phase I	Surface water	CI4	SW-001(70)-CI4-171014	SW-001(70)-CI4-171014-MS SW-001(70)-CI4-171014-MSD	MS/MSD
Phase I	Surface water	CI4	SW-002(20)-CI4-171014	SW-002(20)-CI4-171014-MS SW-002(20)-CI4-171014-MSD	MS/MSD
Phase I	Surface water	HI1	SW-001(3)-HI1-171211	SW-001(3)-HI1-171211-MS SW-001(3)-HI1-171211-MSD	MS/MSD
Phase I	Sediment	CI1B	SD-001(15)-CI1B-171011	DUP-06-171011	Field duplicate
Phase I	Sediment	CI1C	SD-001(12)-CI1C-171011	DUP-05-171011	Field duplicate
Phase I	Sediment	CI2C	SD-001(13)-CI2C-171011	DUP-04-171011	Field duplicate
Phase I	Sediment	CI4A	SD-001(76)-CI4A-171102	SD-DUP-009-171102	Field duplicate
Phase I	Sediment	CI4C	SD-001(19)-CI4C-171012	SD-001(19)-CI4C-171012-MS SD-001(19)-CI4C-171012-MSD	MS/MSD
Phase I	Sediment pore water	HI1C	PW001-HQ1C-171104	PW001-DUP-171104	Field duplicate
Phase I	Sediment pore water	HI1A	PW001-HI1A-171102	PW001-HI1A-171102-MS PW001-HI1A-171102-MSD	MS/MSD
Phase I	Aquatic plants	CI4	AV-001-CI4-171005	AV-001-CI4-171005-FD	Field duplicate
Phase I	Invertebrates	CI3	AI-001-CI3-171005	AI-001-CI3-171005-FD	Field duplicate
Phase I	Invertebrates	LHL1	AI-001-LHL1-171012	AI-001-LHL1-171012-FD	Field duplicate
Phase I	Invertebrates	LHL4	AI-001-LHL4-171012	AI-001-LHL4-171012-MS AI-001-LHL4-171012-MSD	MS/MSD

Table 1-4: Parent, Field Duplicate, and MS/MSD Sample Relationships (Phase I and II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Phase	Sample Matrix	Sample Location	Parent Sample	QC / Ovary Sample ID	Type
Phase II	Adult Fish	CI	FWB001(LMB)-CI-180616	FWB001(LMB)-CI-180616	Field duplicate
Phase II	Adult Fish	LHL1	FWB001(LMB)-LHL1-180616	FWB001(LMB)-LHL1-180616	Field duplicate
Phase II	YOY Sunfish	UCI	YOY-001-UCI	YOY-001-UCIDUP	Sample duplicate
Phase II	Surface Water	CI4	SW001(70)-CI4-180616	DUP-001-180616	Field duplicate
Phase II	Surface Water	CI4	SW001(70)-CI4-180616	DUP-001-180616	Field duplicate
Phase II	Surface Water	HQ	SW001(10)-HQI-180615	SW001(10)-HQI-180615-MS	MS/MSD
Phase II	Surface Water	HQ	SW001(10)-HQI-180615	SW001(10)-HQI-180615-MSD	MS/MSD
Phase II	Surface Water	LHL-6	SW001(100)-LHL6-180617	DUP-002-180617	Field duplicate
Phase II	Surface Water	LHL-6	SW001(100)-LHL6-180617	DUP-002-180617	Field duplicate
Phase II	Sediment	CI2.2C	SD001(10)-CI2.2C-180619	DUP-003-180619	Field duplicate
Phase II	Sediment	CI3A	SD001(23)-CI3A-180620	DUP-004-180620	Field duplicate
Phase II	Sediment	CI4C	SD001(10)-CI4C-180620	SD001(10)-CI4C-180620-MS	MS/MSD
Phase II	Sediment	CI4C	SD001(10)-CI4C-180620	SD001(10)-CI4C-180620-MSD	MS/MSD
Phase II	Porewater	CIA	PW001-CIA-180719	FD001-180719	Field duplicate
Phase II	Porewater	CI3A	PW001-CI3A-180719	FD002-180720	Field duplicate
Phase II	Porewater	CI3.1A	PW001-CI3.1A-180719	FD003-180720	Field duplicate
Phase II	YOY Fish	HI	YOY-PRES-001-HI-E	YOY-PRES-001-HI-EDUP	Field duplicate
Phase II	YOY Fish	HI	YOY-PRES-001-HI-E	YOY-PRES-001-HI-EMS	MS/MSD
Phase II	YOY Fish	HI	YOY-PRES-001-HI-E	YOY-PRES-001-HI-EMSD	MS/MSD

Notes:

AI Aquatic invertebrate
AV Aquatic vegetation
BG Bluegill
BT Brown trout
CC Channel catfish
CI Curds Inlet
DR Dix River
FD Field duplicate
FF Fish fillet
FHC Flathead catfish
FWB Fish whole-body
GS Green sunfish
HQ HQ Inlet
HI Hardin Inlet
HS Hognose sucker
LHL Lower Herrington Lake
LMB Largemouth bass
MHL Middle Herrington Lake
MS/MSD Matrix spike/matrix
PW Pore water
QC Quality Control
SD Sediment
SS Spotted sucker
SW Surface water
YOY Young-of-the-Year

Table 2-1A: Phase I Adult Bluegill and Green Sunfish Analytical Results (Fillet/Remains, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	CI		CI		CI		CI		CI		CI		CI	
					Sample Date	10/04/2017		10/04/2017		10/04/2017		10/04/2017		10/04/2017		10/04/2017		10/04/2017	
					Sample Type	N		N		N		N		FD		FD		FD	
					Lab ID	K1712350		K1712350		K1712350		K1712350		K1712350		K1712350		K1712350	
					Sample ID	FF-001(BG)-CI-171004		FF-002(BG)-CI-171004		FWB-001(BG)-CI-171004		FWB-002(BG)-CI-171004		FF-001(BG)-CI-171004-FD		FF-002(BG)-CI-171004-FD		FWB-001(BG)-CI-171004-FD	
Analyte	CAS_RN	Method	BASIS	Unit		Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Lipids	LIPIDS	NOAA LIPID	Wet	%		0.57		0.46		6.7		5.4		0.44		0.37		6.3	
Solids (total)	C-008	ZFZDRY	Wet	%		20.8		21.2		33.1		33.3		21.2		21.2		33.1	
Suspended solids (total)	C-009	ZFZDRY	Wet	%															
Weight, Tissue	WTBIOT	UNKNOWN	Wet	g		75.991		100.546		133.762		176.722							
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.04	U	0.018	J	0.274		0.402		0.020	J	< 0.039	U	0.277	
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		< 0.008	U	0.004	J	0.091		0.134		0.004	J	< 0.008	U	0.092	
Arsenic	7440-38-2	SW6020	Dry	mg/kg		0.39	J	0.50	J	0.71		0.98		0.45	J	0.46	J	0.78	
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.08	J	0.11	J	0.24		0.33		0.10	J	0.10	J	0.26	
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.08	U	< 0.08	U	0.21	J	0.30	J	< 0.08	U	0.04	J	0.24	J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.017	U	< 0.017	U	0.07		0.10		< 0.017	U	0.009	J	0.08	
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.08	U	< 0.08	U	0.06	J	0.10		< 0.08	U	< 0.08	U	< 0.08	U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.017	U	< 0.017	U	0.021	J	0.034		< 0.017	U	< 0.017	U	< 0.026	U
Boron	7440-42-8	SW6020	Dry	mg/kg		0.66		2.44		2.97		6.33		0.80		2.26		3.17	
Boron	7440-42-8	SW6020	Wet	mg/kg		0.14		0.52		0.98		2.11		0.17		0.48		1.05	
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.040		0.038		0.316		0.300		0.045		0.036		0.357	
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0084		0.0080		0.105		0.100		0.0095		0.0076		0.118	
Iron	7439-89-6	SW6020	Dry	mg/kg		19.1		13.3		130		197		20.2		16.7		153	
Iron	7439-89-6	SW6020	Wet	mg/kg		3.97		2.81		43.0		65.7		4.28		3.53		50.7	
Lead	7439-92-1	SW6020	Dry	mg/kg		< 0.020	U	< 0.020	U	0.127		0.208		< 0.020	U	< 0.020	U	0.159	
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0008	J	< 0.0042	U	0.0419		0.0692		0.0017	J	0.0009	J	0.0527	
Magnesium	7439-95-4	SW6010	Dry	mg/kg		959		1200		1900		2100		1080		1090		1950	
Magnesium	7439-95-4	SW6010	Wet	mg/kg		199		254		629		700		229		231		645	
Mercury	7439-97-6	SW7471B	Dry	mg/kg		0.110		0.091		0.032		0.027		0.105		0.089		0.031	
Mercury	7439-97-6	SW7471B	Wet	mg/kg		0.0229		0.0192		0.0106		0.0091		0.0222		0.0188		0.0101	
Methyl mercury	22967-92-6	ALS SOP	Dry	ng/g		118		104		27.8		32.2		120		114		26.8	
Methyl mercury	22967-92-6	ALS SOP	Wet	ng/g		24.6		22.1		9.3		10.8		25.6		24.1		9	
Selenium	7782-49-2	SW6020	Dry	mg/kg		8.91		10.6		5.08		4.99		10.2		9.18		5.78	
Selenium	7782-49-2	SW6020	Wet	mg/kg		1.85		2.24		1.68		1.66		2.15		1.95		1.91	
Zinc	7440-66-6	SW6020	Dry	mg/kg		35.8		35.4		84.4		77.2		42.4		31.7		92.4	
Zinc	7440-66-6	SW6020	Wet	mg/kg		7.45		7.50		27.9		25.7		8.98		6.73		30.6	
Moisture Content	MOISTURE	CALCULATED	Wet	%		79.2		78.8		66.9		66.7		78.8		78.8		66.9	

Table 2-1A: Phase I Adult Bluegill and Green Sunfish Analytical Results (Fillet/Remains, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	CI		HQ		HQ		HQ		HQ		HQ		HQ	
					Sample Date	10/04/2017		10/04/2017		10/04/2017		10/04/2017		10/04/2017		10/04/2017		10/04/2017	
					Sample Type	FD		N		N		N		N		FD		FD	
					Lab ID	K1712350		K1712350		K1712350		K1712350		K1712350		K1712350		K1712350	
					Sample ID	FWB-002(BG)-CI-171004-FD		FF-001(BG)-HQ-171004		FF-002(BG)-HQ-171004		FWB-001(BG)-HQ-171004		FWB-002(BG)-HQ-171004		FF-002(BG)-HQ-171004-FD		FWB-002(BG)-HQ-171004-FD	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Lipids	LIPIDS	NOAA LIPID	Wet	%	5.9		0.37		0.25		2.4		3.2		0.36		2.7	
Solids (total)	C-008	ZFZDRY	Wet	%	34.2		20.0		20.1		30.3		30.0		20.2		29.5	
Suspended solids (total)	C-009	ZFZDRY	Wet	%														
Weight, Tissue	WTBIOT	UNKNOWN	Wet	g			27.319		30.034		55.009		55.475					
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g	0.402		0.019	J	< 0.039	U	0.182		0.161		< 0.039	U	0.133	
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g	0.137		0.004	J	< 0.008	U	0.055		0.048		< 0.008	U	0.039	
Arsenic	7440-38-2	SW6020	Dry	mg/kg	1.00		0.35	J	0.30	J	0.49	J	0.53		0.33	J	0.53	
Arsenic	7440-38-2	SW6020	Wet	mg/kg	0.34		0.07	J	0.06	J	0.15	J	0.16		0.07	J	0.16	
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g	0.32	J	< 0.08	U	< 0.08	U	0.21	J	0.17	J	< 0.08	U	0.13	J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g	0.11		< 0.016	U	< 0.016	U	0.06		0.05		< 0.016	U	0.04	
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g	0.08		< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g	0.027		< 0.016	U	< 0.016	U	< 0.024	U	< 0.024	U	< 0.016	U	< 0.023	U
Boron	7440-42-8	SW6020	Dry	mg/kg	6.52		< 0.50	U	< 0.50	U	0.97		1.47		< 0.50	U	1.50	
Boron	7440-42-8	SW6020	Wet	mg/kg	2.23		0.07	J	0.07	J	0.29		0.44		0.07	J	0.44	
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.317		0.045		0.031		0.126		0.131		0.034		0.114	
Cadmium	7440-43-9	SW6020	Wet	mg/kg	0.108		0.0091		0.0062		0.0382		0.0393		0.0069		0.0337	
Iron	7439-89-6	SW6020	Dry	mg/kg	216		17.0		25.5		106		120		11.4		126	
Iron	7439-89-6	SW6020	Wet	mg/kg	74.0		3.39		5.12		32.1		36.0		2.31		37.1	
Lead	7439-92-1	SW6020	Dry	mg/kg	0.204		< 0.020	U	< 0.020	U	0.103		0.118		< 0.020	U	0.116	
Lead	7439-92-1	SW6020	Wet	mg/kg	0.0697		< 0.0040	U	< 0.0040	U	0.0313		0.0355		< 0.0040	U	0.0343	
Magnesium	7439-95-4	SW6010	Dry	mg/kg	2110		1050		1050		2470		2430		1160		2230	
Magnesium	7439-95-4	SW6010	Wet	mg/kg	721		209		212		747		729		234		658	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.028		0.160		0.147		0.045		0.066		0.136		0.053	
Mercury	7439-97-6	SW7471B	Wet	mg/kg	0.0094		0.0319		0.0295		0.0138		0.0199		0.0274		0.0157	
Methyl mercury	22967-92-6	ALS SOP	Dry	ng/g	25.5		128		126		54.7		42.8		79.5		24.5	
Methyl mercury	22967-92-6	ALS SOP	Wet	ng/g	8.8		25.5		25.4		16.7		12.9		16.1		7.2	
Selenium	7782-49-2	SW6020	Dry	mg/kg	5.19		6.5		6.99		3.8		3.8		6.27		3.78	
Selenium	7782-49-2	SW6020	Wet	mg/kg	1.77		1.31		1.40		1.14		1.15		1.27		1.11	
Zinc	7440-66-6	SW6020	Dry	mg/kg	76.5		52.0		53.0		109		127		51.6		128	
Zinc	7440-66-6	SW6020	Wet	mg/kg	26.2		10.4		10.7		33.1		38.2		10.4		37.6	
Moisture Content	MOISTURE	CALCULATED	Wet	%	65.8		80.0		79.9		69.7		70.0		79.8		70.5	

Table 2-1A: Phase I Adult Bluegill and Green Sunfish Analytical Results (Fillet/Remains, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	LHL1		LHL1		LHL1		LHL1		LHL2		LHL2		LHL2		
				Sample Date	10/04/2017		10/04/2017		10/11/2017		10/11/2017		10/05/2017		10/05/2017		10/05/2017		
				Sample Type	N		N		N		N		N		N		N		
				Lab ID	K1712350		K1712350		K1712347		K1712347		K1712350		K1712350		K1712350		
				Sample ID	FF-002(BG)-LHL1-171004		FWB-002(BG)-LHL1-171004		FF-001(BG)-LHL1-171011		FWB-001(BG)-LHL1-171011		FF-001(BG)-LHL2-171005		FF-002(BG)-LHL2-171005		FWB-001(BG)-LHL2-171005		
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	
Lipids	LIPIDS	NOAA LIPID	Wet	%	0.26		1.7		0.35		2.7		0.34		0.22		2.8		
Solids (total)	C-008	ZFZDRY	Wet	%	20.5		31.5		20.5		29.3		20.5		19.7		30.2		
Suspended solids (total)	C-009	ZFZDRY	Wet	%															
Weight, Tissue	WTBIOT	UNKNOWN	Wet	g	54.638		111.849		62.955		140.535		52.709		39.499		94.115		
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g	< 0.039	U	0.035	J	< 0.039	U	0.030	J	< 0.039	UJ	< 0.039	UJ	0.037	J	
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g	< 0.008	U	0.011	J	< 0.008	U	0.009	J	< 0.008	U	< 0.008	U	0.011	J	
Arsenic	7440-38-2	SW6020	Dry	mg/kg	0.22	J	0.24	J	0.28	J	0.27	J	0.24	J	0.31	J	0.28	J	
Arsenic	7440-38-2	SW6020	Wet	mg/kg	0.05	J	0.07	J	0.06	J	0.08	J	0.05	J	0.062	J	0.08	J	
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g	< 0.08	U	0.05	J	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g	< 0.016	U	0.015	J	< 0.016	U	< 0.023	U	< 0.016	U	< 0.015	U	< 0.024	U	
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g	< 0.016	U	< 0.025	U	< 0.016	U	< 0.023	U	< 0.016	U	< 0.015	U	< 0.024	U	
Boron	7440-42-8	SW6020	Dry	mg/kg	< 0.50	U	1.44		0.38	J	1.97		< 0.50	U	< 0.50	U	0.80		
Boron	7440-42-8	SW6020	Wet	mg/kg	0.05	J	0.45		0.08	J	0.58		< 0.10	U	0.056	J	0.24		
Cadmium	7440-43-9	SW6020	Dry	mg/kg	< 0.020	U	0.091		0.009	J	0.077		< 0.020	U	0.036		0.071		
Cadmium	7440-43-9	SW6020	Wet	mg/kg	0.0038	J	0.0287		0.0019	J	0.0224		0.0035	J	0.0072		0.0215		
Iron	7439-89-6	SW6020	Dry	mg/kg	14.9		108		27.7		72.7		16.7		24.0		58.5		
Iron	7439-89-6	SW6020	Wet	mg/kg	3.06		34.0		5.68		21.3		3.43		4.73		17.7		
Lead	7439-92-1	SW6020	Dry	mg/kg	< 0.020	U	0.114		< 0.020	U	0.074		< 0.020	U	< 0.020	U	0.069		
Lead	7439-92-1	SW6020	Wet	mg/kg	< 0.0041	U	0.0358		0.0015	J	0.0216		0.0010	J	0.0017	J	0.0209		
Magnesium	7439-95-4	SW6010	Dry	mg/kg	1140		2720		1390		2350		1090		1060		2150		
Magnesium	7439-95-4	SW6010	Wet	mg/kg	234		858		285		689		223		210		649		
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.227		0.078		0.190		0.078		0.142		0.257		0.052		
Mercury	7439-97-6	SW7471B	Wet	mg/kg	0.0464		0.0246		0.0390		0.0228		0.0291		0.0507		0.0158		
Methyl mercury	22967-92-6	ALS SOP	Dry	ng/g	192		62.1		186		74.9		102		173		48.9		
Methyl mercury	22967-92-6	ALS SOP	Wet	ng/g	39.4		19.6		38.2		22		21		34.1		14.8		
Selenium	7782-49-2	SW6020	Dry	mg/kg	5.01		2.9		4.9		3.02		4.7		6.29		2.94		
Selenium	7782-49-2	SW6020	Wet	mg/kg	1.03		0.92		1.01		0.88		0.96		1.24		0.89		
Zinc	7440-66-6	SW6020	Dry	mg/kg	52.8		125		61.2		118		47.9		65.1		113		
Zinc	7440-66-6	SW6020	Wet	mg/kg	10.8		39.2		12.6		34.5		9.81		12.8		34.1		
Moisture Content	MOISTURE	CALCULATED	Wet	%	79.5		68.5		79.5		70.7		79.5		80.3		69.8		

Table 2-1A: Phase I Adult Bluegill and Green Sunfish Analytical Results (Fillet/Remains, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL2		LHL3		LHL3		LHL3		LHL3		LHL4		LHL4	
					Sample Date	10/05/2017		10/05/2017		10/05/2017		10/05/2017		10/05/2017		10/03/2017		10/03/2017	
					Sample Type	N		N		N		N		N		N		N	
					Lab ID	K1712350		K1712347		K1712347		K1712350		K1712350		K1712350		K1712350	
					Sample ID	FWB-002(BG)-LHL2-171005		FF-002(BG)-LHL3-171005		FWB-002(BG)-LHL3-171005		FF-001(BG)-LHL3-171005		FWB-001(BG)-LHL3-171005		FF-001(BG)-LHL4-171003		FF-002(BG)-LHL4-171003	
Analyte	CAS_RN	Method	BASIS	Unit		Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Lipids	LIPIDS	NOAA LIPID	Wet	%		0.48		2.94		1.9		0.25		2.3		0.22		0.22	
Solids (total)	C-008	ZFZDRY	Wet	%		29.3		20.3		27.7		20.6		31.6		18.1		19.8	
Suspended solids (total)	C-009	ZFZDRY	Wet	%															
Weight, Tissue	WTBIOT	UNKNOWN	Wet	g		82.822		40.79		106.128		57.784		111.453		86.674		73.36	
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		0.026	J	< 0.039	U	0.049		< 0.039	UJ	0.023	J	< 0.039	U	< 0.039	U
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		0.008	J	< 0.008	U	0.014		< 0.008	U	0.007	J	< 0.007	U	< 0.008	U
Arsenic	7440-38-2	SW6020	Dry	mg/kg		0.29	J	0.28	J	0.39	J	0.27	J	0.24	J	0.20	J	0.18	J
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.08	J	0.06	J	0.11	J	0.06	J	0.08	J	0.037	J	0.035	J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		0.05	J	< 0.08	U	0.04	J	< 0.08	U	< 0.08	U	< 0.02	U	< 0.08	U
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		0.013	J	< 0.016	U	0.012	J	< 0.016	U	< 0.025	U	< 0.014	U	< 0.016	U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.023	U	< 0.016	U	< 0.021	U	< 0.016	U	< 0.025	U	< 0.014	U	< 0.016	U
Boron	7440-42-8	SW6020	Dry	mg/kg		0.97		0.52		2.47		< 0.50	U	1.24		< 0.50	U	< 0.50	U
Boron	7440-42-8	SW6020	Wet	mg/kg		0.29		0.11		0.68		0.06	J	0.39		0.059	J	0.047	J
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.121		0.015	J	0.103		< 0.020	U	0.096		0.028		0.020	
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0355		0.0030	J	0.0284		0.0033	J	0.0303		0.0051		0.0040	
Iron	7439-89-6	SW6020	Dry	mg/kg		68.6		14.8		106		19.7		57.3		16.9		21.6	
Iron	7439-89-6	SW6020	Wet	mg/kg		20.1		3.01		29.5		4.06		18.1		3.06		4.28	
Lead	7439-92-1	SW6020	Dry	mg/kg		0.101		0.031		0.124		< 0.020	U	0.083		< 0.020	U	< 0.020	U
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0297		0.0063		0.0342		0.0039	J	0.0263		0.0012	J	0.0011	J
Magnesium	7439-95-4	SW6010	Dry	mg/kg		2730		1390		2040		1050		2400		1190		1160	
Magnesium	7439-95-4	SW6010	Wet	mg/kg		799		281		565		217		758		216		229	
Mercury	7439-97-6	SW7471B	Dry	mg/kg		0.086		0.128		0.060		0.144		0.043		0.257		0.252	
Mercury	7439-97-6	SW7471B	Wet	mg/kg		0.0252		0.0260		0.0166		0.0296		0.0135		0.0465		0.0499	
Methyl mercury	22967-92-6	ALS SOP	Dry	ng/g		74		125		57.9		110		38.6		131		236	
Methyl mercury	22967-92-6	ALS SOP	Wet	ng/g		21.7		25.3		16.1		22.7		12.2		23.7		46.7	
Selenium	7782-49-2	SW6020	Dry	mg/kg		3.61		5.82		3.86		4.9		3.5		6.2		5.75	
Selenium	7782-49-2	SW6020	Wet	mg/kg		1.06		1.18		1.07		1.02		1.11		1.13		1.14	
Zinc	7440-66-6	SW6020	Dry	mg/kg		143		54.3		117		44.9		102		55.7		56.2	
Zinc	7440-66-6	SW6020	Wet	mg/kg		42.0		11.0		32.5		9.25		32.1		10.1		11.1	
Moisture Content	MOISTURE	CALCULATED	Wet	%		70.7		79.7		72.3		79.4		68.4		81.9		80.2	

Table 2-1A: Phase I Adult Bluegill and Green Sunfish Analytical Results (Fillet/Remains, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL4		LHL4		LHL5		LHL5		LHL5		LHL5		LHL6	
					Sample Date	10/03/2017		10/03/2017		10/11/2017		10/11/2017		10/11/2017		10/11/2017		10/11/2017	
					Sample Type	N		N		N		N		N		N		N	
					Lab ID	K1712350		K1712350		K1712347		K1712347		K1712347		K1712347		K1712347	
					Sample ID	FWB-001(BG)-LHL4-171003		FWB-002(BG)-LHL4-171003		FF-001(BG)-LHL5-171011		FF-002(BG)-LHL5-171011		FWB-001(BG)-LHL5-171011		FWB-002(BG)-LHL5-171011		FF-001(BG)-LHL6-171011	
Analyte	CAS_RN	Method	BASIS	Unit		Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Lipids	LIPIDS	NOAA LIPID	Wet	%		1.1		2.1		0.27		0.25		1.2		1.2		0.24	
Solids (total)	C-008	ZFZDRY	Wet	%		31.1		31.8		20.5		20.1		27.8		27.9		19.6	
Suspended solids (total)	C-009	ZFZDRY	Wet	%															
Weight, Tissue	WTBIOT	UNKNOWN	Wet	g		198.26		142.351		82.303		66.205		179.861		138.936		74.48	
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		0.019	J	0.028	J	< 0.04	U	< 0.039	UJ	0.021	J	0.019	J	< 0.04	U
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		0.006	J	0.009	J	< 0.008	U	< 0.008	U	0.006	J	0.005	J	< 0.008	U
Arsenic	7440-38-2	SW6020	Dry	mg/kg		0.13	J	0.16	J	0.25	J	0.29	J	0.21	J	0.21	J	0.25	J
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.04	J	0.05	J	0.05	J	0.06	J	0.06	J	0.06	J	0.049	J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.025	U	< 0.025	U	< 0.016	U	< 0.016	U	< 0.022	U	< 0.022	U	< 0.015	U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.025	U	< 0.025	U	< 0.016	U	< 0.016	U	< 0.022	U	< 0.022	U	< 0.015	U
Boron	7440-42-8	SW6020	Dry	mg/kg		1.62		0.96		0.21	J	0.28	J	0.95		1.12		0.35	J
Boron	7440-42-8	SW6020	Wet	mg/kg		0.50		0.30		0.04	J	0.06	J	0.26		0.31		0.068	J
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.094		0.103		0.008	J	0.010	J	0.079		0.066		0.007	J
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0292		0.0327		0.0016	J	0.0019	J	0.0220		0.0185		0.0013	J
Iron	7439-89-6	SW6020	Dry	mg/kg		56.8		61.8		15.7		18.7		77.0		65.5		18.2	
Iron	7439-89-6	SW6020	Wet	mg/kg		17.7		19.7		3.22		3.76		21.4		18.3		3.58	
Lead	7439-92-1	SW6020	Dry	mg/kg		0.074		0.062		< 0.020	U	< 0.020	U	0.096		0.069		< 0.020	U
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0230		0.0198		0.0018	J	0.0020	J	0.0267		0.0193		0.0024	J
Magnesium	7439-95-4	SW6010	Dry	mg/kg		2770		2580		1300		1360		2310		2450		1320	
Magnesium	7439-95-4	SW6010	Wet	mg/kg		860		822		267		273		643		683		258	
Mercury	7439-97-6	SW7471B	Dry	mg/kg		0.073		0.068		0.130		0.182		0.044		0.076		0.199	
Mercury	7439-97-6	SW7471B	Wet	mg/kg		0.0228		0.0218		0.0267		0.0366		0.0121		0.0212		0.0390	
Methyl mercury	22967-92-6	ALS SOP	Dry	ng/g		91		66.2		150		187		54.8		69.2		213	
Methyl mercury	22967-92-6	ALS SOP	Wet	ng/g		28.4		21.2		30.7		37.5		15.3		19.3		41.8	
Selenium	7782-49-2	SW6020	Dry	mg/kg		3.6		3.27		4.7		4.36		2.97		2.8		4.9	
Selenium	7782-49-2	SW6020	Wet	mg/kg		1.11		1.04		0.95		0.88		0.83		0.79		0.96	
Zinc	7440-66-6	SW6020	Dry	mg/kg		112		127		67.5		63.0		117		129		57.7	
Zinc	7440-66-6	SW6020	Wet	mg/kg		35.0		40.2		13.8		12.7		32.6		35.9		11.3	
Moisture Content	MOISTURE	CALCULATED	Wet	%		68.9		68.2		79.5		79.9		72.2		72.1		80.4	

Table 2-1A: Phase I Adult Bluegill and Green Sunfish Analytical Results (Fillet/Remains, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location		LHL6		LHL6		LHL6		MHL1		MHL1		MHL1		MHL1	
					Sample Date		10/11/2017		10/11/2017		10/11/2017		10/15/2017		10/15/2017		10/15/2017		10/15/2017	
					Sample Type		N		N		N		N		N		N		N	
					Lab ID		K1712347		K1712347		K1712347		K1712347		K1712347		K1712347		K1712347	
					Sample ID		FF-002(BG)-LHL6-171011		FWB-001(BG)-LHL6-171011		FWB-002(BG)-LHL6-171011		FF-001(BG)-MHL1-171015		FF-002(BG)-MHL1-171015		FWB-001(BG)-MHL1-171015		FWB-002(BG)-MHL1-171015	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Lipids	LIPIDS	NOAA LIPID	Wet	%	0.26		1.4		1.1		0.39		0.52		1.9		2.3	
Solids (total)	C-008	ZFZDRY	Wet	%	19.2		29.4		28.0		19.4		30.0		29.3		19.9	
Suspended solids (total)	C-009	ZFZDRY	Wet	%														
Weight, Tissue	WTBIOT	UNKNOWN	Wet	g	56.032		172.005		114.202		90.76		72.553		159.868		116.935	
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g	< 0.039	U	< 0.04	U	0.016	J	< 0.039	U	< 0.04	U	< 0.04	U	0.020	J
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g	< 0.008	U	< 0.012	U	0.005	J	< 0.008	U	< 0.012	U	< 0.012	U	0.004	J
Arsenic	7440-38-2	SW6020	Dry	mg/kg	0.26	J	0.21	J	0.22	J	0.20	J	0.22	J	0.18	J	0.25	J
Arsenic	7440-38-2	SW6020	Wet	mg/kg	0.050	J	0.06	J	0.06	J	0.038	J	0.06	J	0.05	J	0.05	J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g	< 0.015	U	< 0.023	U	< 0.022	U	< 0.015	U	< 0.024	U	< 0.023	U	< 0.016	U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g	< 0.015	U	< 0.023	U	< 0.022	U	< 0.015	U	< 0.024	U	< 0.023	U	< 0.016	U
Boron	7440-42-8	SW6020	Dry	mg/kg	< 0.50	U	0.80		0.81		0.31	J	0.28	J	0.40	J	1.40	
Boron	7440-42-8	SW6020	Wet	mg/kg	< 0.096	U	0.24		0.23		0.061	J	0.08	J	0.12	J	0.28	
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.008	J	0.049		0.052		0.005	J	0.009	J	0.020	J	0.019	J
Cadmium	7440-43-9	SW6020	Wet	mg/kg	0.0015	J	0.0145		0.0146		0.0009	J	0.0026	J	0.0057	J	0.0039	J
Iron	7439-89-6	SW6020	Dry	mg/kg	18.9		61.4		61.2		18.2		24.6		60.4		86.9	
Iron	7439-89-6	SW6020	Wet	mg/kg	3.63		18.1		17.1		3.53		7.38		17.7		17.3	
Lead	7439-92-1	SW6020	Dry	mg/kg	< 0.020	U	0.060		0.069		< 0.020	U	< 0.020	U	0.084		0.122	
Lead	7439-92-1	SW6020	Wet	mg/kg	0.0019	J	0.0177		0.0192		0.0019	J	0.0032	J	0.0245		0.0243	
Magnesium	7439-95-4	SW6010	Dry	mg/kg	1380		2520		2600		1230		1170		2510		2330	
Magnesium	7439-95-4	SW6010	Wet	mg/kg	264		742		729		238		350		734		463	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.194		0.065		0.067		0.246		0.161		0.076		0.051	
Mercury	7439-97-6	SW7471B	Wet	mg/kg	0.0372		0.0191		0.0187		0.0477		0.0484		0.0223		0.0102	
Methyl mercury	22967-92-6	ALS SOP	Dry	ng/g	183		66.9		69.1		192		169		87.1		65.8	
Methyl mercury	22967-92-6	ALS SOP	Wet	ng/g	35.1		19.7		19.4		37.2		50.9		25.6		13.1	
Selenium	7782-49-2	SW6020	Dry	mg/kg	4.20		3.08		2.46		2.0		1.7		1.31		1.31	
Selenium	7782-49-2	SW6020	Wet	mg/kg	0.81		0.91		0.69		0.38		0.50		0.38		0.26	
Zinc	7440-66-6	SW6020	Dry	mg/kg	63.2		109		134		50.6		48.5		120		125	
Zinc	7440-66-6	SW6020	Wet	mg/kg	12.1		32.0		37.4		9.82		14.5		35.1		24.9	
Moisture Content	MOISTURE	CALCULATED	Wet	%	80.8		70.6		72.0		80.6		70.0		70.7		80.1	

Table 2-1A: Phase I Adult Bluegill and Green Sunfish Analytical Results (Fillet/Remains, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	MHL3		MHL3		MHL3		MHL3		DR	
					Sample Date	10/14/2017		10/14/2017		10/14/2017		10/14/2017		10/14/2017	
					Sample Type	N		N		N		N		N	
					Lab ID	K1712347		K1712347		K1712347		K1712347		K1712347	
					Sample ID	FF-001(BG)-MHL3-171014		FF-002(BG)-MHL3-171014		FWB-001(BG)-MHL3-171014		FWB-002(BG)-MHL3-171014		FF-001(GS)-DR-171014	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Lipids	LIPIDS	NOAA LIPID	Wet	%	0.37		0.36		2.5		3.1		0.27	
Solids (total)	C-008	ZFZDRY	Wet	%	20.6		19.9		30.5		30.4		20.4	
Suspended solids (total)	C-009	ZFZDRY	Wet	%										
Weight, Tissue	WTBIOT	UNKNOWN	Wet	g	57.978		67.606		102.558		103.568		42.336	
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g	< 0.039	U	< 0.039	UJ	0.019	J	0.046		< 0.04	U
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g	< 0.008	U	< 0.008	U	0.006	J	0.014		< 0.008	U
Arsenic	7440-38-2	SW6020	Dry	mg/kg	0.19	J	0.22	J	0.18	J	0.27	J	0.16	J
Arsenic	7440-38-2	SW6020	Wet	mg/kg	0.04	J	0.04	J	0.05	J	0.08	J	0.03	J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g	< 0.08	U	< 0.08	U	< 0.08	U	0.04	J	< 0.08	U
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g	< 0.016	U	< 0.015	U	< 0.024	U	0.013	J	< 0.016	U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g	< 0.016	U	< 0.015	U	< 0.024	U	< 0.024	U	< 0.016	U
Boron	7440-42-8	SW6020	Dry	mg/kg	< 0.50	U	< 0.50	U	0.39	J	1.22		< 0.50	U
Boron	7440-42-8	SW6020	Wet	mg/kg	< 0.10	U	< 0.100	U	0.12	J	0.37		< 0.10	U
Cadmium	7440-43-9	SW6020	Dry	mg/kg	< 0.020	U	< 0.020	U	0.028		0.022		0.007	J
Cadmium	7440-43-9	SW6020	Wet	mg/kg	< 0.0041	U	< 0.0040	U	0.0085		0.0067		0.0014	J
Iron	7439-89-6	SW6020	Dry	mg/kg	13.9		13.5		56.6	J	125		21.6	
Iron	7439-89-6	SW6020	Wet	mg/kg	2.87		2.70		17.3		37.9		4.40	
Lead	7439-92-1	SW6020	Dry	mg/kg	< 0.020	U	< 0.020	U	0.277		0.160		< 0.020	U
Lead	7439-92-1	SW6020	Wet	mg/kg	0.0014	J	0.0008	J	0.0845		0.0487		0.0014	J
Magnesium	7439-95-4	SW6010	Dry	mg/kg	1310		1250		2240		2240		1160	
Magnesium	7439-95-4	SW6010	Wet	mg/kg	270		250		683		681		236	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.130		0.163		0.056		0.056		0.437	
Mercury	7439-97-6	SW7471B	Wet	mg/kg	0.0267		0.0324		0.0171		0.0170		0.0891	
Methyl mercury	22967-92-6	ALS SOP	Dry	ng/g	150		156		57.3		62.4		375	
Methyl mercury	22967-92-6	ALS SOP	Wet	ng/g	31		31		17.5		19.1		76.5	
Selenium	7782-49-2	SW6020	Dry	mg/kg	1.01		1.09		0.70	J	0.9	J	3.32	
Selenium	7782-49-2	SW6020	Wet	mg/kg	0.21		0.22		0.21	J	0.26	J	0.68	
Zinc	7440-66-6	SW6020	Dry	mg/kg	42.9		50.0		100		122		45.1	
Zinc	7440-66-6	SW6020	Wet	mg/kg	8.84		9.96		30.6		37.1		9.21	
Moisture Content	MOISTURE	CALCULATED	Wet	%	79.4		80.1		69.5		69.6		79.6	

Table 2-1A: Phase I Adult Bluegill and Green Sunfish Analytical Results (Fillet/Remains, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	DR		DR		DR		DR		DR	
					Sample Date	10/14/2017		10/16/2017		10/16/2017		10/16/2017		10/16/2017	
					Sample Type	N		N		N		N		N	
					Lab ID	K1712347		K1712347		K1712347		K1712347		K1712347	
					Sample ID	FWB-001(GS)-DR-171014		FF-001(BG)-DR-171016		FF-002(GS)-DR-171016		FWB-001(BG)-DR-171016		FWB-002(GS)-DR-171016	
Analyte	CAS_RN	Method	BASIS	Unit		Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Lipids	LIPIDS	NOAA LIPID	Wet	%		1.5		1.1		0.55		2.9		3.0	
Solids (total)	C-008	ZFZDRY	Wet	%		27.4		19.8		20.3		28.4		27.4	
Suspended solids (total)	C-009	ZFZDRY	Wet	%											
Weight, Tissue	WTBIOT	UNKNOWN	Wet	g		90.47		18.333		15.858		33.035		36.917	
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.039	U	< 0.04	U	< 0.039	U	0.040		0.035	J
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		< 0.011	U	< 0.008	U	< 0.008	U	0.012		0.010	J
Arsenic	7440-38-2	SW6020	Dry	mg/kg		0.18	J	0.09	J	0.37	J	0.13	J	0.39	J
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.05	J	0.018	J	0.07	J	0.04	J	0.11	J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U	< 0.08	U
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.022	U	< 0.016	U	< 0.016	U	< 0.022	U	< 0.022	U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.08	U	< 0.08	U	< 0.08	U	0.04	J	< 0.08	U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.022	U	< 0.016	U	< 0.016	U	0.012	J	< 0.022	U
Boron	7440-42-8	SW6020	Dry	mg/kg		0.29	J	< 0.50	U	< 0.50	U	< 0.50	U	< 0.50	U
Boron	7440-42-8	SW6020	Wet	mg/kg		0.08	J	< 0.099	U	< 0.10	U	< 0.14	U	< 0.14	U
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.042		0.007	J	0.020	J	0.023		0.051	
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0115		0.0014	J	0.0040	J	0.0066		0.0139	
Iron	7439-89-6	SW6020	Dry	mg/kg		82.2		19.4		21.6		76.4		138	
Iron	7439-89-6	SW6020	Wet	mg/kg		22.5		3.83		4.38		21.7		37.9	
Lead	7439-92-1	SW6020	Dry	mg/kg		0.072		0.008	J	0.011	J	0.072		0.104	
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0196		0.0016	J	0.0022	J	0.0203		0.0285	
Magnesium	7439-95-4	SW6010	Dry	mg/kg		2020		1100		1020		1980		1870	
Magnesium	7439-95-4	SW6010	Wet	mg/kg		553		217		208		561		513	
Mercury	7439-97-6	SW7471B	Dry	mg/kg		0.176		0.182		0.394		0.090		0.162	
Mercury	7439-97-6	SW7471B	Wet	mg/kg		0.0482		0.0359		0.0800		0.0255		0.0443	
Methyl mercury	22967-92-6	ALS SOP	Dry	ng/g		187		253		334		93.8		162	
Methyl mercury	22967-92-6	ALS SOP	Wet	ng/g		51.2		50.1		67.9		26.7		44.5	
Selenium	7782-49-2	SW6020	Dry	mg/kg		2.4		2.4		3.87		1.8		3.00	
Selenium	7782-49-2	SW6020	Wet	mg/kg		0.66		0.48		0.79		0.52		0.82	
Zinc	7440-66-6	SW6020	Dry	mg/kg		99.7		48.3		55.2		104		127	
Zinc	7440-66-6	SW6020	Wet	mg/kg		27.3		9.57		11.2		29.5		34.9	
Moisture Content	MOISTURE	CALCULATED	Wet	%		72.6		80.2		79.7		71.6		72.6	

Notes:

%: Percent
CI: Curd's Inlet
DR: Dix River
FD: Field Duplicate Sample
g: grams
HQ: HQ Inlet
IQ: Interpreted qualifier, data flags from third party validation
J: Concentration is greater than method detection limit but less than lab reporting limit
LHL: Lower Herrington Lake
mg/kg: milligrams per kilogram
MHL: Middle Herrington Lake
N: Normal Sample
ng/g: nanograms per gram
U: Constituent was analyzed for, but not detected
ug/g: micrograms per gram

Table 2-1B: Phase I Adult Bluegill and Green Sunfish Calculated Whole-Body Results (Dry Weight Selenium)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Location	Fish ID	Portion	Weight of Portion	Total Weight of Fish (Fillet + Carcass)	Selenium	
					Portion mg/kg dw	Calculated whole fish mg/kg dw
CI	BG-1	1-Fillet	76.0	209.8	8.91	6.5
		3-Carcass	133.8		5.08	
	BG-1 Dup	1-Fillet	76.0	209.8	10.2	7.4
		3-Carcass	133.8		5.78	
	BG-2	1-Fillet	100.5	277.3	10.6	7.0
		3-Carcass	176.7		4.99	
	BG-2 Dup	1-Fillet	100.5	277.3	9.18	6.6
		3-Carcass	176.7		5.19	
HQ	BG-1	1-Fillet	27.3	82.3	6.5	4.7
		3-Carcass	55.0		3.8	
	BG-2	1-Fillet	30.0	85.5	6.99	4.9
		3-Carcass	55.5		3.8	
	BG-2 Dup	1-Fillet	30.0	85.5	6.27	4.7
		3-Carcass	55.5		3.78	
LHL1	BG-1	1-Fillet	63.0	203.5	4.9	3.6
		3-Carcass	140.5		3.02	
	BG-2	1-Fillet	54.6	166.5	5.01	3.6
		3-Carcass	111.8		2.9	
LHL2	BG-1	1-Fillet	52.7	146.8	4.7	3.6
		3-Carcass	94.1		2.94	
	BG-2	1-Fillet	39.5	122.3	6.29	4.5
		3-Carcass	82.8		3.61	
LHL3	BG-1	1-Fillet	57.8	169.2	4.9	4.0
		3-Carcass	111.5		3.5	
	BG-2	1-Fillet	40.8	146.9	5.82	4.4
		3-Carcass	106.1		3.86	
LHL4	BG-1	1-Fillet	86.7	284.9	6.2	4.4
		3-Carcass	198.3		3.6	
	BG-2	1-Fillet	73.4	215.7	5.75	4.1
		3-Carcass	142.4		3.27	
LHL5	BG-1	1-Fillet	82.3	262.2	4.7	3.5
		3-Carcass	179.9		2.97	
	BG-2	1-Fillet	66.2	205.1	4.36	3.3
		3-Carcass	138.9		2.8	
LHL6	BG-1	1-Fillet	74.5	246.5	4.9	3.6
		3-Carcass	172.0		3.08	
	BG-2	1-Fillet	56.0	170.2	4.2	3.0
		3-Carcass	114.2		2.46	
MHL1	BG-1	1-Fillet	90.8	250.6	2	1.6
		3-Carcass	159.9		1.31	
	BG-2	1-Fillet	72.6	189.5	1.7	1.5
		3-Carcass	116.9		1.31	
MHL3	BG-1	1-Fillet	58.0	160.5	1.01	0.8
		3-Carcass	102.6		0.7	
	BG-2	1-Fillet	67.6	171.2	1.09	1.0
		3-Carcass	103.6		0.9	
DR	BG-1	1-Fillet	18.3	51.4	2.4	2.0
		3-Carcass	33.0		1.8	
	GS-1	1-Fillet	42.3	132.8	3.32	2.7
		3-Carcass	90.5		2.4	
	GS-2	1-Fillet	15.9	52.8	3.87	3.3
		3-Carcass	36.9		3	

Notes:

BG: Bluegill
CI: Curd's Inlet
DR: Dix River
dw: Dry Weight
Dup: Duplicate Sample
GS: Green Sunfish
HQ: HQ Inlet
LHL: Lower Herrington Lake
mg/kg: millligrams per kilogram
MHL: Middle Herrington Lake

Table 2-1C: Phase I Adult Bluegill and Green Sunfish Calculated Whole-Body Results (Wet-weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Arsenic EPA 1632A		Arsenic III		Arsenic SW6020	
Location	Fish ID	Portion	Weight of Portion	Total Weight of Fish (Fillet + Carcass)	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww
CI	BG-1	1-Fillet	76.0	209.8	0	0.058	0	0.045	0.08	0.18
		3-Carcass	133.8		0.091		0.07		0.24	
	BG-1 Dup	1-Fillet	76.0	209.8	0.004	0.06	0	0.051	0.1	0.2
		3-Carcass	133.8		0.092		0.08		0.26	
	BG-2	1-Fillet	100.5	277.3	0.004	0.087	0	0.064	0.11	0.25
		3-Carcass	176.7		0.134		0.1		0.33	
	BG-2 Dup	1-Fillet	100.5	277.3	0	0.087	0.009	0.073	0.1	0.25
		3-Carcass	176.7		0.137		0.11		0.34	
HQ	BG-1	1-Fillet	27.3	82.3	0.004	0.038	0	0.04	0.07	0.12
		3-Carcass	55.0		0.055		0.06		0.15	
	BG-2	1-Fillet	30.0	85.5	0	0.031	0	0.032	0.06	0.12
		3-Carcass	55.5		0.048		0.05		0.16	
	BG-2 Dup	1-Fillet	30.0	85.5	0	0.025	0	0.026	0.07	0.13
		3-Carcass	55.5		0.039		0.04		0.16	
LHL1	BG-1	1-Fillet	63.0	203.5	0	0.0062	0	0	0.06	0.074
		3-Carcass	140.5		0.009		0		0.08	
	BG-2	1-Fillet	54.6	166.5	0	0.0074	0	0.01	0.05	0.063
		3-Carcass	111.8		0.011		0.015		0.07	
LHL2	BG-1	1-Fillet	52.7	146.8	0	0.0071	0	0	0.05	0.069
		3-Carcass	94.1		0.011		0		0.08	
	BG-2	1-Fillet	39.5	122.3	0	0.0054	0	0.0088	0.062	0.074
		3-Carcass	82.8		0.008		0.013		0.08	
LHL3	BG-1	1-Fillet	57.8	169.2	0	0.0046	0	0	0.06	0.073
		3-Carcass	111.5		0.007		0		0.08	
	BG-2	1-Fillet	40.8	146.9	0	0.01	0	0.0087	0.06	0.096
		3-Carcass	106.1		0.014		0.012		0.11	
LHL4	BG-1	1-Fillet	86.7	284.9	0	0.0042	0	0	0.037	0.039
		3-Carcass	198.3		0.006		0		0.04	
	BG-2	1-Fillet	73.4	215.7	0	0.0059	0	0	0.035	0.045
		3-Carcass	142.4		0.009		0		0.05	
LHL5	BG-1	1-Fillet	82.3	262.2	0	0.0041	0	0	0.05	0.057
		3-Carcass	179.9		0.006		0		0.06	
	BG-2	1-Fillet	66.2	205.1	0	0.0034	0	0	0.06	0.06
		3-Carcass	138.9		0.005		0		0.06	
LHL6	BG-1	1-Fillet	74.5	246.5	0	0	0	0	0.049	0.057
		3-Carcass	172.0		0		0		0.06	
	BG-2	1-Fillet	56.0	170.2	0	0.0034	0	0	0.05	0.057
		3-Carcass	114.2		0.005		0		0.06	
MHL1	BG-1	1-Fillet	90.8	250.6	0	0	0	0	0.038	0.046
		3-Carcass	159.9		0		0		0.05	
	BG-2	1-Fillet	72.6	189.5	0	0.0025	0	0	0.06	0.054
		3-Carcass	116.9		0.004		0		0.05	
MHL3	BG-1	1-Fillet	58.0	160.5	0	0.0038	0	0	0.04	0.046
		3-Carcass	102.6		0.006		0		0.05	
	BG-2	1-Fillet	67.6	171.2	0	0.0085	0	0.0079	0.04	0.064
		3-Carcass	103.6		0.014		0.013		0.08	
DR	BG-1	1-Fillet	18.3	51.4	0	0.0077	0	0	0.018	0.032
		3-Carcass	33.0		0.012		0		0.04	
	GS-1	1-Fillet	42.3	132.8	0	0	0	0	0.03	0.044
		3-Carcass	90.5		0		0		0.05	
	GS-2	1-Fillet	15.9	52.8	0	0.007	0	0	0.07	0.098
		3-Carcass	36.9		0.01		0		0.11	

Table 2-1C: Phase I Adult Bluegill and Green Sunfish Calculated Whole-Body Results (Wet-weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Arsenic V		Boron		Cadmium	
Location	Fish ID	Portion	Weight of Portion	Total Weight of Fish (Fillet + Carcass)	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww
CI	BG-1	1-Fillet	76.0	209.8	0	0.013	0.14	0.68	0.0084	0.07
		3-Carcass	133.8		0.021		0.98		0.105	
	BG-1 Dup	1-Fillet	76.0	209.8	0	0	0.17	0.73	0.0095	0.079
		3-Carcass	133.8		0		1.05		0.118	
	BG-2	1-Fillet	100.5	277.3	0	0.022	0.52	1.5	0.008	0.067
		3-Carcass	176.7		0.034		2.11		0.1	
	BG-2 Dup	1-Fillet	100.5	277.3	0	0.017	0.48	1.6	0.0076	0.072
		3-Carcass	176.7		0.027		2.23		0.108	
HQ	BG-1	1-Fillet	27.3	82.3	0	0	0.07	0.22	0.0091	0.029
		3-Carcass	55.0		0		0.29		0.0382	
	BG-2	1-Fillet	30.0	85.5	0	0	0.07	0.31	0.0062	0.028
		3-Carcass	55.5		0		0.44		0.0393	
	BG-2 Dup	1-Fillet	30.0	85.5	0	0	0.07	0.31	0.0069	0.024
		3-Carcass	55.5		0		0.44		0.0337	
LHL1	BG-1	1-Fillet	63.0	203.5	0	0	0.08	0.43	0.0019	0.016
		3-Carcass	140.5		0		0.58		0.0224	
	BG-2	1-Fillet	54.6	166.5	0	0	0.05	0.32	0.0038	0.021
		3-Carcass	111.8		0		0.45		0.0287	
LHL2	BG-1	1-Fillet	52.7	146.8	0	0	0	0.15	0.0035	0.015
		3-Carcass	94.1		0		0.24		0.0215	
	BG-2	1-Fillet	39.5	122.3	0	0	0.056	0.21	0.0072	0.026
		3-Carcass	82.8		0		0.29		0.0355	
LHL3	BG-1	1-Fillet	57.8	169.2	0	0	0.06	0.28	0.0033	0.021
		3-Carcass	111.5		0		0.39		0.0303	
	BG-2	1-Fillet	40.8	146.9	0	0	0.11	0.52	0.003	0.021
		3-Carcass	106.1		0		0.68		0.0284	
LHL4	BG-1	1-Fillet	86.7	284.9	0	0	0.059	0.37	0.0051	0.022
		3-Carcass	198.3		0		0.5		0.0292	
	BG-2	1-Fillet	73.4	215.7	0	0	0.047	0.21	0.004	0.023
		3-Carcass	142.4		0		0.3		0.0327	
LHL5	BG-1	1-Fillet	82.3	262.2	0	0	0.04	0.19	0.0016	0.016
		3-Carcass	179.9		0		0.26		0.022	
	BG-2	1-Fillet	66.2	205.1	0	0	0.06	0.23	0.0019	0.013
		3-Carcass	138.9		0		0.31		0.0185	
LHL6	BG-1	1-Fillet	74.5	246.5	0	0	0.068	0.19	0.0013	0.011
		3-Carcass	172.0		0		0.24		0.0145	
	BG-2	1-Fillet	56.0	170.2	0	0	0	0.15	0.0015	0.01
		3-Carcass	114.2		0		0.23		0.0146	
MHL1	BG-1	1-Fillet	90.8	250.6	0	0	0.061	0.099	0.0009	0.004
		3-Carcass	159.9		0		0.12		0.0057	
	BG-2	1-Fillet	72.6	189.5	0	0	0.08	0.2	0.0026	0.0034
		3-Carcass	116.9		0		0.28		0.0039	
MHL3	BG-1	1-Fillet	58.0	160.5	0	0	0	0.077	0	0.0054
		3-Carcass	102.6		0		0.12		0.0085	
	BG-2	1-Fillet	67.6	171.2	0	0	0	0.22	0	0.0041
		3-Carcass	103.6		0		0.37		0.0067	
DR	BG-1	1-Fillet	18.3	51.4	0	0.0077	0	0	0.0014	0.0047
		3-Carcass	33.0		0.012		0		0.0066	
	GS-1	1-Fillet	42.3	132.8	0	0	0	0.054	0.0014	0.0083
		3-Carcass	90.5		0		0.08		0.0115	
	GS-2	1-Fillet	15.9	52.8	0	0	0	0	0.004	0.011
		3-Carcass	36.9		0		0		0.0139	

Table 2-1C: Phase I Adult Bluegill and Green Sunfish Calculated Whole-Body Results (Wet-weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Iron		Lead		Magnesium	
Location	Fish ID	Portion	Weight of Portion	Total Weight of Fish (Fillet + Carcass)	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww
CI	BG-1	1-Fillet	76.0	209.8	3.97	29	0.0008	0.027	199	470
		3-Carcass	133.8		43		0.0419		629	
	BG-1 Dup	1-Fillet	76.0	209.8	4.28	34	0.0017	0.034	229	490
		3-Carcass	133.8		50.7		0.0527		645	
	BG-2	1-Fillet	100.5	277.3	2.81	43	0	0.044	254	540
		3-Carcass	176.7		65.7		0.0692		700	
	BG-2 Dup	1-Fillet	100.5	277.3	3.53	48	0.0009	0.045	231	540
		3-Carcass	176.7		74		0.0697		721	
HQ	BG-1	1-Fillet	27.3	82.3	3.39	23	0	0.021	209	570
		3-Carcass	55.0		32.1		0.0313		747	
	BG-2	1-Fillet	30.0	85.5	5.12	25	0	0.023	212	550
		3-Carcass	55.5		36		0.0355		729	
	BG-2 Dup	1-Fillet	30.0	85.5	2.31	25	0	0.022	234	510
		3-Carcass	55.5		37.1		0.0343		658	
LHL1	BG-1	1-Fillet	63.0	203.5	5.68	16	0.0015	0.015	285	560
		3-Carcass	140.5		21.3		0.0216		689	
	BG-2	1-Fillet	54.6	166.5	3.06	24	0	0.024	234	650
		3-Carcass	111.8		34		0.0358		858	
LHL2	BG-1	1-Fillet	52.7	146.8	3.43	13	0.001	0.014	223	500
		3-Carcass	94.1		17.7		0.0209		649	
	BG-2	1-Fillet	39.5	122.3	4.73	15	0.0017	0.021	210	610
		3-Carcass	82.8		20.1		0.0297		799	
LHL3	BG-1	1-Fillet	57.8	169.2	4.06	13	0.0039	0.019	217	570
		3-Carcass	111.5		18.1		0.0263		758	
	BG-2	1-Fillet	40.8	146.9	3.01	22	0.0063	0.026	281	490
		3-Carcass	106.1		29.5		0.0342		565	
LHL4	BG-1	1-Fillet	86.7	284.9	3.06	13	0.0012	0.016	216	660
		3-Carcass	198.3		17.7		0.023		860	
	BG-2	1-Fillet	73.4	215.7	4.28	14	0.0011	0.013	229	620
		3-Carcass	142.4		19.7		0.0198		822	
LHL5	BG-1	1-Fillet	82.3	262.2	3.22	16	0.0018	0.019	267	520
		3-Carcass	179.9		21.4		0.0267		643	
	BG-2	1-Fillet	66.2	205.1	3.76	14	0.002	0.014	273	550
		3-Carcass	138.9		18.3		0.0193		683	
LHL6	BG-1	1-Fillet	74.5	246.5	3.58	14	0.0024	0.013	258	600
		3-Carcass	172.0		18.1		0.0177		742	
	BG-2	1-Fillet	56.0	170.2	3.63	13	0.0019	0.014	264	580
		3-Carcass	114.2		17.1		0.0192		729	
MHL1	BG-1	1-Fillet	90.8	250.6	3.53	13	0.0019	0.016	238	550
		3-Carcass	159.9		17.7		0.0245		734	
	BG-2	1-Fillet	72.6	189.5	7.38	14	0.0032	0.016	350	420
		3-Carcass	116.9		17.3		0.0243		463	
MHL3	BG-1	1-Fillet	58.0	160.5	2.87	12	0.0014	0.054	270	530
		3-Carcass	102.6		17.3		0.0845		683	
	BG-2	1-Fillet	67.6	171.2	2.7	24	0.0008	0.03	250	510
		3-Carcass	103.6		37.9		0.0487		681	
DR	BG-1	1-Fillet	18.3	51.4	3.83	15	0.0016	0.014	217	440
		3-Carcass	33.0		21.7		0.0203		561	
	GS-1	1-Fillet	42.3	132.8	4.4	17	0.0014	0.014	236	450
		3-Carcass	90.5		22.5		0.0196		553	
	GS-2	1-Fillet	15.9	52.8	4.38	28	0.0022	0.021	208	420
		3-Carcass	36.9		37.9		0.0285		513	

Table 2-1C: Phase I Adult Bluegill and Green Sunfish Calculated Whole-Body Results (Wet-weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Mercury		Methyl mercury		Selenium	
Location	Fish ID	Portion	Weight of Portion	Total Weight of Fish (Fillet + Carcass)	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion ug/kg	Calculated whole fish ug/kg	Portion mg/kg ww	Calculated whole fish mg/kg ww
CI	BG-1	1-Fillet	76.0	209.8	0.0229	0.015	0.0246	0.015	1.85	1.7
		3-Carcass	133.8		0.0106		0.0093		1.68	
	BG-1 Dup	1-Fillet	76.0	209.8	0.0222	0.014	0.0256	0.015	2.15	2
		3-Carcass	133.8		0.0101		0.009		1.91	
	BG-2	1-Fillet	100.5	277.3	0.0192	0.013	0.0221	0.015	2.24	1.9
		3-Carcass	176.7		0.0091		0.0108		1.66	
	BG-2 Dup	1-Fillet	100.5	277.3	0.0188	0.013	0.0241	0.014	1.95	1.8
		3-Carcass	176.7		0.0094		0.0088		1.77	
HQ	BG-1	1-Fillet	27.3	82.3	0.0319	0.02	0.0255	0.02	1.31	1.2
		3-Carcass	55.0		0.0138		0.0167		1.14	
	BG-2	1-Fillet	30.0	85.5	0.0295	0.023	0.0254	0.017	1.4	1.2
		3-Carcass	55.5		0.0199		0.0129		1.15	
	BG-2 Dup	1-Fillet	30.0	85.5	0.0274	0.02	0.0161	0.01	1.27	1.2
		3-Carcass	55.5		0.0157		0.0072		1.11	
LHL1	BG-1	1-Fillet	63.0	203.5	0.039	0.028	0.0382	0.027	1.01	0.92
		3-Carcass	140.5		0.0228		0.022		0.88	
	BG-2	1-Fillet	54.6	166.5	0.0464	0.032	0.0394	0.026	1.03	0.96
		3-Carcass	111.8		0.0246		0.0196		0.92	
LHL2	BG-1	1-Fillet	52.7	146.8	0.0291	0.021	0.021	0.017	0.96	0.92
		3-Carcass	94.1		0.0158		0.0148		0.89	
	BG-2	1-Fillet	39.5	122.3	0.0507	0.033	0.0341	0.026	1.24	1.1
		3-Carcass	82.8		0.0252		0.0217		1.06	
LHL3	BG-1	1-Fillet	57.8	169.2	0.0296	0.019	0.0227	0.016	1.02	1.1
		3-Carcass	111.5		0.0135		0.0122		1.11	
	BG-2	1-Fillet	40.8	146.9	0.026	0.019	0.0253	0.019	1.18	1.1
		3-Carcass	106.1		0.0166		0.0161		1.07	
LHL4	BG-1	1-Fillet	86.7	284.9	0.0465	0.03	0.0237	0.027	1.13	1.1
		3-Carcass	198.3		0.0228		0.0284		1.11	
	BG-2	1-Fillet	73.4	215.7	0.0499	0.031	0.0467	0.03	1.14	1.1
		3-Carcass	142.4		0.0218		0.0212		1.04	
LHL5	BG-1	1-Fillet	82.3	262.2	0.0267	0.017	0.0307	0.02	0.95	0.87
		3-Carcass	179.9		0.0121		0.0153		0.83	
	BG-2	1-Fillet	66.2	205.1	0.0366	0.026	0.0375	0.025	0.88	0.82
		3-Carcass	138.9		0.0212		0.0193		0.79	
LHL6	BG-1	1-Fillet	74.5	246.5	0.039	0.025	0.0418	0.026	0.96	0.93
		3-Carcass	172.0		0.0191		0.0197		0.91	
	BG-2	1-Fillet	56.0	170.2	0.0372	0.025	0.0351	0.025	0.81	0.73
		3-Carcass	114.2		0.0187		0.0194		0.69	
MHL1	BG-1	1-Fillet	90.8	250.6	0.0477	0.031	0.0372	0.03	0.38	0.38
		3-Carcass	159.9		0.0223		0.0256		0.38	
	BG-2	1-Fillet	72.6	189.5	0.0484	0.025	0.0509	0.028	0.5	0.35
		3-Carcass	116.9		0.0102		0.0131		0.26	
MHL3	BG-1	1-Fillet	58.0	160.5	0.0267	0.021	0.031	0.022	0.21	0.21
		3-Carcass	102.6		0.0171		0.0175		0.21	
	BG-2	1-Fillet	67.6	171.2	0.0324	0.023	0.031	0.024	0.22	0.24
		3-Carcass	103.6		0.017		0.0191		0.26	
DR	BG-1	1-Fillet	18.3	51.4	0.0359	0.029	0.0501	0.035	0.48	0.51
		3-Carcass	33.0		0.0255		0.0267		0.52	
	GS-1	1-Fillet	42.3	132.8	0.0891	0.061	0.0765	0.059	0.68	0.67
		3-Carcass	90.5		0.0482		0.0512		0.66	
	GS-2	1-Fillet	15.9	52.8	0.08	0.055	0.0679	0.052	0.79	0.81
		3-Carcass	36.9		0.0443		0.0445		0.82	

Table 2-1C: Phase I Adult Bluegill and Green Sunfish Calculated Whole-Body Results (Wet-weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Zinc	
Location	Fish ID	Portion	Weight of Portion	Total Weight of Fish (Fillet + Carcass)	Portion mg/kg ww	Calculated whole fish mg/kg ww
CI	BG-1	1-Fillet	76.0	209.8	7.45	20
		3-Carcass	133.8		27.9	
	BG-1 Dup	1-Fillet	76.0	209.8	8.98	23
		3-Carcass	133.8		30.6	
	BG-2	1-Fillet	100.5	277.3	7.5	19
		3-Carcass	176.7		25.7	
	BG-2 Dup	1-Fillet	100.5	277.3	6.73	19
		3-Carcass	176.7		26.2	
HQ	BG-1	1-Fillet	27.3	82.3	10.4	26
		3-Carcass	55.0		33.1	
	BG-2	1-Fillet	30.0	85.5	10.7	29
		3-Carcass	55.5		38.2	
	BG-2 Dup	1-Fillet	30.0	85.5	10.4	28
		3-Carcass	55.5		37.6	
LHL1	BG-1	1-Fillet	63.0	203.5	12.6	28
		3-Carcass	140.5		34.5	
	BG-2	1-Fillet	54.6	166.5	10.8	30
		3-Carcass	111.8		39.2	
LHL2	BG-1	1-Fillet	52.7	146.8	9.81	25
		3-Carcass	94.1		34.1	
	BG-2	1-Fillet	39.5	122.3	12.8	33
		3-Carcass	82.8		42	
LHL3	BG-1	1-Fillet	57.8	169.2	9.25	24
		3-Carcass	111.5		32.1	
	BG-2	1-Fillet	40.8	146.9	11	27
		3-Carcass	106.1		32.5	
LHL4	BG-1	1-Fillet	86.7	284.9	10.1	27
		3-Carcass	198.3		35	
	BG-2	1-Fillet	73.4	215.7	11.1	30
		3-Carcass	142.4		40.2	
LHL5	BG-1	1-Fillet	82.3	262.2	13.8	27
		3-Carcass	179.9		32.6	
	BG-2	1-Fillet	66.2	205.1	12.7	28
		3-Carcass	138.9		35.9	
LHL6	BG-1	1-Fillet	74.5	246.5	11.3	26
		3-Carcass	172.0		32	
	BG-2	1-Fillet	56.0	170.2	12.1	29
		3-Carcass	114.2		37.4	
MHL1	BG-1	1-Fillet	90.8	250.6	9.82	26
		3-Carcass	159.9		35.1	
	BG-2	1-Fillet	72.6	189.5	14.5	21
		3-Carcass	116.9		24.9	
MHL3	BG-1	1-Fillet	58.0	160.5	8.84	23
		3-Carcass	102.6		30.6	
	BG-2	1-Fillet	67.6	171.2	9.96	26
		3-Carcass	103.6		37.1	
DR	BG-1	1-Fillet	18.3	51.4	9.57	22
		3-Carcass	33.0		29.5	
	GS-1	1-Fillet	42.3	132.8	9.21	22
		3-Carcass	90.5		27.3	
	GS-2	1-Fillet	15.9	52.8	11.2	28
		3-Carcass	36.9		34.9	

Notes:

BG	Bluegill	HQ	HQ Inlet
CI	Curd's Inlet	LHL	Lower Herrington Lake
DR	Dix River	mg/kg	milligrams per kilogram
Dup	Duplicate Sample	MHL	Middle Herrington Lake
EPA	Environmental Protection Agency	ug/kg	micrograms per kilogram
GS	Green Sunfish	ww	Wet Weight

Table 2-1D: Phase II Adult Bluegill Results (Whole Body, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI		HQ		LHL1		LHL2		LHL3		LHL6	
				Sample Date	06/15/2018		06/15/2018		06/16/2018		06/16/2018		06/16/2018		06/16/2018	
				Sample Type	N		N		N		N		N		N	
				Lab ID	K1806206-001		K1806158-002		K1806158-006		K1806158-005		K1806158-008		K1806158-003	
				Sample ID	FWB001(BG)-CI-180615		FWB001(BG)-HQ-180615		FWB001(BG)-LHL1-180616		FWB001(BG)-LHL2-180616		FWB001(BG)-LHL3-180616		FWB001(BG)-LHL6-180616	
Analyte	CASRN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Selenium	7782-49-2	Dry	SW6020	mg/kg	5.28		4.42		2.74		3.7		3.39		2.4	
Selenium	7782-49-2	Wet	SW6020	mg/kg	1.26		1.13		0.69		0.92		0.74		0.60	
Lipids	LIPIDS	Wet	NOAA LIPID	%	8.6		7.9		7.9		8.3		5.7		7.7	
Solids (total)	C-008	Wet	ZFZDRY	%	23.8		25.6		25.3		25.0		21.8		24.8	
Moisture Content	MOISTURE	Wet	CALCULATED	%	76.2		74.4		74.7		75.0		78.2		75.2	

Notes:

%: Percent
BG: Bluegill
CI: Curd's Inlet
DR: Dix River
FD: Field Duplicate Sample
g: grams
HQ: HQ Inlet
IQ: Interpreted qualifier, data flags from third party validation. Note: QA resulted in no qualifiers for these data
LHL: Lower Herrington Lake
mg/kg: milligrams per kilogram
N: Normal Sample

Table 2-1E: Phase I Adult Bass, Catfish, Trout, and Sucker Analytical Results and Calculated Whole-Body Results (Dry Wt. Selenium)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Sampling Region	Fish Sample ID	Fish Portion	Weight of Portion (in grams)	Total Fish Weight (2 x Fillet) + Ovary (if present) + Carcass (in grams)	Selenium Concentration in Portion (in mg/kg dw)	Selenium Concentration in Calculated Whole Fish (in mg/kg dw)
CI (Curds Inlet)	CC-1	FF	588	2449	2.6	2.31
		FWB	1273		2.04	
	FHC-1	FF	783	3317	6	4.6
		FO	14		14.5	
		FWB	1737		3.25	
	LMB-1	FF	328	1534	7.08	5.5
		FO	7		8.93	
		FWB	871		4.29	
	LMB-2	FF	193	964	5.98	4.07
		FWB	578		2.79	
	LMB-2 FD	FF	193	389	5.33	5.3
		FWB	4		2.52	
LHL1 (Rocky Run)	CC-1	FF	310	1470	1.8	1.62
		FWB	850		1.49	
	FHC-1	FF	162	729	4.33	3.27
		FWB	404		2.41	
	LMB-1	FF	399	1658	4.19	3.32
		FO	4		4.8	
		FWB	856		2.5	
	LMB-2	FF	290	1467	4.2	3.25
		FWB	887		2.63	
LHL2 (Dix Dam)	CC-1	FF	211	1065	2.41	1.99
		FWB	643		1.71	
	FHC-1	FF	113	580	7.34	5.13
		FWB	354		3.72	
	KB-1	FF	391	1839	5.3	3.75
		FO	4		6.89	
		FWB	1053		2.58	
	LMB-1	FF	302	1487	4.31	3.12
		FWB	882		2.3	
	LMB-1 FD	FF	302	608	4.3	4.29
		FWB	4		2.61	
LHL3	CC-1	FF	330	1633	2.7	2.62
		FWB	973		2.57	
	CC-1 FD	FF	330	1633	2.6	2.43
		FWB	973		2.32	
	KB-1	FF	275	1372	5.5	4.1
		FO	3		6.08	
		FWB	818		3.15	
	CC-2	FF	1260	5316	1.3	1.6
		FO	130		6.59	
		FWB	2666		1.65	
	KB-2	FF	314	1881	4.67	3.62
		FO	4		5.4	
		FWB	1250		3.08	

Table 2-1E: Phase I Adult Bass, Catfish, Trout, and Sucker Analytical Results and Calculated Whole-Body Results (Dry Wt. Selenium)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Sampling Region	Fish Sample ID	Fish Portion	Weight of Portion (in grams)	Total Fish Weight (2 x Fillet) + Ovary (if present) + Carcass (in grams)	Selenium Concentration in Portion (in mg/kg dw)	Selenium Concentration in Calculated Whole Fish (in mg/kg dw)
LHL4	CC-1	FF	463	2109	2.69	2.33
		FWB	1183		2.04	
	FHC-1	FF	628	2828	4.77	3.35
		FWB	1572		2.21	
	KB-1	FF	137	668	5.44	4.13
		FO	3		6.4	
		FWB	392		3.19	
	LMB-1	FF	168	770	4.97	4.04
		FO	2		6.3	
		FWB	433		3.31	
LHL5 (Entrance to Mallard Cove)	CC-1	FF	1587	6846	1.5	1.35
		FO	76		6.6	
		FWB	3596		1.1	
	LMB-1	FF	573	2685	4.47	3.29
		FO	6		4.2	
		FWB	1533		2.4	
	CC-2	FF	774	3839	1.69	1.4
		FWB	2291		1.2	
	LMB-2	FF	617	2522	3.7	2.81
		FWB	1288		1.95	
LHL6 (Near Sunset Marina)	CC-1	FF	1465	6120	1.5	1.39
		FO	10		5.78	
		FWB	3180		1.28	
	KB-1	FF	269	1425	3.97	3.01
		FO	5		6.7	
		FWB	882		2.4	
	LMB-1	FF	314	1492	5.66	4.32
		FO	8		7.56	
		FWB	857		3.3	
	CC-2	FF	403	1811	1.1	1.21
		FWB	1005		1.3	
MHL1 (Lake Mile 14)	FHC-1	FF	460	2176	1.97	1.56
		FO	10		10.9	
		FWB	1246		1.19	
	KB-1	FF	205	934	1.6	1.38
		FO	3		3.3	
		FWB	520		1.2	
	LMB-1	FF	273	1312	1.81	1.52
		FWB	766		1.31	
	FHC-2	FF	1111	6104	1.9	1.2
		FWB	3882		0.8	

Table 2-1E: Phase I Adult Bass, Catfish, Trout, and Sucker Analytical Results and Calculated Whole-Body Results (Dry Wt. Selenium)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Sampling Region	Fish Sample ID	Fish Portion	Weight of Portion (in grams)	Total Fish Weight (2 x Fillet) + Ovary (if present) + Carcass (in grams)	Selenium Concentration in Portion (in mg/kg dw)	Selenium Concentration in Calculated Whole Fish (in mg/kg dw)
MHL3 (Lake Mile 20)	CC-1	FF	537	2306	0.7	0.738
		FO	22		5.11	
		FWB	1211		0.69	
	LMB-1	FF	543	2433	1.53	1.33
		FO	12		3.95	
		FWB	1335		1.14	
	CC-2	FF	339	2051	0.95	0.95
		FWB	1373		0.95	
	LMB-2	FF	416	2146	1.36	1.15
		FWB	1314		1.01	
DR (Dix River)	BT-1	FF	53	236	2.1	2.89
		FO	34		6.95	
		FWB	96		2.3	
	HS-1	FF	74	413	5.1	4.06
		FO	10		5.86	
		FWB	256		3.4	
	LMB-1	FF	109	484	4.28	3.58
		FO	7		6.37	
		FWB	259		2.91	
	SS-1	FF	50	224	6.29	5.3
		FWB	124		4.5	

Notes:

BT: Brown Trout
CC: Channel Catfish
CI: Curd's Inlet
DR: Dix River
dw: Dry Weight
FHC: Flathead Catfish
FF: Fish Fillet
FO: Fish Ovary
FWB: Whole-Body Fish
HS: Northern Hogsucker
KB: Kentucky Bass
LHL: Lower Herrington Lake
LMB: Largemouth Bass
mg/kg: milligrams per kilogram
MHL: Middle Herrington Lake
SS: Spotted Sucker

Table 2-1F: Phase I Adult Bass, Catfish, Trout, and Sucker Analytical Results and Calculated Whole-Body Results (Wet-weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Arsenic 1632A		Arsenic III		Arsenic SW6020		Arsenic V		Boron		Cadmium		Iron	
Location	Fish ID	Portion	Portion Weight	Whole body Weight (2x fillet + remains)	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww
CI	CC-1	FF	588	2449	0	0.0052	0	0	0.04	0.0712	0	0	0.07	0.418	0.0023	0.0143	3.85	19.1
		FWB	1273		0.01		0		0.1		0		0.74		0.0253		33.1	
	FHC-1	FF	783	3303	0	0.00631	0	0	0.05	0.0763	0	0	0.24	0.619	0.0107	0.0397	3.55	15.4
		FWB	1737		0.012		0		0.1		0		0.96		0.0659		26	
	LMB-1	FF	328	1527	0	0.00285	0	0	0.25	0.307	0	0	0	0	0.0007	0.006	1.36	7.54
		FWB	871		0.005		0		0.35		0		0		0.01		12.2	
	LMB-2	FF	192.89	963.94	0	0.0042	0	0	0.18	0.222	0	0	0	0.084	0.0029	0.0611	1.64	57.2
		FWB	578.16		0.007		0		0.25		0		0.14		0.1		94.3	
	LMB-2 FD	FF	192.89	389.358	0	0.0000827	0	0	0.17	0.17	0	0	0	0.00138	0.0031	0.00374	1.54	2.09
		FWB	3.578		0.009		0		0.22		0		0.15		0.0732		61.7	
LHL1	CC-1	FF	310.22	1470.31	0	0	0	0	0.01	0.01	0	0	0.05	0.166	0.002	0.00703	5.94	17.7
		FWB	849.87		0		0		0.01		0		0.25		0.0107		26.3	
	FHC-1	FF	162.29	728.67	0	0	0	0	0.009	0.0151	0	0	0.079	0.263	0.0013	0.00718	2.94	12.1
		FWB	404.09		0		0		0.02		0		0.41		0.0119		19.5	
	LMB-1	FF	399	1654	0	0	0	0	0.31	0.476	0	0	0	0	0.0016	0.00843	1.61	10.1
		FWB	856		0		0		0.63		0		0		0.0148		18.1	
	LMB-2	FF	290	1467	0	0	0	0	0.35	0.525	0	0	0	0	0	0.00707	2.54	11.2
		FWB	887		0		0		0.64		0		0		0.0117		16.8	
LHL2	CC-1	FF	211	1065	0	0.00664	0	0	0.02	0.0623	0	0	0	0.254	0.0011	0.00708	4.32	34.3
		FWB	643		0.011		0		0.09		0		0.42		0.011		53.9	
	FHC-1	FF	113	580	0	0	0	0	0.015	0.0242	0	0	0.126	0.409	0.0023	0.00877	4.11	14.1
		FWB	354		0		0		0.03		0		0.59		0.0129		20.5	
	KB-1	FF	391.35	1835.42	0	0.00344	0	0	0.32	0.372	0	0	0	0	0.001	0.00576	2.45	9.82
		FWB	1052.72		0.006		0		0.41		0		0		0.0093		15.3	
	LMB-1	FF	302.41	1486.89	0	0	0	0	0.31	0.399	0	0	0	0	0.0016	0.00848	2.16	9.18
		FWB	882.07		0		0		0.46		0		0		0.0132		14	
	LMB-1 FD	FF	302.41	608.398	0	0	0	0	0.33	0.331	0	0	0	0	0.001	0.00107	2.23	2.3
		FWB	3.578		0		0		0.52		0		0		0.0136		14.6	
LHL3	CC-1	FF	330	1633	0	0.00417	0	0	0.02	0.0319	0	0	0	0.119	0.0007	0.0158	5.77	93.5
		FWB	973		0.007		0		0.04		0		0.2		0.0261		153	
	CC-1 FD	FF	330	1633	0	0.00417	0	0	0.02	0.026	0	0	0	0.101	0.0008	0.00652	5.02	53.1
		FWB	973		0.007		0		0.03		0		0.17		0.0104		85.7	
	KB-1	FF	275.46	1368.79	0	0	0	0	0.36	0.491	0	0	0	0	0	0.004	2.67	9.74
		FWB	817.87		0		0		0.58		0		0		0.0067		14.5	
	CC-2	FF	1260	5186	0	0	0	0	0.04	0.0451	0	0	0.08	0.157	0.0018	0.018	3.61	19.4
		FWB	2666		0		0		0.05		0		0.23		0.0333		34.4	
	KB-2	FF	313.96	1877.92	0	0	0	0	0.38	0.506	0	0	0	0	0	0.00752	3.25	9.21
		FWB	1250		0		0		0.57		0		0		0.0113		12.2	
LHL4	CC-1	FF	463	2109	0	0	0	0	0.01	0.0156	0	0	0	0.0954	0.0032	0.0137	4.82	17.7
		FWB	1183		0		0		0.02		0		0.17		0.0219		27.7	
	FHC-1	FF	628	2828	0	0	0	0	0.03	0.0467	0	0	0.13	0.363	0.0014	0.0147	5.33	13
		FWB	1572		0		0		0.06		0		0.55		0.0254		19.2	
	KB-1	FF	136.72	665.03	0	0	0	0	0.27	0.341	0	0	0	0	0.0043	0.0123	2.03	10.7
		FWB	391.59		0		0		0.39		0		0		0.0179		16.7	
	LMB-1	FF	167.69	768.47	0	0	0	0	0.16	0.228	0	0	0	0	0.0022	0.00744	1.75	7.3
		FWB	433.09		0		0		0.28		0		0		0.0115		11.6	

Table 2-1F: Phase I Adult Bass, Catfish, Trout, and Sucker Analytical Results and Calculated Whole-Body Results (Wet-weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Arsenic 1632A		Arsenic III		Arsenic SW6020		Arsenic V		Boron		Cadmium		Iron	
Location	Fish ID	Portion	Portion Weight	Whole body Weight (2x fillet + remains)	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww
LHL5	CC-1	FF	1587	6770	0	0	0	0	0.04	0.04	0	0	0	0.0797	0.0011	0.00524	3.34	7.36
		FWB	3596		0		0		0.04		0		0.15		0.0089		10.9	
	LMB-1	FF	573	2679	0	0	0	0	0.34	0.443	0	0	0.07	0.11	0.0009	0.00594	2.36	8.16
		FWB	1533		0		0		0.52		0		0.14		0.0097		12.5	
	CC-2	FF	774	3839	0	0.00418	0	0	0.03	0.0419	0	0	0.06	0.257	0	0.00436	3.12	13.9
		FWB	2291		0.007		0		0.05		0		0.39		0.0073		21.2	
	LMB-2	FF	617	2522	0	0	0	0	0.34	0.468	0	0	0	0	0	0.0048	2.35	7.69
		FWB	1288		0		0		0.59		0		0		0.0094		12.8	
LHL6	CC-1	FF	1465	6110	0	0	0	0	0.03	0.0456	0	0	0	0	0	0.00697	3.73	10.9
		FWB	3180		0		0		0.06		0		0		0.0134		17.6	
	KB-1	FF	269	1420	0	0	0	0	0.26	0.372	0	0	0	0	0	0.00447	2.04	10.2
		FWB	882		0		0		0.44		0		0		0.0072		15.1	
	LMB-1	FF	314.1	1484.87	0	0	0	0	0.18	0.243	0	0	0	0	0.0008	0.00507	1.78	7.79
		FWB	856.67		0		0		0.29		0		0		0.0082		12.2	
	CC-2	FF	403	1811	0	0.00555	0	0	0.07	0.0866	0	0	0	0.0666	0	0.00677	5.14	13.6
		FWB	1005		0.01		0		0.1		0		0.12		0.0122		20.3	
MHL1	FHC-1	FF	460.07	2166.59	0	0.00288	0	0	0.02	0.043	0	0	0.05	0.102	0.0025	0.00728	3.54	10.2
		FWB	1246.45		0.005		0		0.06		0		0.14		0.0108		15.1	
	KB-1	FF	205.4	930.58	0	0	0	0	0.35	0.473	0	0	0	0	0	0.0014	2.9	9.6
		FWB	519.78		0		0		0.57		0		0		0.0025		14.9	
	LMB-1	FF	272.62	1311.66	0	0	0	0	0.26	0.406	0	0	0	0	0	0.0038	1.97	11.2
		FWB	766.42		0		0		0.51		0		0		0.0065		17.7	
	FHC-2	FF	1111	6104	0	0	0	0	0.02	0.0391	0	0	0	0.0509	0	0.00757	2.17	8.49
		FWB	3882		0		0		0.05		0		0.08		0.0119		12.1	
MHL3	CC-1	FF	536.69	2284.02	0	0	0	0	0.05	0.0712	0	0	0	0	0	0.00323	3.84	15.2
		FWB	1210.64		0		0		0.09		0		0		0.0061		25.2	
	LMB-1	FF	543	2421	0	0	0	0	0.29	0.455	0	0	0	0	0	0.00447	1.69	13.4
		FWB	1335		0		0		0.59		0		0		0.0081		22.9	
	CC-2	FF	339	2051	0	0.00402	0	0	0.04	0.0601	0	0	0	0.0602	0	0.00462	3.86	33.7
		FWB	1373		0.006		0		0.07		0		0.09		0.0069		48.5	
	LMB-2	FF	416	2146	0	0	0	0	0.29	0.406	0	0	0	0	0	0.00202	2.47	9.65
		FWB	1314		0		0		0.48		0		0		0.0033		14.2	
DR	BT-1	FF	52.66	201.48	0	0.00143	0	0	0.23	0.216	0	0	0	0	0.0026	0.00274	5.47	10.7
		FWB	96.16		0.003		0		0.2		0		0		0.0029		16.4	
	HS-1	FF	73.5	403.17	0	0.00318	0	0	0.05	0.0436	0	0	0.11	0.205	0.0026	0.0117	4.67	8.37
		FWB	256.17		0.005		0		0.04		0		0.26		0.0169		10.5	
	LMB-1	FF	109.25	477.05	0	0.00434	0	0	0.07	0.0754	0	0	0	0	0.0022	0.00767	3.49	12.4
		FWB	258.55		0.008		0		0.08		0		0		0.0123		20	
	SS-1	FF	50.24	224.32	0	0.00442	0	0	0.02	0.031	0	0	0.13	0.262	0.0032	0.00469	3.92	17.5
		FWB	123.84		0.008		0		0.04		0		0.37		0.0059		28.5	

Table 2-1F: Phase I Adult Bass, Catfish, Trout, and Sucker Analytical Results and Calculated Whole-Body Results (Wet-weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Lead		Magnesium		Mercury		Methyl mercury		Selenium		Zinc	
Location	Fish ID	Portion	Portion Weight	Whole body Weight (2x fillet + remains)	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww
CI	CC-1	FF	588	2449	0.0027	0.0179	178	324	0.0394	0.0347	43.2	36.6	0.62	0.703	7.62	16.3
		FWB	1273		0.032		458		0.0303		30.5		0.78		24.4	
	FHC-1	FF	783	3303	0.0017	0.00827	224	333	0.153	0.107	142	104	1.53	1.41	5.17	17.5
		FWB	1737		0.0142		432		0.0662		69.6		1.29		28.6	
	LMB-1	FF	328	1527	0.0009	0.00609	274	458	0.0922	0.0684	86.2	65.1	1.56	1.48	7.67	14.4
		FWB	871		0.01		596		0.0504		49.2		1.41		19.5	
	LMB-2	FF	192.89	963.94	0.001	0.0125	270	489	0.0863	0.061	108	74.4	1.22	0.956	10.3	18
		FWB	578.16		0.0201		635		0.0442		51.9		0.78		23.1	
	LMB-2 FD	FF	192.89	389.358	0.0017	0.00184	236	239	0.0867	0.0863	116	115	1.09	1.09	10.3	10.4
		FWB	3.578		0.0164		573		0.0385		39.6		0.7		21	
LHL1	CC-1	FF	310.22	1470.31	0.0034	0.017	191	374	0.0364	0.0289	50.5	35.3	0.44	0.486	11.9	21.3
		FWB	849.87		0.027		508		0.0234		24.2		0.52		28.2	
	FHC-1	FF	162.29	728.67	0	0.00865	188	303	0.0948	0.0682	108	71.7	0.81	0.721	4.42	15.5
		FWB	404.09		0.0156		395		0.0468		42.6		0.65		24.4	
	LMB-1	FF	399	1654	0.0012	0.00901	268	435	0.0967	0.0698	106	75.3	0.9	0.921	7.06	14.3
		FWB	856		0.0163		591		0.0448		46.6		0.94		21.1	
	LMB-2	FF	290	1467	0	0.00405	292	395	0.101	0.0731	115	81.7	0.99	0.99	7.21	14
		FWB	887		0.0067		463		0.0549		60		0.99		18.4	
LHL2	CC-1	FF	211	1065	0.002	0.0219	191	352	0.0392	0.026	56.4	38.9	0.58	0.622	8.14	16.9
		FWB	643		0.0349		457		0.0174		27.4		0.65		22.6	
	FHC-1	FF	113	580	0.003	0.0135	227	416	0.176	0.121	198	143	1.39	1.17	5.4	21.4
		FWB	354		0.0202		537		0.0851		108		1.03		31.6	
	KB-1	FF	391.35	1835.42	0.0009	0.00555	241	335	0.0827	0.0608	98.3	69.1	1.2	1.03	8.45	16.5
		FWB	1052.72		0.009		405		0.0445		47.4		0.91		22.5	
	LMB-1	FF	302.41	1486.89	0.0009	0.00541	227	495	0.0823	0.0533	97.9	68.5	0.95	0.849	6.78	13
		FWB	882.07		0.0085		678		0.0334		48.3		0.78		17.2	
	LMB-1 FD	FF	302.41	608.398	0.001	0.00103	237	238	0.0704	0.0702	93.9	93.6	0.95	0.95	6.89	6.95
		FWB	3.578		0.0069		481		0.0374		42.3		0.88		17.4	
LHL3	CC-1	FF	330	1633	0.0035	0.0208	189	352	0.0417	0.0397	45	26.1	0.55	0.681	8.59	18
		FWB	973		0.0325		462		0.0383		13.2		0.77		24.4	
	CC-1 FD	FF	330	1633	0.0027	0.00991	197	239	0.0437	0.0274	57.4	34	0.53	0.5	8.08	13.3
		FWB	973		0.0148		268		0.0164		18.1		0.48		16.8	
	KB-1	FF	275.46	1368.79	0.0016	0.00877	246	454	0.0928	0.0835	122	99.2	1.31	1.26	9.74	21.4
		FWB	817.87		0.0136		594		0.0772		83.8		1.23		29.2	
	CC-2	FF	1260	5186	0.0013	0.0352	176	246	0.095	0.0795	94.5	68.6	0.43	0.612	7.35	16.6
		FWB	2666		0.0672		313		0.0649		44.1		0.7		25.3	
	KB-2	FF	313.96	1877.92	0.0013	0.00536	248	437	0.0872	0.0757	118	86.4	1.15	1.15	9.03	18.9
		FWB	1250		0.0074		532		0.0699		70.6		1.15		23.9	
LHL4	CC-1	FF	463	2109	0.0011	0.0104	180	342	0.162	0.106	207	119	0.6	0.611	8.05	18.1
		FWB	1183		0.0177		469		0.0625		51		0.62		25.9	
	FHC-1	FF	628	2828	0.002	0.0134	210	383	0.221	0.165	379	246	1	0.872	6.4	19.4
		FWB	1572		0.0225		522		0.12		139		0.77		29.8	
	KB-1	FF	136.72	665.03	0.0075	0.0163	241	411	0.142	0.0948	166	101	1.23	1.12	8.96	20.3
		FWB	391.59		0.0225		529		0.0619		56.3		1.05		28.3	
	LMB-1	FF	167.69	768.47	0.002	0.00572	250	385	0.0536	0.0387	64.6	40	1.06	1.04	8.28	14.6
		FWB	433.09		0.0086		490		0.0272		20.9		1.02		19.5	

Table 2-1F: Phase I Adult Bass, Catfish, Trout, and Sucker Analytical Results and Calculated Whole-Body Results (Wet-weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Lead		Magnesium		Mercury		Methyl mercury		Selenium		Zinc	
Location	Fish ID	Portion	Portion Weight	Whole body Weight (2x fillet + remains)	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww	Portion mg/kg ww	Calculated whole fish mg/kg ww
LHL5	CC-1	FF	1587	6770	0.0024	0.00846	211	471	0.119	0.0959	169	119	0.46	0.479	8.61	20.2
		FWB	3596		0.0138		701		0.0756		74.2		0.46		30.4	
	LMB-1	FF	573	2679	0.0017	0.00656	253	429	0.053	0.0432	96.2	67.5	0.98	0.912	7.46	13.5
		FWB	1533		0.0102		560		0.0359		46.1		0.86		18.1	
	CC-2	FF	774	3839	0.0013	0.014	246	458	0.0508	0.0339	43.7	34.6	0.46	0.448	8.83	17.3
		FWB	2291		0.0225		601		0.0225		28.4		0.44		23.1	
	LMB-2	FF	617	2522	0.001	0.00953	273	412	0.061	0.0459	105	236	0.78	0.754	6.56	12.5
		FWB	1288		0.0177		546		0.0315		361		0.73		18.1	
LHL6	CC-1	FF	1465	6110	0.0011	0.0276	231	288	0.146	0.106	207	139	0.44	0.484	7.42	13.2
		FWB	3180		0.052		341		0.0691		76		0.52		18.6	
	KB-1	FF	269	1420	0.0008	0.00471	270	502	0.135	0.0869	171	107	0.88	0.851	6.93	18.3
		FWB	882		0.0071		643		0.0576		68.5		0.83		25.2	
	LMB-1	FF	314.1	1484.87	0.001	0.00752	228	421	0.155	0.112	167	126	1.25	1.18	6.49	12.6
		FWB	856.67		0.0123		563		0.0808		96		1.12		17.1	
	CC-2	FF	403	1811	0.0016	0.0215	218	314	0.0467	0.0333	58.5	40.2	0.32	0.414	7.69	15.1
		FWB	1005		0.0374		391		0.0226		25.5		0.49		21.1	
MHL1	FHC-1	FF	460.07	2166.59	0.0016	0.0105	205	351	0.2	0.149	269	175	0.42	0.392	4.99	16.6
		FWB	1246.45		0.0171		458		0.112		106		0.36		25.2	
	KB-1	FF	205.4	930.58	0.003	0.00646	207	371	0.0714	0.0605	102	78.5	0.37	0.411	6.67	15.7
		FWB	519.78		0.0092		501		0.0518		59.9		0.44		22.8	
	LMB-1	FF	272.62	1311.66	0.0008	0.00425	219	350	0.103	0.0776	141	100	0.41	0.451	7.11	13.8
		FWB	766.42		0.0067		443		0.0596		71.5		0.48		18.5	
	FHC-2	FF	1111	6104	0.001	0.0168	181	473	0.329	0.266	427	278	0.4	0.349	5.94	25.2
		FWB	3882		0.0259		640		0.23		192		0.32		36.3	
MHL3	CC-1	FF	536.69	2284.02	0.0018	0.0116	202	263	0.15	0.113	190	131	0.2	0.251	7.85	14.4
		FWB	1210.64		0.0202		318		0.0809		78.2		0.27		20.2	
	LMB-1	FF	543	2421	0.0007	0.0127	281	425	0.182	0.124	165	118	0.33	0.37	7.33	13.7
		FWB	1335		0.0225		543		0.0775		79		0.4		18.9	
	CC-2	FF	339	2051	0.0013	0.0352	202	395	0.049	0.0355	76.7	48	0.24	0.307	7.05	18.5
		FWB	1373		0.0519		490		0.0289		33.9		0.34		24.2	
	LMB-2	FF	416	2146	0	0.00484	303	482	0.0769	0.0546	84	61.2	0.31	0.334	7.8	13.8
		FWB	1314		0.0079		596		0.0405		46.7		0.35		17.6	
DR	BT-1	FF	52.66	201.48	0.0016	0.0132	206	278	0.0174	0.0148	22.5	22.6	0.43	0.842	14.2	29.9
		FWB	96.16		0.026		357		0.012		22.7		0.58		47	
	HS-1	FF	73.5	403.17	0.0016	0.00586	281	444	0.0269	0.0198	27.3	29	1.06	1.05	9.63	17.2
		FWB	256.17		0.0083		538		0.0158		30		1.03		21.5	
	LMB-1	FF	109.25	477.05	0.0009	0.00545	262	450	0.152	0.114	186	145	0.93	0.941	9.2	14.8
		FWB	258.55		0.0093		608		0.0819		111		0.94		19.6	
	SS-1	FF	50.24	224.32	0.0022	0.0167	253	431	0.0316	0.0255	38.6	34.6	1.27	1.23	7.91	17.2
		FWB	123.84		0.0285		575		0.0205		31.3		1.19		24.7	

Notes:

BT: Brown Tout
CC: Channel Catfish
CI: Curd's Inlet
DR: Dix River
FF: Fillet
FHC: Flathead Catfish
FWB: Remains
HS: Northern Hogsucker
KB: Kentucky Bass
LHL: Lower Herrington Lake
LMB: Largemouth Bass
mg/kg: milligrams per kilogram
SS: Spotted Sucker
ww: Wet Weight

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI	CI	CI	CI	CI
				Sample ID	FF-001(CC)-CI-171013	FF-001(FHC)-CI-171013	FF-001(LMB)-CI-171004	FF-002(LMB)-CI-171004	FF-002(LMB)-CI-171004-FD
				Lab Sample ID	K1712469-022	K1712469-018	K1712479-002	K1712476-014	K1712476-032
				Sample Date	10/13/2017	10/13/2017	10/04/2017	10/04/2017	10/04/2017
				Sample Type	N	N	N	N	FD
Analyte	CASRN	Method	Basis	Unit	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%	76.5	74.4	78.0	79.6	79.6
Lipids	LIPIDS	NOAA LIPID	Wet	%			4.6	1.6	2.2
Solids (total)	C-008	ZFZDRY	Wet	%	23.5	25.6	22.0	20.4	20.4
Suspended solids (total)	C-009	ZFZDRY	Wet	%					
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g	< 0.04 U	< 0.039 U	< 0.039	< 0.039	< 0.04
Arsenic	7440-38-2	SW6020	Dry	mg/kg	0.17 J	0.18 J	1.13	0.89	0.82
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g	< 0.08 U	< 0.078 U	< 0.078	< 0.079	< 0.079
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g	< 0.08 U	< 0.078 U	< 0.078	< 0.079	< 0.079
Boron	7440-42-8	SW6020	Dry	mg/kg	0.31 J	0.95	< 0.50	< 0.50	< 0.50
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.010 J	0.042	0.003	0.014	0.015
Iron	7439-89-6	SW6020	Dry	mg/kg	16.4	13.9	6.18	8.05	7.56
Lead	7439-92-1	SW6020	Dry	mg/kg	0.012 J	0.007 J	0.004	0.005	0.008
Magnesium	7439-95-4	SW6010	Dry	mg/kg	759	876	1250	1320	1160
Mercury	7439-97-6	SW7471	Dry	mg/kg	0.168	0.596	0.419	0.423	0.425
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	184	554	392	527	568
Selenium	7782-49-2	SW6020	Dry	mg/kg	2.6	6.0	7.08	5.98	5.33
Zinc	7440-66-6	SW6020	Dry	mg/kg	32.4	20.2	34.9	50.6	50.4
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g	< 0.009 U	< 0.01 U	< 0.009	< 0.008	< 0.008
Arsenic	7440-38-2	SW6020	Wet	mg/kg	0.04 J	0.05 J	0.25	0.18	0.17
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g	< 0.019 U	< 0.02 U	< 0.017	< 0.016	< 0.016
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g	< 0.019 U	< 0.02 U	< 0.017	< 0.016	< 0.016
Boron	7440-42-8	SW6020	Wet	mg/kg	0.07 J	0.24	< 0.11	< 0.10	< 0.10
Cadmium	7440-43-9	SW6020	Wet	mg/kg	0.0023 J	0.0107	0.0007	0.0029	0.0031
Iron	7439-89-6	SW6020	Wet	mg/kg	3.85	3.55	1.36	1.64	1.54
Lead	7439-92-1	SW6020	Wet	mg/kg	0.0027 J	0.0017 J	0.0009	0.0010	0.0017
Magnesium	7439-95-4	SW6010	Wet	mg/kg	178	224	274	270	236
Mercury	7439-97-6	SW7471	Wet	mg/kg	0.0394	0.153	0.0922	0.0863	0.0867
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g	43.2	142	86.2	108	116
Selenium	7782-49-2	SW6020	Wet	mg/kg	0.62	1.53	1.56	1.22	1.09
Zinc	7440-66-6	SW6020	Wet	mg/kg	7.62	5.17	7.67	10.3	10.3

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	CI	CI	CI	CI	CI	CI
					Sample ID	FO-001(FHC)-CI-171013	FO-001(LMB)-CI-171004	FWB-001(CC)-CI-171013	001(FHC)-CI-171013	001(LMB)-CI-171004	002(LMB)-CI-171004
					Lab Sample ID	K1712469-020	K1712479-004	K1712469-023	K1712469-019	K1712479-003	K1712476-015
					Sample Date	10/13/2017	10/04/2017	10/13/2017	10/13/2017	10/04/2017	10/04/2017
					Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		83.3	82.0	61.7	60.2	67.1	72.1
Lipids	LIPIDS	NOAA LIPID	Wet	%		1.5				22	10.6
Solids (total)	C-008	ZFZDRY	Wet	%		16.7	18.0	38.3	39.8	32.9	27.9
Suspended solids (total)	C-009	ZFZDRY	Wet	%		16.7	18.0				
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g				0.027 J	0.030 J	0.016	0.025
Arsenic	7440-38-2	SW6020	Dry	mg/kg				0.25 J	0.26 J	1.07	0.91
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g				< 0.078 U	< 0.079 U	< 0.078	< 0.078
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g				< 0.078 U	< 0.079 U	< 0.078	< 0.078
Boron	7440-42-8	SW6020	Dry	mg/kg				1.92	2.41	< 0.50	0.50
Cadmium	7440-43-9	SW6020	Dry	mg/kg				0.066	0.166	0.031	0.360
Iron	7439-89-6	SW6020	Dry	mg/kg				86.5	65.4	36.9	338
Lead	7439-92-1	SW6020	Dry	mg/kg				0.084	0.036	0.031	0.072
Magnesium	7439-95-4	SW6010	Dry	mg/kg				1200 J	1090 J	1810	2280
Mercury	7439-97-6	SW7471	Dry	mg/kg				0.079	0.166	0.153	0.158
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g				79.4	175	149	186
Selenium	7782-49-2	SW6020	Dry	mg/kg		14.5	8.93	2.04 J	3.25 J	4.29	2.79
Zinc	7440-66-6	SW6020	Dry	mg/kg				63.6 J	71.9 J	59.3	82.8
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g				0.010 J	0.012 J	0.005	0.007
Arsenic	7440-38-2	SW6020	Wet	mg/kg				0.10 J	0.10 J	0.35	0.25
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g				< 0.03 U	< 0.031 U	< 0.026	< 0.022
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g				< 0.03 U	< 0.031 U	< 0.026	< 0.022
Boron	7440-42-8	SW6020	Wet	mg/kg				0.74	0.96	< 0.16	0.14
Cadmium	7440-43-9	SW6020	Wet	mg/kg				0.0253	0.0659	0.0100	0.100
Iron	7439-89-6	SW6020	Wet	mg/kg				33.1	26.0	12.2	94.3
Lead	7439-92-1	SW6020	Wet	mg/kg				0.0320	0.0142	0.0100	0.0201
Magnesium	7439-95-4	SW6010	Wet	mg/kg				458	432	596	635
Mercury	7439-97-6	SW7471	Wet	mg/kg				0.0303	0.0662	0.0504	0.0442
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g				30.5	69.6	49.2	51.9
Selenium	7782-49-2	SW6020	Wet	mg/kg		2.42	1.61	0.78	1.29	1.41	0.78
Zinc	7440-66-6	SW6020	Wet	mg/kg				24.4	28.6	19.5	23.1

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	CI	LHL1	LHL1	LHL1	LHL1	LHL1
					Sample ID	002(LMB)-CI-171004-FD	FF-001(CC)-LHL1-171005	FF-001(FHC)-LHL1-171011	FF-001(LMB)-LHL1-171005	FF-002(LMB)-LHL1-171005	FO-001(LMB)-LHL1-171005
					Lab Sample ID	K1712476-033	K1712471-002	K1712476-021	K1712477-002	K1712477-006	K1712477-004
					Sample Date	10/04/2017	10/05/2017	10/11/2017	10/05/2017	10/05/2017	10/05/2017
					Sample Type	FD	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		72.1	75.8	81.4	78.5	76.8	77.3
Lipids	LIPIDS	NOAA LIPID	Wet	%		9.2	16	1.3	9.4	8.5	
Solids (total)	C-008	ZFZDRY	Wet	%		27.9	24.2	18.6	21.5	23.2	22.7
Suspended solids (total)	C-009	ZFZDRY	Wet	%							22.7
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.04 U	< 0.039	< 0.04	< 0.04	< 0.04	
Arsenic	7440-38-2	SW6020	Dry	mg/kg		0.78	0.04	0.05	1.43	1.50	
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.08	< 0.079	< 0.08	< 0.08	< 0.079	
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.08	< 0.079	< 0.08	< 0.08	< 0.079	
Boron	7440-42-8	SW6020	Dry	mg/kg		0.53	0.20	0.42	< 0.50	< 0.50	
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.262	0.008	0.007	0.008	< 0.020	
Iron	7439-89-6	SW6020	Dry	mg/kg		221	24.6	15.8	7.50	10.9	
Lead	7439-92-1	SW6020	Dry	mg/kg		0.059	0.014	< 0.020	0.006	< 0.020	
Magnesium	7439-95-4	SW6010	Dry	mg/kg		2060	790	1010	1250	1260	
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.138	0.150 J	0.510	0.450	0.435	
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		142	209	578	493	494	
Selenium	7782-49-2	SW6020	Dry	mg/kg		2.52	1.8	4.33	4.19	4.2	4.8
Zinc	7440-66-6	SW6020	Dry	mg/kg		75.3	49.0	23.8	32.8	31.1	
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		0.009	< 0.01	< 0.007	< 0.009	< 0.009	
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.22	0.010	0.009	0.31	0.35	
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.022	< 0.019	< 0.015	< 0.017	< 0.018	
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.022	< 0.019	< 0.015	< 0.017	< 0.018	
Boron	7440-42-8	SW6020	Wet	mg/kg		0.15	0.05	0.079	< 0.11	< 0.12	
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0732	0.0020	0.0013	0.0016	< 0.0046	
Iron	7439-89-6	SW6020	Wet	mg/kg		61.7	5.94	2.94	1.61	2.54	
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0164	0.0034	< 0.0037	0.0012	< 0.0046	
Magnesium	7439-95-4	SW6010	Wet	mg/kg		573	191	188	268	292	
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.0385	0.0364	0.0948	0.0967	0.101	
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		39.6	50.5	108	106	115	
Selenium	7782-49-2	SW6020	Wet	mg/kg		0.70	0.44	0.81	0.90	0.99	1.08
Zinc	7440-66-6	SW6020	Wet	mg/kg		21.0	11.9	4.42	7.06	7.21	

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL1	LHL1	LHL1	LHL1	LHL2	LHL2
					Sample ID	FWB-001(CC)-LHL1-171005	001(FHC)-LHL1-171011	001(LMB)-LHL1-171005	002(LMB)-LHL1-171005	FF-001(CC)-LHL2-171005	FF-001(FHC)-LHL2-171005
					Lab Sample ID	K1712471-003	K1712476-022	K1712477-003	K1712477-007	K1712469-006	K1712468-002
					Sample Date	10/05/2017	10/11/2017	10/05/2017	10/05/2017	10/05/2017	10/05/2017
					Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		65.1	73.0	62.5	62.5	76.0	81.1
Lipids	LIPIDS	NOAA LIPID	Wet	%		25	7.6	36	33		
Solids (total)	C-008	ZFZDRY	Wet	%		34.9	27.0	37.5	37.5	24.0	18.9
Suspended solids (total)	C-009	ZFZDRY	Wet	%							
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.039	< 0.04	< 0.039	< 0.04	< 0.04 U	< 0.039 UJ
Arsenic	7440-38-2	SW6020	Dry	mg/kg		0.04	0.09	1.68	1.72	0.10 J	0.08 J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.079	< 0.08	< 0.078	< 0.08	< 0.079 U	< 0.079 U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.079	< 0.08	< 0.078	< 0.08	< 0.079 U	< 0.079 U
Boron	7440-42-8	SW6020	Dry	mg/kg		0.72	1.51	< 0.50	< 0.50	< 0.50 U	0.67
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.031	0.044	0.040	0.031	0.004 J	0.012 J
Iron	7439-89-6	SW6020	Dry	mg/kg		75.3	72.2	48.3	44.8	18.0	21.7
Lead	7439-92-1	SW6020	Dry	mg/kg		0.077	0.058	0.043	0.018	0.008 J	0.016 J
Magnesium	7439-95-4	SW6010	Dry	mg/kg		1460	1460	1580	1230	794	1200
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.067 J	0.173	0.120	0.146	0.163	0.929 J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		69.1	158	124	160	235	1050
Selenium	7782-49-2	SW6020	Dry	mg/kg		1.49	2.41	2.50	2.63	2.41	7.34
Zinc	7440-66-6	SW6020	Dry	mg/kg		80.7	90.5	56.2	49.1	33.9	28.6
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		< 0.014	< 0.011	< 0.015	< 0.015	< 0.01 U	< 0.007 U
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.01	0.02	0.63	0.64	0.02 J	0.015 J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.028	< 0.022	< 0.029	< 0.03	< 0.019 U	< 0.015 U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.028	< 0.022	< 0.029	< 0.03	< 0.019 U	< 0.015 U
Boron	7440-42-8	SW6020	Wet	mg/kg		0.25	0.41	< 0.19	< 0.19	< 0.12 U	0.126
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0107	0.0119	0.0148	0.0117	0.0011 J	0.0023 J
Iron	7439-89-6	SW6020	Wet	mg/kg		26.3	19.5	18.1	16.8	4.32	4.11
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0270	0.0156	0.0163	0.0067	0.0020 J	0.0030 J
Magnesium	7439-95-4	SW6010	Wet	mg/kg		508	395	591	463	191	227
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.0234	0.0468	0.0448	0.0549	0.0392	0.176
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		24.2	42.6	46.6	60	56.4	198
Selenium	7782-49-2	SW6020	Wet	mg/kg		0.52	0.65	0.94	0.99	0.58	1.39
Zinc	7440-66-6	SW6020	Wet	mg/kg		28.2	24.4	21.1	18.4	8.14	5.40

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL2	LHL2	LHL2	LHL2	LHL2	LHL2
					Sample ID	FF-001(KB)-LHL2-171005	FF-001(LMB)-LHL2-171005	LHL2-171005-FD	FO-001(KB)-LHL2-171005	FWB-001(CC)-LHL2-171005	001(FHC)-LHL2-171005
					Lab Sample ID	K1712476-017	K1712469-009	K1712469-012	K1712476-019	K1712469-007	K1712468-003
					Sample Date	10/05/2017	10/05/2017	10/05/2017	10/05/2017	10/05/2017	10/05/2017
					Sample Type	N	N	FD	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		77.3	78.0	78.0	77.3	62.2	
Lipids	LIPIDS	NOAA LIPID	Wet	%		7.7					
Solids (total)	C-008	ZFZDRY	Wet	%		22.7	22.0	22.0	22.7	37.8	
Suspended solids (total)	C-009	ZFZDRY	Wet	%					22.7		
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.04	< 0.04 U	< 0.04 U		0.028 J	< 0.039 U
Arsenic	7440-38-2	SW6020	Dry	mg/kg		1.43	1.41	1.48		0.24 J	0.12 J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.08	< 0.079 U	< 0.079 U		< 0.078 U	< 0.078 U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.08	< 0.079 U	< 0.079 U		< 0.078 U	< 0.078 U
Boron	7440-42-8	SW6020	Dry	mg/kg		< 0.50	< 0.50 U	< 0.50 U		1.11	2.12
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.004	0.007 J	0.005 J		0.029	0.047
Iron	7439-89-6	SW6020	Dry	mg/kg		10.8	9.80	10.1		143	74.0
Lead	7439-92-1	SW6020	Dry	mg/kg		0.004	0.004 J	0.004 J		0.092	0.073
Magnesium	7439-95-4	SW6010	Dry	mg/kg		1060	1030	1080		1210	1940
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.364	0.374	0.320		0.046	0.307 J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		433	445	427		72.4	389
Selenium	7782-49-2	SW6020	Dry	mg/kg		5.3	4.31	4.3	6.89	1.71	3.72
Zinc	7440-66-6	SW6020	Dry	mg/kg		37.2	30.8	31.3		59.8	114
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		< 0.009	< 0.009 U	< 0.009 U		0.011 J	< 0.011 U
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.32	0.31	0.33		0.09 J	0.03 J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.018	< 0.017 U	< 0.017 U		< 0.029 U	< 0.022 U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.018	< 0.017 U	< 0.017 U		< 0.029 U	< 0.022 U
Boron	7440-42-8	SW6020	Wet	mg/kg		< 0.11	< 0.11 U	< 0.11 U		0.42	0.59
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0010	0.0016 J	0.0010 J		0.0110	0.0129
Iron	7439-89-6	SW6020	Wet	mg/kg		2.45	2.16	2.23		53.9	20.5
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0009	0.0009 J	0.0010 J		0.0349	0.0202
Magnesium	7439-95-4	SW6010	Wet	mg/kg		241	227	237		457	537
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.0827	0.0823	0.0704		0.0174	0.0851
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		98.3	97.9	93.9		27.4	108
Selenium	7782-49-2	SW6020	Wet	mg/kg		1.20	0.95	0.95	1.56	0.65	1.03
Zinc	7440-66-6	SW6020	Wet	mg/kg		8.45	6.78	6.89		22.6	31.6

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL2	LHL2	LHL2	LHL3	LHL3	LHL3
					Sample ID	FWB-001(KB)-LHL2-171005	001(LMB)-LHL2-171005	001(LMB)-LHL2-171005-	FF-001(CC)-LHL3-171005	LHL3-171005-FD	FF-001(KB)-LHL3-171003
					Lab Sample ID	K1712476-018	K1712469-010	K1712469-013	K1712479-006	K1712479-009	K1712476-002
					Sample Date	10/05/2017	10/05/2017	10/05/2017	10/05/2017	10/05/2017	10/03/2017
					Sample Type	N	N	N	N	FD	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		64.7	66.1	66.1	79.5	79.5	76.4
Lipids	LIPIDS	NOAA LIPID	Wet	%		32.9			20	19	8.9
Solids (total)	C-008	ZFZDRY	Wet	%		35.3	33.9	33.9	20.5	20.5	23.6
Suspended solids (total)	C-009	ZFZDRY	Wet	%							
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.04 U	< 0.039 U	< 0.039 U	< 0.4	< 0.04	< 0.039
Arsenic	7440-38-2	SW6020	Dry	mg/kg		1.17	1.37	1.52	0.11	0.11	1.53
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.08	< 0.077 U	< 0.078 U	< 0.08	< 0.08	< 0.078
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.08	< 0.077 U	< 0.078 U	< 0.08	< 0.08	< 0.078
Boron	7440-42-8	SW6020	Dry	mg/kg		< 0.50	< 0.50 U	< 0.50 U	< 0.50	< 0.50	< 0.50
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.026	0.039	0.040	0.004	0.004	< 0.020
Iron	7439-89-6	SW6020	Dry	mg/kg		43.4	41.2	43.0	28.2	24.5	11.3
Lead	7439-92-1	SW6020	Dry	mg/kg		0.026	0.025	0.021	0.017	0.013 J	0.007
Magnesium	7439-95-4	SW6010	Dry	mg/kg		1150	2000	1420	922	962	1040
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.126	0.099	0.110	0.203	0.213	0.393
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		134	142	125	220	280	515
Selenium	7782-49-2	SW6020	Dry	mg/kg		2.58	2.30	2.61	2.70	2.6	5.5
Zinc	7440-66-6	SW6020	Dry	mg/kg		63.8	50.8	51.2	41.9	39.4	41.3
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		0.006	< 0.013 U	< 0.013 U	< 0.008	< 0.008	< 0.009
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.41	0.46	0.52	0.02	0.02	0.36
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.028	< 0.026 U	< 0.026 U	< 0.016	< 0.016	< 0.019
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.028	< 0.026 U	< 0.026 U	< 0.016	< 0.016	< 0.019
Boron	7440-42-8	SW6020	Wet	mg/kg		< 0.18	< 0.17 U	< 0.17 U	< 0.10	< 0.10	< 0.12
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0093	0.0132	0.0136	0.0007	0.0008	< 0.0047
Iron	7439-89-6	SW6020	Wet	mg/kg		15.3	14.0	14.6	5.77	5.02	2.67
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0090	0.0085	0.0069	0.0035	0.0027	0.0016
Magnesium	7439-95-4	SW6010	Wet	mg/kg		405	678	481	189	197	246
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.0445	0.0334	0.0374	0.0417	0.0437	0.0928
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		47.4	48.3	42.3	45	57.4	122
Selenium	7782-49-2	SW6020	Wet	mg/kg		0.91	0.78	0.88	0.55	0.53	1.31
Zinc	7440-66-6	SW6020	Wet	mg/kg		22.5	17.2	17.4	8.59	8.08	9.74

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL3	LHL3	LHL3	LHL3	LHL3	LHL3
					Sample ID	FF-002(CC)-LHL3-171016	FF-002(KB)-LHL3-171004	FO-001(KB)-LHL3-171003	FO-002(CC)-LHL3-171016	FO-002(KB)-LHL3-171004	FWB-001(CC)-LHL3-171005
					Lab Sample ID	K1712474-006	K1712469-002	K1712476-004	K1712474-008	K1712469-004	K1712479-007
					Sample Date	10/16/2017	10/04/2017	10/03/2017	10/16/2017	10/04/2017	10/05/2017
					Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		67.0	75.4	78.6	64.8	77.1	70.1
Lipids	LIPIDS	NOAA LIPID	Wet	%		52			7.8		23
Solids (total)	C-008	ZFZDRY	Wet	%		33.0	24.6	21.4	35.2	22.9	29.9
Suspended solids (total)	C-009	ZFZDRY	Wet	%				21.4	35.2	22.9	
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.04	< 0.04 U				0.022
Arsenic	7440-38-2	SW6020	Dry	mg/kg		0.11	1.53				0.14
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.079	< 0.079 U				< 0.078
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.079	< 0.079 U				< 0.078
Boron	7440-42-8	SW6020	Dry	mg/kg		< 0.50 U	< 0.50 U				0.68
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.005	< 0.020 U				0.087
Iron	7439-89-6	SW6020	Dry	mg/kg		10.9	13.2				511
Lead	7439-92-1	SW6020	Dry	mg/kg		0.004	0.005 J				0.109
Magnesium	7439-95-4	SW6010	Dry	mg/kg		533 J	1010				1540
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.288	0.354				0.128
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		286	481				44
Selenium	7782-49-2	SW6020	Dry	mg/kg		1.3 J	4.67	6.08	6.59	5.4	2.57
Zinc	7440-66-6	SW6020	Dry	mg/kg		22.3	36.7				81.7
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		< 0.013	< 0.01 U				0.007
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.04	0.38				0.04
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.026	< 0.019 U				< 0.023
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.04	< 0.019 U				< 0.023
Boron	7440-42-8	SW6020	Wet	mg/kg		0.08	< 0.12 U				0.20
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0018	< 0.0049 U				0.0261
Iron	7439-89-6	SW6020	Wet	mg/kg		3.61	3.25				153
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0013	0.0013 J				0.0325
Magnesium	7439-95-4	SW6010	Wet	mg/kg		176	248				462
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.0950	0.0872				0.0383
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		94.5	118				13.2
Selenium	7782-49-2	SW6020	Wet	mg/kg		0.43	1.15	1.30	2.32	1.23	0.77
Zinc	7440-66-6	SW6020	Wet	mg/kg		7.35	9.03				24.4

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL3	LHL3	LHL3	LHL3	LHL4	LHL4
					Sample ID	LHL3-171005-FD	FWB-001(KB)-LHL3-171003	FWB-002(CC)-LHL3-171016	FWB-002(KB)-LHL3-171004	FF-001(CC)-LHL4-171012	FF-001(FHC)-LHL4-171012
					Lab Sample ID	K1712479-010	K1712476-003	K1712474-007	K1712469-003	K1712469-015	K1712468-009
					Sample Date	10/05/2017	10/03/2017	10/16/2017	10/04/2017	10/12/2017	10/12/2017
					Sample Type	FD	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		70.1	60.8	57.8	62.6	77.6	79.0
Lipids	LIPIDS	NOAA LIPID	Wet	%		19	27.0	42			
Solids (total)	C-008	ZFZDRY	Wet	%		20.9	39.2	42.2	37.4	22.4	21.0
Suspended solids (total)	C-009	ZFZDRY	Wet	%							
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.04 U	< 0.039	< 0.04	< 0.04 U	< 0.04 U	< 0.039 U
Arsenic	7440-38-2	SW6020	Dry	mg/kg		0.14	1.48	0.11	1.51	0.07 J	0.17 J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.079	< 0.078	< 0.079	< 0.079 U	< 0.079 U	< 0.078 U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.079	< 0.078	< 0.079	< 0.079 U	< 0.079 U	< 0.078 U
Boron	7440-42-8	SW6020	Dry	mg/kg		0.81	< 0.50	0.55	< 0.50 U	< 0.50 U	0.63
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.050	0.017	0.079	0.030	0.014 J	0.007 J
Iron	7439-89-6	SW6020	Dry	mg/kg		410	36.9	81.6	32.5	21.5	25.4
Lead	7439-92-1	SW6020	Dry	mg/kg		0.071 J	0.035	0.159	0.020 J	0.005 J	0.010 J
Magnesium	7439-95-4	SW6010	Dry	mg/kg		1280	1510	741	1420	804	999
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.078	0.197	0.154	0.187	0.723	1.05 J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		86.5	214	104 J	188	925	1670
Selenium	7782-49-2	SW6020	Dry	mg/kg		2.32	3.15	1.65	3.08	2.69	4.77
Zinc	7440-66-6	SW6020	Dry	mg/kg		80.5	74.5	59.9 J	64.0	35.9	30.5
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		0.007	< 0.015	< 0.017	< 0.015 U	< 0.009 U	< 0.009 U
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.03	0.58	0.05	0.57	0.01 J	0.03 J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.024	< 0.03	< 0.034	< 0.03 U	< 0.018 U	< 0.018 U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.024	< 0.03	< 0.04	< 0.03 U	< 0.018 U	< 0.018 U
Boron	7440-42-8	SW6020	Wet	mg/kg		0.17	< 0.20	0.23	< 0.19 U	< 0.11 U	0.13
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0104	0.0067	0.0333	0.0113	0.0032 J	0.0014 J
Iron	7439-89-6	SW6020	Wet	mg/kg		85.7	14.5	34.4	12.2	4.82	5.33
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0148	0.0136	0.0672	0.0074 J	0.0011 J	0.0020 J
Magnesium	7439-95-4	SW6010	Wet	mg/kg		268	594	313	532	180	210
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.0164	0.0772	0.0649	0.0699	0.162	0.221
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		18.1	83.8	44.1	70.6	207	379
Selenium	7782-49-2	SW6020	Wet	mg/kg		0.48	1.23	0.70	1.15	0.60	1.00
Zinc	7440-66-6	SW6020	Wet	mg/kg		16.8	29.2	25.3	23.9	8.05	6.40

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL4	LHL4	LHL4	LHL4	LHL4	LHL4
					Sample ID	FF-001(KB)-LHL4-171003	FF-001(LMB)-LHL4-171003	FO-001(KB)-LHL4-171003	FO-001(LMB)-LHL4-171003	FWB-001(CC)-LHL4-171012	001(FHC)-LHL4-171012
					Lab Sample ID	K1712476-010	K1712476-006	K1712476-012	K1712476-008	K1712469-016	K1712468-010
					Sample Date	10/03/2017	10/03/2017	10/03/2017	10/03/2017	10/12/2017	10/12/2017
					Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		77.3	78.6	79.9	81.6	69.4	
Lipids	LIPIDS	NOAA LIPID	Wet	%		4.3	2.9				
Solids (total)	C-008	ZFZDRY	Wet	%		22.7	21.4	20.1	18.4	30.6	
Suspended solids (total)	C-009	ZFZDRY	Wet	%				20.1	18.4		
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.04	< 0.04			< 0.039 U	< 0.039 U
Arsenic	7440-38-2	SW6020	Dry	mg/kg		1.21	0.74			0.07 J	0.18 J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.079	< 0.079			< 0.078 U	< 0.079 U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.079	< 0.079			< 0.078 U	< 0.079 U
Boron	7440-42-8	SW6020	Dry	mg/kg		< 0.50	< 0.50			0.56	1.56
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.019	0.011			0.072	0.073
Iron	7439-89-6	SW6020	Dry	mg/kg		8.93	8.17			90.4	54.8
Lead	7439-92-1	SW6020	Dry	mg/kg		0.033	0.010			0.058	0.064
Magnesium	7439-95-4	SW6010	Dry	mg/kg		1060	1170			1530	1490
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.625	0.250			0.204	0.344 J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		731	302			167	398
Selenium	7782-49-2	SW6020	Dry	mg/kg		5.44	4.97	6.4	6.3	2.04	2.21
Zinc	7440-66-6	SW6020	Dry	mg/kg		39.5	38.7			84.5	85.0
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		< 0.009	< 0.009			< 0.012 U	< 0.014 U
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.27	0.16			0.02 J	0.06 J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.018	< 0.017			< 0.024 U	< 0.028 U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.018	< 0.017			< 0.024 U	< 0.028 U
Boron	7440-42-8	SW6020	Wet	mg/kg		< 0.11	< 0.11			0.17	0.55
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0043	0.0022			0.0219	0.0254
Iron	7439-89-6	SW6020	Wet	mg/kg		2.03	1.75			27.7	19.2
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0075	0.0020			0.0177	0.0225
Magnesium	7439-95-4	SW6010	Wet	mg/kg		241	250			469	522
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.142	0.0536			0.0625	0.120
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		166	64.6			51	139
Selenium	7782-49-2	SW6020	Wet	mg/kg		1.23	1.06	1.28	1.16	0.62	0.77
Zinc	7440-66-6	SW6020	Wet	mg/kg		8.96	8.28			25.9	29.8

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL4	LHL4	LHL5	LHL5	LHL5	LHL5
					Sample ID	FWB-001(KB)-LHL4-171003	001(LMB)-LHL4-171003	FF-001(CC)-LHL5-171007	FF-001(LMB)-LHL5-171007	FF-002(CC)-LHL5-171007	FF-002(LMB)-LHL5-171007
					Lab Sample ID	K1712476-011	K1712476-007	K1712468-005	K1712479-015	K1712477-009	K1712479-019
					Sample Date	10/03/2017	10/03/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017
					Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		66.9	69.3	69.3	78.0	73.0	78.7
Lipids	LIPIDS	NOAA LIPID	Wet	%		23.4	17.2		11	32	8.9
Solids (total)	C-008	ZFZDRY	Wet	%		33.1	30.7	30.7	22.0	27.0	21.3
Suspended solids (total)	C-009	ZFZDRY	Wet	%							
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.04	< 0.04	< 0.039 U	< 0.04	< 0.04	< 0.04
Arsenic	7440-38-2	SW6020	Dry	mg/kg		1.17	0.92	0.14 J	1.57	0.11	1.58
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.08	< 0.079	< 0.079 U	< 0.079	< 0.079	< 0.08
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.08	< 0.079	< 0.079 U	< 0.079	< 0.079	< 0.08
Boron	7440-42-8	SW6020	Dry	mg/kg		< 0.50	< 0.50	< 0.50 U	0.34	0.23	< 0.50
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.054	0.038	0.004 J	0.004	< 0.020	< 0.020
Iron	7439-89-6	SW6020	Dry	mg/kg		50.4	37.6	10.9	10.7	11.5	11.1
Lead	7439-92-1	SW6020	Dry	mg/kg		0.068	0.028	0.008 J	0.008 J	0.005	0.005 J
Magnesium	7439-95-4	SW6010	Dry	mg/kg		1600	1600	688	1150	909	1280
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.187	0.089	0.388 J	0.241	0.188	0.286
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		170	67.8	552	437	162	495
Selenium	7782-49-2	SW6020	Dry	mg/kg		3.19	3.31	1.50	4.47	1.69	3.7
Zinc	7440-66-6	SW6020	Dry	mg/kg		85.4	63.6	28.1	33.9	32.7	30.8
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		< 0.013	< 0.012	< 0.012 U	< 0.009	< 0.011	< 0.009
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.39	0.28	0.04 J	0.34	0.03	0.34
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.026	< 0.024	< 0.024 U	< 0.017	< 0.021	< 0.017
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.026	< 0.024	< 0.024 U	< 0.017	< 0.021	< 0.017
Boron	7440-42-8	SW6020	Wet	mg/kg		< 0.17	< 0.15	< 0.15 U	0.07	0.06	< 0.11
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0179	0.0115	0.0011 J	0.0009	< 0.0054	< 0.0043
Iron	7439-89-6	SW6020	Wet	mg/kg		16.7	11.6	3.34	2.36	3.12	2.35
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0225	0.0086	0.0024 J	0.0017	0.0013	0.0010
Magnesium	7439-95-4	SW6010	Wet	mg/kg		529	490	211	253	246	273
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.0619	0.0272	0.119	0.0530	0.0508	0.0610
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		56.3	20.9	169	96.2	43.7	105
Selenium	7782-49-2	SW6020	Wet	mg/kg		1.05	1.02	0.46	0.98	0.46	0.78
Zinc	7440-66-6	SW6020	Wet	mg/kg		28.3	19.5	8.61	7.46	8.83	6.56

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL5	LHL5	LHL5	LHL5	LHL5	LHL5
					Sample ID	FO-001(CC)-LHL5-171007	FO-001(LMB)-LHL5-171007	FWB-001(CC)-LHL5-171007	001(LMB)-LHL5-171007	FWB-002(CC)-LHL5-171007	002(LMB)-LHL5-171007
					Lab Sample ID	K1712468-007	K1712479-017	K1712468-006	K1712479-016	K1712477-010	K1712479-020
					Sample Date	10/07/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017
					Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		66.6	72.7		64.3	62.4	62.4
Lipids	LIPIDS	NOAA LIPID	Wet	%		6.6			32	38	34
Solids (total)	C-008	ZFZDRY	Wet	%		33.4	27.3		35.7	37.6	37.6
Suspended solids (total)	C-009	ZFZDRY	Wet	%		33.4	27.3				
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g				< 0.039 U	< 0.04	< 0.039 U	< 0.04
Arsenic	7440-38-2	SW6020	Dry	mg/kg				0.09 J	1.45	0.12	1.58
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g				< 0.078 U	< 0.08	< 0.079	< 0.08
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g				< 0.078 U	< 0.08	< 0.079	< 0.08
Boron	7440-42-8	SW6020	Dry	mg/kg				0.35 J	0.38	1.03	< 0.50
Cadmium	7440-43-9	SW6020	Dry	mg/kg				0.021	0.027	0.020	0.025
Iron	7439-89-6	SW6020	Dry	mg/kg				26.0	35.1	56.3	34.0
Lead	7439-92-1	SW6020	Dry	mg/kg				0.033	0.029 J	0.060	0.047 J
Magnesium	7439-95-4	SW6010	Dry	mg/kg				1670	1570	1600	1450
Mercury	7439-97-6	SW7471	Dry	mg/kg				0.180 J	0.101	0.060	0.084
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g				177	129	75.6	95.4
Selenium	7782-49-2	SW6020	Dry	mg/kg		6.6	4.2	1.1	2.4	1.2	1.95
Zinc	7440-66-6	SW6020	Dry	mg/kg				72.3	50.8	61.6	48.2
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g				< 0.016 U	< 0.014	0.007	< 0.015
Arsenic	7440-38-2	SW6020	Wet	mg/kg				0.04 J	0.52	0.05	0.59
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g				< 0.033 U	< 0.028	< 0.03	< 0.03
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g				< 0.033 U	< 0.028	< 0.03	< 0.03
Boron	7440-42-8	SW6020	Wet	mg/kg				0.15 J	0.14	0.39	< 0.19
Cadmium	7440-43-9	SW6020	Wet	mg/kg				0.0089	0.0097	0.0073	0.0094
Iron	7439-89-6	SW6020	Wet	mg/kg				10.9	12.5	21.2	12.8
Lead	7439-92-1	SW6020	Wet	mg/kg				0.0138	0.0102	0.0225	0.0177
Magnesium	7439-95-4	SW6010	Wet	mg/kg				701	560	601	546
Mercury	7439-97-6	SW7471	Wet	mg/kg				0.0756	0.0359	0.0225	0.0315
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g				74.2	46.1	28.4	361
Selenium	7782-49-2	SW6020	Wet	mg/kg		2.20	1.16	0.46	0.86	0.44	0.73
Zinc	7440-66-6	SW6020	Wet	mg/kg				30.4	18.1	23.1	18.1

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL6	LHL6	LHL6	LHL6	LHL6	LHL6
					Sample ID	FF-001(CC)-LHL6-171007	FF-001(KB)-LHL6-171007	FF-001(LMB)-LHL6-171011	FF-002(CC)-LHL6-171007	FO-001(CC)-LHL6-171007	FO-001(KB)-LHL6-171007
					Lab Sample ID	K1712474-002	K1712479-022	K1712476-024	K1712479-012	K1712474-004	K1712479-024
					Sample Date	10/07/2017	10/07/2017	10/11/2017	10/07/2017	10/07/2017	10/07/2017
					Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		71.1	77.9	78.0	71.8	61.9	79.2
Lipids	LIPIDS	NOAA LIPID	Wet	%		36	6.0	5.8	37	9.0	
Solids (total)	C-008	ZFZDRY	Wet	%		28.9	22.1	22.0	28.2	38.1	20.8
Suspended solids (total)	C-009	ZFZDRY	Wet	%						38.1	20.8
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.04	< 0.04	< 0.04 UJ	< 0.04 UJ		
Arsenic	7440-38-2	SW6020	Dry	mg/kg		0.11	1.18	0.81	0.23		
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.08	< 0.08	< 0.079	< 0.08		
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.08	< 0.08	< 0.079	< 0.08		
Boron	7440-42-8	SW6020	Dry	mg/kg		< 0.50	< 0.50	< 0.50	< 0.50		
Cadmium	7440-43-9	SW6020	Dry	mg/kg		< 0.020	< 0.020	0.004	< 0.020		
Iron	7439-89-6	SW6020	Dry	mg/kg		12.9	9.25	8.08	18.2		
Lead	7439-92-1	SW6020	Dry	mg/kg		0.004	0.004 J	0.005	0.006 J		
Magnesium	7439-95-4	SW6010	Dry	mg/kg		799	1220	1040	772		
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.505	0.611	0.706 J	0.166		
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		717	771	758	207		
Selenium	7782-49-2	SW6020	Dry	mg/kg		1.5	3.97	5.66	1.1	5.78	6.7
Zinc	7440-66-6	SW6020	Dry	mg/kg		25.7	31.4	29.5	27.3		
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		< 0.012	< 0.009	< 0.009	< 0.011		
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.03	0.26	0.18	0.07		
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.023	< 0.018	< 0.017	< 0.023		
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.023	< 0.018	< 0.017	< 0.023		
Boron	7440-42-8	SW6020	Wet	mg/kg		< 0.14	< 0.11	< 0.11	< 0.14		
Cadmium	7440-43-9	SW6020	Wet	mg/kg		< 0.0058	< 0.0044	0.0008	< 0.0056		
Iron	7439-89-6	SW6020	Wet	mg/kg		3.73	2.04	1.78	5.14		
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0011	0.0008	0.0010	0.0016		
Magnesium	7439-95-4	SW6010	Wet	mg/kg		231	270	228	218		
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.146	0.135	0.155	0.0467		
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		207	171	167	58.5		
Selenium	7782-49-2	SW6020	Wet	mg/kg		0.44	0.88	1.25	0.32	2.20	1.38
Zinc	7440-66-6	SW6020	Wet	mg/kg		7.42	6.93	6.49	7.69		

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL6	LHL6	LHL6	LHL6	LHL6	MHL1
					Sample ID	FO-001(LMB)-LHL6-171011	FWB-001(CC)-LHL6-171007	FWB-001(KB)-LHL6-171007	001(LMB)-LHL6-171011	FWB-002(CC)-LHL6-171007	FF-001(FHC)-MHL1-171014
					Lab Sample ID	K1712476-026	K1712474-003	K1712479-023	K1712476-025	K1712479-013	K1712471-005
					Sample Date	10/11/2017	10/07/2017	10/07/2017	10/11/2017	10/07/2017	10/14/2017
					Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		80.7	59.6	65.3	66.7	63.0	78.9
Lipids	LIPIDS	NOAA LIPID	Wet	%			40	29	21.6	38	5.5
Solids (total)	C-008	ZFZDRY	Wet	%		19.3	40.4	34.7	33.3	37.0	21.1
Suspended solids (total)	C-009	ZFZDRY	Wet	%		19.3					
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g			< 0.04	< 0.04	< 0.04	0.026	< 0.039
Arsenic	7440-38-2	SW6020	Dry	mg/kg			0.14	1.26	0.87	0.26	0.08
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g			< 0.08	< 0.079	< 0.08	< 0.08	< 0.079
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g			< 0.08	< 0.079	< 0.08	< 0.08	< 0.079
Boron	7440-42-8	SW6020	Dry	mg/kg			< 0.50	< 0.50	< 0.50	0.32	0.24
Cadmium	7440-43-9	SW6020	Dry	mg/kg			0.033	0.021	0.025	0.033	0.012
Iron	7439-89-6	SW6020	Dry	mg/kg			43.5	43.4	36.5	54.8	16.8
Lead	7439-92-1	SW6020	Dry	mg/kg			0.129	0.020 J	0.037	0.101 J	0.008
Magnesium	7439-95-4	SW6010	Dry	mg/kg			844	1850	1690	1060	973
Mercury	7439-97-6	SW7471	Dry	mg/kg			0.171	0.166	0.243	0.061	0.947 J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g			188	197	288	68.8	1280
Selenium	7782-49-2	SW6020	Dry	mg/kg		7.56	1.28	2.40	3.3	1.3	1.97
Zinc	7440-66-6	SW6020	Dry	mg/kg			46.1	72.5	51.3	56.9	23.6
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g			< 0.016	< 0.014	< 0.013	0.010	< 0.008
Arsenic	7440-38-2	SW6020	Wet	mg/kg			0.06	0.44	0.29	0.10	0.02
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g			< 0.032	< 0.028	< 0.027	< 0.03	< 0.017
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g			< 0.032	< 0.028	< 0.027	< 0.03	< 0.017
Boron	7440-42-8	SW6020	Wet	mg/kg			< 0.20	< 0.17	< 0.17	0.12	0.05
Cadmium	7440-43-9	SW6020	Wet	mg/kg			0.0134	0.0072	0.0082	0.0122	0.0025
Iron	7439-89-6	SW6020	Wet	mg/kg			17.6	15.1	12.2	20.3	3.54
Lead	7439-92-1	SW6020	Wet	mg/kg			0.0520	0.0071	0.0123	0.0374	0.0016
Magnesium	7439-95-4	SW6010	Wet	mg/kg			341	643	563	391	205
Mercury	7439-97-6	SW7471	Wet	mg/kg			0.0691	0.0576	0.0808	0.0226	0.200
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g			76	68.5	96	25.5	269
Selenium	7782-49-2	SW6020	Wet	mg/kg		1.46	0.52	0.83	1.12	0.49	0.42
Zinc	7440-66-6	SW6020	Wet	mg/kg			18.6	25.2	17.1	21.1	4.99

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Filet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	MHL1	MHL1	MHL1	MHL1	MHL1	MHL1
					Sample ID	FF-001(KB)-MHL1-171014	FF-001(LMB)-MHL1-171015	FF-002(FHC)-MHL1-171014	FO-001(FHC)-MHL1-171014	FO-001(KB)-MHL1-171014	FWB-001(FHC)-MHL1-171014
					Lab Sample ID	K1712471-009	K1712471-017	K1712468-012	K1712471-007	K1712471-011	K1712471-006
					Sample Date	10/14/2017	10/15/2017	10/14/2017	10/14/2017	10/14/2017	10/14/2017
					Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		76.5	77.1	78.4	83.2	74.6	69.8
Lipids	LIPIDS	NOAA LIPID	Wet	%		11	7.5		1.7		21
Solids (total)	C-008	ZFZDRY	Wet	%		23.5	22.9	21.6	16.8	25.4	30.2
Suspended solids (total)	C-009	ZFZDRY	Wet	%		--	--	--	16.8	25.4	--
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.039	< 0.039	< 0.04 U	--	--	< 0.04 U
Arsenic	7440-38-2	SW6020	Dry	mg/kg		1.50	1.15	0.11 J	--	--	0.18
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.078	< 0.079	< 0.079 U	--	--	< 0.08
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.078	< 0.079	< 0.079 U	--	--	< 0.08
Boron	7440-42-8	SW6020	Dry	mg/kg		< 0.50	< 0.50	< 0.50 U	--	--	0.46
Cadmium	7440-43-9	SW6020	Dry	mg/kg		< 0.020	< 0.020	< 0.020 U	--	--	0.036
Iron	7439-89-6	SW6020	Dry	mg/kg		12.3	8.60	10.1	--	--	49.9
Lead	7439-92-1	SW6020	Dry	mg/kg		0.013	0.004	0.005 J	--	--	0.057
Magnesium	7439-95-4	SW6010	Dry	mg/kg		882	957	836	--	--	1520
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.304 J	0.448 J	1.52 J	--	--	0.369 J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		433	614	1980	--	--	350
Selenium	7782-49-2	SW6020	Dry	mg/kg		1.60	1.81	1.9	10.9	3.3	1.19
Zinc	7440-66-6	SW6020	Dry	mg/kg		28.4	31.0	27.5	--	--	83.4
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		< 0.009	< 0.009	< 0.009 U	--	--	0.005
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.35	0.26	0.02 J	--	--	0.06
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.018	< 0.018	< 0.017 U	--	--	< 0.024
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.018	< 0.018	< 0.017 U	--	--	< 0.024
Boron	7440-42-8	SW6020	Wet	mg/kg		< 0.12	< 0.11	< 0.11 U	--	--	0.14
Cadmium	7440-43-9	SW6020	Wet	mg/kg		< 0.0047	< 0.0046	< 0.0043 U	--	--	0.0108
Iron	7439-89-6	SW6020	Wet	mg/kg		2.90	1.97	2.17	--	--	15.1
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0030	0.0008	0.0010 J	--	--	0.0171
Magnesium	7439-95-4	SW6010	Wet	mg/kg		207	219	181	--	--	458
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.0714	0.103	0.329	--	--	0.112
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		102	141	427	--	--	106
Selenium	7782-49-2	SW6020	Wet	mg/kg		0.37	0.41	0.40	1.83	0.83	0.36
Zinc	7440-66-6	SW6020	Wet	mg/kg		6.67	7.11	5.94	--	--	25.2

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	MHL1	MHL1	MHL1	MHL3	MHL3	MHL3
					Sample ID	FWB-001(KB)-MHL1-171014	001(LMB)-MHL1-171015	002(FHC)-MHL1-171014	FF-001(CC)-MHL3-171014	FF-001(LMB)-MHL3-171014	FF-002(CC)-MHL3-171014
					Lab Sample ID	K1712471-010	K1712471-018	K1712468-013	K1712471-013	K1712477-012	K1712468-015
					Sample Date	10/14/2017	10/15/2017	10/14/2017	10/14/2017	10/14/2017	10/14/2017
					Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit		Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%		62.8	63.2		72.4	78.5	74.4
Lipids	LIPIDS	NOAA LIPID	Wet	%		26	29		25	8.1	
Solids (total)	C-008	ZFZDRY	Wet	%		37.2	36.8		27.6	21.5	25.6
Suspended solids (total)	C-009	ZFZDRY	Wet	%							
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g		< 0.039	< 0.04 UJ	< 0.039 U	< 0.039	< 0.04	< 0.039
Arsenic	7440-38-2	SW6020	Dry	mg/kg		1.52	1.39	0.13 J	0.17	1.36	0.16 J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g		< 0.079	< 0.079	< 0.077 U	< 0.078	< 0.08	< 0.078 U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g		< 0.079	< 0.079	< 0.077 U	< 0.078	< 0.08	< 0.078 U
Boron	7440-42-8	SW6020	Dry	mg/kg		< 0.50	< 0.50	0.20 J	< 0.50	< 0.50	< 0.50 U
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.007	0.018	0.030	< 0.020	< 0.020	< 0.020 U
Iron	7439-89-6	SW6020	Dry	mg/kg		40.1	48.1	30.0	13.9	7.85	15.1
Lead	7439-92-1	SW6020	Dry	mg/kg		0.025	0.018	0.064	0.006	0.003	0.005 J
Magnesium	7439-95-4	SW6010	Dry	mg/kg		1350	1200	1590	732	1310	791
Mercury	7439-97-6	SW7471	Dry	mg/kg		0.139 J	0.162 J	0.570 J	0.542 J	0.847	0.191 J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		161	194	477	689	766	300
Selenium	7782-49-2	SW6020	Dry	mg/kg		1.2	1.31	0.80 J	0.7	1.53	0.95 J
Zinc	7440-66-6	SW6020	Dry	mg/kg		61.4	50.3	90.0	28.4	34.1	27.6
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g		< 0.015	< 0.015	< 0.016 U	< 0.011	< 0.009	< 0.01 U
Arsenic	7440-38-2	SW6020	Wet	mg/kg		0.57	0.51	0.05 J	0.05	0.29	0.04 J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g		< 0.029	< 0.029	< 0.031 U	< 0.022	< 0.017	< 0.02 U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g		< 0.029	< 0.029	< 0.031 U	< 0.022	< 0.017	< 0.02 U
Boron	7440-42-8	SW6020	Wet	mg/kg		< 0.19	< 0.18	0.08 J	< 0.14	< 0.11	< 0.13 U
Cadmium	7440-43-9	SW6020	Wet	mg/kg		0.0025	0.0065	0.0119	< 0.0055	< 0.0043	< 0.0051 U
Iron	7439-89-6	SW6020	Wet	mg/kg		14.9	17.7	12.1	3.84	1.69	3.86
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0092	0.0067	0.0259	0.0018	0.0007	0.0013 J
Magnesium	7439-95-4	SW6010	Wet	mg/kg		501	443	640	202	281	202
Mercury	7439-97-6	SW7471	Wet	mg/kg		0.0518	0.0596	0.230	0.150	0.182	0.0490
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		59.9	71.5	192	190	165	76.7
Selenium	7782-49-2	SW6020	Wet	mg/kg		0.44	0.48	0.32 J	0.20	0.33	0.24 J
Zinc	7440-66-6	SW6020	Wet	mg/kg		22.8	18.5	36.3	7.85	7.33	7.05

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	MHL3	MHL3	MHL3	MHL3	MHL3	MHL3
				Sample ID	FF-002(LMB)-MHL3-171014	FO-001(CC)-MHL3-171014	FO-001(LMB)-MHL3-171014	FWB-001(CC)-MHL3-171014	001(LMB)-MHL3-171014	FWB-002(CC)-MHL3-171014
				Lab Sample ID	K1712477-016	K1712471-015	K1712477-014	K1712471-014	K1712477-013	K1712468-016
				Sample Date	10/14/2017	10/14/2017	10/14/2017	10/14/2017	10/14/2017	10/14/2017
				Sample Type	N	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit	Result	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%	77.5	67.5	81.3	61.2	64.9	
Lipids	LIPIDS	NOAA LIPID	Wet	%	8.3	6.7	1.6	34	29	
Solids (total)	C-008	ZFZDRY	Wet	%	22.5	32.5	18.7	38.8	35.1	
Suspended solids (total)	C-009	ZFZDRY	Wet	%		32.5	18.7			
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g	< 0.04			< 0.039	< 0.039	0.016 J
Arsenic	7440-38-2	SW6020	Dry	mg/kg	1.28			0.22	1.69	0.20 J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g	< 0.08			< 0.079	< 0.078	< 0.078 U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g	< 0.08			< 0.079	< 0.078	< 0.078 U
Boron	7440-42-8	SW6020	Dry	mg/kg	< 0.50			< 0.50	< 0.50	0.25 J
Cadmium	7440-43-9	SW6020	Dry	mg/kg	< 0.020			0.016	0.023	0.019 J
Iron	7439-89-6	SW6020	Dry	mg/kg	11.0			64.9	65.4	134
Lead	7439-92-1	SW6020	Dry	mg/kg	< 0.020			0.052	0.064	0.143
Magnesium	7439-95-4	SW6010	Dry	mg/kg	1350			820	1550	1350
Mercury	7439-97-6	SW7471	Dry	mg/kg	0.342			0.208 J	0.221	0.080 J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	373			201	225	93.4
Selenium	7782-49-2	SW6020	Dry	mg/kg	1.36	5.11	3.95	0.69	1.14	0.95 J
Zinc	7440-66-6	SW6020	Dry	mg/kg	34.7			52.2	53.9	66.6
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g	< 0.009			< 0.015	< 0.014	0.006 J
Arsenic	7440-38-2	SW6020	Wet	mg/kg	0.29			0.09	0.59	0.07 J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g	< 0.018			< 0.031	< 0.027	< 0.028 U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g	< 0.018			< 0.031	< 0.027	< 0.028 U
Boron	7440-42-8	SW6020	Wet	mg/kg	< 0.11			< 0.19	< 0.18	0.09 J
Cadmium	7440-43-9	SW6020	Wet	mg/kg	< 0.0045			0.0061	0.0081	0.0069 J
Iron	7439-89-6	SW6020	Wet	mg/kg	2.47			25.2	22.9	48.5
Lead	7439-92-1	SW6020	Wet	mg/kg	< 0.0045			0.0202	0.0225	0.0519
Magnesium	7439-95-4	SW6010	Wet	mg/kg	303			318	543	490
Mercury	7439-97-6	SW7471	Wet	mg/kg	0.0769			0.0809	0.0775	0.0289
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g	84			78.2	79	33.9
Selenium	7782-49-2	SW6020	Wet	mg/kg	0.31	1.66	0.74	0.27	0.40	0.34 J
Zinc	7440-66-6	SW6020	Wet	mg/kg	7.80			20.2	18.9	24.2

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	MHL3	DR	DR	DR	DR
				Sample ID	002(LMB)-MHL3-171014	FF-001(BT)-DR-171016	FF-001(HS)-DR-171016	FF-001(LMB)-DR-171016	FF-001(SS)-DR-171016
				Lab Sample ID	K1712477-017	K1712476-028	K1712468-021	K1712471-020	K1712468-018
				Sample Date	10/14/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017
				Sample Type	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%	65.0	79.1	79.3	78.2	79.8
Lipids	LIPIDS	NOAA LIPID	Wet	%	32	3.1		2.3	
Solids (total)	C-008	ZFZDRY	Wet	%	35.0	20.9	20.7	21.8	20.2
Suspended solids (total)	C-009	ZFZDRY	Wet	%					
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g	< 0.04	< 0.04	< 0.039 U	< 0.04	< 0.039 UJ
Arsenic	7440-38-2	SW6020	Dry	mg/kg	1.38	1.11	0.23 J	0.32	0.12 J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g	< 0.08	< 0.08	< 0.078 U	< 0.079	< 0.079 U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g	< 0.08	< 0.08	< 0.078 U	< 0.079	< 0.079 U
Boron	7440-42-8	SW6020	Dry	mg/kg	< 0.50	< 0.50	0.51	< 0.50	0.65
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.010	0.013	0.013 J	0.010	0.016 J
Iron	7439-89-6	SW6020	Dry	mg/kg	40.4	26.2	22.6	16.0	19.4
Lead	7439-92-1	SW6020	Dry	mg/kg	0.023	0.008	0.008 J	0.004	0.011 J
Magnesium	7439-95-4	SW6010	Dry	mg/kg	1700	985	1360	1200	1250
Mercury	7439-97-6	SW7471	Dry	mg/kg	0.116	0.083	0.130	0.697	0.157
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	133	108	132	851	191
Selenium	7782-49-2	SW6020	Dry	mg/kg	1.01	2.1	5.10	4.28	6.29
Zinc	7440-66-6	SW6020	Dry	mg/kg	50.4	68.1	46.5	42.2	39.2
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g	< 0.014	< 0.08	< 0.008 U	< 0.009	< 0.008 U
Arsenic	7440-38-2	SW6020	Wet	mg/kg	0.48	0.23	0.05 J	0.07	0.02 J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g	< 0.028	< 0.017	< 0.016 U	< 0.017	< 0.016 U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g	< 0.028	< 0.017	< 0.016 U	< 0.017	< 0.016 U
Boron	7440-42-8	SW6020	Wet	mg/kg	< 0.18	< 0.10	0.11	< 0.11	0.13
Cadmium	7440-43-9	SW6020	Wet	mg/kg	0.0033	0.0026	0.0026 J	0.0022	0.0032 J
Iron	7439-89-6	SW6020	Wet	mg/kg	14.2	5.47	4.67	3.49	3.92
Lead	7439-92-1	SW6020	Wet	mg/kg	0.0079	0.0016	0.0016 J	0.0009	0.0022 J
Magnesium	7439-95-4	SW6010	Wet	mg/kg	596	206	281	262	253
Mercury	7439-97-6	SW7471	Wet	mg/kg	0.0405	0.0174	0.0269	0.152	0.0316
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g	46.7	22.5	27.3	186	38.6
Selenium	7782-49-2	SW6020	Wet	mg/kg	0.35	0.43	1.06	0.93	1.27
Zinc	7440-66-6	SW6020	Wet	mg/kg	17.6	14.2	9.63	9.20	7.91

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	DR	DR	DR	DR	DR
				Sample ID	FO-001(BT)-DR-171016	FO-001(HS)-DR-171016	FO-001(LMB)-DR-171016	FWB-001(BT)-DR-171016	FWB-001(HS)-DR-171016
				Lab Sample ID	K1712476-030	K1712468-023	K1712471-022	K1712476-029	K1712468-022
				Sample Date	10/16/2017	10/16/2017	10/16/2017	10/16/2017	10/16/2017
				Sample Type	N	N	N	N	N
Analyte	CASRN	Method	Basis	Unit	Result	Result	Result	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%	59.2	78.8	79.4	74.9	69.9
Lipids	LIPIDS	NOAA LIPID	Wet	%	8.4	1.2		9.4	
Solids (total)	C-008	ZFZDRY	Wet	%	40.8	21.2	20.6	25.1	30.1
Suspended solids (total)	C-009	ZFZDRY	Wet	%	40.8	21.2	20.6		
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g				0.014	0.018 J
Arsenic	7440-38-2	SW6020	Dry	mg/kg				0.80	0.13 J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g				< 0.078	< 0.079 U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g				< 0.078	< 0.079 U
Boron	7440-42-8	SW6020	Dry	mg/kg				< 0.50	0.88
Cadmium	7440-43-9	SW6020	Dry	mg/kg				0.012	0.056
Iron	7439-89-6	SW6020	Dry	mg/kg				65.5	34.9
Lead	7439-92-1	SW6020	Dry	mg/kg				0.104	0.028
Magnesium	7439-95-4	SW6010	Dry	mg/kg				1420	1790
Mercury	7439-97-6	SW7471	Dry	mg/kg				0.048	0.053
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g				89.8	98.6
Selenium	7782-49-2	SW6020	Dry	mg/kg	6.95	5.86	6.37	2.30	3.4
Zinc	7440-66-6	SW6020	Dry	mg/kg				187	71.4
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g				0.003	0.005 J
Arsenic	7440-38-2	SW6020	Wet	mg/kg				0.20	0.04 J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g				< 0.02	< 0.024 U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g				< 0.02	< 0.024 U
Boron	7440-42-8	SW6020	Wet	mg/kg				< 0.13	0.26
Cadmium	7440-43-9	SW6020	Wet	mg/kg				0.0029	0.0169
Iron	7439-89-6	SW6020	Wet	mg/kg				16.4	10.5
Lead	7439-92-1	SW6020	Wet	mg/kg				0.0260	0.0083
Magnesium	7439-95-4	SW6010	Wet	mg/kg				357	538
Mercury	7439-97-6	SW7471	Wet	mg/kg				0.0120	0.0158
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g				22.7	30
Selenium	7782-49-2	SW6020	Wet	mg/kg	2.84	1.24	1.31	0.58	1.03
Zinc	7440-66-6	SW6020	Wet	mg/kg				47.0	21.5

Table 2-1G: Phase I Adult Bass and Catfish, Trout, and Sucker Analytical Results (Fillet, Remains, and Ovary, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	DR	DR
				Sample ID	FWB-001(LMB)-DR-171016	FWB-001(SS)-DR-171016
				Lab Sample ID	K1712471-021	K1712468-019
				Sample Date	10/16/2017	10/16/2017
				Sample Type	N	N
Analyte	CASRN	Method	Basis	Unit	Result	Result
Moisture Content	MOISTURE	CALCULATED	Wet	%	67.6	73.6
Lipids	LIPIDS	NOAA LIPID	Wet	%	17	
Solids (total)	C-008	ZFZDRY	Wet	%	32.4	26.4
Suspended solids (total)	C-009	ZFZDRY	Wet	%		
Arsenic	7440-38-2	EPA 1632A	Dry	ug/g	0.025	0.032 J
Arsenic	7440-38-2	SW6020	Dry	mg/kg	0.24	0.14 J
Arsenic III	22541-54-4	EPA 1632A	Dry	ug/g	< 0.08	< 0.078 U
Arsenic V	17428-41-0	EPA 1632A	Dry	ug/g	< 0.08	< 0.078 U
Boron	7440-42-8	SW6020	Dry	mg/kg	< 0.50	1.40
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.038	0.022
Iron	7439-89-6	SW6020	Dry	mg/kg	61.9	108
Lead	7439-92-1	SW6020	Dry	mg/kg	0.029	0.108
Magnesium	7439-95-4	SW6010	Dry	mg/kg	1880	2180
Mercury	7439-97-6	SW7471	Dry	mg/kg	0.253	0.078
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	341	118
Selenium	7782-49-2	SW6020	Dry	mg/kg	2.91	4.5
Zinc	7440-66-6	SW6020	Dry	mg/kg	60.4	93.6
Arsenic	7440-38-2	EPA 1632A	Wet	ug/g	0.008	0.008 J
Arsenic	7440-38-2	SW6020	Wet	mg/kg	0.08	0.04 J
Arsenic III	22541-54-4	EPA 1632A	Wet	ug/g	< 0.026	< 0.021 U
Arsenic V	17428-41-0	EPA 1632A	Wet	ug/g	< 0.026	< 0.021 U
Boron	7440-42-8	SW6020	Wet	mg/kg	< 0.16	0.37
Cadmium	7440-43-9	SW6020	Wet	mg/kg	0.0123	0.0059
Iron	7439-89-6	SW6020	Wet	mg/kg	20.0	28.5
Lead	7439-92-1	SW6020	Wet	mg/kg	0.0093	0.0285
Magnesium	7439-95-4	SW6010	Wet	mg/kg	608	575
Mercury	7439-97-6	SW7471	Wet	mg/kg	0.0819	0.0205
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g	111	31.3
Selenium	7782-49-2	SW6020	Wet	mg/kg	0.94	1.19
Zinc	7440-66-6	SW6020	Wet	mg/kg	19.6	24.7

Notes:

%: Percent
BT: Brown Trout
CC: Channel Catfish
CI: Curd's Inlet
DR: Dix River
EPA: Environmental Protection Agency
FD: Field Duplicate Sample
FF: Fish Filet Sample
FHC: Flathead Catfish
FO: Fish Ovary Sample
FWB: Fish Remains Sample
HS: Northern Hogsucker
IQ: Interpreted qualifier, data flags from third party validation. Note: QA resulted in no qualifiers for these data
J: Result is greater than method detection limit but less than lab reporting limit
KB: Kentucky Bass
LHL: Lower Herrington Lake
LMB: Largemouth Bass
mg/kg: milligrams per kilogram
MHL: Middle Herrington Lake
N: Normal Sample
ng/g: nanograms per gram
SS: Spotted Sucker
T: Total
U: Constituent was analyzed for, but not detected
ug/g: micrograms per gram

Table 2-1H: Phase II Adult Bass and Catfish Analytical Results (Whole-Body, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI		CI		LHL1		LHL1	
				Sample Date	06/16/2018		06/19/2018		06/16/2018		06/20/2018	
				Sample Type	N		N		N		N	
				Lab ID	K1806499-001		K1806499-002		K1806158-007		K1806480-003	
				Sample ID	FWB001(LMB)-CI-180616		FWB001(FHC)-CI-180619		FWB001(LMB)-LHL1-180616		FWB001(FHC)-LHL1-180620	
Analyte	CASRN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Selenium	7782-49-2	Dry	SW6020	mg/kg	3.32		3.20		4.76		3.37	
Selenium	7782-49-2	Wet	SW6020	mg/kg	0.97		0.98		1.32		0.88	
Lipids	LIPIDS	Wet	NOAA LIPID	%	20		30		14		23	
Solids (total)	C-008	Wet	ZFZDRY	%	29.2		30.6		27.8		26.0	
Moisture Content	MOISTURE	Wet	CALCULATED	%	70.8		69.4		72.2		74.0	

				Location	LHL2		LHL2		LHL6		LHL6	
				Sample Date	06/16/2018		06/20/2018		06/16/2018		06/20/2018	
				Sample Type	N		N		N		N	
				Lab ID	K1806480-001		K1806480-002		K1806158-004		K1806480-004	
				Sample ID	FWB001(LMB)-LHL2-180616		FWB001(FHC)-LHL2-180620		FWB001(LMB)-LHL6-180616		FWB001(FHC)-LHL6-180620	
Analyte	CASRN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Selenium	7782-49-2	Dry	SW6020	mg/kg	4.21		2.98		2.0		1.6	
Selenium	7782-49-2	Wet	SW6020	mg/kg	1.15		0.83		0.62		0.41	
Lipids	LIPIDS	Wet	NOAA LIPID	%	14		26		27		19	
Solids (total)	C-008	Wet	ZFZDRY	%	27.3		27.7		30.2		25.6	
Moisture Content	MOISTURE	Wet	CALCULATED	%	72.7		72.3		69.8		74.4	

Notes:

%: Percent
CI: Curd's Inlet
FHC: Flathead Catfish
IQ: Interpreted qualifier, data flags from third party validation. Note: QA resulted in no qualifiers for these data
LHL: Lower Herrington Lake
LMB: Largemouth Bass
mg/kg: milligrams per kilogram
N: Normal Sample
NOAA: National Oceanic and Atmospheric Administration

Table 2-1I: Phase II Young-of-the-Year Bluegill Analytical Results (Whole-Body, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	UCI		UCI		UCI		MCI		MCI	
				Sample Date	07/20/2018		07/20/2018		07/20/2018		07/21/2018		07/21/2018	
				Sample Type	N		N		FD		N		N	
				Sample ID	YOY-001-UCI		YOY-002-UCI		YOY-001-UCIDUP		YOY-003-MCI		YOY-004-MCI	
Analyte	CASRN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Selenium	7782-49-2	Dry	SW6020A	mg/kg	24.8		21.8		24.5		14.4		15.6	
Selenium	7782-49-2	Wet	SW6020A	mg/kg	4.14		3.72				2.36		2.48	
Lipids	LIPIDS	Wet	NOAA LIPID	%	2.1		2.0		2.3		1.1		1.4	
Solids (total)	C-008	Wet	ZFZDRY	%	16.7		17.1		17.0		16.4		15.9	
Selenium	7782-49-2	Dry	SW7742	mg/kg	26.1				31.5		20.0			
Selenium	7782-49-2	Wet	SW7742	mg/kg	4.35						3.28			
Moisture Content	MOISTURE	Wet	CALCULATED	%	83.3		82.9				83.6		84.1	

				Location	LCI		LCI		LCI		LCI		LHL1	
				Sample Date	07/23/2018		07/23/2018		07/25/2018		07/25/2018		07/22/2018	
				Sample Type	N		N		N		N		N	
				Sample ID	YOY-005-LCI		YOY-006-LCI		YOY-007-HQI		YOY-008-HQI		YOY-009-LHL1	
Analyte	CASRN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Selenium	7782-49-2	Dry	SW6020A	mg/kg	9.02		9.27		7.8		9.09		5.22	
Selenium	7782-49-2	Wet	SW6020A	mg/kg	1.44		1.77		1.69		1.89		0.68	
Lipids	LIPIDS	Wet	NOAA LIPID	%	1.8		1.6		1.9		1.2		0.75	
Solids (total)	C-008	Wet	ZFZDRY	%	16.0		19.1		21.5		20.8		13.1	
Selenium	7782-49-2	Dry	SW7742	mg/kg			14.1		11.3		16.9		3.85	
Selenium	7782-49-2	Wet	SW7742	mg/kg			2.69		2.43		3.52		0.50	
Moisture Content	MOISTURE	Wet	CALCULATED	%	84.0		80.9		78.5		79.2		86.9	

Table 2-1I: Phase II Young-of-the-Year Bluegill Analytical Results (Whole-Body, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	LHL1		HI		HI		LHL6		LHL6	
				Sample Date	07/22/2018		07/25/2018		07/25/2018		07/24/2018		07/24/2018	
				Sample Type	N		N		N		N		N	
				Sample ID	YOY-010-LHL1		YOY-013-HI		YOY-014-HI		YOY-011-LHL6		YOY-012-LHL6	
Analyte	CASRN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Selenium	7782-49-2	Dry	SW6020A	mg/kg	5.6		5.0		5.40		3.2		3.28	
Selenium	7782-49-2	Wet	SW6020A	mg/kg	0.70		1.11		1.16		0.64		0.66	
Lipids	LIPIDS	Wet	NOAA LIPID	%	1.2		1.8		2.3		1.3		1.5	
Solids (total)	C-008	Wet	ZFZDRY	%	12.5		21.9		21.5		20.2		20.0	
Selenium	7782-49-2	Dry	SW7742	mg/kg	3.67		9.69		9.58		3.23		6.31	
Selenium	7782-49-2	Wet	SW7742	mg/kg	0.46		2.12		2.06		0.65		1.26	
Moisture Content	MOISTURE	Wet	CALCULATED	%	87.5		78.1		78.5		79.8		80.0	

				Location	HI		HI		MCI		MCI	
				Sample Date	11/27/2018		11/27/2018		11/27/2018		11/27/2018	
				Sample Type	N		N		N		N	
				Sample ID	YOY-PRES-001-HI-E		YOY-PRES-002-HI-N		YOY-PRES-001-MCI-E		YOY-PRES-002-MCI-N	
Analyte	CASRN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Selenium	7782-49-2	Dry	SW6020A	mg/kg	5.29		4.89		15.8		15.5	
Selenium	7782-49-2	Wet	SW6020A	mg/kg	0.87		0.92		1.85		1.98	
Lipids	LIPIDS	Wet	NOAA LIPID	%								
Solids (total)	C-008	Wet	ZFZDRY	%	16.4		18.8		11.7		12.8	
Selenium	7782-49-2	Dry	SW7742	mg/kg								
Selenium	7782-49-2	Wet	SW7742	mg/kg								
Moisture Content	MOISTURE	Wet	CALCULATED	%								

Table 2-1I: Phase II Young-of-the-Year Bluegill Analytical Results (Whole-Body, Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Notes:

%: Percent
CI: Curd's Inlet
FD: Field Duplicate Sample
HI: Hardin Inlet
IQ: Interpreted qualifier, data flags from third party validation. Note: QA resulted in no qualifiers for these data
LCI: Lower Curds Inlet
LHL: Lower Herrington Lake
MCI: Middle Curds Inlet
mg/kg: milligrams per kilogram
N: Normal Sample
NOAA: National Oceanic and Atmospheric Administration
UCI: Upper Curds Inlet
YOY: Young of the Year

Table 2-2A: Phase I Surface Water Analytical Results (Stratification and Overturn)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI1		CI1		CI1		CI2		CI2		CI2		CI3	
				Season	Stratification		Stratification		Overturn		Stratification		Stratification		Overturn		Stratification	
				Sample Date	10/14/2017		10/14/2017		12/11/2017		10/14/2017		10/14/2017		12/11/2017		10/14/2017	
				Sample Type	N		FD		N		N		FD		N		N	
				Lab ID	K1711263		K1711263		K1713449		K1711263		K1711263		K1713449		K1711263	
				Sample ID	SW-001(5)-CI1-171014		DUP-01-171014		SW001(2)CI1-171211		SW-001(10)-CI2-171014		DUP-02-171014		SW001(4)CI2-171211		SW-001(10)-CI3-171014	
Analyte	CAS RN	D/T	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	1.44		1.41		2.24		1.42		1.53		2.65		1.36	
Arsenic	7440-38-2	T	E200.8	ug/l	1.74		1.39		3.55		1.59		1.72		5.48		1.58	
Boron	7440-42-8	D	E200.8	ug/l	552		442		2560		461		461		2240		441	
Boron	7440-42-8	T	E200.8	ug/l	391		452		2520		450		426		2290		536	
Cadmium	7440-43-9	D	E200.8	ug/l	< 0.020	U	< 0.020	U	0.211		< 0.020	U	< 0.020	U	0.180		< 0.020	U
Cadmium	7440-43-9	T	E200.8	ug/l	0.156		< 0.020	U	0.343		0.028		< 0.020	U	0.377		< 0.020	U
Iron	7439-89-6	D	E200.8	ug/l	77.1		16.9		6.5		47.7		86.3		11.5		23.7	
Iron	7439-89-6	T	E200.8	ug/l	142		53.2		295		99.2		140		614		62.9	
Lead	7439-92-1	D	E200.8	ug/l					< 0.010	U					< 0.010	U		
Lead	7439-92-1	T	E200.8	ug/l					0.264						0.631			
Magnesium	7439-95-4	D	E200.8	ug/l	11800		11200		27400		11700		12100		25600		11300	
Magnesium	7439-95-4	T	E200.8	ug/l	12200		11000		27400		11900		11900		25600		11400	
Mercury	7439-97-6	D	E1631	ng/l	1710		535		1.03		715		1100		1.24		970	
Mercury	7439-97-6	T	SW7470	ug/l	7.78		3.03		< 0.20	U	4.28		5.02		< 0.20	U	6.46	
Methylmercury	22967-92-6	D	E1630	ng/l	0.59		0.23		< 0.1	U	0.12		0.27		< 0.1	U	0.16	
Methylmercury	22967-92-6	T	E1630	ng/l	0.86		0.2		< 0.1	U	0.18		0.39		0.06	J	0.59	
Selenium	7782-49-2	D	E200.8	ug/l	2.0		1.2		4.9		1.7		2.2		4.5		1.4	
Selenium	7782-49-2	T	E200.8	ug/l	2.1		1.3		5.2		1.7		2.1		4.6		1.4	
Zinc	7440-66-6	D	E200.8	ug/l	2.8		< 2.0	U	3.4		< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U
Zinc	7440-66-6	T	E200.8	ug/l	9.8		2.9		3.6		3.3		4.2		5.3		2.3	
Dissolved Organic Carbon	DOC	D	SW9060	mg/l					3.41						3.39			
Hardness (Filtered)	FHARD	D	SM2340C	mg/l	184		152		256		166		179		251		159	
Hardness (total)	THARD	T	SM2340C	mg/l					265						257			
Hardness, Total	HARD	T	SM2340C	mg/l	183		153		265		170		183		257		166	
Organic Carbon (dissolved)	C-012D	D	SW9060	mg/l	4.07		3.57		3.41		3.57		3.64		3.39		3.86	
Organic Carbon (total)	C-012	T	SW9060	mg/l	4.64		3.55		3.14		3.59		3.44		3.25		3.55	
Sulfate	14808-79-8	D	E300	mg/l	64.5		51.5		107		59.8		64.7		99.8		53.5	
Sulfate	14808-79-8	T	E300	mg/l	63.6		52.1		107		59.3		64.3		100		53.0	

Table 2-2A: Phase I Surface Water Analytical Results (Stratification and Overturn)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI3		CI3		CI4		CI4		CI4		CI4		HQ1	
				Season	Stratification		Overturn		Stratification		Stratification		Overturn		Overturn		Stratification	
				Sample Date	10/14/2017		12/11/2017		10/14/2017		10/14/2017		12/12/2017		12/12/2017		10/04/2017	
				Sample Type	FD		N		N		N		N		FD		N	
				Lab ID	K1711263		K1713449		K1711263		K1711263		K1713449		K1713449		K1711264	
				Sample ID	DUP-03-171014		SW001(9)CI3-171211		SW-001(70)-CI4-171014		SW-002(20)-CI4-171014		SW001(25)CI4-171212		DUP-001-171212		SW-001(10)-HQ1-171004	
Analyte	CAS RN	D/T	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	1.51		1.77		1.92		1.30		1.39		1.38		1.19	
Arsenic	7440-38-2	T	E200.8	ug/l	1.68		2.04		2.65		1.34		1.49		1.59		1.12	
Boron	7440-42-8	D	E200.8	ug/l	467		794		458		435		302		324		387	
Boron	7440-42-8	T	E200.8	ug/l	459		728		401		425		317		316		414	
Cadmium	7440-43-9	D	E200.8	ug/l	< 0.020	U	0.064		< 0.020	U	< 0.020	U	0.023		0.029		0.009	J
Cadmium	7440-43-9	T	E200.8	ug/l	< 0.020	U	0.092		0.073		0.029		0.037		0.040		< 0.020	U
Iron	7439-89-6	D	E200.8	ug/l	57.2		7.5		29.0		7.8		3.9		3.8		< 2.0	U
Iron	7439-89-6	T	E200.8	ug/l	114		112		148		39.8		63.9		67.8		23.7	
Lead	7439-92-1	D	E200.8	ug/l			< 0.010	U					< 0.010	U	< 0.010	U		
Lead	7439-92-1	T	E200.8	ug/l			< 0.010	U					< 0.010	U	< 0.010	U		
Magnesium	7439-95-4	D	E200.8	ug/l	11400		15000		11700		10700		11500		11300		10400	
Magnesium	7439-95-4	T	E200.8	ug/l	11500		14700		11700		10900		11400		11400		10400	
Mercury	7439-97-6	D	E1631	ng/l	1500		0.68		319		522		< 0.5	U	< 0.5	U	< 0.5	UJ
Mercury	7439-97-6	T	SW7470	ug/l	5.69		< 0.20	U	1.96		3.19		< 0.20	U	< 0.20	U	< 0.20	U
Methylmercury	22967-92-6	D	E1630	ng/l	0.34		0.03	J	0.29		0.14		0.03	J	0.04	J	0.03	J
Methylmercury	22967-92-6	T	E1630	ng/l	0.27		0.05	J	0.2	J	0.61		0.04	J	0.05	J	0.04	J
Selenium	7782-49-2	D	E200.8	ug/l	2.2		1.6		1.5		0.9	J	0.8	J	0.8	J	0.8	J
Selenium	7782-49-2	T	E200.8	ug/l	2.0		1.2		1.6		1.0		0.8	J	0.8	J	0.9	J
Zinc	7440-66-6	D	E200.8	ug/l	< 2.0	U	< 2.0	U	< 2.0	U	< 2.0	U	2.2		3.4		0.6	J
Zinc	7440-66-6	T	E200.8	ug/l	4.5		< 2.0	U	4.2		< 2.0	U	6.7		2.2		1.0	J
Dissolved Organic Carbon	DOC	D	SW9060	mg/l			3.18						3.33		3.42			
Hardness (Filtered)	FHARD	D	SM2340C	mg/l	166		181		166		156		155		160		145	
Hardness (total)	THARD	T	SM2340C	mg/l			175						155		159			
Hardness, Total	HARD	T	SM2340C	mg/l	179		175		156		154		155		159		149	
Organic Carbon (dissolved)	C-012D	D	SW9060	mg/l	3.85		3.18		3.85		3.71		3.33		3.42		4.15	
Organic Carbon (total)	C-012	T	SW9060	mg/l	3.49		3.25		3.94		3.40		3.16		3.20		3.60	
Sulfate	14808-79-8	D	E300	mg/l	61.7		43.7		47.7		49.1		31.8		31.7		41.0	
Sulfate	14808-79-8	T	E300	mg/l	61.1		43.7		47.7		49.1		31.2		30.8		41.8	

Table 2-2A: Phase I Surface Water Analytical Results (Stratification and Overturn)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	HQ1		LHL1		LHL1		LHL1		LHL2		LHL2		LHL2	
				Season	Overturn		Stratification		Stratification		Overturn		Stratification		Stratification		Stratification	
				Sample Date	12/11/2017		10/06/2017		10/06/2017		12/11/2017		10/06/2017		10/06/2017		10/06/2017	
				Sample Type	N		N		N		N		N		N		N	
				Lab ID	K1713449		K1711264		K1711264		K1713449		K1711264		K1711264		K1711264	
				Sample ID	SW001(9)HQ1-171211		SW-001(20)-LHL1-171006		SW-002(60)-LHL1-171006		SW001(25)LHL1-171211		SW-001(25)-LHL2-171006		SW-002(50)-LHL2-171006		SW-003(100)-LHL2-171006	
Analyte	CAS RN	D/T	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	1.37		1.04		1.83		1.29		1.03		1.34		1.46	
Arsenic	7440-38-2	T	E200.8	ug/l	1.38		1.00		1.81		1.33		1.08		1.40		1.51	
Boron	7440-42-8	D	E200.8	ug/l	223		403		235		199		414		238		212	
Boron	7440-42-8	T	E200.8	ug/l	230		415		211		202		419		243		221	
Cadmium	7440-43-9	D	E200.8	ug/l	0.014	J	< 0.020	U	< 0.020	U	0.008	J	< 0.020	U	< 0.020	U	< 0.020	U
Cadmium	7440-43-9	T	E200.8	ug/l	0.023		< 0.020	U	< 0.020	U	0.016	J	< 0.020	U	< 0.020	U	< 0.020	U
Iron	7439-89-6	D	E200.8	ug/l	< 2.0	U	11.7		157		2.4		2.1		6.7		128	
Iron	7439-89-6	T	E200.8	ug/l	40.1		9.8		226		35.3		9.1		16.1		147	
Lead	7439-92-1	D	E200.8	ug/l	< 0.010	U					< 0.010	U						
Lead	7439-92-1	T	E200.8	ug/l	< 0.010	U					< 0.010	U						
Magnesium	7439-95-4	D	E200.8	ug/l	11000		10700		9140		10600		10500		9380		9280	
Magnesium	7439-95-4	T	E200.8	ug/l	11100		10600		9320		11200		10700		9480		9270	
Mercury	7439-97-6	D	E1631	ng/l	0.68		< 0.5	U	< 0.5	U	0.62		< 0.5	U	0.77		< 0.5	U
Mercury	7439-97-6	T	SW7470	ug/l	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U
Methylmercury	22967-92-6	D	E1630	ng/l	0.04	J	< 0.1	U	< 0.1	U	0.04	J	< 0.1	U	0.45		< 0.1	U
Methylmercury	22967-92-6	T	E1630	ng/l	0.04	J	< 0.1	UJ	0.24	J	0.05	J	< 0.1	UJ	0.18	J	< 0.1	UJ
Selenium	7782-49-2	D	E200.8	ug/l	0.6	J	0.8	J	0.2	J	0.5	J	0.8	J	0.3	J	< 1.0	U
Selenium	7782-49-2	T	E200.8	ug/l	0.6	J	0.8	J	0.2	J	0.6	J	0.8	J	0.3	J	0.3	J
Zinc	7440-66-6	D	E200.8	ug/l	< 2.0	U	1.2	J	0.9	J	2.3		0.6	J	1.6	J	0.5	J
Zinc	7440-66-6	T	E200.8	ug/l	< 2.0	U	2.5		0.7	J	< 2.0	U	0.8	J	0.7	J	0.6	J
Dissolved Organic Carbon	DOC	D	SW9060	mg/l	3.43						3.58							
Hardness (Filtered)	FHARD	D	SM2340C	mg/l	149		141		139		146		138		140		145	
Hardness (total)	THARD	T	SM2340C	mg/l	152						155							
Hardness, Total	HARD	T	SM2340C	mg/l	152		147		146		155		144		146		146	
Organic Carbon (dissolved)	C-012D	D	SW9060	mg/l	3.43		6.18		3.18		3.58		3.57		3.86		4.20	
Organic Carbon (total)	C-012	T	SW9060	mg/l	3.21		3.37		3.05		3.16		3.40				3.02	
Sulfate	14808-79-8	D	E300	mg/l	28.0		38.4		26.7		27.6		38.9		28.7		27.3	
Sulfate	14808-79-8	T	E300	mg/l	28.3		38.6		27.1		27.3		38.7		29.5		27.9	

Table 2-2A: Phase I Surface Water Analytical Results (Stratification and Overturn)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	LHL2		LHL3		LHL3		LHL3		LHL3		LHL4		LHL4	
				Season	Overturn		Stratification		Stratification		Stratification		Overturn		Stratification		Stratification	
				Sample Date	12/11/2017		10/06/2017		10/06/2017		10/06/2017		12/12/2017		10/07/2017		10/07/2017	
				Sample Type	N		N		N		N		N		N		N	
				Lab ID	K1713449		K1711264		K1711264		K1711264		K1713449		K1711264		K1711264	
				Sample ID	SW001(25)LH L2-171211		SW-001(20)-LHL3-171006		SW-002(70)-LHL3-171006		SW-003(100)-LHL3-171006		SW001(25)LH L3-171212		SW-001(20)-LHL4-171007		SW-002(70)-LHL4-171007	
Analyte	CAS RN	D/T	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	1.16		1.12		1.63		1.22		1.16		1.04		1.15	
Arsenic	7440-38-2	T	E200.8	ug/l	1.21		1.15		1.73		1.23		1.19		1.14		1.27	
Boron	7440-42-8	D	E200.8	ug/l	200		416		162		188		200		356		72	
Boron	7440-42-8	T	E200.8	ug/l	207		356		168		210		207		317		68	
Cadmium	7440-43-9	D	E200.8	ug/l	0.011	J	< 0.020	U	< 0.020	U	< 0.020	U	0.011	J	< 0.020	U	< 0.020	U
Cadmium	7440-43-9	T	E200.8	ug/l	0.024		< 0.020	U	< 0.020	U	< 0.020	U	0.015	J	< 0.020	U	< 0.020	U
Iron	7439-89-6	D	E200.8	ug/l	2.7		3.6		161		60.4		< 2.0	U	5.6		146	
Iron	7439-89-6	T	E200.8	ug/l	33.9		13.9		195		71.1		38.1		19.0		146	
Lead	7439-92-1	D	E200.8	ug/l	< 0.010	U							< 0.010	U				
Lead	7439-92-1	T	E200.8	ug/l	< 0.010	U							< 0.010	U				
Magnesium	7439-95-4	D	E200.8	ug/l	10800		10600		8960		9090		10300		10000		8480	
Magnesium	7439-95-4	T	E200.8	ug/l	11000		10800		9060		9530		10600		10200		8760	
Mercury	7439-97-6	D	E1631	ng/l	< 0.5	U	< 0.5	UJ	< 0.5	UJ	< 0.5	UJ	0.64		0.83	J	0.98	J
Mercury	7439-97-6	T	SW7470	ug/l	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U	0.03	J+	< 0.20	U
Methylmercury	22967-92-6	D	E1630	ng/l	0.04	J	0.06	J	0.04	J	0.09	J	0.03	J	0.05	J	0.06	J
Methylmercury	22967-92-6	T	E1630	ng/l	0.06	J	0.04	J	0.1		0.12		0.04	J	0.07	J	0.22	J
Selenium	7782-49-2	D	E200.8	ug/l	0.6	J	0.8	J	0.2	J	0.2	J	0.5	J	0.7	J	< 1.0	U
Selenium	7782-49-2	T	E200.8	ug/l	0.6	J	0.8	J	0.3	J	0.3	J	0.5	J	0.7	J	< 1.0	U
Zinc	7440-66-6	D	E200.8	ug/l	< 2.0	U	0.5	J	0.5	J	0.8	J	< 2.0	U	1.0	J	1.0	J
Zinc	7440-66-6	T	E200.8	ug/l	< 2.0	U	1.1	J	0.8	J	0.9	J	2.5		0.8	J	0.8	J
Dissolved Organic Carbon	DOC	D	SW9060	mg/l	3.29								5.53					
Hardness (Filtered)	FHARD	D	SM2340C	mg/l	150		142		146		136		146		143		135	
Hardness (total)	THARD	T	SM2340C	mg/l	156								153					
Hardness, Total	HARD	T	SM2340C	mg/l	156		142		144		140		153		139		137	
Organic Carbon (dissolved)	C-012D	D	SW9060	mg/l	3.29		3.40		3.22		4.68		5.53		3.54		3.83	
Organic Carbon (total)	C-012	T	SW9060	mg/l	3.07		3.18		3.09		3.30		3.07		3.44		3.71	
Sulfate	14808-79-8	D	E300	mg/l	27.4		39.5		26.2		27.6		27.6		35.4		18.0	
Sulfate	14808-79-8	T	E300	mg/l	29.0		40.0		26.7		28.2		27.4		36.5		18.4	

Table 2-2A: Phase I Surface Water Analytical Results (Stratification and Overturn)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	LHL4		LHL4		HI1		HI1		LHL5		LHL5		LHL5	
				Season	Stratification		Overturn		Stratification		Overturn		Stratification		Stratification		Stratification	
				Sample Date	10/07/2017		12/12/2017		10/05/2017		12/11/2017		10/07/2017		10/07/2017		10/07/2017	
				Sample Type	N		N		N		N		N		N		N	
				Lab ID	K1711264		K1713449		K1711264		K1713449		K1711264		K1711264		K1711264	
				Sample ID	SW-003(100)-LHL4-171007		SW001(25)LHL4-171211		SW-001(10)-HI1-171005		SW001(3)HI1-171211		SW-001(20)-LHL5-171007		SW-002(70)-LHL5-171007		SW-003(100)-LHL5-171007	
Analyte	CAS RN	D/T	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	0.91		1.19		1.07		1.17		0.97		1.19		0.96	
Arsenic	7440-38-2	T	E200.8	ug/l	0.94		1.10		1.03		1.20		1.09		1.15		0.94	
Boron	7440-42-8	D	E200.8	ug/l	135		183		374		190		353		76		226	
Boron	7440-42-8	T	E200.8	ug/l	141		183		397		179		328		73		191	
Cadmium	7440-43-9	D	E200.8	ug/l	< 0.020	U	0.011	J	< 0.020	U	0.010	J	< 0.020	U	< 0.020	U	< 0.020	U
Cadmium	7440-43-9	T	E200.8	ug/l	< 0.020	U	0.022		< 0.020	U	0.016	J	< 0.020	U	< 0.020	U	< 0.020	U
Iron	7439-89-6	D	E200.8	ug/l	66.6		2.2		2.5		2.8		7.5		41.3		47.5	
Iron	7439-89-6	T	E200.8	ug/l	87.2		37.8		35.1		51.2		12.1		49.7		63.0	
Lead	7439-92-1	D	E200.8	ug/l			< 0.010	U			< 0.010	U						
Lead	7439-92-1	T	E200.8	ug/l			< 0.010	U			< 0.010	U						
Magnesium	7439-95-4	D	E200.8	ug/l	8630		10400		10000		10500		10300		8410		8910	
Magnesium	7439-95-4	T	E200.8	ug/l	8820		10400		10300		10700		9780		8250		8900	
Mercury	7439-97-6	D	E1631	ng/l	2.83	J	< 0.5	U	< 0.5	UJ	< 0.5	U	4.49	J	4.37	J	< 0.5	UJ
Mercury	7439-97-6	T	SW7470	ug/l	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U	0.08	J+	0.06	J+	< 0.20	U
Methylmercury	22967-92-6	D	E1630	ng/l	0.03	J	0.05	J	< 0.1	U	0.03	J	0.09	J	0.07	J	0.04	J
Methylmercury	22967-92-6	T	E1630	ng/l	0.15	J	0.05	J	0.04	J	0.03	J	0.09	J	0.19	J	0.06	J
Selenium	7782-49-2	D	E200.8	ug/l	0.2	J	0.5	J	0.8	J	0.5	J	0.6	J	< 1.0	U	0.3	J
Selenium	7782-49-2	T	E200.8	ug/l	0.3	J	0.5	J	0.7	J	0.5	J	0.7	J	< 1.0	U	0.3	J
Zinc	7440-66-6	D	E200.8	ug/l	1.2	J	2.0		1.0	J	7.1		0.8	J	2.2		0.6	J
Zinc	7440-66-6	T	E200.8	ug/l	0.8	J	< 2.0	U	2.3		< 2.0	U	1.2	J	3.1		0.6	J
Dissolved Organic Carbon	DOC	D	SW9060	mg/l			3.41				2.99							
Hardness (Filtered)	FHARD	D	SM2340C	mg/l	137				139		147		137		137		149	
Hardness (total)	THARD	T	SM2340C	mg/l							152							
Hardness, Total	HARD	T	SM2340C	mg/l	138				142		152		140		134		142	
Organic Carbon (dissolved)	C-012D	D	SW9060	mg/l	4.03		3.41		3.55		2.99		3.31		3.66		3.51	
Organic Carbon (total)	C-012	T	SW9060	mg/l	2.98		3.03		3.53		2.91		3.52		3.54		2.99	
Sulfate	14808-79-8	D	E300	mg/l	23.1		26.1		36.6		25.8		34.4		19.2		29.2	
Sulfate	14808-79-8	T	E300	mg/l	23.1		26.6		37.3		25.1		35.4		19.5		29.2	

Table 2-2A: Phase I Surface Water Analytical Results (Stratification and Overturn)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	LHL5		LHL6		LHL6		LHL6		LHL6		DR1	
				Season	Overturn		Stratification		Stratification		Stratification		Overturn		Stratification	
				Sample Date	12/12/2017		10/07/2017		10/07/2017		10/07/2017		12/12/2017		10/07/2017	
				Sample Type	N		N		N		N		N		N	
				Lab ID	K1713449		K1711264		K1711264		K1711264		K1713449		K1711264	
				Sample ID	SW001(25)LH L5-171212		SW-001(20)-LHL6-171007		SW-002(70)-LHL6-171007		SW-003(100)-LHL6-171007		SW001(25)LH L6-171212		SW-001(10)-DR1-171007	
Analyte	CAS RN	D/T	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	1.12		0.89		1.04		1.18		0.92		1.38	
Arsenic	7440-38-2	T	E200.8	ug/l	1.10		0.92		1.04		1.32		0.95		1.54	
Boron	7440-42-8	D	E200.8	ug/l	164		166		32.5		31.1		124		264	
Boron	7440-42-8	T	E200.8	ug/l	171		200		33.1		30.4		123		246	
Cadmium	7440-43-9	D	E200.8	ug/l	0.007	J	< 0.020	U	< 0.020	U	< 0.020	U	0.005	J	0.149	
Cadmium	7440-43-9	T	E200.8	ug/l	0.011	J	< 0.020	U	< 0.020	U	< 0.020	U	0.007	J	0.122	
Iron	7439-89-6	D	E200.8	ug/l	2.3		3.7		13.5		146		3.9		6.6	
Iron	7439-89-6	T	E200.8	ug/l	36.5		7.3		37.9		211		40.6		72.9	
Lead	7439-92-1	D	E200.8	ug/l	< 0.010	U							< 0.010	U		
Lead	7439-92-1	T	E200.8	ug/l	< 0.010	U							< 0.010	U		
Magnesium	7439-95-4	D	E200.8	ug/l	10400		8810		7880		8080		10200		9440	
Magnesium	7439-95-4	T	E200.8	ug/l	10500		8940		7710		9570		10100		9550	
Mercury	7439-97-6	D	E1631	ng/l	< 0.5	U	1.1	J	2.16	J	3.12	J	< 0.5	U	< 0.5	UJ
Mercury	7439-97-6	T	SW7470	ug/l	< 0.20	U	< 0.20	U	< 0.20	U	0.14	J+	< 0.20	U	< 0.20	U
Methylmercury	22967-92-6	D	E1630	ng/l	0.05	J	0.07	J	0.06	J	0.13		0.04	J	< 0.1	U
Methylmercury	22967-92-6	T	E1630	ng/l	0.06	J	0.04	J	0.07	J	0.19	J	0.05	J	0.05	J
Selenium	7782-49-2	D	E200.8	ug/l	0.4	J	0.4	J	< 1.0	U	< 1.0	U	0.3	J	0.5	J
Selenium	7782-49-2	T	E200.8	ug/l	0.5	J	0.4	J	< 1.0	U	< 1.0	U	0.4	J	0.5	J
Zinc	7440-66-6	D	E200.8	ug/l	5.4		0.6	J	1.7	J	1.9	J	2.1		0.8	J
Zinc	7440-66-6	T	E200.8	ug/l	< 2.0	U	1.5	J	1.3	J	1.6	J	< 2.0	U	1.5	J
Dissolved Organic Carbon	DOC	D	SW9060	mg/l	5.10								5.30			
Hardness (Filtered)	FHARD	D	SM2340C	mg/l			120		126		136				148	
Hardness (total)	THARD	T	SM2340C	mg/l												
Hardness, Total	HARD	T	SM2340C	mg/l			125		128		137				146	
Organic Carbon (dissolved)	C-012D	D	SW9060	mg/l	5.10		3.78		4.17		4.42		5.30		2.86	
Organic Carbon (total)	C-012	T	SW9060	mg/l	3.07		3.79		4.07		3.82		3.14		2.86	
Sulfate	14808-79-8	D	E300	mg/l	26.0		24.3		15.0		15.2		22.5		30.1	
Sulfate	14808-79-8	T	E300	mg/l	25.5		24.8		15.0		15.5		22.8		30.7	

Notes:

%: Percent
CI: Curd's Inlet
D: Dissolved
DR: Dix River
FD: Field Duplicate Sample
HI: Hardin's Inlet
HQ: HQ Inlet
IQ: Interpreted qualifier, data flags from third party validation
J: Concentration is greater than the method detection limit but less than the laboratory reporting limit
J+: The analyte was positively identified; the value is the approximate concentration of the analyte in the sample, and may have a potential positive bias.
LHL: Lower Herrington Lake
mg/l: milligrams per liter
N: Normal Sample
ng/l: nanograms per liter
T: Total
U: Constituent was analyzed for, but not detected
ug/l: micrograms per liter
UJ: Material analyzed for, but not detected. The value is an estimate. May be inaccurate or imprecise.

Table 2-2B: Phase II Surface Water Analytical Results (Stratification)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI2.2		CI3.1		CI4		CI4		CI4	
				Start Depth	10		13		10		70		70	
				Season	Stratification		Stratification		Stratification		Stratification		Stratification	
				Sample Date	06/16/2018		06/16/2018		06/16/2018		06/16/2018		06/16/2018	
				Sample Type	N		N		N		N		FD	
				Lab ID	K1805775-001		K1805775-002		K1805780-002		K1805780-001		K1805777-005	
				Sample ID	SW001(10)-CI2.2-180616		SW001(13)-CI3.1-180616		SW001(10)-CI4-180616		SW001(70)-CI4-180616		DUP-001-180616	
Analyte	CASRN	T/D	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	1.71		1.60		1.26		3.98		3.66	
Arsenic	7440-38-2	T	E200.8	ug/l	2.20		2.10		1.29		4.88		4.89	
Boron	7440-42-8	D	E200.8	ug/l	1850		1790		932		292		314	
Boron	7440-42-8	T	E200.8	ug/l	1890		1800		902		300		305	
Cadmium	7440-43-9	D	E200.8	ug/l	0.151		0.137		0.039		0.033		0.030	
Cadmium	7440-43-9	T	E200.8	ug/l	0.204		0.184		0.086		0.067		0.080	
Iron	7439-89-6	D	E200.8	ug/l	7.0		6.2		2.4		10.2		8.9	
Iron	7439-89-6	T	E200.8	ug/l	125		97.5		37.2		294		311	
Lead	7439-92-1	D	E200.8	ug/l	0.111		0.020		0.013	J	0.065		0.010	J
Lead	7439-92-1	T	E200.8	ug/l	0.228		0.173		0.081		0.355		0.365	
Magnesium	7439-95-4	D	E200.7	ug/l	17300		16300		11800		8730		8640	
Magnesium	7439-95-4	T	E200.7	ug/l	16900		17200		12100		9050		8040	
Mercury	7439-97-6	D	E1631	ng/l	< 0.5	U	< 0.5	U	< 0.5	U	< 0.5	U	< 0.5	U
Mercury	7439-97-6	T	E1631	ng/l	1.97		1.52		0.99		1.19		1.14	
Methylmercury	22967-92-6	D	E1630	ng/l	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U
Methylmercury	22967-92-6	T	E1630	ng/l	< 0.1	U	0.03	J	< 0.1	U	< 0.1	U	< 0.1	U
Selenium	7782-49-2	D	E200.8	ug/l	5.5		5.2		2.7		1.0	J	1.0	J
Selenium	7782-49-2	T	E200.8	ug/l	5.4		5.1		2.6		1.0		1.1	
Zinc	7440-66-6	D	E200.8	ug/l	2.2		0.4	J	0.5	J	1.4	J	< 2.0	U
Zinc	7440-66-6	T	E200.8	ug/l	3.4		1.4	J	< 2.0	U	< 2.0	U	2.4	

Table 2-2B: Phase II Surface Water Analytical Results (Stratification)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	HQ		HQ		LHL1		LHL1		LHL3	
				Start Depth	10		50		10		70		10	
				Season	Stratification		Stratification		Stratification		Stratification		Stratification	
				Sample Date	06/15/2018		06/15/2018		06/15/2018		06/15/2018		06/15/2018	
				Sample Type	N		N		N		N		N	
				Lab ID	K1805777-004		K1805777-003		K1805777-001		K1805778-001		K1805777-002	
				Sample ID	SW001(10)-HQI-180615		SW001(50)-HQI-180615		SW001(10)-LHL1-180615		SW001(70)-LHL1-180615		SW001(10)-LHL3-180615	
Analyte	CASRN	T/D	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	1.00		1.35		0.89		0.99		1.08	
Arsenic	7440-38-2	T	E200.8	ug/l	1.13		2.26		0.93		1.07		1.24	
Boron	7440-42-8	D	E200.8	ug/l	407		232		370		171		613	
Boron	7440-42-8	T	E200.8	ug/l	417		261		375		160		624	
Cadmium	7440-43-9	D	E200.8	ug/l	0.008	J	0.023		0.010	J	0.018	J	0.012	J
Cadmium	7440-43-9	T	E200.8	ug/l	0.017	J	0.079		0.032		0.015	J	0.075	
Iron	7439-89-6	D	E200.8	ug/l	1.2	J	22.1		1.4	J	5.5		2.9	
Iron	7439-89-6	T	E200.8	ug/l	18.9		466		27.3		154		92.8	
Lead	7439-92-1	D	E200.8	ug/l	0.011	J	0.089		0.010	J	0.045		0.019	J
Lead	7439-92-1	T	E200.8	ug/l	0.036		0.555		0.140		0.150		0.185	
Magnesium	7439-95-4	D	E200.7	ug/l	9860		7070		7100		7740		9570	
Magnesium	7439-95-4	T	E200.7	ug/l	10100		7980		7750		6860		10800	
Mercury	7439-97-6	D	E1631	ng/l	< 0.5	U	< 0.5	U	< 0.5	U	< 0.5	U	0.56	
Mercury	7439-97-6	T	E1631	ng/l	0.58		2.2		0.72		0.84		0.78	
Methylmercury	22967-92-6	D	E1630	ng/l	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U
Methylmercury	22967-92-6	T	E1630	ng/l	< 0.1	U	0.05	J	< 0.1	U	0.03	J	< 0.1	U
Selenium	7782-49-2	D	E200.8	ug/l	1.3		0.7	J	1.1		0.6	J	1.9	
Selenium	7782-49-2	T	E200.8	ug/l	1.4		0.8	J	1.1		0.4	J	2.0	
Zinc	7440-66-6	D	E200.8	ug/l	< 2.0	U	< 2.0	U	< 2.0	U	6.7		< 2.0	U
Zinc	7440-66-6	T	E200.8	ug/l	0.5	J	2.3		1.9	J	< 2.0	U	2.2	

Table 2-2B: Phase II Surface Water Analytical Results (Stratification)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	LHL3		LHL6		LHL6		LHL6		LHL6	
				Start Depth	80		10		100		100		50	
				Season	Stratification		Stratification		Stratification		Stratification		Stratification	
				Sample Date	06/15/2018		06/17/2018		06/17/2018		06/17/2018		06/17/2018	
				Sample Type	N		N		N		FD		N	
				Lab ID	K1805778-002		K1805776-003		K1805776-001		K1805776-004		K1805776-002	
				Sample ID	SW001(80)-LHL3-180615		SW001(10)-LHL6-180617		SW001(100)-LHL6-180617		DUP-002-180617		SW001(50)-LHL6-180617	
Analyte	CASRN	T/D	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	0.53		0.65		0.46	J	0.46	J	0.59	
Arsenic	7440-38-2	T	E200.8	ug/l	0.46	J	0.70		0.51		0.48	J	0.61	
Boron	7440-42-8	D	E200.8	ug/l	65.0		136		17.2		16.5		40.7	
Boron	7440-42-8	T	E200.8	ug/l	65.3		138		15.5		15.4		40.1	
Cadmium	7440-43-9	D	E200.8	ug/l	0.014	J	0.007	J	0.007	J	0.010	J	0.006	J
Cadmium	7440-43-9	T	E200.8	ug/l	0.017	J	0.013	J	0.027		0.007	J	0.011	J
Iron	7439-89-6	D	E200.8	ug/l	5.9		1.9	J	11.2		11.6		6.4	
Iron	7439-89-6	T	E200.8	ug/l	30.2		22.8		42.1		46.8		28.2	
Lead	7439-92-1	D	E200.8	ug/l	0.013	J	0.010	J	0.013	J	0.014	J	0.021	
Lead	7439-92-1	T	E200.8	ug/l	< 0.020	U	0.048		0.072		0.051		0.046	
Magnesium	7439-95-4	D	E200.7	ug/l	7260		6520		6100		5990		6480	
Magnesium	7439-95-4	T	E200.7	ug/l	6730		7150		6610		6620		6990	
Mercury	7439-97-6	D	E1631	ng/l	< 0.5	U	< 0.5	U	< 0.5	U	0.84		< 0.5	U
Mercury	7439-97-6	T	E1631	ng/l	< 0.5	U	< 0.5	U	0.83		0.93		< 0.5	U
Methylmercury	22967-92-6	D	E1630	ng/l	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	UJ	< 0.1	U
Methylmercury	22967-92-6	T	E1630	ng/l	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U
Selenium	7782-49-2	D	E200.8	ug/l	0.3	J	0.4	J	< 1.0	U	< 1.0	U	0.2	J
Selenium	7782-49-2	T	E200.8	ug/l	0.3	J	0.5	J	< 1.0	U	< 1.0	U	0.2	J
Zinc	7440-66-6	D	E200.8	ug/l	0.5	J	< 2.0	U	0.7	J	0.9	J	< 2.0	U
Zinc	7440-66-6	T	E200.8	ug/l	< 2.0	U	1.5	J	1.3	J	1.3	J	1.2	J

Notes:

%: Percent
CI: Curd's Inlet
D: Dissolved
FD: Field Duplicate Sample
HQ: HQ Inlet
IQ: Interpreted qualifier, data flags from third party validation
J: Concentration is greater than the method detection limit but less than the laboratory reporting limit
LHL: Lower Herrington Lake
N: Normal Sample
ng/l: nanograms per liter
T: Total
U: Constituent was analyzed for, but not detected
ug/l: micrograms per liter

Table 2-3A: Phase I Sediment Pore Water Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CURDS1		CURDS1		CURDS2A		CURDS2B		CURDS2C		CURDSNB	
				Sample Date	11/03/2017		11/03/2017		11/04/2017		11/03/2017		11/03/2017		11/03/2017	
				Sample Type	N		N		N		N		N		N	
				Lab ID	K1712055		K1712055		K1712059		K1712059		K1712059		K1712055	
				Sample ID	K1712055-002 PW001-CURDS1-171103		PW001-CURDS1-171103		PW001-CURDS2A-171104		PW001-CURDS2B-171103		PW001-CURDS2C-171103		K1712055-001 PW001-CURDSNB-171103	
Analyte	CAS RN	D/T	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l			4.59		123		14.4		5.05			
Arsenic	7440-38-2	D	EPA 1632A	ug/l			2.81		112		6.1		2.99			
Arsenic III	22541-54-4	D	EPA 1632A	ug/l			0.0322		71.6		0.078		0.0668			
Arsenic V	17428-41-0	D	EPA 1632A	ug/l			2.77		40.1		6.02		2.92			
Boron	7440-42-8	D	E200.8	ug/l			1220		605		1020		940			
Cadmium	7440-43-9	D	E200.8	ug/l			0.021		0.072		0.014	J	0.025			
Iron	7439-89-6	D	E200.8	ug/l			11.2		739		36.9		28.8			
Magnesium	7439-95-4	D	E200.8	ug/l			16500		13000		14800		15300			
Mercury	7439-97-6	D	E1631	ng/l			0.98		4.03		1.16		1.33			
Mercury	7439-97-6	D	SW7470	ug/l			< 0.20	U	< 0.20	U	0.04	J	0.09	J		
Methylmercury	22967-92-6	D	E1630	ng/l			< 0.1	U	< 0.1	UJ	< 0.1	UJ	< 0.1	UJ		
Selenium	7782-49-2	D	E200.8	ug/l			3.2		0.8	J	2.7		3.0			
Selenium (unknown)	UNKNOWN SE	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.2	U			< 0.2	U	< 0.2	U	< 0.2	U	< 0.2	U
Selenium +4	SE +4	T	SE-SPEC-HPLC/CCMSVA	ug/l	0.65				< 0.1	U	0.46		0.54		0.38	
Selenium +6	SE +6	T	SE-SPEC-HPLC/CCMSVA	ug/l	4.04				< 0.1	U	1.82		2.17		2.12	
Selenocyanate	3425-46-5	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1	U			0.18		< 0.1	U	< 0.1	U	< 0.1	U
Zinc	7440-66-6	D	E200.8	ug/l			3.4		107		2.1		< 2.0	U		
Organic Carbon (dissolved)	C-012D	D	SW9060	mg/l							3.77		3.41			
Sulfate	14808-79-8	D	E300	mg/l					36.3		74.3		84.0			

Table 2-3A: Phase I Sediment Pore Water Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CURDSNB		CI1C		CI2A		CI2C		CI3C		HQ1A	
				Sample Date	11/03/2017		11/03/2017		11/04/2017		11/03/2017		11/03/2017		11/04/2017	
				Sample Type	N		N		N		N		N		N	
				Lab ID	K1712055		K1712059		K1712059		K1712059		K1712059		K1712059	
				Sample ID	PW001-CURDSNB-171103		PW001-CI1C-171103		PW001-CI2A-171104		PW001-CI2C-171103		PW001-CI3C-171103		PW001-HQ1A-171104	
Analyte	CAS RN	D/T	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	5.83		3.48		29.2		1.04		2.32		2.87	
Arsenic	7440-38-2	D	EPA 1632A	ug/l	2.24		2.7		30.9		0.515		0.946		1.9	
Arsenic III	22541-54-4	D	EPA 1632A	ug/l	< 0.02	U	< 0.02	U	0.0967		0.038		0.0397		0.0591	
Arsenic V	17428-41-0	D	EPA 1632A	ug/l	2.22		2.69		30.8		0.477		0.906		1.84	
Boron	7440-42-8	D	E200.8	ug/l	1760		1090		494		950		457		171	
Cadmium	7440-43-9	D	E200.8	ug/l	0.063		0.042		0.012	J	0.021		0.008	J	0.006	J
Iron	7439-89-6	D	E200.8	ug/l	83.0		24.4		69.7		8.7		62.8		31.9	
Magnesium	7439-95-4	D	E200.8	ug/l	21100		17000		11700		15600		11400		5840	
Mercury	7439-97-6	D	E1631	ng/l	1.69		1.26		0.97		1.1		1.19		1.18	
Mercury	7439-97-6	D	SW7470	ug/l	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U
Methylmercury	22967-92-6	D	E1630	ng/l	< 0.1	U	< 0.1	UJ	< 0.1	UJ	< 0.1	UJ	< 0.1	UJ	< 0.1	UJ
Selenium	7782-49-2	D	E200.8	ug/l	5.0		3.7		1.0	J	2.3		1.3		1.2	
Selenium (unknown)	UNKNOWN SE	T	SE-SPEC-HPLC/CCMSVA	ug/l			< 0.2	U	< 0.2	U	< 0.2	U	< 0.2	U	< 0.2	U
Selenium +4	SE +4	T	SE-SPEC-HPLC/CCMSVA	ug/l			0.32		0.14		0.12		0.22		0.29	
Selenium +6	SE +6	T	SE-SPEC-HPLC/CCMSVA	ug/l			2.64		0.32		1.77		0.75		0.56	
Selenocyanate	3425-46-5	T	SE-SPEC-HPLC/CCMSVA	ug/l			< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U
Zinc	7440-66-6	D	E200.8	ug/l	3.3		< 2.0	U	4.6		2.1		3.6		2.2	
Organic Carbon (dissolved)	C-012D	D	SW9060	mg/l	3.93		3.51		4.16		2.74		3.25		3.53	
Sulfate	14808-79-8	D	E300	mg/l	143		120		46.8		92.9		48.9		45.5	

Table 2-3A: Phase I Sediment Pore Water Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	HQ1B		HQ1C		HI1A		HI1B		HI1C		HI1C	
				Sample Date	11/04/2017		11/04/2017		11/02/2017		11/03/2017		11/01/2017		11/04/2017	
				Sample Type	N		N		N		N		N		FD	
				Lab ID	K1712059		K1712059		K1712059		K1712059		K1712059		K1712059	
				Sample ID	PW001-HQ1B-171104		PW001-HQ1C-171104		PW001-HI1A-171102		PW001-HI1B-171103		PW001-HI1C-171101		PW001-DUP-171104	
Analyte	CAS RN	D/T	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	38.8		1.14		4.47		9.07		5.71		1.05	
Arsenic	7440-38-2	D	EPA 1632A	ug/l	26.1		0.555		5.42		6.7		3.35		0.524	
Arsenic III	22541-54-4	D	EPA 1632A	ug/l	5.39		0.0642		2.99		1.15		1.76		0.0486	
Arsenic V	17428-41-0	D	EPA 1632A	ug/l	20.7		0.491		2.43		5.55		1.59		0.475	
Boron	7440-42-8	D	E200.8	ug/l	346		304		198		173		225		310	
Cadmium	7440-43-9	D	E200.8	ug/l	< 0.020	U	< 0.020	U	< 0.020	U	< 0.020	U	< 0.020	U	< 0.020	U
Iron	7439-89-6	D	E200.8	ug/l	2020		30.4		324		2510		148		20.9	
Magnesium	7439-95-4	D	E200.8	ug/l	16500		10200		13000		10900		13600		10400	
Mercury	7439-97-6	D	E1631	ng/l	1.39		1.03		0.95		1.55				1.29	
Mercury	7439-97-6	D	SW7470	ug/l	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U	< 0.20	U
Methylmercury	22967-92-6	D	E1630	ng/l	< 0.1	UJ	< 0.1	UJ	0.06	J	0.1	J	0.12	J	< 0.1	UJ
Selenium	7782-49-2	D	E200.8	ug/l	0.6	J	0.8	J	0.3	J	0.3	J	0.2	J	0.8	J
Selenium (unknown)	UNKNOWN SE	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.2	U	< 0.2	U	< 0.2	U	< 0.2	U	< 0.2	U	< 0.2	U
Selenium +4	SE +4	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1	U	0.12		< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U
Selenium +6	SE +6	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1	U	0.4		< 0.1	U	< 0.1	U	0.11		< 0.1	U
Selenocyanate	3425-46-5	T	SE-SPEC-HPLC/CCMSVA	ug/l	0.15		< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U
Zinc	7440-66-6	D	E200.8	ug/l	2.1		2.5		2.5		3.8		2.8		4.8	
Organic Carbon (dissolved)	C-012D	D	SW9060	mg/l	4.49		2.86				3.79					
Sulfate	14808-79-8	D	E300	mg/l	34.2		39.3				17.5				39.5	

Notes:

CI: Curd's Inlet
D: Dissolved
EPA: United States Environmental Protection Agency
HI: Hardin's Inlet
HQ: HQ Inlet
IQ: Interpreted qualifier, data flags from third party validation
J: Concentration is greater than the method detection limit but less than the laboratory reporting limit
J+: Concentration is greater than the method detection limit but less than the lab reporting limit estimate. May be inaccurate or imprecise.
mg/l: milligrams per liter
N: Normal sample
ng/l: nanograms per liter
SW: Surface water
T: Total
U: Constituent was analyzed for, but not detected
ug/l: micrograms per liter
UJ: Material was analyzed for, but not detected. The value is an estimate. May be inaccurate or imprecise.

Table 2-3B: Phase II Sediment Pore Water Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI1A		CI1A		CI1B		CI2B	
				Sample Date	07/19/2018		07/19/2018		07/19/2018		07/19/2018	
				Sample Type	N		FD		N		N	
				Sample ID	PW001-CIA-180719		FD001-180719		PW001-CIB-180719		PW001-CI2B-180719	
Analyte	CASRN	T/D	ANALYTIC_METHOD	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	88.5		18.3		9.04		10.8	
Arsenic	7440-38-2	T	E1632A	ug/l	50.7		12.3		8.06		9.2	
Arsenic III	22541-54-4	T	E1632A	ug/l	30.2		0.14		0.429		0.289	
Arsenic V	17428-41-0	T	E1632A	ug/l	20.5		12.2		7.63		8.91	
Boron	7440-42-8	D	E200.8	ug/l	5820		5970		1540		3120	
Cadmium	7440-43-9	D	E200.8	ug/l	< 0.050		0.087		0.034		< 0.020	
Iron	7439-89-6	D	E200.8	ug/l	122		46.2		127		21.6	
Lead	7439-92-1	D	E200.8	ug/l	0.056		0.163		0.065		0.040	
Magnesium	7439-95-4	D	E200.7	ug/l	42300		36800		14500		34500	
Mercury	7439-97-6	D	E1631	ng/l	4.16		3.08		1.24		1.51	
Mercury	7439-97-6	D	SW7470	ug/l	< 0.20		< 0.20		< 0.20		< 0.20	
Methylmercury	22967-92-6	D	E1630	ng/l	0.13		0.11		0.03		< 0.1	
Selenium	7782-49-2	D	E200.8	ug/l	2.7		8.8		2.9		1.8	
Selenium (unknown)	UNKNOWN SE	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.2		< 0.2		< 0.2		< 0.2	
Selenium +4	SE +4	T	SE-SPEC-HPLC/CCMSVA	ug/l	0.29		1.51		0.65		0.13	
Selenium +6	SE +6	T	SE-SPEC-HPLC/CCMSVA	ug/l	0.3		6.63		1.87		< 0.1	
Selenocyanate	3425-46-5	T	SE-SPEC-HPLC/CCMSVA	ug/l	1.08		< 0.1		< 0.1		0.56	
Zinc	7440-66-6	D	E200.8	ug/l	5.6		9.7		10.1		8.4	

Table 2-3B: Phase II Sediment Pore Water Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI2.1A		CI2.1B		CI2.2A		CI2.2B	
				Sample Date	07/19/2018		07/19/2018		07/19/2018		07/19/2018	
				Sample Type	N		N		N		N	
				Sample ID	PW001-CI2.1A-180719		PW001-CI2.1B-180719		PW001-CI2.2A-180719		PW001-CI2.2B-180719	
Analyte	CASRN	T/D	ANALYTIC_METHOD	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	375		20.9		290		18.8	
Arsenic	7440-38-2	T	E1632A	ug/l	131		24.1		715		50.5	
Arsenic III	22541-54-4	T	E1632A	ug/l	93.6		2.83		575		1.31	
Arsenic V	17428-41-0	T	E1632A	ug/l	37.4		21.3		140		49.2	
Boron	7440-42-8	D	E200.8	ug/l	3060		2870		2210		2590	
Cadmium	7440-43-9	D	E200.8	ug/l	< 0.020		0.010		< 0.020		< 0.020	
Iron	7439-89-6	D	E200.8	ug/l	4850		621		2750		69.5	
Lead	7439-92-1	D	E200.8	ug/l	0.013		0.012		0.013		0.036	
Magnesium	7439-95-4	D	E200.7	ug/l	45700		34500		35100		23300	
Mercury	7439-97-6	D	E1631	ng/l	0.9		1.74		2.05		1.02	
Mercury	7439-97-6	D	SW7470	ug/l	< 0.20		< 0.20		< 0.20		< 0.20	
Methylmercury	22967-92-6	D	E1630	ng/l	0.04		0.04		0.03		0.07	
Selenium	7782-49-2	D	E200.8	ug/l	1.5		1.1		1.2		3.4	
Selenium (unknown)	UNKNOWN SE	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.2		< 0.2		< 0.2		< 0.2	
Selenium +4	SE +4	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1		< 0.1		< 0.1		< 0.1	
Selenium +6	SE +6	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1		< 0.1		< 0.1		< 0.1	
Selenocyanate	3425-46-5	T	SE-SPEC-HPLC/CCMSVA	ug/l	0.11		< 0.1		< 0.1		0.24	
Zinc	7440-66-6	D	E200.8	ug/l	3.6		4.6		4.1		10.1	

Table 2-3B: Phase II Sediment Pore Water Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI3A		CI3A		CI3B		CI3.1A	
				Sample Date	07/19/2018		07/20/2018		07/19/2018		07/19/2018	
				Sample Type	N		FD		N		N	
				Sample ID	PW001-CI3A-180719		FD002-180720		PW001-CI3B-180719		PW001-CI3.1A-180719	
Analyte	CASRN	T/D	ANALYTIC_METHOD	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	444		764		64.8		1500	
Arsenic	7440-38-2	T	E1632A	ug/l	633		974		51.5		2130	
Arsenic III	22541-54-4	T	E1632A	ug/l	613		852		8.76		1900	
Arsenic V	17428-41-0	T	E1632A	ug/l	20		122		42.7		230	
Boron	7440-42-8	D	E200.8	ug/l	2030		2180		2070		2030	
Cadmium	7440-43-9	D	E200.8	ug/l	< 0.020		< 0.020		2.04		< 0.020	
Iron	7439-89-6	D	E200.8	ug/l	6700		8170		628		7480	
Lead	7439-92-1	D	E200.8	ug/l	0.009		0.012		3.11		0.015	
Magnesium	7439-95-4	D	E200.7	ug/l	25500		29700		31100		24900	
Mercury	7439-97-6	D	E1631	ng/l	1.04		0.8		< 0.5	U	< 0.5	U
Mercury	7439-97-6	D	SW7470	ug/l	< 0.20		< 0.20		< 0.20		< 0.20	
Methylmercury	22967-92-6	D	E1630	ng/l	< 0.1		< 0.1		0.04		< 0.1	
Selenium	7782-49-2	D	E200.8	ug/l	1.4		1.3		7.5		1.2	
Selenium (unknown)	UNKNOWN SE	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.2		< 0.2		< 0.2		< 0.2	
Selenium +4	SE +4	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1		< 0.1		< 0.1		< 0.1	
Selenium +6	SE +6	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1		< 0.1		< 0.1		< 0.1	
Selenocyanate	3425-46-5	T	SE-SPEC-HPLC/CCMSVA	ug/l	0.12		0.1		< 0.1		< 0.1	
Zinc	7440-66-6	D	E200.8	ug/l	8.0		6.5		6.0		8.0	

Table 2-3B: Phase II Sediment Pore Water Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI3.1A		CI3.1B		CI3.1B		CI3.2A	
				Sample Date	07/20/2018		07/20/2018		07/20/2018		07/19/2018	
				Sample Type	FD		N		N		N	
				Sample ID	FD003-180720		PW001-CI3.1B-180720		PW001-CI3.1B-1807220		PW001-CI3.2A-180719	
Analyte	CASRN	T/D	ANALYTIC_METHOD	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	201		73.5				585	
Arsenic	7440-38-2	T	E1632A	ug/l	255		114				194	
Arsenic III	22541-54-4	T	E1632A	ug/l	244		17.2				1.18	
Arsenic V	17428-41-0	T	E1632A	ug/l	11		96.8				193	
Boron	7440-42-8	D	E200.8	ug/l	1770		576				1360	
Cadmium	7440-43-9	D	E200.8	ug/l	< 0.020		< 0.020				0.017	
Iron	7439-89-6	D	E200.8	ug/l	885		3670				196	
Lead	7439-92-1	D	E200.8	ug/l	0.020		0.022				0.030	
Magnesium	7439-95-4	D	E200.7	ug/l	30700		17900				18500	
Mercury	7439-97-6	D	E1631	ng/l	0.8		0.93				1.35	
Mercury	7439-97-6	D	SW7470	ug/l	< 0.20		< 0.20				< 0.20	
Methylmercury	22967-92-6	D	E1630	ng/l	< 0.1		< 0.1				< 0.1	
Selenium	7782-49-2	D	E200.8	ug/l	1.0		0.7				0.7	
Selenium (unknown)	UNKNOWN SE	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.2				< 0.2		< 0.2	
Selenium +4	SE +4	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1				< 0.1		< 0.1	
Selenium +6	SE +6	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1				< 0.1		< 0.1	
Selenocyanate	3425-46-5	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1				0.16		< 0.1	
Zinc	7440-66-6	D	E200.8	ug/l	3.2		7.3				4.0	

Table 2-3B: Phase II Sediment Pore Water Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI3.2B		CI4A		CI4B	
				Sample Date	07/20/2018		07/20/2018		07/20/2018	
				Sample Type	N		N		N	
				Sample ID	PW001-CI3.2B-180720		PW001-CI4A-180720		PW001-CI4B-180720	
Analyte	CASRN	T/D	ANALYTIC_METHOD	Unit	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	D	E200.8	ug/l	135		18.0		2.79	
Arsenic	7440-38-2	T	E1632A	ug/l	161		13.2		2.71	
Arsenic III	22541-54-4	T	E1632A	ug/l	3.14		0.268		0.082	
Arsenic V	17428-41-0	T	E1632A	ug/l	158		12.9		2.63	
Boron	7440-42-8	D	E200.8	ug/l	1330		606		2460	
Cadmium	7440-43-9	D	E200.8	ug/l	< 0.020		< 0.020		< 0.020	
Iron	7439-89-6	D	E200.8	ug/l	1880		136		50.7	
Lead	7439-92-1	D	E200.8	ug/l	0.023		0.066		0.374	
Magnesium	7439-95-4	D	E200.7	ug/l	16800		11100		18700	
Mercury	7439-97-6	D	E1631	ng/l	1.4		0.88		1.38	
Mercury	7439-97-6	D	SW7470	ug/l	< 0.20		< 0.20		< 0.20	
Methylmercury	22967-92-6	D	E1630	ng/l	0.06		0.11		0.05	
Selenium	7782-49-2	D	E200.8	ug/l	0.8		2.5		4.4	
Selenium (unknown)	UNKNOWN SE	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.2		< 0.2		< 0.2	
Selenium +4	SE +4	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1		1.62		0.59	
Selenium +6	SE +6	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1		0.37		3.45	
Selenocyanate	3425-46-5	T	SE-SPEC-HPLC/CCMSVA	ug/l	< 0.1		< 0.1		< 0.1	
Zinc	7440-66-6	D	E200.8	ug/l	5.7		6.8		14.0	

Notes:

CI: Curd's Inlet
D: Dissolved
IQ: Interpreted qualifier, data flags from third party validation
N : Normal sample
ng/l: nanograms per liter
SW: Surface water
T: Total
U: Constituent was analyzed for, but not detected
ug/l: micrograms per liter

Table 2-4A: February 2017 Sediment Analytical Results for Curds Inlet and Hardin Inlet
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CURDS1A	CURDS1B	CURDS1C	CURDS2A	CURDS2B
				Sample Date	02/01/2017	02/01/2017	02/01/2017	02/01/2017	02/01/2017
				Sample Type	N	N	N	N	N
				Lab ID	180-63061-1	180-63061-2	180-63061-3	180-63061-4	180-63061-5
				Sample ID	Curds1A_20170201	Curds1B_20170201	Curds1C_20170201	Curds2A_20170201	Curds2B_20170201
Analyte	CASRN	T/D	Method	Unit	Result	Result	Result	Result	Result
Arsenic	7440-38-2	T	SW6020	mg/kg	350	50	50	110	69
Iron	7439-89-6	T	SW6020	mg/kg	61,000	12,000	18,000	29,000	36,000
Lead	7439-92-1	T	SW6020	mg/kg	21	14	6.1	18	23
Selenium	7782-49-2	T	SW6020	mg/kg	16	3.5	1.2	5.9	2.5
Organic Carbon (total)	C-012	T	SW9060	mg/kg	140,000	14,000	28,000	42,000	14,000
Solids (total)	C-008	T	E160.3	%	20.9	74.3	66.0	53.5	61.9

				Location	CURDS2C	Hardin1A	Hardin1B	Hardin1B	Hardin1C
				Sample Date	02/01/2017	02/01/2017	02/01/2017	02/01/2017	02/01/2017
				Sample Type	N	N	N	FD	N
				Lab ID	180-63061-6	180-63061-7	180-63061-8	180-63061-10	180-63061-9
				Sample ID	Curds2C_20170201	Hardin1A_20170201	Hardin1B_20170201	Hardin1B_20170201_FD	Hardin1C_20170201
Analyte	CASRN	T/D	Method	Unit	Result	Result	Result	Result	Result
Arsenic	7440-38-2	T	SW6020	mg/kg	13	9.1	34	24	9.4
Iron	7439-89-6	T	SW6020	mg/kg	26,000	23,000	34,000	30,000	29,000
Lead	7439-92-1	T	SW6020	mg/kg	17	24	37	37	20
Selenium	7782-49-2	T	SW6020	mg/kg	0.92	1.0	2	1.7	0.61
Organic Carbon (total)	C-012	T	SW9060	mg/kg	6,000	19,000	21,000	23,000	5,200
Solids (total)	C-008	T	E160.3	%	76.8	61.1	60.2	56.4	74.3

Source:

Amec Foster Wheeler. 2017. Table 3. Sediment Analytical Results. E.W. Brown Generating Station, Mercer County, Kentucky (Alt/ 3148). Project No. 7362162396.

Notes:

%: Percent
CURDS: Curd's Inlet
FD: Field Duplicate
Hardin: Hardin Inlet
mg/kg: milligrams per kilogram
N: Normal
T: Total

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	CURDS1		CURDS1A		CURDS2A		CURDS2B		CURDS2C	
					Sample Depth (ft)			12							
					Sample Date	11/03/2017		10/11/2017		11/04/2017		11/03/2017		11/03/2017	
					Sample Type	N		N		N		N		N	
					Lab ID	K1712054		K1711619		K1712054		K1712054		K1712054	
					Sample ID	SD-001-CURDS1		SD-001(12)-CURDS1A-171011		SD-001-CURDS2A		SD-001-CURDS2B		SD-001-CURDS2C	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	SW6020	Dry	mg/kg			91.6							
Boron	7440-42-8	SW6020	Dry	mg/kg			11.5							
Cadmium	7440-43-9	SW6020	Dry	mg/kg			0.333							
Iron	7439-89-6	SW6010	Dry	mg/kg			33300							
Lead	7439-92-1	SW6010	Dry	mg/kg			26							
Magnesium	7439-95-4	SW6010	Dry	mg/kg			2640							
Mercury	7439-97-6	SW7471B	Dry	mg/kg			0.021	J						
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g			0.34	J						
Selenium	7782-49-2	SW6020	Dry	mg/kg			1.4							
Zinc	7440-66-6	SW6020	Dry	mg/kg			62.4							
Grain Size 0.001 MM	GRNSZ0.001MM	D422	Dry	%	4.31				1.66		10.26		19.20	
Grain Size 0.005 MM	GRNSZ0.005MM	D422	Dry	%	11.51				28.34		18.48		24.56	
Grain Size 0.074 MM	GRNSZ0.074MM	D422	Dry	%	23.54				73.00		32.24		33.55	
Grain Size 0.075 MM	GRNSZ0.075MM	D422	Dry	%	27.85				89.39		33.82		35.10	
Grain Size 0.106 mm	GRNSZ0.106MM	D422	Dry	%	27.93				89.79		34.64		35.52	
Grain Size 0.250 MM	GRNSZ0.250MM	D422	Dry	%	29.18				97.51		36.98		36.62	
Grain Size 0.425 mm	GRNSZ0.425MM	D422	Dry	%	30.50				98.81		39.23		37.61	
Grain Size 0.850 MM	GRNSZ0.85MM	D422	Dry	%	33.48				99.62		43.54		38.92	
Grain Size 2 MM	GRNSZ2MM	D422	Dry	%	38.91				99.98		50.16		40.26	
Grain Size 4.75 MM	GRNSZ4.75MM	D422	Dry	%	44.81				100.00		59.62		41.45	
Grain Size 9.5 MM	GRNSZ9.5MM	D422	Dry	%	56.38				100.00		79.34		48.55	
Grain Size 19 MM	GRNSZ19MM	D422	Dry	%	99.78				100.00		99.35		99.89	
Organic Carbon (total)	C-012	SW9060	Dry	%			0.63							
Solids (total)	C-008	E160.3	Dry	%										
Solids (total)	C-008	E160.3	Wet	%			64.0							
Water	7732-18-5	D2216	Wet	%			56.2							
Sulfate	14808-79-8	E300	Dry	mg/kg			81							

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CURDSNB		CI1A		CI1B		CI1B		CI1C	
				Sample Depth (ft)			16		15				12	
				Sample Date	11/03/2017		10/11/2017		10/11/2017		10/11/2017		10/11/2017	
				Sample Type	N		N		N		FD		N	
				Lab ID	K1712054		K1711369		K1711369		K1711369		K1711372	
				Sample ID	SD-001-CURDSNB		SD-001(16)-CI1A-171011		SD-001(15)-CI1B-171011		DUP-006-171011		SD-001(12)-CI1C-171011	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	SW6020	Dry	mg/kg			391	J	64.7	J	90.7	J	35.6	
Boron	7440-42-8	SW6020	Dry	mg/kg			72.3		13.4		20.5		8.86	
Cadmium	7440-43-9	SW6020	Dry	mg/kg			10.1		1.62		2.26		0.472	
Iron	7439-89-6	SW6010	Dry	mg/kg			51200	J	40800	J	38700	J	35200	J
Lead	7439-92-1	SW6010	Dry	mg/kg			21		26		27		27	
Magnesium	7439-95-4	SW6010	Dry	mg/kg			5230	J	2990	J	2910	J	1790	
Mercury	7439-97-6	SW7471B	Dry	mg/kg			0.107	J	0.058	J	0.056	J	0.050	
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g			< 0.7	U	< 0.4	U	< 0.5	U	< 0.4	U
Selenium	7782-49-2	SW6020	Dry	mg/kg			14.1		3.4		4.5		1.4	
Zinc	7440-66-6	SW6020	Dry	mg/kg			245	J	76.3	J	124	J	112	
Grain Size 0.001 MM	GRNSZ0.001MM	D422	Dry	%	17.91									
Grain Size 0.005 MM	GRNSZ0.005MM	D422	Dry	%	32.29									
Grain Size 0.074 MM	GRNSZ0.074MM	D422	Dry	%	56.35									
Grain Size 0.075 MM	GRNSZ0.075MM	D422	Dry	%	58.61									
Grain Size 0.106 mm	GRNSZ0.106MM	D422	Dry	%	61.29									
Grain Size 0.250 MM	GRNSZ0.250MM	D422	Dry	%	69.20									
Grain Size 0.425 mm	GRNSZ0.425MM	D422	Dry	%	72.96									
Grain Size 0.850 MM	GRNSZ0.85MM	D422	Dry	%	78.80									
Grain Size 2 MM	GRNSZ2MM	D422	Dry	%	86.88									
Grain Size 4.75 MM	GRNSZ4.75MM	D422	Dry	%	98.68									
Grain Size 9.5 MM	GRNSZ9.5MM	D422	Dry	%	99.18									
Grain Size 19 MM	GRNSZ19MM	D422	Dry	%	99.18									
Organic Carbon (total)	C-012	SW9060	Dry	%			7.46		1.73		2.50		1.62	
Solids (total)	C-008	E160.3	Dry	%									65.0	
Solids (total)	C-008	E160.3	Wet	%			39.6		60.6		58.7			
Water	7732-18-5	D2216	Wet	%			153		65.0		70.3		53.9	
Sulfate	14808-79-8	E300	Dry	mg/kg			1440		1120		980		106	

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI1C		CI1C		CI2A		CI2A		CI2B	
				Sample Depth (ft)					20				17	
				Sample Date	10/11/2017		11/03/2017		10/11/2017		11/04/2017		10/11/2017	
				Sample Type	FD		N		N		N		N	
				Lab ID	K1711369		K1712054		K1711372		K1712054		K1711372	
				Sample ID	DUP-005-171011		SD-001-CI1C		SD-001(20)-CI2A-171011		SD-001-CI2A		SD-001(17)-CI2B-171011	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	SW6020	Dry	mg/kg	70.5	J			132				115	
Boron	7440-42-8	SW6020	Dry	mg/kg	6.38				29.6				27.5	
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.625				4.72				4.86	
Iron	7439-89-6	SW6010	Dry	mg/kg	64000	J			32300	J			36700	J
Lead	7439-92-1	SW6010	Dry	mg/kg	38.3				20				24	
Magnesium	7439-95-4	SW6010	Dry	mg/kg	1720	J			6720				3730	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.053	J			0.118				0.087	
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	< 0.4	U			< 0.5	U			< 0.6	U
Selenium	7782-49-2	SW6020	Dry	mg/kg	1.4				12.8				13.7	
Zinc	7440-66-6	SW6020	Dry	mg/kg	114	J			149				145	
Grain Size 0.001 MM	GRNSZ0.001MM	D422	Dry	%			17.34				0			
Grain Size 0.005 MM	GRNSZ0.005MM	D422	Dry	%			24.02				24.44			
Grain Size 0.074 MM	GRNSZ0.074MM	D422	Dry	%			35.19				68.60			
Grain Size 0.075 MM	GRNSZ0.075MM	D422	Dry	%			36.94				73.01			
Grain Size 0.106 mm	GRNSZ0.106MM	D422	Dry	%			37.94				82.19			
Grain Size 0.250 MM	GRNSZ0.250MM	D422	Dry	%			39.58				95.77			
Grain Size 0.425 mm	GRNSZ0.425MM	D422	Dry	%			40.43				98.25			
Grain Size 0.850 MM	GRNSZ0.85MM	D422	Dry	%			41.49				99.58			
Grain Size 2 MM	GRNSZ2MM	D422	Dry	%			42.38				99.92			
Grain Size 4.75 MM	GRNSZ4.75MM	D422	Dry	%			43.13				99.97			
Grain Size 9.5 MM	GRNSZ9.5MM	D422	Dry	%			44.22				99.97			
Grain Size 19 MM	GRNSZ19MM	D422	Dry	%			61.37				99.97			
Organic Carbon (total)	C-012	SW9060	Dry	%	1.51				3.22				4.92	
Solids (total)	C-008	E160.3	Dry	%					50.5				45.9	
Solids (total)	C-008	E160.3	Wet	%	64.3									
Water	7732-18-5	D2216	Wet	%	55.5				98.3				118	
Sulfate	14808-79-8	E300	Dry	mg/kg	176				1260				1120	

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI2C		CI2C		CI2C		CI3A		CI3B	
				Sample Depth (ft)	13						31		21	
				Sample Date	10/11/2017		10/11/2017		11/03/2017		10/11/2017		10/11/2017	
				Sample Type	N		FD		N		N		N	
				Lab ID	K1711372		K1711372		K1712054		K1711372		K1711372	
				Sample ID	SD-001(13)-CI2C-171011		DUP-004-171011		SD-001-CI2C		SD-001(31)-CI3A-171011		SD-001(21)-CI3B-171011	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	SW6020	Dry	mg/kg	32.0		27.6				448		93.6	
Boron	7440-42-8	SW6020	Dry	mg/kg	7.92		7.42				19.6		7.84	
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.367		0.338				1.48		0.573	
Iron	7439-89-6	SW6010	Dry	mg/kg	35100	J	36000	J			58300	J	68500	J
Lead	7439-92-1	SW6010	Dry	mg/kg	24		24				26		26	
Magnesium	7439-95-4	SW6010	Dry	mg/kg	2980		2980				3610		2870	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.047		0.057	J			0.069		0.038	
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	< 0.4	U	< 0.5	U			< 0.6	U	< 0.4	U
Selenium	7782-49-2	SW6020	Dry	mg/kg	1.4		1.3	J			32.8		1.6	
Zinc	7440-66-6	SW6020	Dry	mg/kg	71.9		65.7				130		68.2	
Grain Size 0.001 MM	GRNSZ0.001MM	D422	Dry	%					23.53					
Grain Size 0.005 MM	GRNSZ0.005MM	D422	Dry	%					39.01					
Grain Size 0.074 MM	GRNSZ0.074MM	D422	Dry	%					64.94					
Grain Size 0.075 MM	GRNSZ0.075MM	D422	Dry	%					75.41					
Grain Size 0.106 mm	GRNSZ0.106MM	D422	Dry	%					75.86					
Grain Size 0.250 MM	GRNSZ0.250MM	D422	Dry	%					76.68					
Grain Size 0.425 mm	GRNSZ0.425MM	D422	Dry	%					77.28					
Grain Size 0.850 MM	GRNSZ0.85MM	D422	Dry	%					78.14					
Grain Size 2 MM	GRNSZ2MM	D422	Dry	%					79.13					
Grain Size 4.75 MM	GRNSZ4.75MM	D422	Dry	%					79.89					
Grain Size 9.5 MM	GRNSZ9.5MM	D422	Dry	%					84.82					
Grain Size 19 MM	GRNSZ19MM	D422	Dry	%					99.91					
Organic Carbon (total)	C-012	SW9060	Dry	%	1.17		1.37				3.13		1.35	
Solids (total)	C-008	E160.3	Dry	%	63.5		57.1				44.5		67.4	
Solids (total)	C-008	E160.3	Wet	%										
Water	7732-18-5	D2216	Wet	%	57.3		75.1				124		47.9	
Sulfate	14808-79-8	E300	Dry	mg/kg	124		88				454		58	

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI3C		CI3C		CI4A		CI4A		CI4A	
				Sample Depth (ft)	12						76			
				Sample Date	10/11/2017		11/03/2017		11/02/2017		11/02/2017		11/02/2017	
				Sample Type	N		N		N		N		FD	
				Lab ID	K1711372		K1712054		K1712054		K1712090		K1712090	
				Sample ID	SD-001(12)-CI3C-171011		SD-001-CI3C		SD-001-CI4A		SD-001(76)-CI4A-171102		SD-DUP-009-171102	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	SW6020	Dry	mg/kg	18.1						120		123	
Boron	7440-42-8	SW6020	Dry	mg/kg	7.39						46.6		43.5	
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.299						3.35		3.19	
Iron	7439-89-6	SW6010	Dry	mg/kg	23600	J					35200		35200	
Lead	7439-92-1	SW6010	Dry	mg/kg	19						28.6		25.8	
Magnesium	7439-95-4	SW6010	Dry	mg/kg	2700						4930		4900	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.024						0.143		0.140	
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	< 0.4	U					< 0.6	U	0.3	J
Selenium	7782-49-2	SW6020	Dry	mg/kg	1.2						9.2		8.8	
Zinc	7440-66-6	SW6020	Dry	mg/kg	48.1						121		118	
Grain Size 0.001 MM	GRNSZ0.001MM	D422	Dry	%			14.92		32.78					
Grain Size 0.005 MM	GRNSZ0.005MM	D422	Dry	%			19.50		52.94					
Grain Size 0.074 MM	GRNSZ0.074MM	D422	Dry	%			27.17		86.70					
Grain Size 0.075 MM	GRNSZ0.075MM	D422	Dry	%			28.49		93.79					
Grain Size 0.106 mm	GRNSZ0.106MM	D422	Dry	%			28.82		96.07					
Grain Size 0.250 MM	GRNSZ0.250MM	D422	Dry	%			29.68		98.82					
Grain Size 0.425 mm	GRNSZ0.425MM	D422	Dry	%			30.34		99.47					
Grain Size 0.850 MM	GRNSZ0.85MM	D422	Dry	%			31.16		99.77					
Grain Size 2 MM	GRNSZ2MM	D422	Dry	%			32.10		99.90					
Grain Size 4.75 MM	GRNSZ4.75MM	D422	Dry	%			32.53		100.00					
Grain Size 9.5 MM	GRNSZ9.5MM	D422	Dry	%			36.42		100.00					
Grain Size 19 MM	GRNSZ19MM	D422	Dry	%			41.46		100.00					
Organic Carbon (total)	C-012	SW9060	Dry	%	2.20						3.02		3.00	
Solids (total)	C-008	E160.3	Dry	%	65.2									
Solids (total)	C-008	E160.3	Wet	%							42.8		42.6	
Water	7732-18-5	D2216	Wet	%	53.5						133		135	
Sulfate	14808-79-8	E300	Dry	mg/kg	91						2090	J	2630	J

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI4B		CI4C		HQ1A		HQ1A		HQ1A	
				Sample Depth (ft)	20		19		20		20			
				Sample Date	10/12/2017		10/12/2017		10/11/2017		10/11/2017		11/04/2017	
				Sample Type	N		N		N		N		N	
				Lab ID	K1711369		K1711619		K1711619		K1711619		K1712054	
				Sample ID	SD-001(20)-CI4B-171012		SD-001(19)-CI4C-171012		DS-001(20)-H21A-171011		SD-001(20)-H21A-171011		SD-001-HQ1A	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	SW6020	Dry	mg/kg	40.0	J	17.6				32.9			
Boron	7440-42-8	SW6020	Dry	mg/kg	2.95		4.59				48.4			
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.332		0.292				2.36			
Iron	7439-89-6	SW6010	Dry	mg/kg	10300	J	25400				17400			
Lead	7439-92-1	SW6010	Dry	mg/kg	2.2	J	16.0				15	J		
Magnesium	7439-95-4	SW6010	Dry	mg/kg	6220	J	5720				4720			
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.006	J	0.026				0.059	J		
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	< 0.3	U	0.09	J			1.7			
Selenium	7782-49-2	SW6020	Dry	mg/kg	0.66		0.7	J			15.5			
Zinc	7440-66-6	SW6020	Dry	mg/kg	18.8	J	43.9				67.6			
Grain Size 0.001 MM	GRNSZ0.001MM	D422	Dry	%									23.15	
Grain Size 0.005 MM	GRNSZ0.005MM	D422	Dry	%									36.05	
Grain Size 0.074 MM	GRNSZ0.074MM	D422	Dry	%									57.64	
Grain Size 0.075 MM	GRNSZ0.075MM	D422	Dry	%									57.33	
Grain Size 0.106 mm	GRNSZ0.106MM	D422	Dry	%									59.82	
Grain Size 0.250 MM	GRNSZ0.250MM	D422	Dry	%									64.73	
Grain Size 0.425 mm	GRNSZ0.425MM	D422	Dry	%									69.73	
Grain Size 0.850 MM	GRNSZ0.85MM	D422	Dry	%									77.85	
Grain Size 2 MM	GRNSZ2MM	D422	Dry	%									83.62	
Grain Size 4.75 MM	GRNSZ4.75MM	D422	Dry	%									86.67	
Grain Size 9.5 MM	GRNSZ9.5MM	D422	Dry	%									94.70	
Grain Size 19 MM	GRNSZ19MM	D422	Dry	%									99.67	
Organic Carbon (total)	C-012	SW9060	Dry	%	0.41		0.88				15.5			
Solids (total)	C-008	E160.3	Dry	%										
Solids (total)	C-008	E160.3	Wet	%	75.7		65.7		23.2					
Water	7732-18-5	D2216	Wet	%	32.4		52.2				331			
Sulfate	14808-79-8	E300	Dry	mg/kg	185		79				654			

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	HQ1B		HQ1B		HQ1C		HQ1C		LHL1B	
					Sample Depth (ft)	17				13				20	
					Sample Date	10/11/2017		11/04/2017		10/11/2017		11/04/2017		10/12/2017	
					Sample Type	N		N		N		N		N	
					Lab ID	K1711619		K1712054		K1711619		K1712054		K1711619	
					Sample ID	SD-001(17)-H21B-171011		SD-001-HQ1B		SD-001(13)-HQ1C-171011		SD-001-HQ1C		SD-001(20)-LHL1B-171012	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	SW6020	Dry	mg/kg	50.2				19.1				9.3	
Boron	7440-42-8	SW6020	Dry	mg/kg	21.3				8.63				17.2	
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.999				0.268				0.910	
Iron	7439-89-6	SW6010	Dry	mg/kg	23200				27600				17300	
Lead	7439-92-1	SW6010	Dry	mg/kg	20				18				13	J
Magnesium	7439-95-4	SW6010	Dry	mg/kg	3560				4320				17600	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.034	J			0.034				0.041	J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	0.41	J			0.46				0.46	J
Selenium	7782-49-2	SW6020	Dry	mg/kg	7.1				0.9	J			4.9	
Zinc	7440-66-6	SW6020	Dry	mg/kg	44.7				56.6				72.0	
Grain Size 0.001 MM	GRNSZ0.001MM	D422	Dry	%			20.74				15.01			
Grain Size 0.005 MM	GRNSZ0.005MM	D422	Dry	%			34.72				25.99			
Grain Size 0.074 MM	GRNSZ0.074MM	D422	Dry	%			58.12				44.38			
Grain Size 0.075 MM	GRNSZ0.075MM	D422	Dry	%			60.07				51.12			
Grain Size 0.106 mm	GRNSZ0.106MM	D422	Dry	%			62.68				51.54			
Grain Size 0.250 MM	GRNSZ0.250MM	D422	Dry	%			68.35				52.39			
Grain Size 0.425 mm	GRNSZ0.425MM	D422	Dry	%			72.12				53.16			
Grain Size 0.850 MM	GRNSZ0.85MM	D422	Dry	%			77.30				54.17			
Grain Size 2 MM	GRNSZ2MM	D422	Dry	%			83.55				55.51			
Grain Size 4.75 MM	GRNSZ4.75MM	D422	Dry	%			87.30				57.07			
Grain Size 9.5 MM	GRNSZ9.5MM	D422	Dry	%			95.78				62.81			
Grain Size 19 MM	GRNSZ19MM	D422	Dry	%			99.51				78.76			
Organic Carbon (total)	C-012	SW9060	Dry	%	7.38				1.26				3.87	
Solids (total)	C-008	E160.3	Dry	%										
Solids (total)	C-008	E160.3	Wet	%	46.4				67.1					
Water	7732-18-5	D2216	Wet	%	116				49.1				266	
Sulfate	14808-79-8	E300	Dry	mg/kg	209				134				529	

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	LHL1B		LHL1C		LHL2B		LHL2C		LHL3B	
				Sample Depth (ft)	20		20		20		20		17	
				Sample Date	10/12/2017		10/12/2017		10/12/2017		10/12/2017		10/12/2017	
				Sample Type	N		N		N		N		N	
				Lab ID	K1711619		K1711619		K1711369		K1711369		K1711619	
				Sample ID	SD-001(20-LGL1B-171012		SD-001(20)-LHL1C-171012		SD-001(20)-LHL2B-171012		SD-001(20)-LHL2C-171012		SD-001(17)-LHL3B-171012	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	SW6020	Dry	mg/kg			10.7		26.9	J	28.9	J	14.9	
Boron	7440-42-8	SW6020	Dry	mg/kg			20.2		7.89		6.86		11.1	
Cadmium	7440-43-9	SW6020	Dry	mg/kg			0.853		0.465		0.646		0.436	
Iron	7439-89-6	SW6010	Dry	mg/kg			17200		28300	J	34100	J	13600	
Lead	7439-92-1	SW6010	Dry	mg/kg			17	J	9.7		16.1		14	J
Magnesium	7439-95-4	SW6010	Dry	mg/kg			17800		4940	J	8950	J	12200	
Mercury	7439-97-6	SW7471B	Dry	mg/kg			0.061	J	0.033	J	0.0294	J	0.019	J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g			0.48	J	< 0.4	U	< 0.5	U	0.71	
Selenium	7782-49-2	SW6020	Dry	mg/kg			4.7		1.57		3.61		1.7	J
Zinc	7440-66-6	SW6020	Dry	mg/kg			59.1		38.6	J	61.5	J	70.2	
Grain Size 0.001 MM	GRNSZ0.001MM	D422	Dry	%										
Grain Size 0.005 MM	GRNSZ0.005MM	D422	Dry	%										
Grain Size 0.074 MM	GRNSZ0.074MM	D422	Dry	%										
Grain Size 0.075 MM	GRNSZ0.075MM	D422	Dry	%										
Grain Size 0.106 mm	GRNSZ0.106MM	D422	Dry	%										
Grain Size 0.250 MM	GRNSZ0.250MM	D422	Dry	%										
Grain Size 0.425 mm	GRNSZ0.425MM	D422	Dry	%										
Grain Size 0.850 MM	GRNSZ0.85MM	D422	Dry	%										
Grain Size 2 MM	GRNSZ2MM	D422	Dry	%										
Grain Size 4.75 MM	GRNSZ4.75MM	D422	Dry	%										
Grain Size 9.5 MM	GRNSZ9.5MM	D422	Dry	%										
Grain Size 19 MM	GRNSZ19MM	D422	Dry	%										
Organic Carbon (total)	C-012	SW9060	Dry	%			6.30		2.20		4.02		2.58	
Solids (total)	C-008	E160.3	Dry	%										
Solids (total)	C-008	E160.3	Wet	%	27.3		27.7		64.0		54.7		49.9	
Water	7732-18-5	D2216	Wet	%			260		56.3		82.8		104	
Sulfate	14808-79-8	E300	Dry	mg/kg			642		803		1350		230	

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	LHL3C		LHL4B		LHL4C		HI1B		LHL5B	
				Sample Depth (ft)	24		22		19				16	
				Sample Date	10/12/2017		10/12/2017		10/12/2017		11/03/2017		10/12/2017	
				Sample Type	N		N		N		N		N	
				Lab ID	K1711619		K1711619		K1711619		K1712054		K1711619	
				Sample ID	SD-001(24)-LHL3C-171012		SD-001(22)-LHL4B-171012		SD-001(19)-LHL4C-171012		SD-001-HI1B		SD-001(16)-LHL5B-171012	
Analyte	CAS_RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	SW6020	Dry	mg/kg	8.58		16.9		6.44				7.98	
Boron	7440-42-8	SW6020	Dry	mg/kg	18.5		3.52		10.7				9.16	
Cadmium	7440-43-9	SW6020	Dry	mg/kg	0.470		0.128		0.237				0.279	
Iron	7439-89-6	SW6010	Dry	mg/kg	10400		18800		10700				19700	
Lead	7439-92-1	SW6010	Dry	mg/kg	8	J	9	J	8	J			12.7	
Magnesium	7439-95-4	SW6010	Dry	mg/kg	8180		5140		18200				5360	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.018	J	0.006	J	0.016	J			0.026	
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	0.34	J	0.13	J	< 0.6	U			0.04	J
Selenium	7782-49-2	SW6020	Dry	mg/kg	3.8		0.5	J	2.2				0.55	J
Zinc	7440-66-6	SW6020	Dry	mg/kg	24.6		24.3		37.7				47.7	
Grain Size 0.001 MM	GRNSZ0.001MM	D422	Dry	%							25.82			
Grain Size 0.005 MM	GRNSZ0.005MM	D422	Dry	%							47.26			
Grain Size 0.074 MM	GRNSZ0.074MM	D422	Dry	%							83.15			
Grain Size 0.075 MM	GRNSZ0.075MM	D422	Dry	%							97.62			
Grain Size 0.106 mm	GRNSZ0.106MM	D422	Dry	%							98.52			
Grain Size 0.250 MM	GRNSZ0.250MM	D422	Dry	%							99.45			
Grain Size 0.425 mm	GRNSZ0.425MM	D422	Dry	%							99.70			
Grain Size 0.850 MM	GRNSZ0.85MM	D422	Dry	%							99.86			
Grain Size 2 MM	GRNSZ2MM	D422	Dry	%							100.00			
Grain Size 4.75 MM	GRNSZ4.75MM	D422	Dry	%							100.00			
Grain Size 9.5 MM	GRNSZ9.5MM	D422	Dry	%							100.00			
Grain Size 19 MM	GRNSZ19MM	D422	Dry	%							100.00			
Organic Carbon (total)	C-012	SW9060	Dry	%	11.9		0.38		3.58				0.91	
Solids (total)	C-008	E160.3	Dry	%										
Solids (total)	C-008	E160.3	Wet	%	40.0		72.4		52.9				66.2	
Water	7732-18-5	D2216	Wet	%	150		38.1		89.0				51.1	
Sulfate	14808-79-8	E300	Dry	mg/kg	349		253		461				45	

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL5C		LHL6B		LHL6C		DR1	
					Sample Depth (ft)	21		20		20		1	
					Sample Date	10/12/2017		10/12/2017		10/12/2017		10/16/2017	
					Sample Type	N		N		N		N	
					Lab ID	K1711619		K1711619		K1711369		K1711619	
					Sample ID	SD-001(21)-LHL5C-171012		SD-001(20)-LHL6B-171012		SD-001(20)-LHL6C-171012		SD-001(1)-DR1-171016	
Analyte	CAS_RN	Method	BASIS	Unit		Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	SW6020	Dry	mg/kg		22.2		1.73		8.44	J	12.0	
Boron	7440-42-8	SW6020	Dry	mg/kg		6.57		6.38		20.3		3.40	
Cadmium	7440-43-9	SW6020	Dry	mg/kg		0.363		0.057		0.394		0.327	
Iron	7439-89-6	SW6010	Dry	mg/kg		26600		4940		14100	J	29600	
Lead	7439-92-1	SW6010	Dry	mg/kg		28		< 11	U	9	J	18	
Magnesium	7439-95-4	SW6010	Dry	mg/kg		5810		23600		7890	J	3770	
Mercury	7439-97-6	SW7471B	Dry	mg/kg		0.023		0.004	J	0.031	J	0.029	
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		0.06	J	0.21		1.74		0.05	J
Selenium	7782-49-2	SW6020	Dry	mg/kg		1.9		0.4	J	4.1		0.5	J
Zinc	7440-66-6	SW6020	Dry	mg/kg		63.9		10.9		44.8	J	67.2	
Grain Size 0.001 MM	GRNSZ0.001MM	D422	Dry	%									
Grain Size 0.005 MM	GRNSZ0.005MM	D422	Dry	%									
Grain Size 0.074 MM	GRNSZ0.074MM	D422	Dry	%									
Grain Size 0.075 MM	GRNSZ0.075MM	D422	Dry	%									
Grain Size 0.106 mm	GRNSZ0.106MM	D422	Dry	%									
Grain Size 0.250 MM	GRNSZ0.250MM	D422	Dry	%									
Grain Size 0.425 mm	GRNSZ0.425MM	D422	Dry	%									
Grain Size 0.850 MM	GRNSZ0.85MM	D422	Dry	%									
Grain Size 2 MM	GRNSZ2MM	D422	Dry	%									
Grain Size 4.75 MM	GRNSZ4.75MM	D422	Dry	%									
Grain Size 9.5 MM	GRNSZ9.5MM	D422	Dry	%									
Grain Size 19 MM	GRNSZ19MM	D422	Dry	%									
Organic Carbon (total)	C-012	SW9060	Dry	%		1.42		1.51		17.9		0.86	
Solids (total)	C-008	E160.3	Dry	%									
Solids (total)	C-008	E160.3	Wet	%		55.2		65.2		26.2		71.2	
Water	7732-18-5	D2216	Wet	%		81.1		53.3		281		40.5	
Sulfate	14808-79-8	E300	Dry	mg/kg		153		185		3620		12.0	

Table 2-4B: Phase I Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Notes:

%:	Percent
CI:	Curd's Inlet
DR:	Dix River
FD:	Field Duplicate
HQ:	HQ Inlet
IQ:	Interpreted qualifier, data flags from third party validation
J:	Concentration is greater than the method detection limit but less than the lab reporting limit
LHL:	Lower Herrington Lake
mg/kg:	milligrams per kilogram
mm:	millimeter
N:	Normal
ng/g:	nanograms per gram
U:	Constituent was analyzed for, but not detected

Table 2-4C: Phase II Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI2.1A		CI2.1B		CI2.1C		CI2.2A		CI2.2B	
				Sample Depth (ft)	18		17		10		19		17	
				Sample Date	06/19/2018		06/19/2018		06/19/2018		06/19/2018		06/19/2018	
				Sample Type	N		N		N		N		N	
				Lab ID	K1806156-001		K1806155-002		K1806155-003		K1806156-002		K1806155-004	
				Sample ID	SD001(18)-CI2.1A-180619		SD001(17)-CI2.1B-180619		SD001(10)-CI2.1C-180619		SD001(19)-CI2.2A-180619		SD001(17)-CI2.2B-180619	
Analyte	CAS_RN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	Dry	SW6020	mg/kg	224		125		51.6		415		324	
Boron	7440-42-8	Dry	SW6020	mg/kg	47.0	J	32.3		7.56		25.6	J	29.5	
Cadmium	7440-43-9	Dry	SW6020	mg/kg	7.76		4.38		0.811		3.31		4.20	
Iron	7439-89-6	Dry	SW6010	mg/kg	34100		28800		33400		52200		49100	
Lead	7439-92-1	Dry	SW6020	mg/kg	21.5		18.1		31.4		25.7		24.9	
Magnesium	7439-95-4	Dry	SW6010	mg/kg	7100		5970		2800		5130		4330	
Mercury	7439-97-6	Dry	SW7471B	mg/kg	0.122		< 0.015	U	0.011		0.085		0.002	J
Methylmercury	22967-92-6	Dry	ALS SOP	ng/g	0.58	J	0.37	J	< 0.6	U	< 0.7	UJ	0.20	J
Selenium	7782-49-2	Dry	SW6020	mg/kg	17.7		10.0		1.7		12.1		13.3	
Zinc	7440-66-6	Dry	SW6020	mg/kg	189		125		76.4		129		132	
Solids (total)	C-008	Wet	E160.3	%	44.0		43.4		60.3		60.7		49.3	

Table 2-4C: Phase II Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI2.2C		CI2.2C		CI3A		CI3A		CI3B	
				Sample Depth (ft)	10				23				20	
				Sample Date	06/19/2018		06/19/2018		06/20/2018		06/20/2018		06/20/2018	
				Sample Type	N		FD		N		FD		N	
				Lab ID	K1806155-005		K1806155-001		K1806156-010		K1806156-003		K1806156-011	
				Sample ID	SD001(10)-CI2.2C-180619		DUP-003-180619		SD001(23)-CI3A-180620		DUP-004-180620		SD001(20)-CI3B-180620	
Analyte	CAS_RN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	Dry	SW6020	mg/kg	58.0		59.8		371		369		234	
Boron	7440-42-8	Dry	SW6020	mg/kg	6.64		7.47		24.1	J	25.5	J	16.4	J
Cadmium	7440-43-9	Dry	SW6020	mg/kg	0.513		0.686		2.77		2.78		2.26	
Iron	7439-89-6	Dry	SW6010	mg/kg	28000		40200		50300		49900		35800	
Lead	7439-92-1	Dry	SW6020	mg/kg	24.6		37.1		26.2		25.1		25.4	
Magnesium	7439-95-4	Dry	SW6010	mg/kg	1990		2460		3870		3570		4010	
Mercury	7439-97-6	Dry	SW7471B	mg/kg	0.003	J	0.007	J	0.082		0.084		0.078	
Methylmercury	22967-92-6	Dry	ALS SOP	ng/g	< 0.6	U	< 0.4	U	< 0.8	UJ	< 0.8	UJ	< 0.6	UJ
Selenium	7782-49-2	Dry	SW6020	mg/kg	2.0		1.5		24.1		23.7		10.9	
Zinc	7440-66-6	Dry	SW6020	mg/kg	57.5		68.4		148		136		93.0	
Solids (total)	C-008	Wet	E160.3	%	58.9		64.8		53.2		49.0		60.3	

Table 2-4C: Phase II Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI3C		CI3.1A		CI3.1B		CI3.1C		CI3.2A	
				Sample Depth (ft)	10		30		17		10		35	
				Sample Date	06/20/2018		06/20/2018		06/20/2018		06/20/2018		06/20/2018	
				Sample Type	N		N		N		N		N	
				Lab ID	K1806156-012		K1806156-007		K1806156-008		K1806156-009		K1806155-008	
				Sample ID	SD001(10)-CI3C-180620		SD001(30)-CI3.1A-180620		SD001(17)-CI3.1B-180620		SD001(10)-CI3.1C-180620		SD001(35)-CI3.2A-180620	
Analyte	CAS_RN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	Dry	SW6020	mg/kg	24.4		421		16.7		49.9		351	
Boron	7440-42-8	Dry	SW6020	mg/kg	7.17	J	22.2	J	8.88	J	7.14	J	12.7	
Cadmium	7440-43-9	Dry	SW6020	mg/kg	0.519		3.24		0.564		0.718		0.677	
Iron	7439-89-6	Dry	SW6010	mg/kg	27400		53700		24000		25100		51700	
Lead	7439-92-1	Dry	SW6020	mg/kg	19.0		23.8		20.4		24.4		25.2	
Magnesium	7439-95-4	Dry	SW6010	mg/kg	4020		3260		2510		4380		1620	
Mercury	7439-97-6	Dry	SW7471B	mg/kg	0.041		0.098		0.064		0.050		0.075	
Methylmercury	22967-92-6	Dry	ALS SOP	ng/g	< 0.6	UJ	< 0.9	UJ	< 0.7	UJ	< 0.7	UJ	< 0.7	U
Selenium	7782-49-2	Dry	SW6020	mg/kg	1.2		36.7		0.85	J	2.4		13.6	
Zinc	7440-66-6	Dry	SW6020	mg/kg	53.5		141		61.3		67.8		78.3	
Solids (total)	C-008	Wet	E160.3	%	66.1		43.3		67.2		60.7		58.7	

Table 2-4C: Phase II Sediment Analytical Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI3.2B		CI3.2C		CI4A		CI4B		CI4C	
				Sample Depth (ft)	17		10		72		17		10	
				Sample Date	06/20/2018		06/20/2018		06/20/2018		06/20/2018		06/20/2018	
				Sample Type	N		N		N		N		N	
				Lab ID	K1806156-005		K1806156-006		K1806155-006		K1806155-007		K1806156-004	
				Sample ID	SD001(17)-CI3.2B-180620		SD001(10)-CI3.2C-180620		SD001(72)-CI4A-180620		SD001(17)-CI4B-180620		SD001(10)-CI4C-180620	
Analyte	CAS_RN	Basis	Method	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Arsenic	7440-38-2	Dry	SW6020	mg/kg	29.2		36.8		133		33.6		22.5	
Boron	7440-42-8	Dry	SW6020	mg/kg	5.06	J	5.89	J	57.0		8.51		7.20	J
Cadmium	7440-43-9	Dry	SW6020	mg/kg	0.379		0.482		4.07		0.401		0.370	
Iron	7439-89-6	Dry	SW6010	mg/kg	26100		28600		31900		24100		27700	
Lead	7439-92-1	Dry	SW6020	mg/kg	21.6		21.4		26.7		16.1		18.8	
Magnesium	7439-95-4	Dry	SW6010	mg/kg	2860		4850		3550		8860		6790	
Mercury	7439-97-6	Dry	SW7471B	mg/kg	0.056		0.054		0.125		0.0344		0.040	
Methylmercury	22967-92-6	Dry	ALS SOP	ng/g	< 0.7	UJ	< 0.8	UJ	0.31	J	< 0.5	U	< 0.7	UJ
Selenium	7782-49-2	Dry	SW6020	mg/kg	1.0		1.4		12.4		1.0	J	0.8	J
Zinc	7440-66-6	Dry	SW6020	mg/kg	56.0		71.9		132		47.3		49.8	
Solids (total)	C-008	Wet	E160.3	%	66.6		64.4		43.5		66.9		63.2	

Notes:

%: Percent
CI: Curd's Inlet
FD: Field Duplicate
IQ: Interpreted qualifier, data flags from third party validation
J: Concentration is greater than the method detection limit but less than the lab reporting limit
mg/kg: milligrams per kilogram
mm: millimeter
N: Normal
ng/g: nanograms per gram
U: Constituent was analyzed for, but not detected

Table 2-5: Phase I Aquatic Vegetation Analytical Results (Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI1		CI2		CI3		CI4		CI4	
				Sample Date	10/04/2017		10/05/2017		10/05/2017		10/05/2017		10/05/2017	
				Sample Type	N		N		N		N		FD	
				Lab ID	K1712478		K1712478		K1712478		K1712478		K1712478	
				Sample ID	AV-001-CI1-171004		AV-001-CI2-171005		AV-001-CI3-171005		AV-001-CI4-171005		AV-001-CI4-171005-FD	
Analyte	CAS RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Solids (total)	C-008	ZFZDRY	Wet	%	12.9		11.9		14.2		10.6		11.0	
Arsenic	7440-38-2	SW6020A	Dry	mg/kg	8.33		8.60		4.41		3.98		4.07	
Arsenic	7440-38-2	SW6020A	Wet	mg/kg	1.07		1.02		0.626		0.422		0.448	
Boron	7440-42-8	SW6020A	Dry	mg/kg	274		129		119		98.9		90.5	
Boron	7440-42-8	SW6020A	Wet	mg/kg	35.4		15.3		16.9		10.5		9.96	
Cadmium	7440-43-9	SW6020A	Dry	mg/kg	1.67	J	0.786	J	2.77	J	1.15	J	1.05	J
Cadmium	7440-43-9	SW6020A	Wet	mg/kg	0.215		0.0935		0.393		0.122		0.116	
Iron	7439-89-6	SW6020A	Dry	mg/kg	5870		6010		2900		2820		2690	
Iron	7439-89-6	SW6020A	Wet	mg/kg	757		716		412		299		296	
Lead	7439-92-1	SW6020	Dry	mg/kg	3.28		8.13		10.2		4.83		6.20	
Lead	7439-92-1	SW6020	Wet	mg/kg	0.424		0.967		1.46		0.511		0.682	
Magnesium	7439-95-4	SW6010C	Dry	mg/kg	3110		3550		3640		4910		4810	
Magnesium	7439-95-4	SW6010C	Wet	mg/kg	402		423		517		520		529	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.019	J	0.036		0.024		0.025		0.023	
Mercury	7439-97-6	SW7471B	Wet	mg/kg	0.0024	J	0.0042		0.0034		0.0027		0.0025	
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	8.42	J	< 9.8	U	< 10	U	< 10	U	< 10	U
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g	1.09	J	< 1.2	U	< 1.4	U	< 1.1	U	< 1.1	U
Selenium	7782-49-2	SW6020A	Dry	mg/kg	1.96		2.64		2.4		1.7		1.67	
Selenium	7782-49-2	SW6020A	Wet	mg/kg	0.25		0.31		0.34		0.18		0.18	
Zinc	7440-66-6	SW6020A	Dry	mg/kg	38.9		56.6		44.6		45.1		42.5	
Zinc	7440-66-6	SW6020A	Wet	mg/kg	5.02		6.74		6.34		4.78		4.67	
Moisture Content	MOISTURE	CALCULATED	Wet	%	87.1		88.1		85.8		89.4		89.0	

Table 2-5: Phase I Aquatic Vegetation Analytical Results (Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	HQ		LHL1		LHL2		LHL3	
				Sample Date	10/06/2017		10/12/2017		10/12/2017		10/12/2017	
				Sample Type	N		N		N		N	
				Lab ID	K1712478		K1712478		K1712478		K1712478	
				Sample ID	AV-001-HQ-171006		AV-001-LHL1-171012		AV-001-LHL2-171012		AV-001-LHL3-171012	
Analyte	CAS RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Solids (total)	C-008	ZFZDRY	Wet	%	7.43		34.7		29.5		32.9	
Arsenic	7440-38-2	SW6020A	Dry	mg/kg	7.30		4.91		9.59		3.61	
Arsenic	7440-38-2	SW6020A	Wet	mg/kg	0.543		1.70		2.83		1.19	
Boron	7440-42-8	SW6020A	Dry	mg/kg	160		44.9		47.1		40.0	
Boron	7440-42-8	SW6020A	Wet	mg/kg	11.9		15.6		13.9		13.1	
Cadmium	7440-43-9	SW6020A	Dry	mg/kg	0.604	J	0.147	J	0.165	J	0.091	J
Cadmium	7440-43-9	SW6020A	Wet	mg/kg	0.0449		0.0512		0.0488		0.0300	
Iron	7439-89-6	SW6020A	Dry	mg/kg	5190		5290		9200		3850	
Iron	7439-89-6	SW6020A	Wet	mg/kg	386		1840		2710		1270	
Lead	7439-92-1	SW6020	Dry	mg/kg	20.1		3.71		5.09		2.19	
Lead	7439-92-1	SW6020	Wet	mg/kg	1.49		1.29		1.50		0.722	
Magnesium	7439-95-4	SW6010C	Dry	mg/kg	3670		23800		6100		8800	
Magnesium	7439-95-4	SW6010C	Wet	mg/kg	273		8270		1800		2890	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.027		0.023		0.024		0.008	J
Mercury	7439-97-6	SW7471B	Wet	mg/kg	0.0020		0.0079		0.0071		0.0025	J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g			< 9.8	U	< 9.8	U	< 10	U
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g			< 3.4	U	< 2.9	U	< 3.3	U
Selenium	7782-49-2	SW6020A	Dry	mg/kg	1.53		1.8		2.3		1.13	
Selenium	7782-49-2	SW6020A	Wet	mg/kg	0.113		0.64		0.69		0.37	
Zinc	7440-66-6	SW6020A	Dry	mg/kg	41.4		16.1		22.5		8.49	
Zinc	7440-66-6	SW6020A	Wet	mg/kg	3.07		5.58		6.63		2.79	
Moisture Content	MOISTURE	CALCULATED	Wet	%	92.6		65.3		70.5		67.1	

Table 2-5: Phase I Aquatic Vegetation Analytical Results (Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	LHL4		LHL5		LHL6		DR	
				Sample Date	10/12/2017		10/12/2017		10/12/2017		10/07/2017	
				Sample Type	N		N		N		N	
				Lab ID	K1712478		K1712478		K1712478		K1712478	
				Sample ID	AV-001-LHL4-171012		AV-001-LHL5-171012		AV-001-LHL6-171012		AV-001-DR-171007	
Analyte	CAS RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Solids (total)	C-008	ZFZDRY	Wet	%	22.5		20.5		20.3		18.2	
Arsenic	7440-38-2	SW6020A	Dry	mg/kg	3.82		4.97		3.73		14.9	
Arsenic	7440-38-2	SW6020A	Wet	mg/kg	0.86		1.02		0.76		2.71	
Boron	7440-42-8	SW6020A	Dry	mg/kg	41.2		37.9		35.7		40.6	
Boron	7440-42-8	SW6020A	Wet	mg/kg	9.28		7.77		7.24		7.38	
Cadmium	7440-43-9	SW6020A	Dry	mg/kg	0.096		0.128		0.332		0.868	J
Cadmium	7440-43-9	SW6020A	Wet	mg/kg	0.0216		0.0262		0.0674		0.158	
Iron	7439-89-6	SW6020A	Dry	mg/kg	1670		800		3310		14300	
Iron	7439-89-6	SW6020A	Wet	mg/kg	376		164		672		2610	
Lead	7439-92-1	SW6020	Dry	mg/kg	1.57		0.763		3.67		11.3	
Lead	7439-92-1	SW6020	Wet	mg/kg	0.354		0.156		0.745		2.06	
Magnesium	7439-95-4	SW6010C	Dry	mg/kg	5080		4450		4010		6820	
Magnesium	7439-95-4	SW6010C	Wet	mg/kg	1140		913		814		1240	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	< 0.020	U	< 0.020	U	0.023		0.052	
Mercury	7439-97-6	SW7471B	Wet	mg/kg	0.0019	J	0.0022	J	0.0046		0.0095	
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	< 9.9	U	< 9.9	U	< 9.9	U	4.12	J
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g	< 2.2	U	< 2	U	< 2	U	0.75	J
Selenium	7782-49-2	SW6020A	Dry	mg/kg	2.5		3.43		3.63		2.44	
Selenium	7782-49-2	SW6020A	Wet	mg/kg	0.56		0.70		0.74		0.44	
Zinc	7440-66-6	SW6020A	Dry	mg/kg	6.71		12.8		20.4		53.5	
Zinc	7440-66-6	SW6020A	Wet	mg/kg	1.51		2.62		4.13		9.73	
Moisture Content	MOISTURE	CALCULATED	Wet	%	77.5		79.5		79.7		81.8	

Notes:

%: Percent
CI: Curd's Inlet
DR: Dix River
FD: Field Duplicate
HQ: HQ Inlet
IQ: Interpreted qualifier, data flags from third party validation
J: Concentration is greater than the method detection limit but less than the laboratory reporting limit
LHL: Lower Herrington Lake
mg/kg: milligrams per kilogram
N: Normal
ng/g: nanograms per gram
U: Constituent was analyzed for, but not detected

Table 2-6: Phase I Aquatic Invertebrate Analytical Results (Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	CI1		CI2		CI3		CI3		CI4	
				Sample Date	10/04/2017		10/05/2017		10/05/2017		10/05/2017		10/05/2017	
				Sample Type	N		N		N		FD		N	
				Lab ID	K1712478		K1712478		K1712478		K1712478		K1712478	
				Sample ID	AI-001-CI1-171004		AI-001-CI2-171005		AI-001-CI3-171005		AI-001-CI3-171005-FD		AI-001-CI4-171005	
Analyte	CAS RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Lipids	LIPIDS	NOAA LIPID	Dry	%	0.28		2.7		0.42		0.64		1.6	
Lipids	LIPIDS	NOAA LIPID	Wet	%	0.10		0.92		0.14		0.23		0.52	
Solids (total)	C-008	ZFZDRY	Wet	%	35.0		33.8		34.6		35.2		31.5	
Arsenic	7440-38-2	SW6020A	Dry	mg/kg	0.68		1.07		1.20		1.12		0.99	
Arsenic	7440-38-2	SW6020A	Wet	mg/kg	0.24		0.36		0.42		0.39		0.31	
Boron	7440-42-8	SW6020A	Dry	mg/kg	9.00		13.5		8.03		8.07		8.41	
Boron	7440-42-8	SW6020A	Wet	mg/kg	3.15		4.56		2.78		2.84		2.65	
Cadmium	7440-43-9	SW6020A	Dry	mg/kg	0.518	J	0.414	J	1.06	J	0.876	J	0.891	J
Cadmium	7440-43-9	SW6020A	Wet	mg/kg	0.181		0.140		0.366		0.308		0.281	
Iron	7439-89-6	SW6020A	Dry	mg/kg	227		121		125		130		99.3	
Iron	7439-89-6	SW6020A	Wet	mg/kg	79.6		40.8		43.1		45.9		31.3	
Lead	7439-92-1	SW6020	Dry	mg/kg	0.159		0.081		0.149		0.139		0.111	
Lead	7439-92-1	SW6020	Wet	mg/kg	0.0557		0.0275		0.0516		0.0490		0.0348	
Magnesium	7439-95-4	SW6010C	Dry	mg/kg	3510		2840		3060		3310		3810	
Magnesium	7439-95-4	SW6010C	Wet	mg/kg	1230		960		1060		1160		1200	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.025		0.025		0.033		0.022		0.033	
Mercury	7439-97-6	SW7471B	Wet	mg/kg	0.0086		0.0084		0.0115		0.0078		0.0103	
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	15.5		23.2		29.7		25.0		37.4	
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g	5.42		7.86		10.3		8.79		11.8	
Selenium	7782-49-2	SW6020A	Dry	mg/kg	1.54		2.18		2.3		1.87		1.71	
Selenium	7782-49-2	SW6020A	Wet	mg/kg	0.54		0.74		0.79		0.66		0.54	
Zinc	7440-66-6	SW6020A	Dry	mg/kg	62.1		61.6		61.8		62.9		71.2	
Zinc	7440-66-6	SW6020A	Wet	mg/kg	21.7		20.8		21.4		22.1		22.4	
Moisture Content	MOISTURE	CALCULATED	Wet	%	65.0		66.2		65.4		64.8		68.5	

Table 2-6: Phase I Aquatic Invertebrate Analytical Results (Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Location	HQ		LHL1		LHL1		LHL2		LHL3	
				Sample Date	10/06/2017		10/12/2017		10/12/2017		10/12/2017		10/12/2017	
				Sample Type	N		N		FD		N		N	
				Lab ID	K1712478		K1712478		K1712478		K1712478		K1712478	
				Sample ID	AI-001-HQ-171006		AI-001-LHL1-171012		AI-001-LHL1-171012-FD		AI-001-LHL2-171012		AI-001-LHL3-171012	
Analyte	CAS RN	Method	BASIS	Unit	Result	IQ	Result	IQ	Result	IQ	Result	IQ	Result	IQ
Lipids	LIPIDS	NOAA LIPID	Dry	%	1.2		2.3		1.2		1.5		1.8	
Lipids	LIPIDS	NOAA LIPID	Wet	%	0.46		0.70		0.39		0.42		0.54	
Solids (total)	C-008	ZFZDRY	Wet	%	38.2		30.0		32.2		28.6		30.1	
Arsenic	7440-38-2	SW6020A	Dry	mg/kg	1.44		1.77		1.41		1.52		1.36	
Arsenic	7440-38-2	SW6020A	Wet	mg/kg	0.55		0.53		0.45		0.43		0.41	
Boron	7440-42-8	SW6020A	Dry	mg/kg	5.60		9.12		9.31		9.41		10.3	
Boron	7440-42-8	SW6020A	Wet	mg/kg	2.14		2.73		3.00		2.69		3.10	
Cadmium	7440-43-9	SW6020A	Dry	mg/kg	0.337	J	0.282	J	0.204	J	0.316	J	0.190	
Cadmium	7440-43-9	SW6020A	Wet	mg/kg	0.129		0.0845		0.0657		0.0904		0.0572	
Iron	7439-89-6	SW6020A	Dry	mg/kg	273		264		154		80.9		177	
Iron	7439-89-6	SW6020A	Wet	mg/kg	104		79.1		49.5		23.1		53.1	
Lead	7439-92-1	SW6020	Dry	mg/kg	0.171		0.259		0.160		0.098		0.456	
Lead	7439-92-1	SW6020	Wet	mg/kg	0.0653		0.0778		0.0516		0.0281		0.137	
Magnesium	7439-95-4	SW6010C	Dry	mg/kg	2250		3870		3480		3280		3440	
Magnesium	7439-95-4	SW6010C	Wet	mg/kg	858		1160		1120		937		1030	
Mercury	7439-97-6	SW7471B	Dry	mg/kg	0.024		0.037		0.029		0.063		< 0.019	U
Mercury	7439-97-6	SW7471B	Wet	mg/kg	0.0091		0.0112		0.0092		0.0180		0.0057	J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g	24.0		45.1		43.3		54.7		48.1	
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g	9.16		13.5		13.9		15.7		14.5	
Selenium	7782-49-2	SW6020A	Dry	mg/kg	1.9		2.35		2.08		2.4		2.2	
Selenium	7782-49-2	SW6020A	Wet	mg/kg	0.71		0.71		0.67		0.69		0.66	
Zinc	7440-66-6	SW6020A	Dry	mg/kg	46.8		83.1		74.8		65.9		94.8	
Zinc	7440-66-6	SW6020A	Wet	mg/kg	17.9		24.9		24.1		18.9		28.5	
Moisture Content	MOISTURE	CALCULATED	Wet	%	61.8		70.0		67.8		71.4		69.9	

Table 2-6: Phase I Aquatic Invertebrate Analytical Results (Wet and Dry Weight)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

					Location	LHL4		LHL5		LHL6		DR	
					Sample Date	10/12/2017		10/12/2017		10/12/2017		10/07/2017	
					Sample Type	N		N		N		N	
					Lab ID	K1712478		K1712478		K1712478		K1712478	
					Sample ID	AI-001-LHL4-171012		AI-001-LHL5-171012		AI-001-LHL6-171012		AI-001-DR-171007	
Analyte	CAS RN	Method	BASIS	Unit		Result	IQ	Result	IQ	Result	IQ	Result	IQ
Lipids	LIPIDS	NOAA LIPID	Dry	%		4.8		0.89		1.8		2.2	
Lipids	LIPIDS	NOAA LIPID	Wet	%		1.47		0.24		0.49		0.69	
Solids (total)	C-008	ZFZDRY	Wet	%		31.0		27.5		27.6		30.6	
Arsenic	7440-38-2	SW6020A	Dry	mg/kg		0.88		1.76		1.05		2.08	
Arsenic	7440-38-2	SW6020A	Wet	mg/kg		0.27		0.48		0.29		0.64	
Boron	7440-42-8	SW6020A	Dry	mg/kg		8.25		8.39		6.11		4.92	
Boron	7440-42-8	SW6020A	Wet	mg/kg		2.56		2.31		1.69		1.50	
Cadmium	7440-43-9	SW6020A	Dry	mg/kg		0.155		0.244		0.138		0.499	J
Cadmium	7440-43-9	SW6020A	Wet	mg/kg		0.0481		0.0672		0.0381		0.153	
Iron	7439-89-6	SW6020A	Dry	mg/kg		105		115		219		357	
Iron	7439-89-6	SW6020A	Wet	mg/kg		32.6		31.7		60.4		109	
Lead	7439-92-1	SW6020	Dry	mg/kg		0.116		0.172		0.178		0.301	
Lead	7439-92-1	SW6020	Wet	mg/kg		0.0359		0.0474		0.0491		0.0921	
Magnesium	7439-95-4	SW6010C	Dry	mg/kg		4370		2850		2280		2380	
Magnesium	7439-95-4	SW6010C	Wet	mg/kg		1350		784		628		727	
Mercury	7439-97-6	SW7471B	Dry	mg/kg		0.047		0.036		0.043		0.016	J
Mercury	7439-97-6	SW7471B	Wet	mg/kg		0.0145		0.0100		0.0118		0.0048	J
Methylmercury	22967-92-6	ALS SOP	Dry	ng/g		38.5		45.1		46.6		14.5	
Methylmercury	22967-92-6	ALS SOP	Wet	ng/g		12		12.4		12.9		4.45	
Selenium	7782-49-2	SW6020A	Dry	mg/kg		1.3		2.68		1.86		2.21	
Selenium	7782-49-2	SW6020A	Wet	mg/kg		0.41		0.74		0.51		0.68	
Zinc	7440-66-6	SW6020A	Dry	mg/kg		53.7		89.8		76.8		65.4	
Zinc	7440-66-6	SW6020A	Wet	mg/kg		16.7		24.7		21.2		20.0	
Moisture Content	MOISTURE	CALCULATED	Wet	%		69.0		72.5		72.4		69.4	

Notes:

CI: Curd's Inlet
HQ: HQ Inlet
J: Concentration is greater than the method detection limit but less than the lab reporting limit
DR: Dix River
N: Normal
FD: Field Duplicate
IQ: Interpreted qualifier, data flags from third party validation

%: Percent
mg/kg: milligrams per kilogram
ng/g: nanograms per gram
U: Constituent was analyzed for, but not detected

Table 2-7A. Adult Bluegill and Green Sunfish Tissue Results Summary (Whole-Body, Wet and Dry Weight) (Phase I and II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Maximum Detect	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Average Of Detects (ND = no data)
Selenium	7782-49-2	Dry	CI	mg/kg	32	32	100%	7.38	3.8
Selenium	7782-49-2	Wet	CI	mg/kg	32	32	100%	2	0.97
Arsenic EPA 1632A	7440-38-2	Wet	CI	mg/kg	26	23	88%	0.0873	0.021
Arsenic SW6020	7440-38-2	Wet	CI	mg/kg	26	26	100%	0.253	0.093
Arsenic III	22541-54-4	Wet	CI	mg/kg	26	11	42%	0.0734	0.033
Arsenic V	17428-41-0	Wet	CI	mg/kg	26	4	15%	0.0217	0.015
Boron	7440-42-8	Wet	CI	mg/kg	26	24	92%	1.6	0.39
Cadmium	7440-43-9	Wet	CI	mg/kg	26	26	100%	0.0787	0.024
Iron	7439-89-6	Wet	CI	mg/kg	26	26	100%	48.4	21
Lead	7439-92-1	Wet	MHL3	mg/kg	26	26	100%	0.0545	0.023
Magnesium	7439-95-4	Wet	LHL4	mg/kg	26	26	100%	664	540
Mercury	7439-97-6	Wet	DR	mg/kg	26	26	100%	0.0612	0.026
Methylmercury	22967-92-6	Wet	DR	mg/kg	26	26	100%	0.0593	0.025
Zinc	7440-66-6	Wet	LHL2	mg/kg	26	26	100%	32.6	26
Lipids	LIPIDS	Wet	CI	%	32	32	100%	8.6	3
Solids (total)	C-008	Wet	HQ	%	6	6	100%	25.6	24
Moisture Content	MOISTURE	Wet	LHL3	%	32	32	100%	78.2	74

Notes:

%	Percent	LHL	Lower Herrington Lake
CI	Curd's Inlet	mg/kg	Milligrams per kilogram
DR	Dix River	MHL	Middle Herrington Lake
EPA	Environmental Protection Agency	ND	Not detected
HQ	HQ Inlet		

Table 2-7B. Adult Bluegill and Green Sunfish Tissue Results Summary (Fillet, Wet Weight) (Phase I)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Maximum Detect	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Arsenic EPA 1632A	7440-38-2	Wet	Cl/HQ	ug/g	26	3	12%	0.004	0.004	0.0041	0.0018	0.007	0.012	0.002	0.004
Arsenic SW6020	7440-38-2	Wet	CI	mg/kg	26	26	100%	0.11	0.058	0.058	0.058	0.091	0.15	0.004	0.006
Arsenic III	22541-54-4	Wet	CI	ug/g	26	1	4%	0.009	0.009	0.0081	0.0043	0.014	0.024	0.007	0.012
Arsenic V	17428-41-0	Wet	--	ug/g	26	0	0%	--	--	0.0081	0.0041	0.014	0.024	0.007	0.012
Boron	7440-42-8	Wet	CI	mg/kg	26	19	73%	0.52	0.12	0.1	0.093	0.091	0.15	0.036	0.06
Cadmium	7440-43-9	Wet	CI	mg/kg	26	24	92%	0.0095	0.0043	0.0042	0.004	0.0036	0.006	0.0005	0.0009
Iron	7439-89-6	Wet	MHL1	mg/kg	26	26	100%	7.38	3.8	3.8	3.8	0.18	0.3	0.02	0.03
Lead	7439-92-1	Wet	LHL3	mg/kg	26	21	81%	0.0063	0.0019	0.002	0.0016	0.0036	0.006	0.0005	0.0009
Magnesium	7439-95-4	Wet	MHL1	mg/kg	26	26	100%	350	240	240	240	0.18	0.3	0.09	0.15
Mercury	7439-97-6	Wet	DR	mg/kg	26	26	100%	0.0891	0.038	0.038	0.038	0.0036	0.006	0.0007	0.0012
Methylmercury	22967-92-6	Wet	DR	ng/g	26	26	100%	76.5	35	35	35	1.8	2.9	0.5	0.9
Selenium	7782-49-2	Wet	CI	mg/kg	26	26	100%	2.24	1.1	1.1	1.1	0.18	0.3	0.005	0.009
Zinc	7440-66-6	Wet	MHL1	mg/kg	26	26	100%	14.5	10	10	10	0.091	0.15	0.014	0.02
Lipids	LIPIDS	Wet	LHL3	%	26	26	100%	2.94	0.47	0.47	0.47	0.24	0.25	0.24	0.25
Solids (total)	C-008	Wet	MHL1	%	26	26	100%	30	21	21	21	--	--	--	--
Moisture Content	MOISTURE	Wet	LHL4	%	26	26	100%	81.9	79	79	79	--	--	--	--

Notes:

%	Percent	MDL	Method detection limit
CI	Curd's Inlet	mg/kg	Milligrams per kilogram
DR	Dix River	MHL	Middle Herrington Lake
EPA	Environmental Protection Agency	ND	Not detected
g	Grams	ng/g	Nanograms per gram
HQ	HQ Inlet	RDL	Reporting detection limit
LHL	Lower Herrington Lake	ug/g	Micrograms per gram

Table 2-7C. Adult Bass Tissue Results Summary (Whole-Body, Wet and Dry Weight) (Phase I and II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Maximum Detect	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Average Of Detects (ND = no data)
Selenium	7782-49-2	Dry	CI	mg/kg	25	25	100%	5.5	3.4
Selenium	7782-49-2	Wet	CI	mg/kg	25	25	100%	1.48	0.92
Arsenic EPA 1632A	7440-38-2	Wet	DR	mg/kg	21	5	24%	0.00434	0.003
Arsenic SW6020	7440-38-2	Wet	LHL1	mg/kg	21	21	100%	0.525	0.37
Boron	7440-42-8	Wet	LHL5	mg/kg	21	3	14%	0.11	0.065
Cadmium	7440-43-9	Wet	CI	mg/kg	21	21	100%	0.0611	0.0082
Iron	7439-89-6	Wet	CI	mg/kg	21	21	100%	57.2	11
Lead	7439-92-1	Wet	LHL4	mg/kg	21	21	100%	0.0163	0.0068
Magnesium	7439-95-4	Wet	LHL6	mg/kg	21	21	100%	502	410
Mercury	7439-97-6	Wet	MHL3	mg/kg	21	21	100%	0.124	0.074
Methylmercury	22967-92-6	Wet	LHL5	mg/kg	21	21	100%	0.236	0.096
Zinc	7440-66-6	Wet	LHL3	mg/kg	21	21	100%	21.4	15
Lipids	LIPIDS	Wet	LHL6	%	25	22	88%	27	18
Solids (total)	C-008	Wet	LHL6	%	4	4	100%	30.2	29
Moisture Content	MOISTURE	Wet	CI	%	25	25	100%	79.5	71

Notes:

%	Percent	mg/kg	Milligrams per kilogram
CI	Curd's Inlet	MHL	Middle Herrington Lake
DR	Dix River	ND	Not detected
EPA	Environmental Protection Agency	ng/g	Nanograms per gram
LHL	Lower Herrington Lake	ug/g	Micrograms per gram

Table 2-7D. Adult Bass Tissue Results Summary (Fillet, Wet Weight) (Phase I)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Maximum Detect	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Arsenic EPA 1632A	7440-38-2	Wet	--	ug/g	21	0	0%	--	--	0.0045	0.0015	0.008	0.01	0.003	0.003
Arsenic SW6020	7440-38-2	Wet	LHL3	mg/kg	21	21	100%	0.38	0.27	0.27	0.27	0.1	0.12	0.004	0.005
Arsenic III	22541-54-4	Wet	--	ug/g	21	0	0%	--	--	0.0087	0.0045	0.016	0.019	0.008	0.01
Arsenic V	17428-41-0	Wet	--	ug/g	21	0	0%	--	--	0.0087	0.0045	0.016	0.019	0.008	0.01
Boron	7440-42-8	Wet	LHL5	mg/kg	21	1	5%	0.07	0.07	0.056	0.024	0.1	0.12	0.04	0.05
Cadmium	7440-43-9	Wet	LHL4	mg/kg	21	12	57%	0.0043	0.0019	0.002	0.0012	0.0041	0.0049	0.0006	0.0007
Iron	7439-89-6	Wet	DR	mg/kg	21	21	100%	3.49	2.2	2.2	2.2	0.2	0.25	0.02	0.02
Lead	7439-92-1	Wet	LHL4	mg/kg	21	19	90%	0.0075	0.0016	0.0016	0.0015	0.0041	0.0049	0.0006	0.0007
Magnesium	7439-95-4	Wet	MHL3	mg/kg	21	21	100%	303	250	250	250	0.2	1.2	0.1	0.6
Mercury	7439-97-6	Wet	MHL3	mg/kg	21	21	100%	0.182	0.098	0.098	0.098	0.0039	0.0047	0.0008	0.001
Methylmercury	22967-92-6	Wet	DR	ng/g	21	21	100%	186	120	120	120	2	2.4	0.8	1
Selenium	7782-49-2	Wet	CI	mg/kg	21	21	100%	1.56	0.95	0.95	0.95	0.2	0.25	0.006	0.007
Zinc	7440-66-6	Wet	CI	mg/kg	21	21	100%	10.3	7.9	7.9	7.9	0.1	0.12	0.02	0.02
Lipids	LIPIDS	Wet	MHL1/LHL5	%	18	18	100%	11	6.6	6.6	6.6	0.42	1.22	0.42	1.22
Solids (total)	C-008	Wet	LHL3	%	21	21	100%	24.6	22	22	22	--	--	--	--
Moisture Content	MOISTURE	Wet	CI	%	21	21	100%	79.6	78	78	78	--	--	--	--

Notes:

CI	Curd's Inlet	MHL	Middle Herrington Lake
DR	Dix River	mg/kg	Milligrams per kilogram
EPA	Environmental Protection Agency	ng/g	Nanograms per gram
LHL	Lower Herrington Lake	ND	Not detected
MDL	Method detection limit	%	Percent
ug/g	Micrograms per gram	RDL	Reporting detection limit

Table 2-7E. Adult Catfish Tissue Results Summary (Whole-Body, Wet and Dry Weight) (Phase I and II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Maximum Detect	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Average Of Detects (ND = no data)
Selenium	7782-49-2	Dry	LHL2	mg/kg	23	23	100%	5.13	2.3
Selenium	7782-49-2	Wet	CI	mg/kg	23	23	100%	1.41	0.64
Arsenic EPA 1632A	7440-38-2	Wet	LHL2	mg/kg	19	9	47%	0.00664	0.0048
Arsenic SW6020	7440-38-2	Wet	LHL6	mg/kg	19	19	100%	0.0866	0.045
Boron	7440-42-8	Wet	CI	mg/kg	19	17	89%	0.619	0.21
Cadmium	7440-43-9	Wet	CI	mg/kg	19	19	100%	0.0397	0.01
Iron	7439-89-6	Wet	LHL3	mg/kg	19	19	100%	93.5	22
Lead	7439-92-1	Wet	LHL3/MHL3	mg/kg	19	19	100%	0.0352	0.017
Magnesium	7439-95-4	Wet	MHL1	mg/kg	19	19	100%	473	350
Mercury	7439-97-6	Wet	MHL1	mg/kg	19	19	100%	0.266	0.086
Methylmercury	22967-92-6	Wet	MHL1	mg/kg	19	19	100%	0.278	0.099
Zinc	7440-66-6	Wet	MHL1	mg/kg	19	19	100%	25.2	18
Lipids	LIPIDS	Wet	LHL3	%	23	14	61%	46.9	26
Solids (total)	C-008	Wet	CI	%	4	4	100%	30.6	27
Moisture Content	MOISTURE	Wet	LHL1	%	23	23	100%	76.7	61

Notes:

%	Percent	mg/kg	Milligrams per kilogram
CI	Curd's Inlet	MHL	Middle Herrington Lake
EPA	Environmental Protection Agency	ND	Not detected
LHL	Lower Herrington Lake		

Table 2-7F. Adult Catfish Tissue Results Summary (Fillet, Wet Weight) (Phase I)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Maximum Detect	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Arsenic EPA 1632A	7440-38-2	Wet	--	ug/g	19	0	0%	--	--	0.0048	0.0017	0.007	0.013	0.003	0.005
Arsenic SW6020	7440-38-2	Wet	LHL6	mg/kg	19	19	100%	0.07	0.03	0.03	0.03	0.093	0.17	0.004	0.007
Arsenic III	22541-54-4	Wet	--	ug/g	19	0	0%	--	--	0.0097	0.0048	0.015	0.026	0.007	0.013
Arsenic V	17428-41-0	Wet	--	ug/g	19	0	0%	--	--	0.01	0.0049	0.015	0.04	0.007	0.014
Boron	7440-42-8	Wet	CI	mg/kg	19	9	47%	0.24	0.098	0.079	0.06	0.093	0.17	0.037	0.07
Cadmium	7440-43-9	Wet	CI	mg/kg	19	13	68%	0.0107	0.0024	0.0025	0.0018	0.0037	0.0066	0.0006	0.001
Iron	7439-89-6	Wet	LHL1	mg/kg	19	19	100%	5.94	4.1	4.1	4.1	0.18	0.33	0.02	0.03
Lead	7439-92-1	Wet	LHL3	mg/kg	19	18	95%	0.0035	0.002	0.002	0.0019	0.0037	0.0066	0.0006	0.001
Magnesium	7439-95-4	Wet	LHL5	mg/kg	19	19	100%	246	200	200	200	0.18	1.4	0.09	0.7
Mercury	7439-97-6	Wet	MHL1	mg/kg	19	19	100%	0.329	0.12	0.12	0.12	0.0035	0.0063	0.0007	0.0013
Methylmercury	22967-92-6	Wet	MHL1	ng/g	19	19	100%	427	150	150	150	1.8	3.3	0.7	1.3
Selenium	7782-49-2	Wet	CI	mg/kg	19	19	100%	1.53	0.6	0.6	0.6	0.18	0.33	0.006	0.01
Zinc	7440-66-6	Wet	LHL1	mg/kg	19	19	100%	11.9	7.3	7.3	7.3	0.093	0.17	0.015	0.03
Lipids	LIPIDS	Wet	LHL3	%	10	10	100%	52	24	24	24	0.76	1.22	0.76	1.22
Solids (total)	C-008	Wet	LHL3	%	19	19	100%	33	24	24	24	--	--	--	--
Moisture Content	MOISTURE	Wet	LHL1	%	19	19	100%	81.4	76	76	76	--	--	--	--

Notes:

%	Percent	MHL	Middle Herrington Lake
CI	Curd's Inlet	ND	Not detected
EPA	Environmental Protection Agency	ng/g	Nanograms per gram
LHL	Lower Herrington Lake	RDL	Reporting detection limit
MDL	Method detection limit	ug/g	Micrograms per gram
mg/kg	Milligrams per kilogram		

Table 2-7G. Adult Trout and Sucker Tissue Results Summary (Whole-Body, Wet and Dry Weight) (Phase I)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Maximum Detect‡	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Average Of Detects (ND = no data)
Selenium	7782-49-2	Dry	DR	mg/kg	3	3	100%	5.3	4.1
Selenium	7782-49-2	Wet	DR	mg/kg	3	3	100%	1.23	1
Arsenic EPA 1632A	7440-38-2	Wet	DR	mg/kg	3	3	100%	0.00442	0.003
Arsenic SW6020	7440-38-2	Wet	DR	mg/kg	3	3	100%	0.216	0.097
Boron	7440-42-8	Wet	DR	mg/kg	3	2	67%	0.262	0.23
Cadmium	7440-43-9	Wet	DR	mg/kg	3	3	100%	0.0117	0.0064
Iron	7439-89-6	Wet	DR	mg/kg	3	3	100%	17.5	12
Lead	7439-92-1	Wet	DR	mg/kg	3	3	100%	0.0167	0.012
Magnesium	7439-95-4	Wet	DR	mg/kg	3	3	100%	444	380
Mercury	7439-97-6	Wet	DR	mg/kg	3	3	100%	0.0255	0.02
Methylmercury	22967-92-6	Wet	DR	mg/kg	3	3	100%	0.0346	0.029
Zinc	7440-66-6	Wet	DR	mg/kg	3	3	100%	29.9	21
Lipids	LIPIDS	Wet	DR	%	3	1	33%	6.11	6.1
Moisture Content	MOISTURE	Wet	DR	%	3	3	100%	77.1	76

Notes:
‡: Dix River (DR) is the only location where brown trout and suckers were found.

%	Percent	mg/kg	Milligrams per kilogram
DR	Dix River	ND	Not detected
EPA	Environmental Protection Agency	RDL	Reporting detection limit

Table 2-7H. Adult Trout and Sucker Tissue Results Summary (Fillet, Wet Weight) (Phase I)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Maximum Detect‡	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Arsenic EPA 1632A	7440-38-2	Wet	--	ug/g	3	0	0%	--	--	0.016	0.0015	0.008	0.08	0.003	0.003
Arsenic SW6020	7440-38-2	Wet	DR	mg/kg	3	3	100%	0.23	0.1	0.1	0.1	0.1	0.1	0.004	0.004
Arsenic III	22541-54-4	Wet	--	ug/g	3	0	0%	--	--	0.0082	0.004	0.016	0.017	0.008	0.008
Arsenic V	17428-41-0	Wet	--	ug/g	3	0	0%	--	--	0.0082	0.004	0.016	0.017	0.008	0.008
Boron	7440-42-8	Wet	DR	mg/kg	3	2	67%	0.13	0.12	0.097	0.087	0.1	0.1	0.04	0.04
Cadmium	7440-43-9	Wet	DR	mg/kg	3	3	100%	0.0032	0.0028	0.0028	0.0028	0.004	0.0042	0.0006	0.0006
Iron	7439-89-6	Wet	DR	mg/kg	3	3	100%	5.47	4.7	4.7	4.7	0.2	0.21	0.02	0.02
Lead	7439-92-1	Wet	DR	mg/kg	3	3	100%	0.0022	0.0018	0.0018	0.0018	0.004	0.0042	0.0006	0.0006
Magnesium	7439-95-4	Wet	DR	mg/kg	3	3	100%	281	250	250	250	0.2	0.21	0.1	0.1
Mercury	7439-97-6	Wet	DR	mg/kg	3	3	100%	0.0316	0.025	0.025	0.025	0.0038	0.0042	0.0008	0.0008
Methyl mercury	22967-92-6	Wet	DR	ng/g	3	3	100%	38.6	29	29	29	2	2.1	0.8	0.8
Selenium	7782-49-2	Wet	DR	mg/kg	3	3	100%	1.27	0.92	0.92	0.92	0.2	0.21	0.006	0.006
Zinc	7440-66-6	Wet	DR	mg/kg	3	3	1	14.2	11	11	11	0.1	0.1	0.02	0.02
Lipids	LIPIDS	Wet	DR	%	1	1	100%	3.1	3.1	3.1	3.1	1.2	1.2	1.2	1.2
Solids (total)	C-008	Wet	DR	%	3	3	100%	20.9	21	21	21	--	--	--	--
Moisture Content	MOISTURE	Wet	DR	%	3	3	100%	79.8	79	79	79	--	--	--	--

Notes:

%	Percent	ND	Not detected
DR	Dix River	ng/g	Nanograms per gram
EPA	Environmental Protection Agency	RDL	Reporting detection limit
MDL	Method detection limit	ug/g	Micrograms per gram
mg/kg	Milligrams per kilogram		

‡: Dix River (DR) is the only location where brown trout and suckers were found.

Table 2-8. Young-of-the-Year Whole-Body Sunfish Tissue Results Summary (Dry Weight) (Phase II) Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	ETOH Preserved	Location of Maximum Detect	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Selenium	7782-49-2	Dry	No	UCI	mg/kg	15	15	100%	24.8	11	11	11	0.99	1	0.03	0.03
Selenium	7782-49-2	Dry	Yes	MCI	mg/kg	4	4	100%	15.8	10	10	10	1	1	0.03	0.03

Notes:

%	Percent	mg/kg	Milligrams per kilogram
MDL	Method detection limit	RDL	Reporting detection limit
MHL	Middle Herrington Lake	UCI	Upper Curd's Inlet

Table 2-9. Surface Water: Stratification Results Summary (Phase I and II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dissolved/ Total	Location of Max	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Median Detect (ND = 1/2RDL)	Median Detect (ND = 1/2MDL)	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Arsenic	7440-38-2	D	CI4	ug/l	43	43	100%	3.98	1.19	1.19	1.3	1.3	1.3	0.5	0.5	0.08	0.09
Arsenic	7440-38-2	T	CI4	ug/l	43	43	100%	4.89	1.24	1.24	1.5	1.5	1.5	0.5	0.5	0.08	0.09
Boron	7440-42-8	D	CI2.2	ug/l	43	43	100%	1850	314	314	370	370	370	2	100	0.2	30
Boron	7440-42-8	T	CI2.2	ug/l	43	43	100%	1890	305	305	360	360	360	2	100	0.2	30
Cadmium	7440-43-9	D	CI2.2	ug/l	43	17	40%	0.151	0.01	0.0025	0.039	0.021	0.017	0.02	0.02	0.005	0.006
Cadmium	7440-43-9	T	CI2.2	ug/l	43	20	47%	0.204	0.01	0.0025	0.066	0.036	0.032	0.02	0.02	0.005	0.006
Iron	7439-89-6	D	LHL3	ug/l	43	42	98%	161	10.2	10.2	35	34	34	2	2	0.3	0.3
Iron	7439-89-6	T	HQ	ug/l	43	43	100%	466	62.9	62.9	94	94	94	2	2	0.3	0.3
Lead	7439-92-1	D	CI2.2	ug/l	15	15	100%	0.111	0.014	0.014	0.031	0.031	0.031	0.02	0.02	0.004	0.004
Lead	7439-92-1	T	HQ	ug/l	15	14	93%	0.555	0.14	0.14	0.18	0.17	0.17	0.02	0.02	0.004	0.004
Magnesium	7439-95-4	D	CI2.2	ug/l	43	43	100%	17300	9380	9380	9,700	9,700	9,700	5.3	200	0.3	10
Magnesium	7439-95-4	T	CI3.1	ug/l	43	43	100%	17200	9550	9550	9,800	9,800	9,800	5.3	10	0.3	0.7
Mercury	7439-97-6	D	CI1	ng/l	43	19	44%	1710	0.25	0.03	390	170	170	0.5	12.5	0.06	1.5
Mercury	7439-97-6	T	CI1	ng/l	43	24	56%	7780	100	10	1,600	910	880	0.5	200	0.06	20
Methyl mercury	22967-92-6	D	CI1	ng/l	43	22	51%	0.59	0.05	0.03	0.16	0.1	0.087	0.1	0.1	0.03	0.03
Methyl mercury	22967-92-6	T	CI1	ng/l	43	28	65%	0.86	0.05	0.05	0.19	0.14	0.13	0.1	0.1	0.03	0.03
Selenium	7782-49-2	D	CI2.2	ug/l	43	36	84%	5.5	0.7	0.7	1.2	1.1	1	1	1	0.2	0.2
Selenium	7782-49-2	T	CI2.2	ug/l	43	37	86%	5.4	0.7	0.7	1.2	1.1	1	1	1	0.2	0.2
Zinc	7440-66-6	D	LHL1	ug/l	43	29	67%	6.7	1	0.6	1.2	1.2	0.87	2	2	0.08	0.3
Zinc	7440-66-6	T	CI1	ug/l	43	38	88%	9.8	1.3	1.3	2	1.9	1.8	2	2	0.08	0.3
Hardness (filtered)	FHARD	D	CI1	mg/l	28	28	100%	184	142.5	142.5	150	150	150	2	2	0.9	0.9
Hardness (total)	THARD	T	CI1/CI2	mg/l	28	28	100%	183	145	145	150	150	150	2	2	0.8	0.8
Organic Carbon (dissolved)	C-012D	D	LHL1	mg/l	28	28	100%	6.18	3.745	3.745	3.8	3.8	3.8	0.5	0.5	0.07	0.07
Organic Carbon (total)	C-012	T	CI1	mg/l	27	27	100%	4.64	3.49	3.49	3.5	3.5	3.5	0.5	0.5	0.07	0.07
Sulfate	14808-79-8	D	CI2	mg/l	28	28	100%	64.7	34.9	34.9	37	37	37	0.5	2	0.05	0.2
Sulfate	14808-79-8	T	CI2	mg/l	28	28	100%	64.3	35.95	35.95	37	37	37	0.5	2	0.05	0.2

Notes:

%	Percent	mg/l	Milligrams per liter
CI	Curd's Inlet	ND	Not detected
D	Dissolved	ng/l	nanograms per liter
HQ	HQ Inlet	RDL	Reporting detection limit
LHL	Lower Herrington Lake	T	Total
MDL	Method detection limit	ug/l	micrograms per liter

Table 2-10. Surface Water: Overturn Results Summary (Phase I)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dissolved/ Total	Location of Maximum Detect	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Median Detect (ND = 1/2RDL)	Median Detect (ND = 1/2MDL)	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Arsenic	7440-38-2	D	CI2	ug/l	13	13	100%	2.65	1.29	1.29	1.4	1.4	1.4	0.5	0.5	0.08	0.08
Arsenic	7440-38-2	T	CI2	ug/l	13	13	100%	5.48	1.33	1.33	1.8	1.8	1.8	0.5	0.5	0.08	0.08
Boron	7440-42-8	D	CI1	ug/l	13	13	100%	2560	200	200	590	590	590	10	200	1	20
Boron	7440-42-8	T	CI1	ug/l	13	13	100%	2520	207	207	590	590	590	10	200	1	20
Cadmium	7440-43-9	D	CI1	ug/l	13	13	100%	0.211	0.011	0.011	0.045	0.045	0.045	0.02	0.02	0.005	0.005
Cadmium	7440-43-9	T	CI2	ug/l	13	13	100%	0.377	0.023	0.023	0.079	0.079	0.079	0.02	0.02	0.005	0.005
Iron	7439-89-6	D	CI2	ug/l	13	11	85%	11.5	2.8	2.8	4.5	4	3.8	2	2	0.3	0.3
Iron	7439-89-6	T	CI2	ug/l	13	13	100%	614	40.6	40.6	110	110	110	2	2	0.3	0.3
Lead	7439-92-1	D	--	ug/l	13	0	0%	--	0.005	0.002	--	0.005	0.002	0.01	0.01	0.004	0.004
Lead	7439-92-1	T	CI2	ug/l	13	2	15%	0.631	0.005	0.002	0.45	0.073	0.071	0.01	0.01	0.004	0.004
Magnesium	7439-95-4	D	CI1	ug/l	13	13	100%	27400	10800	10800	13,000	13,000	13,000	10	10	0.7	0.7
Magnesium	7439-95-4	T	CI1	ug/l	13	13	100%	27400	11100	11100	14,000	14,000	14,000	10	10	0.7	0.7
Mercury	7439-97-6	D	CI2	ng/l	13	6	46%	1.24	0.25	0.03	0.82	0.51	0.39	0.5	0.5	0.06	0.06
Mercury	7439-97-6	T	--	ug/l	13	0	0%	--	0.1	0.01	--	0.1	0.01	0.2	0.2	0.02	0.02
Methyl mercury	22967-92-6	D	LHL4/LHL5	ng/l	13	11	85%	0.05	0.04	0.04	0.038	0.04	0.035	0.1	0.1	0.03	0.03
Methyl mercury	22967-92-6	T	CI2/LHL2/LHL5	ng/l	13	12	92%	0.06	0.05	0.05	0.048	0.048	0.046	0.1	0.1	0.03	0.03
Selenium	7782-49-2	D	CI1	ug/l	13	13	100%	4.9	0.6	0.6	1.3	1.3	1.3	1	1	0.2	0.2
Selenium	7782-49-2	T	CI1	ug/l	13	13	100%	5.2	0.6	0.6	1.3	1.3	1.3	1	1	0.2	0.2
Zinc	7440-66-6	D	HI1	ug/l	13	8	62%	7.1	2.1	2.1	3.5	2.5	2.2	2	2	0.3	0.3
Zinc	7440-66-6	T	CI4	ug/l	13	5	38%	6.7	1	0.15	4.1	2.2	1.7	2	2	0.3	0.3
Dissolved Organic Carbon	DOC	D	LHL3	mg/l	13	13	100%	5.53	3.41	3.41	3.8	3.8	3.8	0.5	0.5	0.07	0.07
Hardness (filtered)	FHARD	D	CI1	mg/l	10	10	100%	256	152.5	152.5	170	170	170	2	2	0.9	0.9
Hardness (total)	THARD	T	CI1	mg/l	10	10	100%	265	155.5	155.5	180	180	180	2	2	0.8	0.8
Organic Carbon (dissolved)	C-012D	D	LHL3	mg/l	13	13	100%	5.53	3.41	3.41	3.8	3.8	3.8	0.5	0.5	0.07	0.07
Organic Carbon (total)	C-012	T	CI2/CI3	mg/l	13	13	100%	3.25	3.14	3.14	3.1	3.1	3.1	0.5	0.5	0.07	0.07
Sulfate	14808-79-8	D	CI1	mg/l	13	13	100%	107	27.6	27.6	40	40	40	2	2	0.2	0.2
Sulfate	14808-79-8	T	CI1	mg/l	13	13	100%	107	28.3	28.3	40	40	40	2	2	0.2	0.2

Notes:

%	Percent	mg/l	milligrams per liter
CI	Curd's Inlet	ND	Not detected
D	Dissolved	ng/l	nanograms per liter
DR	Dix River	RDL	Reporting detection limit
HI	Hardin's Inlet	T	Total
LHL	Lower Herrington Lake	ug/l	micrograms per liter
MDL	Method detection limit		

Table 2-11. Sediment Results Summary (Phase I and II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Max	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Median Detect (ND = 1/2RDL)	Median Detect (ND = 1/2MDL)	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Arsenic	7440-38-2	Dry	CI3A	mg/kg	53	53	100%	448	40	40	100	100	100	0.29	1.7	0.02	0.1
Boron	7440-42-8	Dry	CI1A	mg/kg	53	53	100%	72.3	10.7	10.7	17	17	17	0.29	1.7	0.03	0.2
Cadmium	7440-43-9	Dry	CI1A	mg/kg	53	53	100%	10.1	0.625	0.625	1.6	1.6	1.6	0.011	0.066	0.004	0.023
Iron	7439-89-6	Dry	CI3B	mg/kg	53	53	100%	68500	29600	29600	32,000	32,000	32,000	4.9	66	1.3	33
Lead	7439-92-1	Dry	CI1C	mg/kg	53	52	98%	38.3	21.5	21.5	21	21	21	0.047	33	0.019	7
Magnesium	7439-95-4	Dry	LHL6B	mg/kg	53	53	100%	23600	4330	4330	5,700	5,700	5,700	1.9	33	0.07	3
Mercury	7439-97-6	Dry	CI4A	mg/kg	53	52	98%	0.143	0.041	0.041	0.051	0.051	0.05	0.0086	0.07	0.0009	0.007
Methyl mercury	22967-92-6	Dry	LHL6C	ng/g	53	20	38%	1.74	0.3	0.035	0.45	0.35	0.19	0.3	1.3	0.03	0.13
Selenium	7782-49-2	Dry	CI3.1A	mg/kg	53	53	100%	36.7	2.2	2.2	6.7	6.7	6.7	0.57	3.3	0.04	0.2
Zinc	7440-66-6	Dry	CI1A	mg/kg	53	53	100%	245	68.2	68.2	83	83	83	0.29	1.7	0.11	0.7
GRAIN SIZE 0.001 MM	GRNSZ0.001MM	Dry	CI4A	%	14	14	100%	32.78	17.625	17.625	16	16	16	--	--	--	--
GRAIN SIZE 0.005 MM	GRNSZ0.005MM	Dry	CI4A	%	14	14	100%	52.94	27.165	27.165	30	30	30	--	--	--	--
GRAIN SIZE 0.074 MM	GRNSZ0.074MM	Dry	CI4A	%	14	14	100%	86.7	56.995	56.995	53	53	53	--	--	--	--
GRAIN SIZE 0.075 MM	GRNSZ0.075MM	Dry	HI1B	%	14	14	100%	97.62	57.97	57.97	58	58	58	--	--	--	--
Grain Size 0.106 mm	GRNSZ0.106MM	Dry	HI1B	%	14	14	100%	98.52	60.555	60.555	60	60	60	--	--	--	--
GRAIN SIZE 0.250 MM	GRNSZ0.250MM	Dry	HI1B	%	14	14	100%	99.45	66.54	66.54	64	64	64	--	--	--	--
Grain Size 0.425 mm	GRNSZ0.425MM	Dry	HI1B	%	14	14	100%	99.7	70.925	70.925	66	66	66	--	--	--	--
GRAIN SIZE 0.850 MM	GRNSZ0.85MM	Dry	HI1B	%	14	14	100%	99.86	77.575	77.575	68	68	68	--	--	--	--
GRAIN SIZE 2 MM	GRNSZ2MM	Dry	HI1B	%	14	14	100%	100	81.34	81.34	71	71	71	--	--	--	--
GRAIN SIZE 4.75 MM	GRNSZ4.75MM	Dry	CI4A/CURDS2A/HI1B	%	14	14	100%	100	83.28	83.28	74	74	74	--	--	--	--
GRAIN SIZE 9.5 MM	GRNSZ9.5MM	Dry	CI4A/CURDS2A/HI1B	%	14	14	100%	100	89.76	89.76	79	79	79	--	--	--	--
GRAIN SIZE 19 MM	GRNSZ19MM	Dry	CI4A/CURDS2A/HI1B	%	14	14	100%	100	99.725	99.725	91	91	91	--	--	--	--
Organic Carbon (total)	C-012	Dry	LHL6C	%	33	33	100%	17.9	2.2	2.2	3.7	3.7	3.7	0.1	0.1	0.02	0.02
Solids (total)	C-008	Dry	CI3B	%	8	8	100%	67.4	60.3	60.3	57	57	57	--	--	--	--
Solids (total)	C-008	Wet	CI4B	%	45	45	100%	75.7	58.9	58.9	55	55	55	--	--	--	--
Water	7732-18-5	Wet	HQ1A	%	33	33	100%	331	75.1	75.1	100	100	100	--	--	--	--
Sulfate	14808-79-8	Dry	LHL6C	mg/kg	33	33	100%	3620	253	253	660	660	660	3.1	47	1.5	47

Notes:

%	Percent	MDL	Method detection limit
CI	Curd's Inlet	mg/kg	Milligrams per kilogram
CURDS	Curd's Inlet	ND	Not detected
D	Dry	ng/g	Nanograms per gram
HI	Hardin's Inlet	RDL	Reporting detection limit
HQ	HQ Inlet	W	Wet
LHL	Lower Herrington Lake		

Table 2-12. Sediment Pore Water Results Summary (Phase I and II)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Location of Max	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Median Detect (ND = 1/2RDL)	Median Detect (ND = 1/2MDL)	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Arsenic E1632A	7440-38-2	CI3.1A	ug/l	34	34	100%	2130	12.75	12.75	170	170	170	0.04	200	0.006	30
Arsenic E200.8	7440-38-2	CI3.1A	ug/l	34	34	100%	1500	18.15	18.15	140	140	140	0.5	0.5	0.08	0.09
Arsenic III	22541-54-4	CI3.1A	ug/l	34	32	94%	1900	1.165	1.165	140	130	130	0.02	200	0.003	30
Arsenic V	17428-41-0	CI3.1A	ug/l	34	34	100%	230	11.6	11.6	38	38	38	0.04	200	0.006	30
Boron	7440-42-8	CI1A	ug/l	34	34	100%	5970	1275	1275	1,600	1,600	1,600	20	200	0.4	50
Cadmium	7440-43-9	CI3B	ug/l	34	15	44%	2.04	0.01	0.0045	0.16	0.079	0.075	0.02	0.05	0.006	0.009
Iron	7439-89-6	CI3A	ug/l	34	34	100%	8170	131.5	131.5	1,300	1,300	1,300	2	2	0.3	0.3
Lead	7439-92-1	CI3B	ug/l	18	18	100%	3.11	0.0265	0.0265	0.23	0.23	0.23	0.02	0.02	0.007	0.007
Magnesium	7439-95-4	CI2.1A	ug/l	34	34	100%	45700	16900	16900	21,000	21,000	21,000	5.3	1000	0.3	200
Mercury E1631	7439-97-6	CI1A	ng/l	33	31	94%	4.16	1.19	1.19	1.5	1.4	1.4	0.5	1.25	0.06	0.15
Mercury SW7470	7439-97-6	CURDS2C	ug/l	34	2	6%	0.09	0.1	0.01	0.065	0.098	0.013	0.2	0.2	0.02	0.02
Methyl mercury	22967-92-6	CI1A	ng/l	34	14	41%	0.13	0.05	0.015	0.071	0.059	0.038	0.1	0.1	0.03	0.04
Selenium	7782-49-2	CI1A	ug/l	34	34	100%	8.8	1.3	1.3	2.1	2.1	2.1	1	1	0.2	0.2
Selenium (unknown)	UNKNOWN SE	--	ug/l	34	0	0%	--	0.1	0.1	--	0.1	0.1	0.2	0.2	0.2	0.2
Selenium +4	SE +4	CI4A	ug/l	34	16	47%	1.62	0.05	0.05	0.5	0.26	0.26	0.1	0.1	0.1	0.1
Selenium +6	SE +6	CI1A	ug/l	34	16	47%	6.63	0.05	0.05	1.8	0.89	0.89	0.1	0.1	0.1	0.1
Selenocyanate	3425-46-5	CI1A	ug/l	34	9	26%	1.08	0.05	0.05	0.3	0.12	0.12	0.1	0.1	0.1	0.1
Zinc	7440-66-6	CURDS2A	ug/l	34	32	94%	107	4.35	4.35	8.5	8.1	8	2	2	0.08	0.2
Organic Carbon (dissolved)	C-012D	HQ1B	mg/l	11	11	100%	4.49	3.53	3.53	3.6	3.6	3.6	0.5	0.5	0.07	0.07
Sulfate	14808-79-8	CURDSNB	mg/l	13	13	100%	143	46.8	46.8	63	63	63	0.5	5	0.05	0.5

Notes:

%	Percent	mg/l	milligrams per liter
CI	Curd's Inlet	ND	Not detected
CURDS	Curd's Inlet	ng/l	nanograms per liter
HI	Hardin's Inlet	RDL	Reporting detection limit
HQ	HQ Inlet	ug/l	micrograms per liter
MDL	Method detection limit		

Table 2-13. Aquatic Vegetation Results Summary (Phase I)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Max	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Median Detect (ND = 1/2RDL)	Median Detect (ND = 1/2MDL)	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Arsenic	7440-38-2	Dry	DR	mg/kg	13	13	100%	14.9	4.91	4.91	6.3	6.3	6.3	0.5	0.5	0.02	0.02
Arsenic	7440-38-2	Wet	LHL2	mg/kg	13	13	100%	2.83	1.02	1.02	1.2	1.2	1.2	0.037	0.17	0.001	0.007
Boron	7440-42-8	Dry	CI1	mg/kg	13	13	100%	274	47.1	47.1	89	89	89	0.5	10	0.2	4
Boron	7440-42-8	Wet	CI1	mg/kg	13	13	100%	35.4	11.9	11.9	13	13	13	0.091	1.3	0.036	0.5
Cadmium	7440-43-9	Dry	CI3	mg/kg	13	13	100%	2.77	0.604	0.604	0.76	0.76	0.76	0.02	0.02	0.003	0.003
Cadmium	7440-43-9	Wet	CI3	mg/kg	13	13	100%	0.393	0.0674	0.0674	0.11	0.11	0.11	0.0015	0.0069	0.0002	0.001
Iron	7439-89-6	Dry	DR	mg/kg	13	13	100%	14300	3850	3850	4,900	4,900	4,900	0.99	1	0.09	0.09
Iron	7439-89-6	Wet	LHL2	mg/kg	13	13	100%	2710	672	672	960	960	960	0.074	0.35	0.007	0.03
Lead	7439-92-1	Dry	HQ	mg/kg	13	13	100%	20.1	4.83	4.83	6.2	6.2	6.2	0.02	0.02	0.003	0.003
Lead	7439-92-1	Wet	DR	mg/kg	13	13	100%	2.06	0.745	0.745	0.95	0.95	0.95	0.0015	0.0069	0.0002	0.001
Magnesium	7439-95-4	Dry	LHL1	mg/kg	13	13	100%	23800	4810	4810	6,400	6,400	6,400	0.99	1	0.6	0.6
Magnesium	7439-95-4	Wet	LHL1	mg/kg	13	13	100%	8270	814	814	1,500	1,500	1,500	0.074	0.35	0.045	0.21
Mercury	7439-97-6	Dry	DR	mg/kg	13	11	85%	0.052	0.023	0.023	0.026	0.023	0.022	0.019	0.022	0.004	0.004
Mercury	7439-97-6	Wet	DR	mg/kg	13	13	100%	0.0095	0.0027	0.0027	0.0041	0.0041	0.0041	0.0016	0.0066	0.0003	0.0014
Methyl mercury	22967-92-6	Dry	CI1	ng/g	12	2	17%	8.42	4.95	2	6.3	5.2	2.7	9.8	10	3.9	4
Methyl mercury	22967-92-6	Wet	CI1	ng/g	12	2	17%	1.09	1	0.425	0.92	1	0.5	1.1	3.4	0.4	1.4
Selenium	7782-49-2	Dry	LHL6	mg/kg	13	13	100%	3.63	2.3	2.3	2.2	2.2	2.2	0.99	1	0.03	0.03
Selenium	7782-49-2	Wet	LHL6	mg/kg	13	13	100%	0.74	0.37	0.37	0.42	0.42	0.42	0.074	0.35	0.002	0.01
Zinc	7440-66-6	Dry	CI2	mg/kg	13	13	100%	56.6	38.9	38.9	32	32	32	0.5	0.5	0.08	0.08
Zinc	7440-66-6	Wet	DR	mg/kg	13	13	100%	9.73	4.78	4.78	4.9	4.9	4.9	0.037	0.17	0.006	0.03
Solids (total)	C-008	Wet	LHL1	%	13	13	100%	34.7	18.2	18.2	19	19	19	--	--	--	--
Moisture Content	MOISTURE	Wet	HQ	%	13	13	100%	92.6	81.8	81.8	81	81	81	--	--	--	--

Notes:

%	Percent	MDL	Method detection limit
CI	Curd's Inlet	mg/kg	milligrams per kilogram
DR	Dix River	ND	Not detected
HQ	HQ Inlet	ng/g	Nanograms per gram
LHL	Lower Herrington Lake	RDL	Reporting detection limit

Table 2-14. Aquatic Invertebrates Results Summary (Phase I)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Constituent Name	CAS Number	Dry/ Wet	Location of Max	Units	Number of Samples	Number of Detects	% Detects	Maximum Detect	Median Detect (ND = 1/2RDL)	Median Detect (ND = 1/2MDL)	Average Of Detects (ND = no data)	Average of Detects (ND=1/2 RDL)	Average of Detects (ND=1/2 MDL)	Range of RDL (low)	Range of RDLs (high)	Range of MDL (low)	Range of MDLs (high)
Arsenic	7440-38-2	Dry	DR	mg/kg	14	14	100%	2.08	1.28	1.28	1.3	1.3	1.3	0.5	0.5	0.02	0.02
Arsenic	7440-38-2	Wet	DR	mg/kg	14	14	100%	0.64	0.415	0.415	0.41	0.41	0.41	0.14	0.19	0.006	0.008
Boron	7440-42-8	Dry	CI2	mg/kg	14	14	100%	13.5	8.4	8.4	8.5	8.5	8.5	0.5	0.5	0.2	0.2
Boron	7440-42-8	Wet	CI2	mg/kg	14	14	100%	4.56	2.71	2.71	2.7	2.7	2.7	0.14	0.19	0.06	0.08
Cadmium	7440-43-9	Dry	CI3	mg/kg	14	14	100%	1.06	0.3265	0.3265	0.44	0.44	0.44	0.02	0.02	0.003	0.003
Cadmium	7440-43-9	Wet	CI3	mg/kg	14	14	100%	0.366	0.1097	0.1097	0.14	0.14	0.14	0.0055	0.0076	0.0008	0.0011
Iron	7439-89-6	Dry	DR	mg/kg	14	14	100%	357	142	142	170	170	170	0.99	1	0.09	0.09
Iron	7439-89-6	Wet	DR	mg/kg	14	14	100%	109	47.7	47.7	56	56	56	0.28	0.38	0.02	0.03
Lead	7439-92-1	Dry	LHL3	mg/kg	14	14	100%	0.456	0.1595	0.1595	0.18	0.18	0.18	0.02	0.02	0.003	0.003
Lead	7439-92-1	Wet	LHL3	mg/kg	14	14	100%	0.137	0.05035	0.05035	0.057	0.057	0.057	0.0055	0.0076	0.0008	0.0011
Magnesium	7439-95-4	Dry	LHL4	mg/kg	14	14	100%	4370	3295	3295	3,200	3,200	3,200	0.99	1	0.6	0.6
Magnesium	7439-95-4	Wet	LHL4	mg/kg	14	14	100%	1350	1045	1045	1,000	1,000	1,000	0.28	0.38	0.17	0.23
Mercury	7439-97-6	Dry	LHL2	mg/kg	14	13	93%	0.063	0.031	0.031	0.033	0.032	0.031	0.019	0.031	0.004	0.006
Mercury	7439-97-6	Wet	LHL2	mg/kg	14	14	100%	0.018	0.0096	0.0096	0.01	0.01	0.01	0.0052	0.0089	0.0011	0.0017
Methyl mercury	22967-92-6	Dry	LHL2	ng/g	14	14	100%	54.7	37.95	37.95	35	35	35	9.8	10	3.9	4
Methyl mercury	22967-92-6	Wet	LHL2	ng/g	14	14	100%	15.7	11.9	11.9	11	11	11	2.7	3.8	1.1	1.5
Selenium	7782-49-2	Dry	LHL5	mg/kg	14	14	100%	2.68	2.13	2.13	2	2	2	0.99	1	0.03	0.03
Selenium	7782-49-2	Wet	CI3	mg/kg	14	14	100%	0.79	0.675	0.675	0.65	0.65	0.65	0.28	0.38	0.008	0.01
Zinc	7440-66-6	Dry	LHL3	mg/kg	14	14	100%	94.8	65.65	65.65	69	69	69	0.5	0.5	0.08	0.08
Zinc	7440-66-6	Wet	LHL3	mg/kg	14	14	100%	28.5	21.55	21.55	22	22	22	0.14	0.19	0.02	0.03
Lipids	LIPIDS	Dry	LHL4	%	14	14	100%	4.8	1.55	1.55	1.7	1.7	1.7	0.13	0.18	0.13	0.18
Lipids	LIPIDS	Wet	LHL4	%	14	14	100%	1.47	0.475	0.475	0.52	0.52	0.52	0.05	0.05	0.05	0.05
Solids (total)	C-008	Wet	HQ	%	14	14	100%	38.2	31.25	31.25	32	32	32	--	--	--	--
Moisture Content	MOISTURE	Wet	LHL5	%	14	14	100%	72.5	68.75	68.75	68	68	68	--	--	--	--

Notes:

%	Percent	MDL	Method detection limit
CI	Curd's Inlet	mg/kg	Milligrams per kilogram
DR	Dix River	ND	Not detected
HQ	HQ Inlet	ng/g	Nanograms per gram
LHL	Lower Herrington Lake	RDL	Reporting detection limit

Table 3-1: Pollution Elimination Discharge System Permitted Facilities Within the Upper and Lower Dix River Watersheds
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Facility Name	County	NPDES No.	Permit Issue Date	Permit Expiration Date	Waterbody	Latitude (decimal degrees)	Longitude (decimal degrees)
KTC GARRARD CO MAINT GARAGE	GARRARD	KYG500079	1/24/2003	3/31/2008	NA	37.59889	-84.56806
GREENVIEW MHP	MERCER	KY0075272	1/15/2008	2/28/2013	MOCKS CRK / UT	37.71861	-84.81639
VICWEST STEEL	BOYD	KYR001736	9/13/2002	9/30/2007	UT / CLARKS RUN	37.62611	-84.79278
KY UTIL E W BROWN GEN STA	MERCER	KY0002020	1/15/2010	2/28/2015	HERRINGTON LAKE	37.78778	-84.71306
CHIMNEY ROCK WASTE MGMT LLC	MERCER	KY0092631	5/2/2007	6/30/2012	HERRINGTON LAKE	37.76056	-84.71889
CATERPILLAR TRACK COMPONENTS	BOYLE	KYR001692	9/13/2002	9/30/2007	CLARKS RUN CRK	37.62389	-84.82028
DANVILLE WTP	BOYLE	KYG640084	2/15/2011	3/31/2016	CLARKS RUN	37.70889	-84.73111
STANFORD WTP	LINCOLN	KYG640036	2/15/2011	3/31/2016	NEALS CRK	37.48778	-84.67528
DIX RIVER STONE	GARRARD	KYG840118	6/22/2007	6/30/2012	DIX RIVER	37.64	-84.66194
VILLAGE INN RESTAURANT	MERCER	KY0027499	9/20/2007	10/31/2012	CANE RUN CRK	37.75222	-84.76111
DANVILLE STP	BOYLE	KY0057193	1/31/2003	1/31/2007	CLARKS RUN	37.62917	-84.73944
TEXAS EASTERN TRANS CORP	LINCOLN	KY0096229	6/13/2007	7/31/2012	KNOBLICK CRK	37.58	-84.75
BROCK RESIDENCE	GARRARD	KYG401500	11/30/2007	12/31/2012	MCKENNIE CRK	37.71083	-84.69083
BURGIN INDEPENDENT SCHOOL	MERCER	KY0040231	2/19/2007	3/31/2012	CANE RUN CRK	37.75417	-84.76306
KTC LINCOLN CO MAINT GARAGE	LINCOLN	KYG500025	1/24/2003	3/31/2008	LOGAN CRK / UT	37.5375	-84.65167
STANFORD STP	LINCOLN	KY0024619	3/6/2001	12/31/2006	LOGAN CRK	37.54	-84.63611
PARADISE CONDOMINIUM CO	MERCER	KY0086550	9/7/2007	10/31/2012	HERRINGTON LAKE	37.72611	-84.72
CALDWELL STONE CO INC	BOYLE	KYG840008	6/22/2007	6/30/2012	CLARKS RUN	37.62833	-84.7475
RR DONNELLEY & SONS CO	BOYLE	KY0080616	2/26/2007	3/31/2012	CLARKS RUN	37.62222	-84.80833
HERRINGTON HAVEN SUBD	GARRARD	KY0053431	9/5/2007	10/31/2012	DIX RIVER	37.66139	-84.68972
KTC BOYLE CO MAINT GARAGE	BOYLE	KYG500126	1/24/2003	3/31/2008	CLARKS RUN / UT	37.62694	-84.79
PHILIPS LIGHTING CO	BOYLE	KY0002607	10/30/2007	11/30/2012	CLARKS RUN / UT	37.64028	-84.78806
BRODHEAD STP	ROCKCASTLE	KY0047431	8/24/2007	9/30/2012	DIX RIVER	37.40806	-84.42
LANCASTER STP	GARRARD	KY0020974	3/23/2001	1/31/2007	WHITE OAK CRK	37.61444	-84.58639
LANCASTER WTP	GARRARD	KYG640101	2/15/2011	3/31/2016	WHITE OAK CRK	37.60611	-84.59222
LINCOLN COUNTY READY MIX INC	LINCOLN	KYR001054	9/13/2002	9/30/2007	NEALS CRK	37.50306	-84.65306
BRAKE PARTS INC	LINCOLN	KYR001774	9/13/2002	9/30/2007	ST ALAPH CRK	37.53	-84.6525
WESTERFIELD RESIDENCE	BOYLE	KYG400035	11/30/2007	12/31/2012	HERRINGTON LAKE	37.69056	-84.70222
CRAB ORCHARD STP	LINCOLN	KY0065897	10/24/2008	11/30/2013	DIX RIVER	37.46583	-84.49556
DENYO MANUFACTURING CORP	BOYLE	KYR001569	9/13/2002	9/30/2007	CLARKS RUN	37.62972	-84.80417
NOF - DANVILLE	BOYLE	KYR001791	9/13/2002	9/30/2007	CLARKS RUN CRK	37.625	-84.79361
KY ARMY NATIONAL GUARD	LINCOLN	KYG640018	2/15/2011	3/31/2016	KNOBLICK CRK	37.57222	-84.78611
HUSTONVILLE ELDERLY APTS	LINCOLN	KY0097713	6/13/2007	7/31/2012	HANGING CRK	37.47333	-84.81333

Notes:

CO	Company
NA	Not Listed in Source Data
No.	Number
NPDES	National Pollutant Discharge Elimination System

Source Data and Location Description Available in More Detail from: "https://www.epa.gov/enviro/pcs-icis-search"

Table 3-2B: USGS (Smith et al. 2014) Ambient Background Soil (0–5cm Interval) Concentrations for Kentucky

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Element	Number of Samples	Mean (mg/kg)	60th Percentile (mg/kg)	95th Percentile (mg/kg)
Arsenic	64	7.95	8.10	17.98
Selenium	64	0.58	0.50	1.13

Notes:

cm	centimeter
mg/kg	milligrams per kilogram
USGS	United States Geological Survey

Per USGS sampling protocol, samples were collected at three depths: 0–5 cm, A horizon, and C horizon, or if the top of the C horizon depth was greater than 1 meter, the C sample was collected between 80–100 cms. Surface soils reported in this figure were collected at a depth of 0–5 cm which is the most transportable and most bio-available of the three sample intervals.

The following guidelines were used in the site selection process to ensure that samples were not collected from obviously contaminated areas:
No sample should be collected within 200 meters (m) of a major highway.
No sample should be collected within 50 m of a rural road.
No sample should be collected within 100 m of a building or structure.
No sample should be collected within 5 kilometers (km) downwind of active major industrial activities such as power plants or smelters.

From the 45 analyzed contituents, arsenic and selenium are reported here.

Table 3-2A: Kentucky Guidance for Ambient Background Assessment (2004)
Background Soil Concentrations
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Element	Mean (mg/kg)	95% UCL of Mean (mg/kg)	60th Percentile (mg/kg)	95th Percentile (mg/kg)
Aluminum	10969	11314	10800	21000
Arsenic	8.9	9.4	8.3	21.2
Barium	111.3	116.9	100	241
Beryllium	0.8	0.83	0.75	1.8
Cadmium	0.68	0.78	0.27	3.9
Chromium	20.5	21.3	19.3	40
Cobalt	11.9	12.4	13.1	25.1
Copper	18.9	21.3	13.8	41.7
Iron	22456	23284	22000	47600
Lead	30	33	20.9	84.6
Manganese	1017	1071	948	2620
Mercury	0.06	0.07	0.059	0.14
Nickel	20.9	21.7	20.2	46.8
Selenium	0.94	0.99	1.38	2.1
Silver	0.42	0.45	0.257	1.2
Thallium	--	--	--	7.95
Vanadium	26.9	27.7	27.3	48.6
Zinc	55	57	48.6	115

Notes:

mg/kg Milligram per kilogram

UCL Upper Confidence Level

Source: State of Kentucky Natural Resources and Environmental Protection Cabinet. 2004. "Kentucky Guidance for Ambient Soil Background Assessment"

Table 3-3A: Selenium and Arsenic Mass Loading from Auxiliary Pond Outfall KPDES BRN-001 (2015-2018)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Data Source	Monitoring Period	Average Flow (MGD)	Selenium Concentration (mg/L)	Estimated Mass of Selenium Entering Herrington Lake (g/day)	Arsenic Concentration (mg/L)	Estimated Mass of Arsenic Entering Herrington Lake (g/day)
DMR Pre-IRM Completion	Q1 2015	7.6	0.021	600	0.008	230
	Q2 2015	6.3	0.043	1000	0.0125*	600
	Q3 2015	8.4	0.025*	790	0.0125*	790
	Q4 2015	5.1	0.015*	290	0.0025*	96
	Q1 2016	5.0	0.053	1000	0.0025*	95
	Q2 2016	4.5	0.032	540	0.0125*	430
	Q3 2016	4.6	0.03	520	0.0125*	430
	Q4 2016	5.2	0.0125*	250	0.0125*	490
			Range Estimate	250–1000		95–790
			Average Estimate	620		400
DMR Post-IRM Completion	Q1 2017	4.2	0.0472	750	0.01346	210
	Q2 2017	4.5	0.0165	280	0.0089	150
	Q3 2017	3.9	0.0197	290	0.0072	110
	Q4 2017	3.2	0.006	95	0.004	48
	Q1 2018	4.3	0.0107	170	0.0131	210
	Q2 2018	4.4	0.0217	360	0.0082	140
	Q3 2018	3.7	0.0395	550	0.0079	110
			Range Estimate	95–750		48–210
			Average Estimate	360		140

Notes:

*	No selenium or arsenic were detected above reporting limit and 1/2 reporting limit was used to estimate daily selenium and arsenic mass loading.
[a]	KPDES Form C data includes concentrations only.
DMR	Discharge Monitoring Report
g	Grams
IRM	Interim Remedial Measures
L	Liter
KPDES	Kentucky Pollution Discharge Elimination System
MGD	Million Gallons per Day
mg	Milligrams
Q	Yearly Quarter

Total Estimates (in g/day) are rounded.

Total Estimates (in g/day) are calculated using the following formula:

*(Concentration (in milligrams per Liter) * (Flow (in gallons per minute (gpm)) * 0.264 gallons per Liter) * 1440 minutes per day) /1000 = grams per day*

Sources: "EWB Metals 2015 to Present (KPDES Monitoring – BRN-001 and BRN-005).xlsx" for concentration data and "Ash Pond Outfall Flow.xlsx" for flow rate data.

Table 3-3B: Selenium Mass Loading from Springs and Seeps (2012–2013)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment
Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Station ID		Years	Range of Observed Flow Rates (gpm)	Average Selenium Concentration (mg/L)	Estimated Mass Loading of Selenium (g/day)	Weighted Average Mass Loading of Selenium (g/day)	Average Arsenic Concentration (mg/L)	Estimated Mass Loading of Arsenic (g/day)	Average Mass Loading of Arsenic (g/day)
CH-040	Dam Toe Right	2012–2013	5–25	0.022	0.6–3	2.1	0.72	20–98	65.3
CH-041	Dam Toe Middle		8–220	Not Measured*	1.0–26*	9.2	0.72	31–860	285.7
CH-042	Dam Toe Left		7–70	Not Measured*	0.8–8.4*	3	0.72	27–270	93.5
				Range Estimate	2.4–37		Range Estimate	78–1200	
				Average Estimate	14		Average Estimate	445	
CH-044	Ditch Spring	2012–2013	5–135	0.032	0.9–24	15.3	0.092	2.5–68	31.8
CH-045	Beaver Dam Cave Spring		3–20	0.021	0.3–2.3	1.2	0.022	0.4–2.4	2.0
				Range Estimate	1.2–26		Range Estimate	2.9–70	
				Average Estimate	17		Average Estimate	34	
CH-046	HQ Spring	2012–2013	200–890	0.05	54–240	165.9	0.007	8–34	21.1
CH-057	Briar Patch Spring		210–2050	0.026	30–290	224.5	0.023	30–260	39.0
				Range Estimate	84–530		Range Estimate	38–290	
				Average Estimate	390		Average Estimate	60	
				Combined Range Estimate	87.6–593		Combined Range Estimate	118.9-1560	
				Combined Average Estimate	421		Combined Average Estimate	539	

Notes:

gpm	Gallons per minute
g	Grams
L	Liter
mg	Milligrams

Range of observed flow rates derived from Table 3 of Amec GWAR (AMEC, 2013) based on field measurements made by Amec in 2011–2012.

Average selenium concentrations calculated from Table 7 of GWAR (AMEC, 2013) based on samples collected in 2012–2013. Averages assume one half the detection limit for non-detects.

Average mass loading estimate calculated using average concentration and midpoint in the range of flow estimates.

* Mass estimates calculated assuming an average selenium concentration of 0.022 mg/L.

Total Estimates (in g/day) are rounded to two significant figures.

Total Estimates (in g/day) are calculated using the following formula:

*(Concentration (in milligrams per Liter) * (Flow (in gallons per minute (gpm)) * 0.264 gallons per Liter) * 1440 minutes per day) /1000 = grams per day*

Table 3-3C: Selenium and Arsenic Mass Loading from HQ and Briar Patch Springs (2017–2018)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W.
Brown Station, Herrington Lake, Mercer County, Kentucky

Spring Sampled	Sampling Date	Spring Flow Rate (gpm)	Selenium Concentration (mg/L)	Selenium Mass Flow (g/day)	Arsenic Concentration (mg/L)	Arsenic Mass Flow (g/day)
HQ Spring	June 27, 2017	380	0.00454	9.39	0.00615	12.72
	February 27, 2018	75	0.00457	1.87	0.00705	2.88
	March 26, 2018	50	0.00518	1.41	0.00758	2.06
	May 23, 2018	20	0.0127	1.38	0.008	0.87
			Range Estimate	1.4–9.4	Range Estimate	0.87–13
			Average Estimate	3.5	Average Estimate	4.6
Briar Patch Spring	June 13, 2017	7.5	0.00574	0.23	0.00747	0.30
	June 20, 2017	20	0.00767	0.83	0.00872	0.95
	June 27, 2017	271	0.0366	54.0	0.00848	12.5
	July 5, 2017	500	0.00653	17.8	0.00827	22.5
	July 12, 2017	180	0.0056	5.49	0.0077	7.54
	July 20, 2017	50	0.00576	1.57	0.00931	2.53
	July 26, 2017	93	0.0147	7.44	0.00807	4.09
	August 1, 2017	100	0.0188	10.2	0.00826	4.50
	August 9, 2017	100	0.00491	2.67	0.00745	4.06
	August 17, 2017	50	0.00427	1.16	0.00774	2.11
	September 14, 2017	100	0.00637	3.47	0.0145	7.89
	September 28, 2017	40	0.00375	0.82	0.00725	1.58
	October 18, 2017	100	0.00734	4.00	0.00807	4.39
	November 15, 2017	30	0.00975	1.59	0.00827	1.35
	December 19, 2017	30	0.00537	0.88	0.00798	1.30
	January 29, 2018	75	0.0336	13.7	0.00667	2.72
	February 27, 2018	50	0.0185	5.03	0.0085	2.31
	March 26, 2018	75	0.0154	6.29	0.00859	3.51
	April 18, 2018	75	0.00843	3.44	0.00791	3.23
	May 23, 2018	100	0.0172	9.36	0.00917	4.99
	June 11, 2018	35	0.00619	1.18	0.0103	1.96
	July 18, 2018	20	0.00496	0.54	0.0093	1.01
	August 9, 2018	25	0.00351	0.48	0.00964	1.31
	October 30, 2018	15	0.005	0.41	0.0084	0.69
			Range Estimate	0.2–54	Range Estimate	0.3–23
			Average Estimate	6.4	Average Estimate	4.1
			HQ Spring and Briar Patch Spring Combined Range	1.6–63.4	Combined Range	1.2–36
			HQ Spring and Briar Patch Spring Combined Average	9.90	Combined Average	8.70

Notes:

g /day	Grams per day
gpm	Gallons per minute
L	Liter
mg	Milligrams

Total Estimates (in g/day) are rounded.

Total Estimates (in g/day) are calculated using the following formula:

*(Concentration (in milligrams per Liter) * (Flow (in gallons per minute (gpm)) * 0.264 gallons per Liter) * 1440 minutes per day) /1000 = grams per day*

Sources: "2018-08-09 Analytical Summary Tables - EW Brown Wastewater.xlsx" received from KU on November 14, 2018.
"2018-12-12 Report for EWB 2018Q3Q4 GW Spring Sampling.pdf" received from Dinsmore & Shohl on January 7, 2019.

Table 3-4A: Historical E.W. Brown Groundwater Monitoring Well Descriptions
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Well Identifier	Location / Description	Installation Date	TOC Elevation	Total Well Depth (ft.)	Lake Elevation in Summer (ft. ASL)	TOC Above Lake (ft.)	Well Bottom Above/Below Lake Surface (ft.)	Well Screen Size (in.)	Screen Length (ft.)	Latitude (decimal degrees)	Longitude (decimal degrees)
PZ-103*	Piezometer	9/8/2016	911.95	120.72	742.00	169.95	49.23	0.010	10	37.7885478	-84.7242295
MW-106	Between LF and Auxilliary Pond	8/9/2016	900.50	94.25	742.00	158.50	64.25	0.010	10	37.7832700	-84.7196608
MW-109	Downgradient of Auxilliary Pond	9/14/2016	864.16	119.33	742.00	122.16	2.83	0.010	10	37.7802621	-84.7152858
MW-110	Downgradient of Auxilliary Pond	8/31/2016	806.07	52.89	742.00	64.07	11.18	0.010	10	37.7820632	-84.7153926
MW-111	Downgradient of Auxilliary Pond and LF	9/15/2016	847.81	108.87	742.00	105.81	-3.06	0.010	10	37.7834182	-84.7175572
MW-112	Downgradient of LF	8/9/2016	810.18	57.94	742.00	68.18	10.24	0.010	10	37.7851857	-84.7160825
MW-113	Downgradient of LF	9/8/2016	826.56	97.78	742.00	84.56	-13.22	0.010	10	37.7866918	-84.7153290
MW-114	Downgradient of LF	8/9/2016	867.1	24.02	742.00	125.10	101.08	0.010	10	37.7879544	-84.7151901
MW-115*	Rockhouse Spring Well	10/6/2016	829.95	28.66	742.00	87.95	59.29	0.010	10	37.7764877	-84.7251034
MW-116*	Hardin Farm Well Upgradient Background	10/6/2016	791.86	98.69	742.00	49.86	-48.83	0.010	10	37.7752284	-84.7158727

Notes:

* Indicates upgradient location

ASL	Above Sea Level
ft.	Feet
in.	Inches
LF	Former Main Pond Land Fill
MW	Groundwater Monitoring Well
PZ	Piezometer
TOC	Top of Casing
Source:	"Monitoring Well Data.xlsx" received February 13th, 2018

Table 3-4B: Historical E.W. Brown Select Groundwater (2016–2019)
Monitoring Well Data
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Groundwater Monitoring Well ID	Sampling Year	Sampling Date(s)	Target	Field Duplicate	Selenium (mg/L)	Arsenic (mg/L)	Boron (mg/L)
MW-106	2016	October 18–19	Landfill		0.021	0.010	0.80
	2016	December 5–6			0.021	0.012	0.83
	2017	January 17–18			0.017	0.014	0.92
	2017	March 6–7			0.016	0.013	0.94
	2017	April 10–11			0.014	0.016	1.0
	2017	May 22–23			0.012	0.015	1.1
	2017	July 18–19			0.011	0.011	1.1
	2017	August 28–29			0.007	0.013	0.92
	2018	March 22–23			0.006	0.038	1.1
	2018	June 19–20			0.011	0.070	1.0
	2019	February 5-6			0.035	0.700	0.9
MW-109	2016	October 18–19	Aux Pond		ND	ND	0.14
	2016	December 5–6			ND	ND	0.21
	2017	January 17–18			ND	ND	0.27
	2017	March 6–7			ND	ND	0.32
	2017	April 10–11			ND	0.0053	0.36
	2017	May 22–23			ND	0.0087	0.38
	2017	July 18–19			ND	0.0110	0.41
	2017	August 28–29			ND	0.0110	0.35
	2018	March 22–23			ND	ND	0.44
	2018	June 19–20			ND	0.0060	0.49
	2019	February 5-6			ND	ND	0.4
MW-110	2016	October 18–19	Aux Pond		ND	ND	2.1
	2016	December 5–6			ND	ND	2.4
	2017	January 17–18			ND	ND	2.3
	2017	March 6–7			ND	ND	2.2
	2017	March 6–7		Yes	ND	ND	2.1
	2017	April 10–11			ND	ND	2.5
	2017	May 22–23			ND	ND	2.4
	2017	July 18–19			ND	ND	2.2
	2017	July 18–19		Yes	ND	ND	2.0
	2017	August 28–29			ND	ND	1.8
	2018	March 22–23			ND	ND	1.6
	2018	June 19–20			ND	ND	1.7
	2019	February 5-6			ND	ND	1.2
	2019	February 5-6		Yes	ND	ND	1.2
MW-111	2016	October 18–19	Landfill		0.02	ND	0.63
	2016	December 5–6			ND	ND	0.66
	2016	December 5–6		Yes	ND	ND	0.65
	2017	January 17–18			ND	ND	0.79
	2017	March 6–7			ND	ND	0.72
	2017	April 10–11			ND	ND	0.91
	2017	May 22–23			ND	ND	0.99
	2017	July 18–19			ND	ND	0.96
	2017	August 28–29			ND	ND	1.0
	2018	March 22–23			ND	ND	1.5
	2018	June 19–20			ND	ND	1.6
	2019	February 5-6			ND	ND	1.5

Table 3-4B: Historical E.W. Brown Select Groundwater (2016–2019) Monitoring Well Data
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Groundwater Monitoring Well ID	Sampling Year	Sampling Date(s)	Target	Field Duplicate	Selenium (mg/L)	Arsenic (mg/L)	Boron (mg/L)
MW-112	2016	October 18–19	Landfill		ND	0.014	3.5
	2016	December 5–6			ND	0.0092	3.0
	2017	January 17–18			ND	0.011	4.5
	2017	January 17–18		Yes	ND	0.010	4.0
	2017	March 6–7			ND	0.0097	5.6
	2017	April 10–11			ND	0.0063	6.5
	2017	May 22–23			ND	0.0077	4.5
	2017	July 18–19			ND	0.0097	3.9
	2017	August 28–29			ND	0.010	4.0
	2018	March 22–23			ND	0.029	3.8
	2018	March 22–23		Yes	ND	0.028	3.6
	2018	June 19–20			ND	0.047	5.5
	2019	February 5-6			ND	0.051	5.3
MW-113	2016	October 18–19	Landfill		ND	ND	1.4
	2016	December 5–6			ND	ND	1.4
	2017	January 17–18			ND	0.010	1.4
	2017	March 6–7			ND	0.0071	1.3
	2017	April 10–11			ND	0.0054	1.6
	2017	May 22–23			ND	0.011	1.5
	2017	July 18–19			ND	0.0066	1.5
	2017	August 28–29			ND	0.012	1.4
	2018	March 22–23			ND	0.0090	1.7
	2018	June 19–20			ND	ND	1.8
	2019	February 5-6			ND	ND	1.6
MW-114	2016	October 18–19	Landfill		ND	ND	0.42
	2016	October 18–19		Yes	ND	ND	0.41
	2016	December 5–6			ND	ND	0.40
	2017	January 17–18			ND	ND	0.43
	2017	March 6–7			ND	ND	0.38
	2017	April 10–11			ND	ND	0.39
	2017	May 22–23			ND	ND	0.40
	2017	July 18–19			ND	ND	0.40
	2017	August 28–29			ND	ND	0.35
	2017	August 28–29		Yes	ND	ND	0.37
	2018	March 22–23			ND	ND	0.41
	2018	June 19–20			ND	ND	0.75
	2018	June 19–20		Yes	ND	ND	0.75
	2019	February 5-6			ND	ND	1.1
MW-217	2019	February 5-6	Characterization		0.0066	ND	0.27
MW-218	2019	February 5-6	Characterization		ND	ND	0.75

Notes:

ID	Identification
mg/L	Milligrams per Liter
MW	Groundwater Monitoring Well
ND	Not detected

The detection limit for Arsenic is 0.005 mg/L.
The detection limit for Selenium is 0.005 mg/L.

For the above selected groundwater monitoring wells, MW-106 is located west of HQ and Briar Patch Springs between the Main Pond and Auxiliary Pond. All of other selected monitoring wells in this table are located east of the CCR ponds (MW-109, MW-110, MW-111, MW-112, MW-113 and MW-114).

Source: "Monitoring Well Data.xlsx" received February 13th, 2018.

Table 3-4C: Estimated Seleneium and Arsenic Mass Loading from Groundwater (May 2017 to June 2018)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Segment	Well Identifier	Area (ft^2) - *A*	Gradient *i*	Hydraulic Conductivity (ft/day) - *K*	Flow (ft^3/day) - Q	Flow (L/day) - *Q*	Selenium						Arsenic					
							Minimum Conc. (ug/L) - c_{min}	Minimum Flux (g/day) - *F*	Maximum Conc. (ug/L) - c_{max}	Maximum Flux (g/day) - *F*	Average Conc. (ug/L) - c	Average Flux (g/day) - F	Minimum Conc. (ug/L) - c_{min}	Minimum Flux (g/day) - *F*	Maximum Conc. (ug/L) - c_{max}	Maximum Flux (g/day) - *F*	Average Conc. (ug/L) - c	Average Flux (g/day) - F
1	MW-114	56,410	0.32	251	4494892	1.27E+08	0	0	0	0	0	0	0	0	0	0	0	0
2	MW-113	27,800	0.19	0.16	839	2.23E+04	0	0	0	0	0	0	2.5*	0.06	12.0	0.27	8.22	0.18
3	MW-112	33,090	0.07	7.2	15726	3.97E+05	0	0	0	0	0	0	7.7	3.06	47.0	18.65	21	8.2
4	MW-111	32,430	0.10	0.12	395	1.12E+04	2.5*	0.03	2.5*	0.03	2.5*	0.03	0	0	0	0	0	0
5	MW-110	36,580	0.10	435	1575475	4.46E+07	0	0	0	0	0	0	0	0	0	0	0	0
6	MW-109	86,470	0.07	0.1	627	1.77E+04	0	0	0	0	0	0	2.5*	0.04	11.0	0.20	7.8	0.14
7	MW-116	106,110	0.15	98	1575573	4.46E+07	0	0	0	0	0	0	0	0	0	0	0	0
							Minimum Total Selenium (g/day) - F_{total}	0.03	Maximum Total Selenium (g/day) - F_{total}	0.03	Average Total Selenium (g/day) - F_{total}	0.03	Minimum Total Arsenic (g/day) - F_{total}	3.2	Maximum Total Arsenic (g/day) - F_{total}	19.1	Average Total Arsenic (g/day) - F_{total}	8.6

Notes:

* For monitoring wells with ND as the maximum or minimum value, half detection limit was used in the calculation (2.5 ug/L for both Arsenic and Selenium).

1) For monitoring wells with ND values for all events (October 2016 to June 2018), a concentration of 0 ug/L was assigned.

2) For monitoring wells with at least one detection for any event (October 2016 to June 2018), the highest detection was assigned the maximum concentration or the lowest detection was assigned the minimum concentration.

Gray Cells: 3) Grayed values indicate no flux for a particular monitoring well due to concentration results or for an inidividual constituent.

4) Estimated flux values calculated using the formula F = c * K * i * A

A	Area
Cmax	Maximum concentration
Cmin	Minimum concentration
Conc.	Concentration
F	Flux
Ftotal	Total flux
ft2	Feet squared
ft/day	Feet per day
g/day	Grams per day
i	Gradient
K	Hydraulic conductivity
Max.	Maximum
Min.	Minimum
MW	Monitoring well
Q	Flow
ug/L	Micrograms per liter

Table 3-5: Selenium and Arsenic Mass Loading from Sediment Sediment Pore Water (2017 – 2018)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Selenium					
Sampling Location	Phase	Sample Identifier	Metal	Se Result ug/L	Se Result g/m^3
CI1A	Phase 2	PW001-CIA-180719	Selenium	2.7	0.0027
CI1A DUP	Phase 2	PW001-CI1A-180719 DUP	Selenium	8.8	0.0088
CI1B	Phase 2	PW001-CIB-180719	Selenium	2.9	0.0029
CI1C	Phase 1	PW001-CI1C-171103	Selenium	3.7	0.0037
CI2.1A	Phase 2	PW001-CI2.1A-180719	Selenium	1.5	0.0015
CI2.1B	Phase 2	PW001-CI2.1B-180719	Selenium	1.1	0.0011
CI2.2A	Phase 2	PW001-CI2.2A-180719	Selenium	1.2	0.0012
CI2.2B	Phase 2	PW001-CI2.2B-180719	Selenium	3.4	0.0034
CI2A	Phase 1	PW001-CI2A-171104	Selenium	1	0.001
CI2B	Phase 2	PW001-CI2B-180719	Selenium	1.8	0.0018
CI2C	Phase 1	PW001-CI2C-171103	Selenium	2.3	0.0023
CI3.1A	Phase 2	PW001-CI3.1A-180719	Selenium	1.2	0.0012
CI3.1A DUP	Phase 2	PW001-CI3.1A-180719 DUP	Selenium	1	0.001
CI3.1B	Phase 2	PW001-CI3.1B-180720	Selenium	0.7	0.0007
CI3.2A	Phase 2	PW001-CI3.2A-180719	Selenium	0.7	0.0007
CI3.2B	Phase 2	PW001-CI3.2B-180720	Selenium	0.8	0.0008
CI3A	Phase 2	PW001-CI3A-180719	Selenium	1.4	0.0014
CI3A DUP	Phase 2	PW001-CI3A-180719 DUP	Selenium	1.3	0.0013
CI3B	Phase 2	PW001-CI3B-180719	Selenium	7.5	0.0075
CI3C	Phase 1	PW001-CI3C-171103	Selenium	1.3	0.0013
CI4A	Phase 2	PW001-CI4A-180720	Selenium	2.5	0.0025
CI4B	Phase 2	PW001-CI4B-180720	Selenium	4.4	0.0044
CURDS1	Phase 1	PW001-CURDS1-171103	Selenium	3.2	0.0032
CURDS2A	Phase 1	PW001-CURDS2A-171104	Selenium	0.8	0.0008
CURDS2B	Phase 1	PW001-CURDS2B-171103	Selenium	2.7	0.0027
CURDS2C	Phase 1	PW001-CURDS2C-171103	Selenium	3	0.003
CURDSNB	Phase 1	PW001-CURDSNB-171103	Selenium	5	0.005

Average Se Result ug/L	Average Result g/m3	Selenate Diffusion Coefficient (m^2/S)	Overall Contamination Area (m^2)	Diffusion Length (m)	Grams/ Second	Grams/ Day
2.5	0.0025	7E-10	20300	0.00035	0.10210	9,18[a]

$$Flux = \frac{\left(\frac{0.0025\ g}{m^3}\right) \cdot \left(\frac{7\ x\ 10^{-10}\ m^2}{s}\right) \cdot (20{,}300\ m^2)}{0.00035\ m} = \frac{0.00010\ g}{s} \approx \frac{9\ g}{day}$$

Arsenic Results					
Sampling Location	Phase	Sample Identifier	Metal	As Result ug/L	As Result g/m^3
CURDS1	Phase 1	PW001-CURDS1-171103	Arsenic	4.59	0.00459
CURDS2A	Phase 1	PW001-CURDS2A-171104	Arsenic	123	0.123
CURDS2B	Phase 1	PW001-CURDS2B-171103	Arsenic	14.4	0.0144
CURDS2C	Phase 1	PW001-CURDS2C-171103	Arsenic	5.05	0.00505
CURDSNB	Phase 1	PW001-CURDSNB-171103	Arsenic	5.83	0.00583
CI1A	Phase 2	PW001-CIA-180719	Arsenic	88.5	0.0885
CI1A DUP	Phase 2	PW001-CI1A-180719 DUP	Arsenic	18.3	0.0183
CI1B	Phase 2	PW001-CIB-180719	Arsenic	9.04	0.00904
CI1C	Phase 1	PW001-CI1C-171103	Arsenic	3.48	0.00348
CI2.1A	Phase 2	PW001-CI2.1A-180719	Arsenic	375	0.375
CI2.1B	Phase 2	PW001-CI2.1B-180719	Arsenic	20.9	0.0209
CI2.2A	Phase 2	PW001-CI2.2A-180719	Arsenic	290	0.29
CI2.2B	Phase 2	PW001-CI2.2B-180719	Arsenic	18.8	0.0188
CI2A	Phase 1	PW001-CI2A-171104	Arsenic	29.2	0.0292
CI2B	Phase 2	PW001-CI2B-180719	Arsenic	10.8	0.0108
CI2C	Phase 1	PW001-CI2C-171103	Arsenic	1.04	0.00104
CI3.1A	Phase 2	PW001-CI3.1A-180719	Arsenic	1500	1.5
CI3.1A DUP	Phase 2	PW001-CI3.1A-180719 DUP	Arsenic	201	0.201
CI3.1B	Phase 2	PW001-CI3.1B-180720	Arsenic	73.5	0.0735
CI3.2A	Phase 2	PW001-CI3.2A-180719	Arsenic	585	0.585
CI3.2B	Phase 2	PW001-CI3.2B-180720	Arsenic	135	0.135
CI3A	Phase 2	PW001-CI3A-180719	Arsenic	444	0.444
CI3A DUP	Phase 2	PW001-CI3A-180719 DUP	Arsenic	764	0.764
CI3B	Phase 2	PW001-CI3B-180719	Arsenic	64.8	0.0648
CI3C	Phase 1	PW001-CI3C-171103	Arsenic	2.32	0.00232
CI4A	Phase 2	PW001-CI4A-180720	Arsenic	18	0.018
CI4B	Phase 2	PW001-CI4B-180720	Arsenic	2.79	0.00279

Average As Result ug/L	Average As Result g/m3	Arsenic Diffusion Coefficient (m^2/S)	Overall Contamination Area (m^2)	Curds Inlet Percent (%) **Reducing** vs. **Oxidizing** Sediment	Diffusion Length (m)	Grams/ Second	Grams/ Day
210.00	0.45	9E-10	20300	20%	0.00035	0.004698	406
220.000	0.018	9E-10	20300	80%	0.00035	0.000752	65
						Total Estimate	**470**

$$Reducing\ Sediment\ Flux = \left(\frac{\left(\frac{0.45\ g}{m^3}\right) \cdot \left(\frac{9\ x\ 10^{-10}\ m^2}{s}\right) \cdot (20{,}300\ m^2)}{0.00035\ m}\right) \cdot 0.2 = \frac{0.0047 g}{s} \approx \frac{406\ g}{day}$$

$$+$$

$$Rest\ of\ Curds\ Inlet\ Flux = \left(\frac{\left(\frac{0.018\ g}{m^3}\right) \cdot \left(\frac{9\ x\ 10^{-10}\ m^2}{s}\right) \cdot (20{,}300\ m^2)}{0.00035\ m}\right) \cdot 0.8 = \frac{0.00074 g}{s} \approx \frac{65\ g}{day}$$

$$\approx 470\ g/day$$

Notes:

As: Arsenic
CI: Curds Inlet
CURDS: Curds Inlet
DUP: Duplicate Sample
g: grams
g/m^3: grams per cubic meter
m: meters
m^2: square meters
m^2/S: square meters per second
NB: North Bank
PW: pore water
s: second
Se: Selenium
SWAC surface weighted average concentration
ug/L micrograms per liter

Table 3-5: Selenium and Arsenic Mass Loading from Sediment Sediment Pore Water (2017 – 2018)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

[a] At an estimated flux rate of 9 grams/day, the relative contribution from contaminated sediments in Curds Inlet is relatively minor compared to estimated loadings from other sources. Although this estimate is an upper-bound diffusive flux rate (because it assumes overlying surface water concentrations are zero), it does not consider potential contribution from resuspension of particulate phases via bioturbation and physical mixing processes. If contribution from resuspension of particulate phases via bioturbation and physical mixing doubles the estimate, that would yield approximately 18 g/day.

Selenium is a representative middle estimate using average concentrations. The higher estimate acknowledges other possible diffusion scenarios including resuspension of particulate and conduction.

Arsenic uses SWAC flux estimates, one for the smaller region containing more reducing sediments with higher concentrations, and one for the rest of Curds Inlet sampling region, and adds them together to produce one SWAC for Curds Inlet.

Table 3-6: Selenium and Arsenic Mass Loading at Upgradient Reference LHL5 & LHL6
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Selenium Results				
Sampling Location	Phase	Sample Identifier	Se Result (ug/L)	Se Result g/m^3
LHL5 (25 ft)	Phase 1	SW001(25)LHL5-171212	0.4	0.0004
LHL5 (20 ft)		SW-001(20)-LHL5-171007	0.6	0.0006
LHL5 (100 ft)		SW-003(100)-LHL5-171007	0.3	0.0003
LHL6 (25 ft)		SW001(25)LHL6-171212	0.3	0.0003
LHL6 (20 ft)		SW-001(20)-LHL6-171007	0.4	0.0004
LHL6 (10 ft)	Phase 2	SW001(10)-LHL6-180617	0.4	0.0004
LHL6 (50 ft)		SW001(50)-LHL6-180617	0.2	0.0002

Average Concentrations	Flow Rate Estimates (m^3/day)	Average Result ug/L	Average Result g/m^3	Mass Loading Estimates (g/day)
	911000	0.37	0.00037	340
	1450000			540
	Average Estimate			440

$$\frac{911{,}000\ m^3}{day} \ x \ \frac{0.00037\ g}{m^3} = \frac{340\ g}{day}$$

$$\frac{1{,}450{,}000\ m^3}{day} \ x \ \frac{0.00037\ g}{m^3} = \frac{540\ g}{day}$$

Arsenic Results				
Sampling Location	Phase	Sample Identifier	As Result (ug/L)	As Result g/m^3
LHL5 (20 ft)	Phase 1	SW-001(20)-LHL5-171007	0.97	0.00097
LHL5 (25 ft)		SW-001(25)LHL5-171212	1.12	0.00112
LHL5 (70 ft)		SW-002(70)-LHL5-171007	1.19	0.00119
LHL5 (100 ft)		SW-003(100)-LHL5-171007	0.96	0.00096
LHL6 (70 ft)		SW-002(70)-LHL6-171007	1.04	0.00104
LHL6 (100 ft)		SW-003(100)-LHL6-171007	1.18	0.00118
LHL6 (20 ft)		SW-001(20)-LHL6-171007	0.89	0.00089
LHL6 (25 ft)		SW-001(25)LHL6-171212	0.92	0.00092
LHL6 (50 ft)	Phase 2	SW-001(50)-LHL6-180617	0.59	0.00059
LHL6 (10 ft)		SW-001(10)-LHL6-180617	0.65	0.00065
LHL6 (100 ft)		SW-001(100)-LHL6-180617	0.46	0.00046
LHL6 Dup (100 ft)		SW-001(100)-LHL6-180617 DUP	0.46	0.00046

Average Concentrations	Flow Rate Estimates (m^3/day)	Average Result ug/L	Average Result g/m^3	Mass Loading Estimates (g/day)
	911000	0.87	0.00087	790
	1450000	0.87	0.00087	1300
	Average Estimate			1045

$$\frac{911{,}000\ m^3}{day} \ x \ \frac{0.00087\ g}{m^3} = \frac{790\ g}{day}$$

$$\frac{1{,}450{,}000\ m^3}{day} \ x \ \frac{0.00087\ g}{m^3} = \frac{1{,}300\ g}{day}$$

Notes:

The maximum detected dissolved surface water concetrations for each site and each sampling date are included

As: Arsenic
DUP: Duplicate Sample
g: grams
g/day grams per day
g/m^3: grams per cubic meter
LHL: Lower Herrington Lake
m^3: cubic meters
m^3/day: cubic meters per day
s: second
Se: Selenium
SW: Surface water
ug/L micrograms per liter

Table 3-7: Source Identification Summary: Selenium and Arsenic
Mass Loading Comparison
Herrington Lake Corrective Action Plan: Site Characterization
Report Mercer County, Kentucky

Source	Years	Source Data	Loading Estimates (g/day)					
			Selenium Low	Selenium High	Selenium Average	Arsenic Low	Arsenic High	Arsenic Average
HQ Spring	2012–2013	Table 3-3B	54	240	165.9	8	34	21.1
Briar Patch Spring		Table 3-3B	30	290	224.5	30	260	39
Dam Toes, Ditch Spring, Beaver Dam Cave Spring		Table 3-3B	3.6	63	30.8	81	1270	478.3
Auxillary Pond Outfall KPDES BRN001	2015–2016	Table 3-3A	250	1000	620	95	790	400
Auxillary Pond Outfall KPDES BRN001	2017–2018	Table 3-3A	95	750	360	48	210	140
HQ Spring		Table 3-3C	1.4	9.4	3.5	0.9	13	4.6
Briar Patch Spring		Table 3-3C	0.2	54	6.4	0.3	23	4.1
Dam Toes, Ditch Spring		Not Applicable	Flow Captured by Toe Drain					
Flux from Curds Inlet Sediments		Table 3-5	9[a]	18[a]	9[a]	180[b]	760[b]	470[b]
Groundwater		Table 3-4C	0.03	0.03	0.03	3.2	19.1	8.6
Upgradient LHL5 & LHL6 (Reference)		Table 3-6	340	540	440	790	1300	1045

Notes:

As	Arsenic
g	Grams
KPDES	Kentucky Pollutant Discharge Elimination System
LHL	Lower Herrington Lake
Se	Selenium
SWAC	Surface Weighted Average Concentration

Total Loading Estimates (in g/day) are rounded.

Total Loading Estimates (in g/day) are calculated using the following formula:

*(Concentration (in milligrams per Liter) * (Flow (in gallons per minute (gpm)) * 0.264 gallons per Liter) * 1440 minutes per day) /1000 = grams per day*

[a] Selenium is a representative middle estimate using average concentrations. The higher estimate acknowledges other possible diffusion scenarios including resuspension of particulate and conduction.

[b] Arsenic uses two SWAC flux estimates, one for the smaller region containing more reducing sediments with higher concentrations, and one for the rest of Curds Inlet sampling region, and adds them together to produce one SWAC for Curds Inlet.

Sources:
Concentration data from: "EWB Metals 2015 to Present (KPDES Monitoring – BRN-001 and BRN-005).xlsx"
Flow-rate data from: "Ash Pond Outfall Flow.xlsx"
Range of observed flow rates derived from Table C-1 of Amec GWAR (AMEC, 2013) based on field measurements made by Amec in 2011–2014.

Table 4-1: Summary of Wells Identified in February 2, 2018 Search of the Kentucky Groundwater Repository
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Nature of Well	AKGWA Well Number	Cumulative Number of Wells
Previously identified in permit application and plugged	00020031	1
Previously identified in permit application and plugged	00055257	2
2018 identified "Plugged" wells	00069576	3
2018 identified "Plugged" wells	00069577	4
Site Monitoring wells	80065004 (MW-109)	5
Site Monitoring wells	80065005 (MW-110)	6
Site Monitoring wells	80065006 (MW-111)	7
Site Monitoring wells	80065007 (PZ-103)	8
Site Monitoring wells	80065008 (MW-106)	9
Site Monitoring wells	80065009 (MW-113)	10
Site Monitoring wells	80065010 (MW-114)	11
Site Monitoring wells	80065015 (MW-112)	12
Site Monitoring wells	80065017 (MW-115)	13
Site Monitoring wells	80065018 (MW-116)	14
Greater than a mile from site and identified as 'unsuitable for use'	00000501 (1.66 miles)	15
Greater than a mile from site 'Domestic single household'	00001785 (2.08 miles)	16
Greater than a mile from site 'Domestic single household'	00020153 (2.49 miles)	17
Greater than a mile from site 'Domestic single household'	40004432 (2.24 miles)	18
Greater than a mile from site	60006412 (2.21 miles)	19
Number of wells of concern:	All wells are either plugged, monitoring wells or are greater than a mile from the site.	0

Notes:
AKGWA Assembled Kentucky Ground Water- unique identity code for springs and ground water.
MW Monitoring Well

Table 4-2: Summary of Springs Identified in February 2, 2018 Search of the Kentucky Groundwater Repository
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

What Was Searched?	Number of Springs	Notes on the Spring including AKGWA number
Search radius of 2 miles of the site within the Kentucky Groundwater Repository	13	See below
Previously identified in 2014 permit application	6	30001946; 90001872; 90001873; 90001874; 90001875; 90001876
More than a mile from site, across hydrological divide	7	30001126 (2.41 miles); 30001287 (1.46 miles and across Dix River); 30001939 (1.05 miles); 30001957 (1.53 miles); 30004428 (2.07 miles across the Lake); 50001207 (2.38 miles); 90003602 (1.40 miles)
Number of springs of concern:	0	All 13 identified in 2018 search were either previously identified as not being an issue, or were more than a mile from the site.

Notes:

AKGWA Assembled Kentucky Ground Water- unique identity code for springs and ground water.

Table 4-3: Human Health Risk-Based Screening Values for Consideration
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Metal	Matrix				Detail on Surface Water Values µg/L			
	Fish Risk-Based Concentration (RBC) Assuming One Meal a Week for adults 10-6 for carcinogens		Sediment (mg/kg) Residential Soil 10-6[a]	Surface Water µg/L MCL or RBC[a]	Kentucky Drinking Water	Kentucky Fish	MCL	RBC
	Value[a]	Unit						
Arsenic	--		0.68	10	10	--	10	--
Total Inorganic Arsenic[b]	0.005	mg/kg ww		--	--	--		--
Boron (Boron and Borates)	516	mg/kg ww	16000	4000	--	--		4000
Cadmium	2.6	mg/kg ww	71	5	5	--	5	--
Lead[c]	0.375	mg/kg ww	400	15	15	--	15	--
Mercury[d]	--	ug/kg ww	23	2	2	0.051	2	--
Methylmercury	0.3	mg/kg ww	7.8	2	2	0.3 mg/kg fish tissue	2	--
Selenium	13	mg/kg ww	390	50	170	4200	50	--
Zinc	774	mg/kg ww	23000	6000	7400	26000	--	6000

Notes:

a Regional Screening Levels (RSLs) for residential soil. Assumes a 1x10-6 cancer risk level for arsenic and a hazard index of 1 for all others except lead. Assumes 50 meals a year (i.e., a 350 day exposure frequency is applied). USEPA (2018a)
b Total inorganic arsenic is AsIII + AsV
c HH screening level based on the USFDA Total Tolerable Daily Intake concentration of 6.0 µg/day is used in Ohio as the basis for a 1 meal / week fish consumption advisory with a concentration basis of 0.375 mg/kg ww.
d Mercury in fish is nearly all methyl mercury and the methyl mercury RBC is used. Soil and water mercury assumed to be inorganic.

--	No toxicty value.
µg/L	Micrograms per liter.
KY	From the Kentucky Administrative Record. http://www.lrc.ky.gov/kar/401/010/031.htm
MCL	Maximum contaminant level.
mg/kg	Miligrams per kilogram.
RBC	Risk based concentration.
ww	Wet weight.

Table 4-4: Screening of Fish Fillet Data for Bluegills and Green Sunfish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk Based Concen-tration [c]	Max Exceeds RBC Yes/No	Min Detect	Mean	Max Detect	FF-001(BG)-CI-171004	FF-002(BG)-CI-171004	FF-001(BG)-CI-171004-FD
Total inorganic Arsenic[d]	2-4A	0.005	No	0.0040	0.0018	0.0040	*0.0015*	0.004	0.004
Boron (Boron and borates)	2-7B	516	No	0.040	0.099	0.52	0.14	0.52	0.17
Cadmium	2-6B	2.6	No	0.00090	0.0041	0.0095	0.0084	0.008	0.0095
Iron	--	1806	No	2.3	3.8	7.4	3.97	2.81	4.28
Lead[e]	2-8B	0.375	No	0.00080	0.0017	0.0063	0.0008	*0.0006*	0.0017
Magnesium	--	NT	No	199	242	350	199	254	229
Methyl Mercury	2-5B	0.30	No	0.016	0.035	0.077	0.0246	0.0221	0.0256
Selenium	2-3D	13	No	0.21	1.1	2.2	1.85	2.24	2.15
Zinc	2-9B	774	No	6.7	10	15	7.45	7.5	8.98

Table 4-4: Screening of Fish Fillet Data for Bluegills and Green Sunfish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk Based Concen-tration [c]	FF-002(BG)-CI-171004-FD	FF-001(BG)-HQ-171004	FF-002(BG)-HQ-171004	FF-002(BG)-HQ-171004-FD	FF-002(BG)-LHL1-171004	FF-001(BG)-LHL1-171011
Total inorganic Arsenic[d]	2-4A	0.005	*0.0015*	0.004	*0.0015*	*0.0015*	*0.0015*	*0.0015*
Boron (Boron and borates)	2-7B	516	0.48	0.07	0.07	0.07	0.05	0.08
Cadmium	2-6B	2.6	0.0076	0.0091	0.0062	0.0069	0.0038	0.0019
Iron	--	1806	3.53	3.39	5.12	2.31	3.06	5.68
Lead[e]	2-8B	0.375	0.0009	*0.0006*	*0.0006*	*0.0006*	*0.0006*	0.0015
Magnesium	--	NT	231	209	212	234	234	285
Methyl Mercury	2-5B	0.30	0.0241	0.0255	0.0254	0.0161	0.0394	0.0382
Selenium	2-3D	13	1.95	1.31	1.4	1.27	1.03	1.01
Zinc	2-9B	774	6.73	10.4	10.7	10.4	10.8	12.6

Table 4-4: Screening of Fish Fillet Data for Bluegills and Green Sunfish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk Based Concen-tration [c]	FF-001(BG)-LHL2-171005	FF-002(BG)-LHL2-171005	FF-002(BG)-LHL3-171005	FF-001(BG)-LHL3-171005	FF-001(BG)-LHL4-171003	FF-002(BG)-LHL4-171003
Total inorganic Arsenic[d]	2-4A	0.005	*0.0015*	*0.0015*	*0.0015*	*0.0015*	*0.001*	*0.0015*
Boron (Boron and borates)	2-7B	516	*0.04*	0.056	0.11	0.06	0.059	0.047
Cadmium	2-6B	2.6	0.0035	0.0072	0.003	0.0033	0.0051	0.004
Iron	--	1806	3.43	4.73	3.01	4.06	3.06	4.28
Lead[e]	2-8B	0.375	0.001	0.0017	0.0063	0.0039	0.0012	0.0011
Magnesium	--	NT	223	210	281	217	216	229
Methyl Mercury	2-5B	0.30	0.021	0.0341	0.0253	0.0227	0.0237	0.0467
Selenium	2-3D	13	0.96	1.24	1.18	1.02	1.13	1.14
Zinc	2-9B	774	9.81	12.8	11	9.25	10.1	11.1

Table 4-4: Screening of Fish Fillet Data for Bluegills and Green Sunfish Compared with Risk-Based Concentrations for Human Healtha,b
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk Based Concen-tration [c]	FF-001(BG)-LHL5-171011	FF-002(BG)-LHL5-171011	FF-001(BG)-LHL6-171011	FF-002(BG)-LHL6-171011	FF-001(BG)-MHL1-171015	FF-002(BG)-MHL1-171015
Total inorganic Arsenic[d]	2-4A	0.005	*0.0015*	*0.0015*	*0.0015*	*0.0015*	*0.0015*	*0.002*
Boron (Boron and borates)	2-7B	516	0.04	0.06	0.068	*0.038*	0.061	0.08
Cadmium	2-6B	2.6	0.0016	0.0019	0.0013	0.0015	0.0009	0.0026
Iron	--	1806	3.22	3.76	3.58	3.63	3.53	7.38
Lead[e]	2-8B	0.375	0.0018	0.002	0.0024	0.0019	0.0019	0.0032
Magnesium	--	NT	267	273	258	264	238	350
Methyl Mercury	2-5B	0.30	0.0307	0.0375	0.0418	0.0351	0.0372	0.0509
Selenium	2-3D	13	0.95	0.88	0.96	0.81	0.38	0.5
Zinc	2-9B	774	13.8	12.7	11.3	12.1	9.82	14.5

Table 4-4: Screening of Fish Fillet Data for Bluegill and Sunfish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk Based Concen-tration [c]	FF-001(BG)-MHL3-171014	FF-002(BG)-MHL3-171014	FF-001(GS)-DR-171014	FF-001(BG)-DR-171016	FF-002(GS)-DR-171016
Total inorganic Arsenic[d]	2-4A	0.005	*0.0015*	*0.0015*	*0.0015*	*0.0015*	*0.0015*
Boron (Boron and borates)	2-7B	516	*0.04*	*0.04*	*0.04*	*0.04*	*0.04*
Cadmium	2-6B	2.6	*0.0006*	*0.0006*	0.0014	0.0014	0.004
Iron	--	1806	2.87	2.7	4.4	3.83	4.38
Lead[e]	2-8B	0.375	0.0014	0.0008	0.0014	0.0016	0.0022
Magnesium	--	NT	270	250	236	217	208
Methyl Mercury	2-5B	0.30	0.031	0.031	0.0765	0.0501	0.0679
Selenium	2-3D	13	0.21	0.22	0.68	0.48	0.79
Zinc	2-9B	774	8.84	9.96	9.21	9.57	11.2

Notes:

[a] All values presented in mg/kg ww.

[b] Non-detect results shown as 1/2 the method detection limit , presented in *grey italics font* .

[c] Risk based concentrations calculated based on 50 meals per year and assuming 8 ounce meals.

[d] Total inorganic arsenic is AsIII + AsV.

[e] HH screening level based on the USFDA Total Tolerable Daily Intake concentration of 6.0 µg/day is used in Ohio as the basis for a 1 meal per week fish consumption advisory with a concentration basis of 0.4 mg/kg ww.
http://epa.ohio.gov/portals/35/fishadvisory/FishAdvisoryProcedure.pdf

BG Bluegill
FF Fish fillet
GS Green sunfish
NT No toxicity value

Table 4-5: Screening of Fish Fillet Data for Larger Fish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk-Based Concen-tration [c]	Maximum Exceeds RBC Yes/No	Minimum Detect	Mean Detected Value	Maximum Detect	FF-CC-1-CI[c]	FF-FHC-1-CI
Total inorganic Arsenic[d]	2-4C	0.005	No	ND	0.0016	ND	0.0015	0.0015
Boron (Boron and borates)	2-7C	516	No	0.05	0.0443	0.24	0.07	0.24
Cadmium	2-6C	2.6	No	0.0007	0.0016	0.0107	0.0023	0.0107
Iron	--	1806	No	1.36	3.2172	5.94	3.85	3.55
Lead[e]	2-8C	0.375	No	0.0007	0.0017	0.0075	0.0027	0.0017
Magnesium	--	NT	No	176	230.5349	303	178	224
Mercury				0.02	0.1007	0.329	0.0394	0.153
Methyl Mercury	2-5C	0.3	Yes	0.02	0.1260	0.427	0.0432	0.142
Selenium	2-3E	13	No	0.2	0.7914	1.56	0.62	1.53
Zinc	2-9C	774	No	4.4	7.8479	14.2	7.62	5.17

Table 4-5: Screening of Fish Fillet Data for Larger Fish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk-Based Concen-tration [c]	FF-LMB-1-CI	FF-LMB-2-CI	FF-LMB-2 FD-CI	FF-CC-1-LHL1	FF-FHC-1-LHL2
Total inorganic Arsenic[d]	2-4C	0.005	0.0015	0.0015	0.0015	0.0015	0.0015
Boron (Boron and borates)	2-7C	516	0.02	0.02	0.02	0.05	0.079
Cadmium	2-6C	2.6	0.0007	0.0029	0.0031	0.002	0.0013
Iron	--	1806	1.36	1.64	1.54	5.94	2.94
Lead[e]	2-8C	0.375	0.0009	0.001	0.0017	0.0034	0.0003
Magnesium	--	NT	274	270	236	191	188
Mercury			0.0922	0.0863	0.0867	0.0364	0.0948
Methyl Mercury	2-5C	0.3	0.0862	0.108	0.116	0.0505	0.108
Selenium	2-3E	13	1.56	1.22	1.09	0.44	0.81
Zinc	2-9C	774	7.67	10.3	10.3	11.9	4.42

Table 4-5: Screening of Fish Fillet Data for Larger Fish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk-Based Concen-tration [c]	FF-LMB-1-LHL3	FF-LMB-2-LHL4	FF-CC-1-LHL2	FF-FHC-1-LHL3	FF-KB-1-LHL4
Total inorganic Arsenic[d]	2-4C	0.005	0.0015	0.0015	0.0015	0.0015	0.0015
Boron (Boron and borates)	2-7C	516	0.02	0.025	0.025	0.126	0.025
Cadmium	2-6C	2.6	0.0016	0.00035	0.0011	0.0023	0.001
Iron	--	1806	1.61	2.54	4.32	4.11	2.45
Lead[e]	2-8C	0.375	0.0012	0.00035	0.002	0.003	0.0009
Magnesium	--	NT	268	292	191	227	241
Mercury			0.0967	0.101	0.0392	0.176	0.0827
Methyl Mercury	2-5C	0.3	0.106	0.115	0.0564	0.198	0.0983
Selenium	2-3E	13	0.9	0.99	0.58	1.39	1.2
Zinc	2-9C	774	7.06	7.21	8.14	5.4	8.45

Table 4-5: Screening of Fish Fillet Data for Larger Fish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk-Based Concen-tration [c]	FF-LMB-1-LHL5	F-LMB-1 FD-LHL	FF-CC-1-LHL3	FF-CC-1 FD-LHL4	FF-KB-1-LHL5
Total inorganic Arsenic[d]	2-4C	0.005	0.0015	0.0015	0.0015	0.0015	0.0015
Boron (Boron and borates)	2-7C	516	0.02	0.02	0.02	0.02	0.025
Cadmium	2-6C	2.6	0.0016	0.001	0.0007	0.0008	0.00035
Iron	--	1806	2.16	2.23	5.77	5.02	2.67
Lead[e]	2-8C	0.375	0.0009	0.001	0.0035	0.0027	0.0016
Magnesium	--	NT	227	237	189	197	246
Mercury			0.0823	0.0704	0.0417	0.0437	0.0928
Methyl Mercury	2-5C	0.3	0.0979	0.0939	0.045	0.0574	0.122
Selenium	2-3E	13	0.95	0.95	0.55	0.53	1.31
Zinc	2-9C	774	6.78	6.89	8.59	8.08	9.74

Table 4-5: Screening of Fish Fillet Data for Larger Fish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk-Based Concen-tration [c]	FF-CC-2-LHL6	FF-KB-2-LHL7	FF-CC-1-LHL4	FF-FHC-1-LHL5	FF-KB-1-LHL6
Total inorganic Arsenic[d]	2-4C	0.005	0.0025	0.0015	0.0015	0.0015	0.0015
Boron (Boron and borates)	2-7C	516	0.08	0.025	0.02	0.13	0.025
Cadmium	2-6C	2.6	0.0018	0.00035	0.0032	0.0014	0.0043
Iron	--	1806	3.61	3.25	4.82	5.33	2.03
Lead[e]	2-8C	0.375	0.0013	0.0013	0.0011	0.002	0.0075
Magnesium	--	NT	176	248	180	210	241
Mercury			0.095	0.0872	0.162	0.221	0.142
Methyl Mercury	2-5C	0.3	0.0945	0.118	0.207	**0.379**	0.166
Selenium	2-3E	13	0.43	1.15	0.6	1	1.23
Zinc	2-9C	774	7.35	9.03	8.05	6.4	8.96

Table 4-5: Screening of Fish Fillet Data for Larger Fish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk-Based Concen-tration [c]	FF-LMB-1-LHL7	FF-CC-1-LHL5	FF-LMB-1-LHL6	FF-CC-2-LHL7	FF-LMB-2-LHL8
Total inorganic Arsenic[d]	2-4C	0.005	0.0015	0.002	0.0015	0.002	0.0015
Boron (Boron and borates)	2-7C	516	0.02	0.03	0.07	0.06	0.02
Cadmium	2-6C	2.6	0.0022	0.0011	0.0009	0.0004	0.0003
Iron	--	1806	1.75	3.34	2.36	3.12	2.35
Lead[e]	2-8C	0.375	0.002	0.0024	0.0017	0.0013	0.001
Magnesium	--	NT	250	211	253	246	273
Mercury			0.0536	0.119	0.053	0.0508	0.061
Methyl Mercury	2-5C	0.3	0.0646	0.169	0.0962	0.0437	0.105
Selenium	2-3E	13	1.06	0.46	0.98	0.46	0.78
Zinc	2-9C	774	8.28	8.61	7.46	8.83	6.56

Table 4-5: Screening of Fish Fillet Data for Larger Fish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk-Based Concen-tration [c]	FF-CC-1-LHL6	FF-KB-1-LHL7	FF-LMB-1-LHL8	FF-CC-2-LHL9	FF-FHC-1-MHL1
Total inorganic Arsenic[d]	2-4C	0.005	0.002	0.0015	0.0015	0.002	0.0015
Boron (Boron and borates)	2-7C	516	0.03	0.02	0.02	0.03	0.05
Cadmium	2-6C	2.6	0.00045	0.00035	0.0008	0.0004	0.0025
Iron	--	1806	3.73	2.04	1.78	5.14	3.54
Lead[e]	2-8C	0.375	0.0011	0.0008	0.001	0.0016	0.0016
Magnesium	--	NT	231	270	228	218	205
Mercury			0.146	0.135	0.155	0.0467	0.2
Methyl Mercury	2-5C	0.3	0.207	0.171	0.167	0.0585	0.269
Selenium	2-3E	13	0.44	0.88	1.25	0.32	0.42
Zinc	2-9C	774	7.42	6.93	6.49	7.69	4.99

Table 4-5: Screening of Fish Fillet Data for Larger Fish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk-Based Concen-tration [c]	FF-KB-1-MHL2	FF-LMB-1-MHL3	FF-FHC-2-MHL4	FF-CC-1-MHL3	FF-LMB-1-MHL4
Total inorganic Arsenic[d]	2-4C	0.005	0.0015	0.0015	0.0015	0.002	0.0015
Boron (Boron and borates)	2-7C	516	0.025	0.025	0.02	0.03	0.02
Cadmium	2-6C	2.6	0.00035	0.00035	0.0003	0.0004	0.0003
Iron	--	1806	2.9	1.97	2.17	3.84	1.69
Lead[e]	2-8C	0.375	0.003	0.0008	0.001	0.0018	0.0007
Magnesium	--	NT	207	219	181	202	281
Mercury			0.0714	0.103	0.329	0.15	0.182
Methyl Mercury	2-5C	0.3	0.102	0.141	**0.427**	0.19	0.165
Selenium	2-3E	13	0.37	0.41	0.4	0.2	0.33
Zinc	2-9C	774	6.67	7.11	5.94	7.85	7.33

Table 4-5: Screening of Fish Fillet Data for Larger Fish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk-Based Concen-tration [c]	FF-CC-2-MHL5	FF-LMB-2-MHL6	FF-BT-1-DR	FF-HS-1-DR	FF-LMB-1-DR
Total inorganic Arsenic[d]	2-4C	0.005	0.002	0.0015	0.0015	0.0015	0.0015
Boron (Boron and borates)	2-7C	516	0.025	0.025	0.02	0.11	0.02
Cadmium	2-6C	2.6	0.0004	0.00035	0.0026	0.0026	0.0022
Iron	--	1806	3.86	2.47	5.47	4.67	3.49
Lead[e]	2-8C	0.375	0.0013	0.00035	0.0016	0.0016	0.0009
Magnesium	--	NT	202	303	206	281	262
Mercury			0.049	0.0769	0.0174	0.0269	0.152
Methyl Mercury	2-5C	0.3	0.0767	0.084	0.0225	0.0273	0.186
Selenium	2-3E	13	0.24	0.31	0.43	1.06	0.93
Zinc	2-9C	774	7.05	7.8	14.2	9.63	9.2

Table 4-5: Screening of Fish Fillet Data for Larger Fish Compared with Risk-Based Concentrations for Human Health[a,b]
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical Name	Figure(s) Showing Concentrations in Comparison with Screening Levels	Risk-Based Concen-tration [c]	FF-SS-1-DR
Total inorganic Arsenic[d]	2-4C	0.005	0.0015
Boron (Boron and borates)	2-7C	516	0.13
Cadmium	2-6C	2.6	0.0032
Iron	--	1806	3.92
Lead[e]	2-8C	0.375	0.0022
Magnesium	--	NT	253
Mercury			0.0316
Methyl Mercury	2-5C	0.3	0.0386
Selenium	2-3E	13	1.27
Zinc	2-9C	774	7.91

Notes:

[a] All values presented in mg/kg ww.

[b] Non-detect results shown as 1/2 the method detection limit, presented in *grey italics font* . Individual exceedances of RBCs are bolded and shaded grey.

[c] Risk-based concentrations calculated based on 50 meals per year and assuming 8 ounce meals.

[d] Total inorganic arsenic is AsIII + AsV.

[e] HH screening level based on the USFDA Total Tolerable Daily Intake concentration of 6.0 µg/day is used in Ohio as the basis for a 1 meal / week fish consumption advisory with a concentration basis of 0.4 mg/kg ww.
http://epa.ohio.gov/portals/35/fishadvisory/FishAdvisoryProcedure.pdf

--	No toxicity value
BT	Brown trout
CC	Channel catfish
FF	Fish fillet
FHC	Flathead catfish
HS	Northern hogsucker
KB	Kentucky bass
LMB	Largemouth bass
mg/kg ww	Milligrams per kilogram, wet weight
ND	Not detected

Table 4-6: Sediment Human Health Screening Summary
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

									Human Health	
Area	Chemical Group	Chemical	Analyzed	Detected	Minimum Detected Concentration (mg/kg)	Mean Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Concentration	Residential Soil RSL (mg/kg)	Ratio of Max Detect to Residential Soil RSL
Curds Inlet	INORG	Arsenic	37	37	13	116	415	CI2.2A (0-0.5 ft)	1	**610.3**
Curds Inlet	INORG	Boron	31	31	2.95	16.1	72.3	CI1A (0-0.5 ft)	16000	0.0
Curds Inlet	INORG	Cadmium	31	31	0.292	1.94	10.1	CI1A (0-0.5 ft)	71	0.1
Curds Inlet	INORG	Iron	37	37	10300	35100	68500	CI3B (0-0.5 ft)	55000	**1.2**
Curds Inlet	INORG	Lead	37	37	2.2	22.2	38.3	CI1C (0-0.5 ft)	400	0.1
Curds Inlet	INORG	Magnesium	31	31	1720	4090	8860	CI4B (0-0.5 ft)		
Curds Inlet	INORG	Mercury	31	30	0.002	0.052	0.122	CI2.1A (0-0.5 ft)	7	0.0
Curds Inlet	INORG	Methylmercury	31	5	0.00009	0.000316	0.00058	CI2.1A (0-0.5 ft)	8	0.0
Curds Inlet	INORG	Selenium	37	37	0.66	5.82	24.1	CI3A (0-0.5 ft)	390	0.1
Curds Inlet	INORG	Zinc	31	31	18.8	93.7	245	CI1A (0-0.5 ft)	23000	0.0
Dix Dam (LHL2)	INORG	Arsenic	2	2	26.9	27.9	28.9	LHL2C (0-0.5 ft)	1	**42.5**
Dix Dam (LHL2)	INORG	Boron	2	2	6.86	7.38	7.89	LHL2B (0-0.5 ft)	16000	0.0
Dix Dam (LHL2)	INORG	Cadmium	2	2	0.465	0.556	0.646	LHL2C (0-0.5 ft)	71	0.0
Dix Dam (LHL2)	INORG	Iron	2	2	28300	31200	34100	LHL2C (0-0.5 ft)	55000	0.6
Dix Dam (LHL2)	INORG	Lead	2	2	9.7	12.9	16.1	LHL2C (0-0.5 ft)	400	0.0
Dix Dam (LHL2)	INORG	Magnesium	2	2	4940	6950	8950	LHL2C (0-0.5 ft)		
Dix Dam (LHL2)	INORG	Mercury	2	2	0.0294	0.0312	0.033	LHL2B (0-0.5 ft)	7	0.0
Dix Dam (LHL2)	INORG	Selenium	2	2	1.57	2.59	3.61	LHL2C (0-0.5 ft)	390	0.0
Dix Dam (LHL2)	INORG	Zinc	2	2	38.6	50.1	61.5	LHL2C (0-0.5 ft)	23000	0.0
Dix River	INORG	Arsenic	1	1	12	12	12	DR1 (0-0.5 ft)	1	**17.6**
Dix River	INORG	Boron	1	1	3.4	3.4	3.4	DR1 (0-0.5 ft)	16000	0.0002
Dix River	INORG	Cadmium	1	1	0.327	0.327	0.327	DR1 (0-0.5 ft)	71	0.005
Dix River	INORG	Iron	1	1	29600	29600	29600	DR1 (0-0.5 ft)	55000	0.5
Dix River	INORG	Lead	1	1	18	18	18	DR1 (0-0.5 ft)	400	0.05
Dix River	INORG	Magnesium	1	1	3770	3770	3770	DR1 (0-0.5 ft)		
Dix River	INORG	Mercury	1	1	0.029	0.029	0.029	DR1 (0-0.5 ft)	7	0.004
Dix River	INORG	Methylmercury	1	1	0.00005	0.00005	0.00005	DR1 (0-0.5 ft)	8	0.00001
Dix River	INORG	Selenium	1	1	0.5	0.5	0.5	DR1 (0-0.5 ft)	390	0.001
Dix River	INORG	Zinc	1	1	67.2	67.2	67.2	DR1 (0-0.5 ft)	23000	0.003
Hardin Inlet	INORG	Arsenic	4	4	9.1	19.1	34	HARDIN1B (0-0.5 ft)	1	**50.0**
Hardin Inlet	INORG	Iron	4	4	23000	29000	34000	HARDIN1B (0-0.5 ft)	55000	0.6
Hardin Inlet	INORG	Lead	4	4	20	29.5	37	HARDIN1B (0-0.5 ft)	400	0.1
Hardin Inlet	INORG	Selenium	4	4	0.61	1.33	2	HARDIN1B (0-0.5 ft)	390	0.01
HQ Inlet	INORG	Arsenic	3	3	19.1	34.1	50.2	HQ1B (0-0.5 ft)	1	**73.8**
HQ Inlet	INORG	Boron	3	3	8.63	26.1	48.4	HQ1A (0-0.5 ft)	16000	0.003
HQ Inlet	INORG	Cadmium	3	3	0.268	1.21	2.36	HQ1A (0-0.5 ft)	71	0.03
HQ Inlet	INORG	Iron	3	3	17400	22700	27600	HQ1C (0-0.5 ft)	55000	0.5
HQ Inlet	INORG	Lead	3	3	15	17.7	20	HQ1B (0-0.5 ft)	400	0.1

Table 4-6: Sediment Human Health Screening Summary
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky Report Mercer County, Kentucky

									Human Health	
Area	Chemical Group	Chemical	Analyzed	Detected	Minimum Detected Concentration (mg/kg)	Mean Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Concentration	Residential Soil RSL (mg/kg)	Ratio of Max Detect to Residential Soil RSL
HQ Inlet	INORG	Magnesium	3	3	3560	4200	4720	HQ1A (0-0.5 ft)		
HQ Inlet	INORG	Mercury	3	3	0.034	0.0423	0.059	HQ1A (0-0.5 ft)	7	0.01
HQ Inlet	INORG	Methylmercury	3	3	0.00041	0.000857	0.0017	HQ1A (0-0.5 ft)	8	0.0002
HQ Inlet	INORG	Selenium	3	3	0.9	7.83	15.5	HQ1A (0-0.5 ft)	390	0.04
HQ Inlet	INORG	Zinc	3	3	44.7	56.3	67.6	HQ1A (0-0.5 ft)	23000	0.003
LHL3	INORG	Arsenic	2	2	8.58	11.7	14.9	LHL3B (0-0.5 ft)	1	**21.9**
LHL3	INORG	Boron	2	2	11.1	14.8	18.5	LHL3C (0-0.5 ft)	16000	0.001
LHL3	INORG	Cadmium	2	2	0.436	0.453	0.47	LHL3C (0-0.5 ft)	71	0.01
LHL3	INORG	Iron	2	2	10400	12000	13600	LHL3B (0-0.5 ft)	55000	0.2
LHL3	INORG	Lead	2	2	8	11	14	LHL3B (0-0.5 ft)	400	0.04
LHL3	INORG	Magnesium	2	2	8180	10200	12200	LHL3B (0-0.5 ft)		
LHL3	INORG	Mercury	2	2	0.018	0.0185	0.019	LHL3B (0-0.5 ft)	7	0.003
LHL3	INORG	Methylmercury	2	2	0.00034	0.000525	0.00071	LHL3B (0-0.5 ft)	8	0.0001
LHL3	INORG	Selenium	2	2	1.7	2.75	3.8	LHL3C (0-0.5 ft)	390	0.01
LHL3	INORG	Zinc	2	2	24.6	47.4	70.2	LHL3B (0-0.5 ft)	23000	0.003
LHL4	INORG	Arsenic	2	2	6.44	11.7	16.9	LHL4B (0-0.5 ft)	1	**24.9**
LHL4	INORG	Boron	2	2	3.52	7.11	10.7	LHL4C (0-0.5 ft)	16000	0.001
LHL4	INORG	Cadmium	2	2	0.128	0.183	0.237	LHL4C (0-0.5 ft)	71	0.003
LHL4	INORG	Iron	2	2	10700	14800	18800	LHL4B (0-0.5 ft)	55000	0.3
LHL4	INORG	Lead	2	2	8	8.5	9	LHL4B (0-0.5 ft)	400	0.02
LHL4	INORG	Magnesium	2	2	5140	11700	18200	LHL4C (0-0.5 ft)		
LHL4	INORG	Mercury	2	2	0.006	0.011	0.016	LHL4C (0-0.5 ft)	7	0.002
LHL4	INORG	Methylmercury	2	1	0.00013	0.00013	0.00013	LHL4B (0-0.5 ft)	8	0.00002
LHL4	INORG	Selenium	2	2	0.5	1.35	2.2	LHL4C (0-0.5 ft)	390	0.01
LHL4	INORG	Zinc	2	2	24.3	31	37.7	LHL4C (0-0.5 ft)	23000	0.002
Reference (LHL5 and LHL6)	INORG	Arsenic	4	4	1.73	10.1	22.2	LHL5C (0-0.5 ft)	1	**32.6**
Reference (LHL5 and LHL6)	INORG	Boron	4	4	6.38	10.6	20.3	LHL6C (0-0.5 ft)	16000	0.001
Reference (LHL5 and LHL6)	INORG	Cadmium	4	4	0.057	0.273	0.394	LHL6C (0-0.5 ft)	71	0.01
Reference (LHL5 and LHL6)	INORG	Iron	4	4	4940	16300	26600	LHL5C (0-0.5 ft)	55000	0.5
Reference (LHL5 and LHL6)	INORG	Lead	4	3	9	16.6	28	LHL5C (0-0.5 ft)	400	0.1
Reference (LHL5 and LHL6)	INORG	Magnesium	4	4	5360	10700	23600	LHL6B (0-0.5 ft)		
Reference (LHL5 and LHL6)	INORG	Mercury	4	4	0.004	0.021	0.031	LHL6C (0-0.5 ft)	7	0.004
Reference (LHL5 and LHL6)	INORG	Methylmercury	4	4	0.00004	0.000513	0.00174	LHL6C (0-0.5 ft)	8	0.0002
Reference (LHL5 and LHL6)	INORG	Selenium	4	4	0.4	1.74	4.1	LHL6C (0-0.5 ft)	390	0.01
Reference (LHL5 and LHL6)	INORG	Zinc	4	4	10.9	41.8	63.9	LHL5C (0-0.5 ft)	23000	0.003
Rocky Run Embayment (LHL1)	INORG	Arsenic	2	2	9.3	10	10.7	LHL1C (0-0.5 ft)	1	**15.7**
Rocky Run Embayment (LHL1)	INORG	Boron	2	2	17.2	18.7	20.2	LHL1C (0-0.5 ft)	16000	0.001
Rocky Run Embayment (LHL1)	INORG	Cadmium	2	2	0.853	0.882	0.91	LHL1B (0-0.5 ft)	71	0.01
Rocky Run Embayment (LHL1)	INORG	Iron	2	2	17200	17300	17300	LHL1B (0-0.5 ft)	55000	0.3

Table 4-6: Sediment Human Health Screening Summary
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

									Human Health	
Area	Chemical Group	Chemical	Analyzed	Detected	Minimum Detected Concentration (mg/kg)	Mean Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Concentration	Residential Soil RSL (mg/kg)	Ratio of Max Detect to Residential Soil RSL
Rocky Run Embayment (LHL1)	INORG	Lead	2	2	13	15	17	LHL1C (0-0.5 ft)	400	0.04
Rocky Run Embayment (LHL1)	INORG	Magnesium	2	2	17600	17700	17800	LHL1C (0-0.5 ft)		
Rocky Run Embayment (LHL1)	INORG	Mercury	2	2	0.041	0.051	0.061	LHL1C (0-0.5 ft)	7	0.01
Rocky Run Embayment (LHL1)	INORG	Methylmercury	2	2	0.00046	0.00047	0.00048	LHL1C (0-0.5 ft)	8	0.0001
Rocky Run Embayment (LHL1)	INORG	Selenium	2	2	4.7	4.8	4.9	LHL1B (0-0.5 ft)	390	0.01
Rocky Run Embayment (LHL1)	INORG	Zinc	2	2	59.1	65.6	72	LHL1B (0-0.5 ft)	23000	0.003

Notes:
Only constituents detected in each area are shown.
Concentration/screening level ratios greater than 1 are shaded in bold.
Sediment concentrations are in dry weight.

LHL Lower Herrington Lake
mg/kg Milligrams per kilogram
RSL Regional Screening Level for residential soil identified by USEPA (2018b).

Table 4-7: Sediment Human Health Screening of Arsenic in All Sediment Samples Under Water 24 Feet or Less Depth
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	Location	Sample Name	Depth of Water above Sample (ft)	Chemical	Conc (mg/kg)	Units	Qual	Residential Soil RSL (mg/kg)	Ratio of Conc to Residential Soil RSL
Curds Inlet (Upper)	CI1A	SD-001(16)-CI1A-171011	16	Arsenic	391	mg/kg	J	0.68	**575**
Curds Inlet (Upper)	CI2B	SD-001(17)-CI2B-171011	17	Arsenic	115	mg/kg		0.68	**169**
Curds Inlet (Lower)	CI4B	SD-001(20)-CI4B-171012	20	Arsenic	40	mg/kg	J	0.68	**59**
Curds Inlet (Lower)	CI4B	SD001(17)-CI4B-180620	17	Arsenic	33.6	mg/kg		0.68	**49**
Curds Inlet (Lower)	CI4C	SD-001(19)-CI4C-171012	19	Arsenic	17.6	mg/kg		0.68	**26**
Curds Inlet (Lower)	CI4C	SD001(10)-CI4C-180620	10	Arsenic	22.5	mg/kg		0.68	**33**
Curds Inlet (Middle)	CI2.2A	SD001(19)-CI2.2A-180619	19	Arsenic	415	mg/kg		0.68	**610**
Curds Inlet (Middle)	CI2.2B	SD001(17)-CI2.2B-180619	17	Arsenic	324	mg/kg		0.68	**476**
Curds Inlet (Middle)	CI2.2C	DUP-003-180619	10	Arsenic	59.8	mg/kg		0.68	**88**
Curds Inlet (Middle)	CI2.2C	SD001(10)-CI2.2C-180619	10	Arsenic	58	mg/kg		0.68	**85**
Curds Inlet (Middle)	CI3.1B	SD001(17)-CI3.1B-180620	17	Arsenic	16.7	mg/kg		0.68	**25**
Curds Inlet (Middle)	CI3.1C	SD001(10)-CI3.1C-180620	10	Arsenic	49.9	mg/kg		0.68	**73**
Curds Inlet (Middle)	CI3.2B	SD001(17)-CI3.2B-180620	17	Arsenic	29.2	mg/kg		0.68	**43**
Curds Inlet (Middle)	CI3.2C	SD001(10)-CI3.2C-180620	10	Arsenic	36.8	mg/kg		0.68	**54**
Curds Inlet (Middle)	CI3A	DUP-004-180620	23	Arsenic	369	mg/kg		0.68	**543**
Curds Inlet (Middle)	CI3A	SD001(23)-CI3A-180620	23	Arsenic	371	mg/kg		0.68	**546**
Curds Inlet (Middle)	CI3B	SD-001(21)-CI3B-171011	21	Arsenic	93.6	mg/kg		0.68	**138**
Curds Inlet (Middle)	CI3B	SD001(20)-CI3B-180620	20	Arsenic	234	mg/kg		0.68	**344**
Curds Inlet (Middle)	CI3C	SD-001(12)-CI3C-171011	12	Arsenic	18.1	mg/kg		0.68	**27**
Curds Inlet (Middle)	CI3C	SD001(10)-CI3C-180620	10	Arsenic	24.4	mg/kg		0.68	**36**
Curds Inlet (Upper)	CI1B	DUP-006-171011	15	Arsenic	90.7	mg/kg	J	0.68	**133**
Curds Inlet (Upper)	CI1B	SD-001(15)-CI1B-171011	15	Arsenic	64.7	mg/kg	J	0.68	**95**
Curds Inlet (Upper)	CI1C	DUP-005-171011	12	Arsenic	70.5	mg/kg	J	0.68	**104**
Curds Inlet (Upper)	CI1C	SD-001(12)-CI1C-171011	12	Arsenic	35.6	mg/kg		0.68	**52**
Curds Inlet (Upper)	CI2.1A	SD001(18)-CI2.1A-180619	18	Arsenic	224	mg/kg		0.68	**329**
Curds Inlet (Upper)	CI2.1B	SD001(17)-CI2.1B-180619	17	Arsenic	125	mg/kg		0.68	**184**
Curds Inlet (Upper)	CI2.1C	SD001(10)-CI2.1C-180619	10	Arsenic	51.6	mg/kg		0.68	**76**
Curds Inlet (Upper)	CI2A	SD-001(20)-CI2A-171011	20	Arsenic	132	mg/kg		0.68	**194**
Curds Inlet (Upper)	CI2C	DUP-004-171011	13	Arsenic	27.6	mg/kg		0.68	**41**
Curds Inlet (Upper)	CI2C	SD-001(13)-CI2C-171011	13	Arsenic	32	mg/kg		0.68	**47**
Curds Inlet (Upper)	CURDS1A	Curds1A_20170201	a	Arsenic	350	mg/kg	F2	0.68	**515**
Curds Inlet (Upper)	CURDS1A	SD-001(12)-CURDS1A-171011	12	Arsenic	91.6	mg/kg		0.68	**135**
Curds Inlet (Upper)	CURDS1B	Curds1B_20170201	a	Arsenic	50	mg/kg		0.68	**74**
Curds Inlet (Upper)	CURDS1C	Curds1C_20170201	a	Arsenic	50	mg/kg		0.68	**74**
Curds Inlet (Upper)	CURDS2A	Curds2A_20170201	a	Arsenic	110	mg/kg		0.68	**162**
Curds Inlet (Upper)	CURDS2B	Curds2B_20170201	a	Arsenic	69	mg/kg		0.68	**101**
Curds Inlet (Upper)	CURDS2C	Curds2C_20170201	a	Arsenic	13	mg/kg		0.68	**19**
Dix Dam (LHL2)	LHL2B	SD-001(20)-LHL2B-171012	20	Arsenic	26.9	mg/kg	J	0.68	**40**
Dix Dam (LHL2)	LHL2C	SD-001(20)-LHL2C-171012	20	Arsenic	28.9	mg/kg	J	0.68	**43**
Dix River	DR1	SD-001(1)-DR1-171016	1	Arsenic	12	mg/kg		0.68	**18**
Hardin Inlet	HARDIN1A	Hardin1A_20170201	a	Arsenic	9.1	mg/kg		0.68	**13**
Hardin Inlet	HARDIN1B	Hardin1B_20170201_FD	a	Arsenic	24	mg/kg		0.68	**35**
Hardin Inlet	HARDIN1B	Hardin1B_20170201	a	Arsenic	34	mg/kg		0.68	**50**
Hardin Inlet	HARDIN1C	Hardin1C_20170201	a	Arsenic	9.4	mg/kg		0.68	**14**

Table 4-7: Sediment Human Health Screening of Arsenic in All Sediment Samples Under Water 24 Feet or Less Depth
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	Location	Sample Name	Depth of Water above Sample (ft)	Chemical	Conc (mg/kg)	Units	Qual	Residential Soil RSL (mg/kg)	Ratio of Conc to Residential Soil RSL
HQ Inlet	HQ1A	SD-001(20)-HQ1A-171011	20	Arsenic	32.9	mg/kg		0.68	**48**
HQ Inlet	HQ1B	SD-001(17)-HQ1B-171011	17	Arsenic	50.2	mg/kg		0.68	**74**
HQ Inlet	HQ1C	SD-001(13)-HQ1C-171011	13	Arsenic	19.1	mg/kg		0.68	**28**
LHL4	LHL4B	SD-001(22)-LHL4B-171012	22	Arsenic	16.9	mg/kg		0.68	**25**
LHL4	LHL4C	SD-001(19)-LHL4C-171012	19	Arsenic	6.44	mg/kg		0.68	**9**
Reference (LHL5 and LHL6)	LHL5B	SD-001(16)-LHL5B-171012	16	Arsenic	7.98	mg/kg		0.68	**12**
Reference (LHL5 and LHL6)	LHL5C	SD-001(21)-LHL5C-171012	21	Arsenic	22.2	mg/kg		0.68	**33**
Reference (LHL5 and LHL6)	LHL6B	SD-001(20)-LHL6B-171012	20	Arsenic	1.73	mg/kg		0.68	**3**
Reference (LHL5 and LHL6)	LHL6C	SD-001(20)-LHL6C-171012	20	Arsenic	8.44	mg/kg	J	0.68	**12**
LHL3	LHL3B	SD-001(17)-LHL3B-171012	17	Arsenic	14.9	mg/kg		0.68	**22**
LHL3	LHL3C	SD-001(24)-LHL3C-171012	24	Arsenic	8.58	mg/kg		0.68	**13**
Rocky Run Embayment (LHL1)	LHL1B	SD-001(20)-LHL1B-171012	20	Arsenic	9.3	mg/kg		0.68	**14**
Rocky Run Embayment (LHL1)	LHL1C	SD-001(20)-LHL1C-171012	20	Arsenic	10.7	mg/kg		0.68	**16**

Notes:

[a]a	Data collected by AMEC with no depth information given. Based on location sample is thought to be under 20 feet of water or less and so is included here and in risk calculations.
CI	Curds Inlet
Conc	Concentration
DR	Dix River
ft.	Feet
F2	MS/MSD RPD exceeds control limits
J	Indicates an estimated value
HQ	HQ Inlet
LHL	Lower Herrington Lake
mg/kg	Milligrams per kilogram
RSL	Regional Screening Level
Qual	Qualifier

Table 4-7: Sediment Human Health Screening of Arsenic in All Sediment Samples Under Water 24 Feet or Less Depth
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	Location	Sample Name	Depth of Water above Sample (ft)	Chemical	Conc (mg/kg)	Units	Qual	Residential Soil RSL (mg/kg)	Ratio of Conc to Residential Soil RSL
HQ Inlet	HQ1A	SD-001(20)-HQ1A-171011	20	Arsenic	32.9	mg/kg		0.68	**48**
HQ Inlet	HQ1B	SD-001(17)-HQ1B-171011	17	Arsenic	50.2	mg/kg		0.68	**74**
HQ Inlet	HQ1C	SD-001(13)-HQ1C-171011	13	Arsenic	19.1	mg/kg		0.68	**28**
LHL4	LHL4B	SD-001(22)-LHL4B-171012	22	Arsenic	16.9	mg/kg		0.68	**25**
LHL4	LHL4C	SD-001(19)-LHL4C-171012	19	Arsenic	6.44	mg/kg		0.68	**9**
Reference (LHL5 and LHL6)	LHL5B	SD-001(16)-LHL5B-171012	16	Arsenic	7.98	mg/kg		0.68	**12**
Reference (LHL5 and LHL6)	LHL5C	SD-001(21)-LHL5C-171012	21	Arsenic	22.2	mg/kg		0.68	**33**
Reference (LHL5 and LHL6)	LHL6B	SD-001(20)-LHL6B-171012	20	Arsenic	1.73	mg/kg		0.68	**3**
Reference (LHL5 and LHL6)	LHL6C	SD-001(20)-LHL6C-171012	20	Arsenic	8.44	mg/kg	J	0.68	**12**
LHL3	LHL3B	SD-001(17)-LHL3B-171012	17	Arsenic	14.9	mg/kg		0.68	**22**
LHL3	LHL3C	SD-001(24)-LHL3C-171012	24	Arsenic	8.58	mg/kg		0.68	**13**
Rocky Run Embayment (LHL1)	LHL1B	SD-001(20)-LHL1B-171012	20	Arsenic	9.3	mg/kg		0.68	**14**
Rocky Run Embayment (LHL1)	LHL1B	SD-001(20)-LHL1B-171012		Arsenic	9.3	mg/kg		0.68	**14**
Rocky Run Embayment (LHL1)	LHL1C	SD-001(20)-LHL1C-171012	20	Arsenic	10.7	mg/kg		0.68	**16**

Notes:

a	Data collected by AMEC with no depth information given. Based on location sample is thought to be under 20 ft. of water or less, therefore it is included in the human health screening and in the risk calculations.
CI	Curds Inlet
Conc	Concentration
ft.	Feet
J	Indicates an estimated value
HQ	HQ Inlet
LHL	Lower Herrington Lake
mg/kg	Milligrams per kilogram
RSL	Regional Screening Level
Qual	Qualifiers

Table 4-8: Surface Water Screening For Human Receptors
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

									Human Health Criteria and Regional Screening Levels (RSLs)					
Area	Chemical Group	Chemical	Measurement Basis	Analyzed	Detected	Minimum Detected Concentration (mg/L)	Maximum Detected Concentration (mg/L)	Location of Maximum Detected Concentration	Kentucky Drinking Water Standard (mg/L)	Ratio of Max Detect to Kentucky Drinking Water Standard	Kentucky Surface Water Standard - Fish Ingestion (mg/L)	Ratio of Max Detect to Kentucky Surface Water Standard - Fish Ingestion	RSL - Tapwater (mg/L)	Ratio of Max Detect to RSL - Tapwater
Curds Inlet	INORG	Arsenic	D	18	18	1.26E-03	3.98E-03	CI4 (6/16/2018)	1.0E-02	4.0E-01			5.2E-05	7.7E+01
Curds Inlet	INORG	Arsenic	T	18	18	1.29E-03	5.48E-03	CI2 (12/11/2017)	1.0E-02	5.5E-01			5.2E-05	1.1E+02
Curds Inlet	INORG	Boron	D	18	18	2.92E-01	2.56E+00	CI1 (12/11/2017)					4.0E+00	6.4E-01
Curds Inlet	INORG	Boron	T	18	18	3.00E-01	2.52E+00	CI1 (12/11/2017)					4.0E+00	6.3E-01
Curds Inlet	INORG	Cadmium	D	18	10	2.30E-05	2.11E-04	CI1 (12/11/2017)	5.0E-03	4.2E-02			9.2E-03	2.3E-02
Curds Inlet	INORG	Cadmium	T	18	14	2.80E-05	3.77E-04	CI2 (12/11/2017)	5.0E-03	7.5E-02			9.2E-03	4.1E-02
Curds Inlet	INORG	Iron	D	18	18	2.40E-03	8.63E-02	CI2 (10/14/2017)	3.0E-01	2.9E-01			1.4E+01	6.2E-03
Curds Inlet	INORG	Iron	T	18	18	3.72E-02	6.14E-01	CI2 (12/11/2017)	3.0E-01	2.0E+00			1.4E+01	4.4E-02
Curds Inlet	INORG	Lead	D	10	5	1.00E-05	1.11E-04	CI2.2 (6/16/2018)					1.5E-02	7.4E-03
Curds Inlet	INORG	Lead	T	10	7	8.10E-05	6.31E-04	CI2 (12/11/2017)					1.5E-02	4.2E-02
Curds Inlet	INORG	Magnesium	D	18	18	8.64E+00	2.74E+01	CI1 (12/11/2017)						
Curds Inlet	INORG	Magnesium	T	18	18	8.04E+00	2.74E+01	CI1 (12/11/2017)						
Curds Inlet	INORG	Mercury	D	18	11	6.80E-07	1.71E-03	CI1 (10/14/2017)	2.0E-03	8.6E-01	5.1E-05	3.4E+01	5.7E-04	3.0E+00
Curds Inlet	INORG	Mercury	T	18	13	9.90E-07	7.78E-03	CI1 (10/14/2017)	2.0E-03	3.9E+00	5.1E-05	1.5E+02	5.7E-04	1.4E+01
Curds Inlet	INORG	Methylmercury	D	18	11	3.00E-08	5.90E-07	CI1 (10/14/2017)			3.0E-04	2.0E-03	2.0E-03	3.0E-04
Curds Inlet	INORG	Methylmercury	T	18	13	3.00E-08	8.60E-07	CI1 (10/14/2017)			3.0E-04	2.9E-03	2.0E-03	4.3E-04
Curds Inlet	INORG	Selenium	D	18	18	8.00E-04	5.50E-03	CI2.2 (6/16/2018)	1.7E-01	3.2E-02	4.2E+00	1.3E-03	1.0E-01	5.5E-02
Curds Inlet	INORG	Selenium	T	18	18	8.00E-04	5.40E-03	CI2.2 (6/16/2018)	1.7E-01	3.2E-02	4.2E+00	1.3E-03	1.0E-01	5.4E-02
Curds Inlet	INORG	Zinc	D	18	8	4.00E-04	3.40E-03	CI1 (12/11/2017)	7.4E+00	4.6E-04	2.6E+01	1.3E-04	6.0E+00	5.7E-04
Curds Inlet	INORG	Zinc	T	18	14	1.40E-03	9.80E-03	CI1 (10/14/2017)	7.4E+00	1.3E-03	2.6E+01	3.8E-04	6.0E+00	1.6E-03
Dix Dam (LHL2)	INORG	Arsenic	D	4	4	1.03E-03	1.46E-03	LHL2 (10/6/2017)	1.0E-02	1.5E-01			5.2E-05	2.8E+01
Dix Dam (LHL2)	INORG	Arsenic	T	4	4	1.08E-03	1.51E-03	LHL2 (10/6/2017)	1.0E-02	1.5E-01			5.2E-05	2.9E+01
Dix Dam (LHL2)	INORG	Boron	D	4	4	2.00E-01	4.14E-01	LHL2 (10/6/2017)					4.0E+00	1.0E-01
Dix Dam (LHL2)	INORG	Boron	T	4	4	2.07E-01	4.19E-01	LHL2 (10/6/2017)					4.0E+00	1.0E-01
Dix Dam (LHL2)	INORG	Cadmium	D	4	1	1.10E-05	1.10E-05	LHL2 (12/11/2017)	5.0E-03	2.2E-03			9.2E-03	1.2E-03
Dix Dam (LHL2)	INORG	Cadmium	T	4	1	2.40E-05	2.40E-05	LHL2 (12/11/2017)	5.0E-03	4.8E-03			9.2E-03	2.6E-03
Dix Dam (LHL2)	INORG	Iron	D	4	4	2.10E-03	1.28E-01	LHL2 (10/6/2017)	3.0E-01	4.3E-01			1.4E+01	9.1E-03
Dix Dam (LHL2)	INORG	Iron	T	4	4	9.10E-03	1.47E-01	LHL2 (10/6/2017)	3.0E-01	4.9E-01			1.4E+01	1.1E-02
Dix Dam (LHL2)	INORG	Magnesium	D	4	4	9.28E+00	1.08E+01	LHL2 (12/11/2017)						
Dix Dam (LHL2)	INORG	Magnesium	T	4	4	9.27E+00	1.10E+01	LHL2 (12/11/2017)						
Dix Dam (LHL2)	INORG	Mercury	D	4	1	7.70E-07	7.70E-07	LHL2 (10/6/2017)	2.0E-03	3.9E-04	5.1E-05	1.5E-02	5.7E-04	1.4E-03
Dix Dam (LHL2)	INORG	Methylmercury	D	4	2	4.00E-08	4.50E-07	LHL2 (10/6/2017)			3.0E-04	1.5E-03	2.0E-03	2.3E-04
Dix Dam (LHL2)	INORG	Methylmercury	T	4	2	6.00E-08	1.80E-07	LHL2 (10/6/2017)			3.0E-04	6.0E-04	2.0E-03	9.0E-05
Dix Dam (LHL2)	INORG	Selenium	D	4	3	3.00E-04	8.00E-04	LHL2 (10/6/2017)	1.7E-01	4.7E-03	4.2E+00	1.9E-04	1.0E-01	8.0E-03
Dix Dam (LHL2)	INORG	Selenium	T	4	4	3.00E-04	8.00E-04	LHL2 (10/6/2017)	1.7E-01	4.7E-03	4.2E+00	1.9E-04	1.0E-01	8.0E-03
Dix Dam (LHL2)	INORG	Zinc	D	4	3	5.00E-04	1.60E-03	LHL2 (10/6/2017)	7.4E+00	2.2E-04	2.6E+01	6.2E-05	6.0E+00	2.7E-04
Dix Dam (LHL2)	INORG	Zinc	T	4	3	6.00E-04	8.00E-04	LHL2 (10/6/2017)	7.4E+00	1.1E-04	2.6E+01	3.1E-05	6.0E+00	1.3E-04
Dix River	INORG	Arsenic	D	1	1	1.38E-03	1.38E-03	DR1 (10/7/2017)	1.0E-02	1.4E-01			5.2E-05	2.7E+01
Dix River	INORG	Arsenic	T	1	1	1.54E-03	1.54E-03	DR1 (10/7/2017)	1.0E-02	1.5E-01			5.2E-05	3.0E+01
Dix River	INORG	Boron	D	1	1	2.64E-01	2.64E-01	DR1 (10/7/2017)					4.0E+00	6.6E-02
Dix River	INORG	Boron	T	1	1	2.46E-01	2.46E-01	DR1 (10/7/2017)					4.0E+00	6.2E-02
Dix River	INORG	Cadmium	D	1	1	1.49E-04	1.49E-04	DR1 (10/7/2017)	5.0E-03	3.0E-02			9.2E-03	1.6E-02
Dix River	INORG	Cadmium	T	1	1	1.22E-04	1.22E-04	DR1 (10/7/2017)	5.0E-03	2.4E-02			9.2E-03	1.3E-02
Dix River	INORG	Iron	D	1	1	6.60E-03	6.60E-03	DR1 (10/7/2017)	3.0E-01	2.2E-02			1.4E+01	4.7E-04

Table 4-8: Surface Water Screening For Human Receptors
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

									Human Health Criteria and Regional Screening Levels (RSLs)					
Area	Chemical Group	Chemical	Measurement Basis	Analyzed	Detected	Minimum Detected Concentration (mg/L)	Maximum Detected Concentration (mg/L)	Location of Maximum Detected Concentration	Kentucky Drinking Water Standard (mg/L)	Ratio of Max Detect to Kentucky Drinking Water Standard	Kentucky Surface Water Standard - Fish Ingestion (mg/L)	Ratio of Max Detect to Kentucky Surface Water Standard - Fish Ingestion	RSL - Tapwater (mg/L)	Ratio of Max Detect to RSL - Tapwater
Dix River	INORG	Iron	T	1	1	7.29E-02	7.29E-02	DR1 (10/7/2017)	3.0E-01	2.4E-01			1.4E+01	5.2E-03
Dix River	INORG	Magnesium	D	1	1	9.44E+00	9.44E+00	DR1 (10/7/2017)						
Dix River	INORG	Magnesium	T	1	1	9.55E+00	9.55E+00	DR1 (10/7/2017)						
Dix River	INORG	Methylmercury	T	1	1	5.00E-08	5.00E-08	DR1 (10/7/2017)			3.0E-04	1.7E-04	2.0E-03	2.5E-05
Dix River	INORG	Selenium	D	1	1	5.00E-04	5.00E-04	DR1 (10/7/2017)	1.7E-01	2.9E-03	4.2E+00	1.2E-04	1.0E-01	5.0E-03
Dix River	INORG	Selenium	T	1	1	5.00E-04	5.00E-04	DR1 (10/7/2017)	1.7E-01	2.9E-03	4.2E+00	1.2E-04	1.0E-01	5.0E-03
Dix River	INORG	Zinc	D	1	1	8.00E-04	8.00E-04	DR1 (10/7/2017)	7.4E+00	1.1E-04	2.6E+01	3.1E-05	6.0E+00	1.3E-04
Dix River	INORG	Zinc	T	1	1	1.50E-03	1.50E-03	DR1 (10/7/2017)	7.4E+00	2.0E-04	2.6E+01	5.8E-05	6.0E+00	2.5E-04
Hardin Inlet	INORG	Arsenic	D	2	2	1.07E-03	1.17E-03	HI1 (12/11/2017)	1.0E-02	1.2E-01			5.2E-05	2.3E+01
Hardin Inlet	INORG	Arsenic	T	2	2	1.03E-03	1.20E-03	HI1 (12/11/2017)	1.0E-02	1.2E-01			5.2E-05	2.3E+01
Hardin Inlet	INORG	Boron	D	2	2	1.90E-01	3.74E-01	HI1 (10/5/2017)					4.0E+00	9.4E-02
Hardin Inlet	INORG	Boron	T	2	2	1.79E-01	3.97E-01	HI1 (10/5/2017)					4.0E+00	9.9E-02
Hardin Inlet	INORG	Cadmium	D	2	1	1.00E-05	1.00E-05	HI1 (12/11/2017)	5.0E-03	2.0E-03			9.2E-03	1.1E-03
Hardin Inlet	INORG	Cadmium	T	2	1	1.60E-05	1.60E-05	HI1 (12/11/2017)	5.0E-03	3.2E-03			9.2E-03	1.7E-03
Hardin Inlet	INORG	Iron	D	2	2	2.50E-03	2.80E-03	HI1 (12/11/2017)	3.0E-01	9.3E-03			1.4E+01	2.0E-04
Hardin Inlet	INORG	Iron	T	2	2	3.51E-02	5.12E-02	HI1 (12/11/2017)	3.0E-01	1.7E-01			1.4E+01	3.7E-03
Hardin Inlet	INORG	Magnesium	D	2	2	1.00E+01	1.05E+01	HI1 (12/11/2017)						
Hardin Inlet	INORG	Magnesium	T	2	2	1.03E+01	1.07E+01	HI1 (12/11/2017)						
Hardin Inlet	INORG	Methylmercury	D	2	1	3.00E-08	3.00E-08	HI1 (12/11/2017)			3.0E-04	1.0E-04	2.0E-03	1.5E-05
Hardin Inlet	INORG	Methylmercury	T	2	2	3.00E-08	4.00E-08	HI1 (10/5/2017)			3.0E-04	1.3E-04	2.0E-03	2.0E-05
Hardin Inlet	INORG	Selenium	D	2	2	5.00E-04	8.00E-04	HI1 (10/5/2017)	1.7E-01	4.7E-03	4.2E+00	1.9E-04	1.0E-01	8.0E-03
Hardin Inlet	INORG	Selenium	T	2	2	5.00E-04	7.00E-04	HI1 (10/5/2017)	1.7E-01	4.1E-03	4.2E+00	1.7E-04	1.0E-01	7.0E-03
Hardin Inlet	INORG	Zinc	D	2	2	1.00E-03	7.10E-03	HI1 (12/11/2017)	7.4E+00	9.6E-04	2.6E+01	2.7E-04	6.0E+00	1.2E-03
Hardin Inlet	INORG	Zinc	T	2	1	2.30E-03	2.30E-03	HI1 (10/5/2017)	7.4E+00	3.1E-04	2.6E+01	8.8E-05	6.0E+00	3.8E-04
HQ Inlet	INORG	Arsenic	D	4	4	1.00E-03	1.37E-03	HQ1 (12/11/2017)	1.0E-02	1.4E-01			5.2E-05	2.6E+01
HQ Inlet	INORG	Arsenic	T	4	4	1.12E-03	2.26E-03	HQ (6/15/2018)	1.0E-02	2.3E-01			5.2E-05	4.3E+01
HQ Inlet	INORG	Boron	D	4	4	2.23E-01	4.07E-01	HQ (6/15/2018)					4.0E+00	1.0E-01
HQ Inlet	INORG	Boron	T	4	4	2.30E-01	4.17E-01	HQ (6/15/2018)					4.0E+00	1.0E-01
HQ Inlet	INORG	Cadmium	D	4	4	8.00E-06	2.30E-05	HQ (6/15/2018)	5.0E-03	4.6E-03			9.2E-03	2.5E-03
HQ Inlet	INORG	Cadmium	T	4	3	1.70E-05	7.90E-05	HQ (6/15/2018)	5.0E-03	1.6E-02			9.2E-03	8.6E-03
HQ Inlet	INORG	Iron	D	4	2	1.20E-03	2.21E-02	HQ (6/15/2018)	3.0E-01	7.4E-02			1.4E+01	1.6E-03
HQ Inlet	INORG	Iron	T	4	4	1.89E-02	4.66E-01	HQ (6/15/2018)	3.0E-01	1.6E+00			1.4E+01	3.3E-02
HQ Inlet	INORG	Lead	D	3	2	1.10E-05	8.90E-05	HQ (6/15/2018)					1.5E-02	5.9E-03
HQ Inlet	INORG	Lead	T	3	2	3.60E-05	5.55E-04	HQ (6/15/2018)					1.5E-02	3.7E-02
HQ Inlet	INORG	Magnesium	D	4	4	7.07E+00	1.10E+01	HQ1 (12/11/2017)						
HQ Inlet	INORG	Magnesium	T	4	4	7.98E+00	1.11E+01	HQ1 (12/11/2017)						
HQ Inlet	INORG	Mercury	D	4	1	6.80E-07	6.80E-07	HQ1 (12/11/2017)	2.0E-03	3.4E-04	5.1E-05	1.3E-02	5.7E-04	1.2E-03
HQ Inlet	INORG	Mercury	T	4	2	5.80E-07	2.20E-06	HQ (6/15/2018)	2.0E-03	1.1E-03	5.1E-05	4.3E-02	5.7E-04	3.9E-03
HQ Inlet	INORG	Methylmercury	D	4	2	3.00E-08	4.00E-08	HQ1 (12/11/2017)			3.0E-04	1.3E-04	2.0E-03	2.0E-05
HQ Inlet	INORG	Methylmercury	T	4	3	4.00E-08	5.00E-08	HQ (6/15/2018)			3.0E-04	1.7E-04	2.0E-03	2.5E-05
HQ Inlet	INORG	Selenium	D	4	4	6.00E-04	1.30E-03	HQ (6/15/2018)	1.7E-01	7.6E-03	4.2E+00	3.1E-04	1.0E-01	1.3E-02
HQ Inlet	INORG	Selenium	T	4	4	6.00E-04	1.40E-03	HQ (6/15/2018)	1.7E-01	8.2E-03	4.2E+00	3.3E-04	1.0E-01	1.4E-02
HQ Inlet	INORG	Zinc	D	4	1	6.00E-04	6.00E-04	HQ1 (10/4/2017)	7.4E+00	8.1E-05	2.6E+01	2.3E-05	6.0E+00	1.0E-04
HQ Inlet	INORG	Zinc	T	4	3	5.00E-04	2.30E-03	HQ (6/15/2018)	7.4E+00	3.1E-04	2.6E+01	8.8E-05	6.0E+00	3.8E-04

Table 4-8: Surface Water Screening For Human Receptors
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

									Human Health Criteria and Regional Screening Levels (RSLs)					
Area	Chemical Group	Chemical	Measurement Basis	Analyzed	Detected	Minimum Detected Concentration (mg/L)	Maximum Detected Concentration (mg/L)	Location of Maximum Detected Concentration	Kentucky Drinking Water Standard (mg/L)	Ratio of Max Detect to Kentucky Drinking Water Standard	Kentucky Surface Water Standard - Fish Ingestion (mg/L)	Ratio of Max Detect to Kentucky Surface Water Standard - Fish Ingestion	RSL - Tapwater (mg/L)	Ratio of Max Detect to RSL - Tapwater
LHL3	INORG	Arsenic	D	6	6	5.30E-04	1.63E-03	LHL3 (10/6/2017)	1.0E-02	1.6E-01			5.2E-05	3.1E+01
LHL3	INORG	Arsenic	T	6	6	4.60E-04	1.73E-03	LHL3 (10/6/2017)	1.0E-02	1.7E-01			5.2E-05	3.3E+01
LHL3	INORG	Boron	D	6	6	6.50E-02	6.13E-01	LHL3 (6/15/2018)					4.0E+00	1.5E-01
LHL3	INORG	Boron	T	6	6	6.53E-02	6.24E-01	LHL3 (6/15/2018)					4.0E+00	1.6E-01
LHL3	INORG	Cadmium	D	6	3	1.10E-05	1.40E-05	LHL3 (6/15/2018)	5.0E-03	2.8E-03			9.2E-03	1.5E-03
LHL3	INORG	Cadmium	T	6	3	1.50E-05	7.50E-05	LHL3 (6/15/2018)	5.0E-03	1.5E-02			9.2E-03	8.2E-03
LHL3	INORG	Iron	D	6	5	2.90E-03	1.61E-01	LHL3 (10/6/2017)	3.0E-01	5.4E-01			1.4E+01	1.2E-02
LHL3	INORG	Iron	T	6	6	1.39E-02	1.95E-01	LHL3 (10/6/2017)	3.0E-01	6.5E-01			1.4E+01	1.4E-02
LHL3	INORG	Lead	D	3	2	1.30E-05	1.90E-05	LHL3 (6/15/2018)					1.5E-02	1.3E-03
LHL3	INORG	Lead	T	3	1	1.85E-04	1.85E-04	LHL3 (6/15/2018)					1.5E-02	1.2E-02
LHL3	INORG	Magnesium	D	6	6	7.26E+00	1.06E+01	LHL3 (10/6/2017)						
LHL3	INORG	Magnesium	T	6	6	6.73E+00	1.08E+01	LHL3 (10/6/2017)						
LHL3	INORG	Mercury	D	6	2	5.60E-07	6.40E-07	LHL3 (12/12/2017)	2.0E-03	3.2E-04	5.1E-05	1.3E-02	5.7E-04	1.1E-03
LHL3	INORG	Mercury	T	6	1	7.80E-07	7.80E-07	LHL3 (6/15/2018)	2.0E-03	3.9E-04	5.1E-05	1.5E-02	5.7E-04	1.4E-03
LHL3	INORG	Methylmercury	D	6	4	3.00E-08	9.00E-08	LHL3 (10/6/2017)			3.0E-04	3.0E-04	2.0E-03	4.5E-05
LHL3	INORG	Methylmercury	T	6	4	4.00E-08	1.20E-07	LHL3 (10/6/2017)			3.0E-04	4.0E-04	2.0E-03	6.0E-05
LHL3	INORG	Selenium	D	6	6	2.00E-04	1.90E-03	LHL3 (6/15/2018)	1.7E-01	1.1E-02	4.2E+00	4.5E-04	1.0E-01	1.9E-02
LHL3	INORG	Selenium	T	6	6	3.00E-04	2.00E-03	LHL3 (6/15/2018)	1.7E-01	1.2E-02	4.2E+00	4.8E-04	1.0E-01	2.0E-02
LHL3	INORG	Zinc	D	6	4	5.00E-04	8.00E-04	LHL3 (10/6/2017)	7.4E+00	1.1E-04	2.6E+01	3.1E-05	6.0E+00	1.3E-04
LHL3	INORG	Zinc	T	6	5	8.00E-04	2.50E-03	LHL3 (12/12/2017)	7.4E+00	3.4E-04	2.6E+01	9.6E-05	6.0E+00	4.2E-04
LHL4	INORG	Arsenic	D	4	4	9.10E-04	1.19E-03	LHL4 (12/12/2017)	1.0E-02	1.2E-01			5.2E-05	2.3E+01
LHL4	INORG	Arsenic	T	4	4	9.40E-04	1.27E-03	LHL4 (10/7/2017)	1.0E-02	1.3E-01			5.2E-05	2.4E+01
LHL4	INORG	Boron	D	4	4	7.20E-02	3.56E-01	LHL4 (10/7/2017)					4.0E+00	8.9E-02
LHL4	INORG	Boron	T	4	4	6.80E-02	3.17E-01	LHL4 (10/7/2017)					4.0E+00	7.9E-02
LHL4	INORG	Cadmium	D	4	1	1.10E-05	1.10E-05	LHL4 (12/12/2017)	5.0E-03	2.2E-03			9.2E-03	1.2E-03
LHL4	INORG	Cadmium	T	4	1	2.20E-05	2.20E-05	LHL4 (12/12/2017)	5.0E-03	4.4E-03			9.2E-03	2.4E-03
LHL4	INORG	Iron	D	4	4	2.20E-03	1.46E-01	LHL4 (10/7/2017)	3.0E-01	4.9E-01			1.4E+01	1.0E-02
LHL4	INORG	Iron	T	4	4	1.90E-02	1.46E-01	LHL4 (10/7/2017)	3.0E-01	4.9E-01			1.4E+01	1.0E-02
LHL4	INORG	Magnesium	D	4	4	8.48E+00	1.04E+01	LHL4 (12/12/2017)						
LHL4	INORG	Magnesium	T	4	4	8.76E+00	1.04E+01	LHL4 (12/12/2017)						
LHL4	INORG	Mercury	D	4	3	8.30E-07	2.83E-06	LHL4 (10/7/2017)	2.0E-03	1.4E-03	5.1E-05	5.5E-02	5.7E-04	5.0E-03
LHL4	INORG	Mercury	T	4	1	3.00E-05	3.00E-05	LHL4 (10/7/2017)	2.0E-03	1.5E-02	5.1E-05	5.9E-01	5.7E-04	5.3E-02
LHL4	INORG	Methylmercury	D	4	4	3.00E-08	6.00E-08	LHL4 (10/7/2017)			3.0E-04	2.0E-04	2.0E-03	3.0E-05
LHL4	INORG	Methylmercury	T	4	4	5.00E-08	2.20E-07	LHL4 (10/7/2017)			3.0E-04	7.3E-04	2.0E-03	1.1E-04
LHL4	INORG	Selenium	D	4	3	2.00E-04	7.00E-04	LHL4 (10/7/2017)	1.7E-01	4.1E-03	4.2E+00	1.7E-04	1.0E-01	7.0E-03
LHL4	INORG	Selenium	T	4	3	3.00E-04	7.00E-04	LHL4 (10/7/2017)	1.7E-01	4.1E-03	4.2E+00	1.7E-04	1.0E-01	7.0E-03
LHL4	INORG	Zinc	D	4	4	1.00E-03	2.00E-03	LHL4 (12/12/2017)	7.4E+00	2.7E-04	2.6E+01	7.7E-05	6.0E+00	3.3E-04
LHL4	INORG	Zinc	T	4	3	8.00E-04	8.00E-04	LHL4 (10/7/2017)	7.4E+00	1.1E-04	2.6E+01	3.1E-05	6.0E+00	1.3E-04
Reference (LHL5 and LHL6)	INORG	Arsenic	D	12	12	4.60E-04	1.19E-03	LHL5 (10/7/2017)	1.0E-02	1.2E-01			5.2E-05	2.3E+01
Reference (LHL5 and LHL6)	INORG	Arsenic	T	12	12	4.80E-04	1.32E-03	LHL6 (10/7/2017)	1.0E-02	1.3E-01			5.2E-05	2.5E+01
Reference (LHL5 and LHL6)	INORG	Boron	D	12	12	1.65E-02	3.53E-01	LHL5 (10/7/2017)					4.0E+00	8.8E-02
Reference (LHL5 and LHL6)	INORG	Boron	T	12	12	1.54E-02	3.28E-01	LHL5 (10/7/2017)					4.0E+00	8.2E-02
Reference (LHL5 and LHL6)	INORG	Cadmium	D	12	6	5.00E-06	1.00E-05	LHL6 (6/17/2018)	5.0E-03	2.0E-03			9.2E-03	1.1E-03
Reference (LHL5 and LHL6)	INORG	Cadmium	T	12	6	7.00E-06	2.70E-05	LHL6 (6/17/2018)	5.0E-03	5.4E-03			9.2E-03	2.9E-03

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E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

									Human Health Criteria and Regional Screening Levels (RSLs)					
Area	Chemical Group	Chemical	Measurement Basis	Analyzed	Detected	Minimum Detected Concentration (mg/L)	Maximum Detected Concentration (mg/L)	Location of Maximum Detected Concentration	Kentucky Drinking Water Standard (mg/L)	Ratio of Max Detect to Kentucky Drinking Water Standard	Kentucky Surface Water Standard - Fish Ingestion (mg/L)	Ratio of Max Detect to Kentucky Surface Water Standard - Fish Ingestion	RSL - Tapwater (mg/L)	Ratio of Max Detect to RSL - Tapwater
Reference (LHL5 and LHL6)	INORG	Iron	D	12	12	1.90E-03	1.46E-01	LHL6 (10/7/2017)	3.0E-01	4.9E-01			1.4E+01	1.0E-02
Reference (LHL5 and LHL6)	INORG	Iron	T	12	12	7.30E-03	2.11E-01	LHL6 (10/7/2017)	3.0E-01	7.0E-01			1.4E+01	1.5E-02
Reference (LHL5 and LHL6)	INORG	Lead	D	6	4	1.00E-05	2.10E-05	LHL6 (6/17/2018)					1.5E-02	1.4E-03
Reference (LHL5 and LHL6)	INORG	Lead	T	6	4	4.60E-05	7.20E-05	LHL6 (6/17/2018)					1.5E-02	4.8E-03
Reference (LHL5 and LHL6)	INORG	Magnesium	D	12	12	5.99E+00	1.04E+01	LHL5 (12/12/2017)						
Reference (LHL5 and LHL6)	INORG	Magnesium	T	12	12	6.61E+00	1.05E+01	LHL5 (12/12/2017)						
Reference (LHL5 and LHL6)	INORG	Mercury	D	12	6	8.40E-07	4.49E-06	LHL5 (10/7/2017)	2.0E-03	2.2E-03	5.1E-05	8.8E-02	5.7E-04	7.9E-03
Reference (LHL5 and LHL6)	INORG	Mercury	T	12	5	8.30E-07	1.40E-04	LHL6 (10/7/2017)	2.0E-03	7.0E-02	5.1E-05	2.7E+00	5.7E-04	2.5E-01
Reference (LHL5 and LHL6)	INORG	Methylmercury	D	12	8	4.00E-08	1.30E-07	LHL6 (10/7/2017)			3.0E-04	4.3E-04	2.0E-03	6.5E-05
Reference (LHL5 and LHL6)	INORG	Methylmercury	T	12	8	4.00E-08	1.90E-07	LHL5 (10/7/2017)			3.0E-04	6.3E-04	2.0E-03	9.5E-05
Reference (LHL5 and LHL6)	INORG	Selenium	D	12	7	2.00E-04	6.00E-04	LHL5 (10/7/2017)	1.7E-01	3.5E-03	4.2E+00	1.4E-04	1.0E-01	6.0E-03
Reference (LHL5 and LHL6)	INORG	Selenium	T	12	7	2.00E-04	7.00E-04	LHL5 (10/7/2017)	1.7E-01	4.1E-03	4.2E+00	1.7E-04	1.0E-01	7.0E-03
Reference (LHL5 and LHL6)	INORG	Zinc	D	12	10	6.00E-04	5.40E-03	LHL5 (12/12/2017)	7.4E+00	7.3E-04	2.6E+01	2.1E-04	6.0E+00	9.0E-04
Reference (LHL5 and LHL6)	INORG	Zinc	T	12	10	6.00E-04	3.10E-03	LHL5 (10/7/2017)	7.4E+00	4.2E-04	2.6E+01	1.2E-04	6.0E+00	5.2E-04
Rocky Run Embayment (LHL1)	INORG	Arsenic	D	5	5	8.90E-04	1.83E-03	LHL1 (10/6/2017)	1.0E-02	1.8E-01			5.2E-05	3.5E+01
Rocky Run Embayment (LHL1)	INORG	Arsenic	T	5	5	9.30E-04	1.81E-03	LHL1 (10/6/2017)	1.0E-02	1.8E-01			5.2E-05	3.5E+01
Rocky Run Embayment (LHL1)	INORG	Boron	D	5	5	1.71E-01	4.03E-01	LHL1 (10/6/2017)					4.0E+00	1.0E-01
Rocky Run Embayment (LHL1)	INORG	Boron	T	5	5	1.60E-01	4.15E-01	LHL1 (10/6/2017)					4.0E+00	1.0E-01
Rocky Run Embayment (LHL1)	INORG	Cadmium	D	5	3	8.00E-06	1.80E-05	LHL1 (6/15/2018)	5.0E-03	3.6E-03			9.2E-03	2.0E-03
Rocky Run Embayment (LHL1)	INORG	Cadmium	T	5	3	1.50E-05	3.20E-05	LHL1 (6/15/2018)	5.0E-03	6.4E-03			9.2E-03	3.5E-03
Rocky Run Embayment (LHL1)	INORG	Iron	D	5	5	1.40E-03	1.57E-01	LHL1 (10/6/2017)	3.0E-01	5.2E-01			1.4E+01	1.1E-02
Rocky Run Embayment (LHL1)	INORG	Iron	T	5	5	9.80E-03	2.26E-01	LHL1 (10/6/2017)	3.0E-01	7.5E-01			1.4E+01	1.6E-02
Rocky Run Embayment (LHL1)	INORG	Lead	D	3	2	1.00E-05	4.50E-05	LHL1 (6/15/2018)					1.5E-02	3.0E-03
Rocky Run Embayment (LHL1)	INORG	Lead	T	3	2	1.40E-04	1.50E-04	LHL1 (6/15/2018)					1.5E-02	1.0E-02
Rocky Run Embayment (LHL1)	INORG	Magnesium	D	5	5	7.10E+00	1.07E+01	LHL1 (10/6/2017)						
Rocky Run Embayment (LHL1)	INORG	Magnesium	T	5	5	6.86E+00	1.12E+01	LHL1 (12/11/2017)						
Rocky Run Embayment (LHL1)	INORG	Mercury	D	5	1	6.20E-07	6.20E-07	LHL1 (12/11/2017)	2.0E-03	3.1E-04	5.1E-05	1.2E-02	5.7E-04	1.1E-03
Rocky Run Embayment (LHL1)	INORG	Mercury	T	5	2	7.20E-07	8.40E-07	LHL1 (6/15/2018)	2.0E-03	4.2E-04	5.1E-05	1.6E-02	5.7E-04	1.5E-03
Rocky Run Embayment (LHL1)	INORG	Methylmercury	D	5	1	4.00E-08	4.00E-08	LHL1 (12/11/2017)			3.0E-04	1.3E-04	2.0E-03	2.0E-05
Rocky Run Embayment (LHL1)	INORG	Methylmercury	T	5	3	3.00E-08	2.40E-07	LHL1 (10/6/2017)			3.0E-04	8.0E-04	2.0E-03	1.2E-04
Rocky Run Embayment (LHL1)	INORG	Selenium	D	5	5	2.00E-04	1.10E-03	LHL1 (6/15/2018)	1.7E-01	6.5E-03	4.2E+00	2.6E-04	1.0E-01	1.1E-02
Rocky Run Embayment (LHL1)	INORG	Selenium	T	5	5	2.00E-04	1.10E-03	LHL1 (6/15/2018)	1.7E-01	6.5E-03	4.2E+00	2.6E-04	1.0E-01	1.1E-02
Rocky Run Embayment (LHL1)	INORG	Zinc	D	5	4	9.00E-04	6.70E-03	LHL1 (6/15/2018)	7.4E+00	9.1E-04	2.6E+01	2.6E-04	6.0E+00	1.1E-03
Rocky Run Embayment (LHL1)	INORG	Zinc	T	5	3	7.00E-04	2.50E-03	LHL1 (10/6/2017)	7.4E+00	3.4E-04	2.6E+01	9.6E-05	6.0E+00	4.2E-04

Notes:
Only constituents detected in each area are shown.
Concentration/screening level ratios greater than 1 are shaded in bold.
Measurement basis; T = total, D = dissolved

CI	Curds Inlet
DR	Dix River
HI	Hardin Inlet
INORG	Inorganic
LHL	Lower Herrington Lake
Max	Maximum
mg/L	Milligrams per liter
RSL	Regional Screening Level

Table 4-9: Exposure Estimates for Recreational Visitors' Ingestion and Dermal Contact with Arsenic in Sediments
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Input Parameters	Units	Reference	Young child 0-6	Ages 6-<16	Adults
Cs - Arsenic Exposure Point Concentration Sediments	mg/kg	Area and site-specific - See Table 4-10			
EF - Exposure Frequency - recreational area	days/year	Site-specific	33	65	65
ED - Exposure duration	year	USEPA 2014, 2018a	6	10	10
FI - Fractional intake (see text)	fraction	USEPA 1989	0.33 to 1.0	0.33 to 1.0	0.33 to 1.0
INs - Soil or sediment ingestion rate	mg/day	USEPA 2014, 2018a	200	100	100
ABSo - Oral bioavailability	Unitless	USEPA 2018a	0.6	0.6	0.6
SA - Dermal surface area	cm^2	USEPA 2014, 2018a	2,373	6,032	6,032
ABSd - Dermal absorption	Unitless	USEPA 2004, 2018a	0.03	0.03	0.03
AF- Adherence Factor for soil or sediment	$mg/cm^{\wedge 2}$	USEPA 2002, 2018a	0.2	0.07	0.07
CF - Conversion factor mg-kg	Unitless	USEPA 2018a	1.00E-06	1.00E-06	1.00E-06
BW - Body weight	kg	USEPA 2014, 2018a KRAG 2002	15	43	80
ATn - Averaging time non-cancer	days	USEPA 2014, 2018a	365	365	365
LT- Lifetime (for cancer estimates)	years	USEPA 2014, 2018a	70		
Atc - Cancer averaging time:	days	USEPA 2014, 2018a	25550		
Calculation of Non-cancer Hazards - (Shown as Intake Before Inclusion of Site Concentration)					
Non-Cancer reference dose (RfD)	mg/kg-day		3.00E-04	3.00E-04	3.00E-04
Non-Cancer Dose Calculations	CDI oral = (Cs x EF x ED x Ins x ABSo x CF) / (365 x ED x BW) CDI dermal = (Cs x EF x ED x SA x AF x ABSd x CF) / (365 x ED x BW)				
CDI - Chronic daily intake oral exposure:	mg/kg-yr		7.2E-07	2.5E-07	1.3E-07
CDI dermal exposure:	mg/kg-yr		8.6E-08	5.2E-08	2.8E-08
Total CDI for Non-Cancer	mg/kg-yr		8.09E-07	3.0E-07	1.6E-07
Calculation of Lifetime Excess Cancer Risks (Shown as Intake Before Inclusion of Site Concentrations)					
Cancer Dose Calculations	CDI oral = (Cs x EF x ED x Ins x ABSo x CF) / (365 x LT x BW) CDI dermal = (Cs x EF x ED x SA x AF x ABSd x CF) / (365 x LT x BW)				
Exposure per age period (CDI for cancer) oral:	mg/kg-d		6.2E-08	3.5E-08	1.9E-08
Exposure per age period (CDI for cancer) dermal:	mg/kg-d		7.4E-09	7.5E-09	4.0E-09
Exposure per age period (CDI for cancer):	mg/kg-d		6.9E-08	4.3E-08	2.3E-08
Lifetime average daily dose:	mg/kg-d		1.4E-07		

Table 4-9: Exposure Estimates for Recreational Visitors' Ingestion and Dermal Contact with Arsenic in Sediments
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Notes:

ABSd	Dermal absorption
ABSo	Oral bioavailability
AF	Adherence Factor for soil or sediment
Atc	Cancer averaging time:
ATn	Averaging time non-cancer
BW	Body weight
CDI	Chronic daily intake
CF	Conversion factor mg-kg
cm2	Square centimeters
Cs	Arsenic Exposure Point Concentration Sediments
ED	Exposure duration
EF	Exposure Frequency, recreational area
INs	Soil or sediment ingestion rate
kg	Kilogram
LT	Lifetime (for cancer estimates)
mg/cm^2	Milligram per square centimeter
mg/day	Milligram per day
mg/kg	Milligram per kilogram
mg/kg-d	Milligram per kilogram per day
mg/kg-yr	Milligram per kilogram per year
RfD	Non-Cancer reference dose
SA	Dermal surface area

Table 4-10: Arsenic in Shallower Sediments Summary Statistics and Exposure Point Concentrations
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	All units (mg/kg)								
	Number of Samples	FoD	Min	Mean	Max	95% UCL BCA	95% UCL ProUCL	Value Used in HHRA	EPC Type
Lower Lake (LHL4, LHL5, LHL6)	6	100%	1.73	10.6	22.2	15.7	16.8	15.7	UCL
Lower Curds Inlet	4	100%	17.6	28.4	40.0	NC	NC	40.0	Max
Middle Curds Inlet	14	100%	16.7	150	415	223	289	223	UCL
Upper Curds Inlet	19	100%	13.0	110	391	161	162	161	UCL
LHL3 (Outside Curds)	2	100%	8.58	11.7	14.9	NC	NC	14.9	Max
Dix Dam (LHL2)	2	100%	26.9	27.9	28.9	NC	NC	28.9	Max
Hardin Inlet	4	100%	9.10	19.1	34.0	NC	NC	34.0	Max
HQ Inlet	3	100%	19.1	34.1	50.2	NC	NC	50.2	Max
Rocky Run Embayment (LHL1)	3	100%	9.30	10.0	10.7	NC	NC	10.7	Max
Dix River	1	100%	12.0	NC	12.0	NC	NC	12.0	Max

Notes:

%	Percentage
BCA	Bias-Corrected and Accelerated
EPC	Exposure Point Concentration
FoD	Frequency of Detection
HHRA	Human Health Risk Assessment
KM	Kaplain-Meier
LHL	Lower Herrington Lake
Max	Maximum
mg/kg	Milligrams per kilogram
Min	Minimum
NC	Not calculated, insufficient number of samples
UCL	Upper Confidence Limit of the mean

Table 4-11: Cancer toxicity for Arsenic - Oral/Dermal Exposure Used in the HHRA
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal	Absorbed Cancer Slope Factor for Dermal		Weight of Evidence/ Cancer Guideline Description	Oral Cancer Slope Factor	
	Value	Units		Value	Units		Source	Date
Inorganic Arsenic	1.5	$(mg/kg\text{-}day)^{-1}$	80 - 96%	1.5	$(mg/kg\text{-}day)^{-1}$	A	IRIS	6/1/1995

Notes:

A	U.S. EPA weight of evidence group A - Known human carcinogen
IRIS	USEPA Integrated Risk Information System, https://www.epa.gov/iris
mg/kg-day	Miligrams per kilogram per day.

Table 4-12: Non-cancer Toxicity for Arsenic - Oral/Dermal Exposure Used in the HHRA
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Chemical of Potential Concern	Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal	Absorbed RfD for Dermal		Primary Organ	Combined Uncertainty and Modifying Factors	RfD Date	
		Value	Units		Value	Units			Source	Date
Inorganic Arsenic	chronic	3.0E-04	mg/kg-d	95%	3.0E-04	mg/kg-d	Cardiovasular and dermal	3/1	IRIS	9/1/1991

Notes:

RfD	Oral reference dose
IRIS	USEPA Integrated Risk Information System, https://www.epa.gov/iris
mg/kg-day	Miligrams per kilogram per day.

Table 4-13: Summary of Hazard Indices and Excess Lifetime Cancer Risk Estimates for Arsenic in Sediments
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Non-Cancer Hazard Indicies[a]				Excess Lifetime Cancer Risk[b]
	Fractional Intake	EPC (UCL or Maximum) mg/kg	Young child 0-<6	Ages 6-<16	Adults	Lifetime
Lower Lake (LHL4, LHL5, LHL6)	1.0	16	0.04	0.02	0.01	3E-06
Lower Curds Inlet	0.33	40	0.04	0.01	0.003	3E-06
Middle Curds Inlet	0.33	223	0.20	0.07	0.003	1E-05
Upper Curds Inlet	0.33	161	0.14	0.05	0.003	1E-05
LHL3 (Outside Curds)	1.0	15	0.04	0.01	0.01	3E-06
Dix Dam (LHL2)	1.0	29	0.08	0.03	0.01	6E-06
Hardin Inlet	1.0	34	0.09	0.03	0.01	7E-06
HQ Inlet	1.0	50	0.14	0.05	0.01	1E-05
Rocky Run Embayment (LHL1)	1.0	11	0.03	0.01	0.01	2E-06
Dix River	1.0	12	0.03	0.01	0.01	2E-06

Notes:

[a] Hazard Quotients for ingestion and dermal contact calculated as (UCL x CDI) /RfD (See Table 4-9)

[b] Excess lifetime cancer risk estimates for ingestion and dermal contact calculated as (UCL x CDI x CSF) (See also Table 4-9)

UCL Concentrations are reported in units of milligram(s) per kilogram.

< Less than
BCA Biad-Corrected and Accelerated
FoD Frequency of Detection
KM Kaplain-Meier
LHL Lower Herrington Lake
NC Not Calculated, insufficient number of samples
UCL Upper Confidence Limit on the mean

Where:	Young child 0-6	Ages 6-<16	Adults	Lifetime
Chronic Daily Intake (Table 4-9) mg/kg-day	8.1E-07	3E-07	2E-07	1.4E-07
Cancer slope factor (CSF) (Table 4-11) $(mg/kg\text{-}day)^{-1}$	1.5			
Reference dose (RfD) (Table 4-12) mg-kg/day	3.00E-04			

Table 4-14: Summary of Cobalt, Molybdenum, and Lithium Concentrations in Groundwater Monitoring Wells in Comparison with Risk-Based Screening Levels
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Groundwater Monitoring Well ID	Sampling Year	Sampling Date(s)	Target	Field Duplicate	Cobalt Concentration (mg/L)	Molydenum Concentration (mg/L)	Lithium Concentration (mg/L)
MW-106	2016	October 18–19	Landfill		<0.0010	0.043	0.073
	2016	December 5–6			<0.0010	0.051	0.040
	2017	January 17–18			<0.0010	0.062	0.043
	2017	March 6–7			<0.0010	0.052	0.053
	2017	April 10–11			<0.0010	0.063	0.050
	2017	May 22–23			<0.0010	0.065	0.055
	2017	July 18–19			<0.0010	0.052	0.062
	2017	August 28–29			<0.0010	0.100	0.044
	2018	March 22–23			0.0016	0.071	0.078
	2018	June 19–20			0.0019	0.180	0.048
MW-109	2016	October 18–19	Aux Pond		<0.0010	0.010	0.022
	2016	December 5–6			<0.0010	0.011	<0.0080
	2017	January 17–18			<0.0010	0.015	<0.0080
	2017	March 6–7			<0.0010	<0.010	<0.0080
	2017	April 10–11			<0.0010	<0.010	<0.0080
	2017	May 22–23			<0.0010	<0.010	<0.0080
	2017	July 18–19			<0.0010	<0.010	<0.0080
	2017	August 28–29			<0.0010	<0.010	<0.0080
	2018	March 22–23			<0.0010	0.028	0.012
	2018	June 19–20			<0.0010	0.086	<0.0080
MW-110	2016	October 18–19	Aux Pond		0.0029	0.025	0.053
	2016	December 5–6			0.0011	0.022	0.061
	2017	January 17–18			0.0023	0.027	0.061
	2017	March 6–7			0.0021	0.023	0.061
	2017	March 6–7		Yes	0.002	0.023	0.061
	2017	April 10–11			0.0021	0.021	0.060
	2017	May 22–23			0.0017	0.023	0.065
	2017	July 18–19			0.0020	0.022	0.057
	2017	July 18–19		Yes	0.0017	0.022	0.058
	2017	August 28–29			0.0021	0.019	0.062
	2018	March 22–23			0.0012	0.022	0.059
	2018	June 19–20			<0.0010	0.018	0.055
MW-111	2016	October 18–19	Landfill		<0.0010	0.021	0.073
	2016	December 5–6			0.0015	0.023	0.092
	2016	December 5–6		Yes	0.0014	0.022	0.091
	2017	January 17–18			0.0018	0.021	0.13
	2017	March 6–7			0.0015	0.019	0.12
	2017	April 10–11			0.0020	0.016	0.14
	2017	May 22–23			0.0026	0.016	0.18
	2017	July 18–19			0.0019	0.016	0.14
	2017	August 28–29			0.0018	0.011	0.21
	2018	March 22–23			<0.0010	<0.010	0.34
	2018	June 19–20			<0.0010	0.019	0.24
MW-112	2016	October 18–19	Landfill		<0.0010	0.13	0.12
	2016	December 5–6			<0.0010	0.088	0.10
	2017	January 17–18			<0.0010	0.15	0.15
	2017	January 17–18		Yes	<0.0010	0.15	0.15
	2017	March 6–7			<0.0010	0.16	0.18
	2017	April 10–11			<0.0010	0.15	0.18
	2017	May 22–23			<0.0010	0.16	0.16
	2017	July 18–19			0.0011	0.18	0.13
	2017	August 28–29			0.0019	0.14	0.14
	2018	March 22–23			0.002	0.19	0.13
	2018	March 22–23		Yes	0.002	0.18	0.12
	2018	June 19–20			0.0037	0.19	0.16

Table 4-14: Summary of Cobalt, Molybdenum, and Lithium Concentrations in Groundwater Monitoring Wells in Comparison with Risk-Based Screening Levels
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Groundwater Monitoring Well ID	Sampling Year	Sampling Date(s)	Target	Field Duplicate	Cobalt Concentration (mg/L)	Molydenum Concentration (mg/L)	Lithium Concentration (mg/L)
MW-113	2016	October 18–19	Landfill		<0.0010	0.011	0.071
	2016	December 5–6			<0.0010	0.011	0.083
	2017	January 17–18			<0.0010	<0.010	0.024
	2017	March 6–7			<0.0010	<0.010	0.056
	2017	April 10–11			<0.0010	<0.010	0.077
	2017	May 22–23			<0.0010	<0.010	0.053
	2017	July 18–19			<0.0010	<0.010	0.067
	2017	August 28–29			<0.0010	<0.010	0.030
	2018	March 22–23			<0.0010	0.0110	0.054
	2018	June 19–20			<0.0010	<0.010	0.076
MW-114	2016	October 18–19	Landfill		0.0059	<0.010	<0.0080
	2016	October 18–19		Yes	0.0058	<0.010	<0.0080
	2016	December 5–6			0.0049	<0.010	<0.0080
	2017	January 17–18			0.0055	<0.010	<0.0080
	2017	March 6–7			0.0061	<0.010	<0.0080
	2017	April 10–11			0.0062	<0.010	<0.0080
	2017	May 22–23			0.0063	<0.010	<0.0080
	2017	July 18–19			0.0059	<0.010	<0.0080
	2017	August 28–29			0.0055	<0.010	<0.0080
	2017	August 28–29		Yes	0.0051	<0.010	<0.0080
	2018	March 22–23			0.0056	<0.010	<0.0080
	2018	June 19–20			0.0063	<0.010	<0.0080
	2018	June 19–20		Yes	0.0064	<0.010	<0.0080
Human Health Groundwater Protection Standards[a]					0.006	0.1	0.04

Notes:

ID Identification

mg/L Milligrams per Liter

MW Groundwater Monitoring Well

For the above selected groundwater monitoring wells, MW-106 is located west of HQ and Briar Patch Springs between the Main Pond and Auxiliary Pond. All of other selected monitoring wells in this table are located east of the CCR ponds (MW-109, MW-110, MW-111, MW-112, MW-113 and MW-114).

Sources: "EWB-CCRMonitor.xlsx"

"Monitoring Well Data.xlsx" received February 13th, 2018.

a Human health groundwater protection standards identified by USEPA in the 2018 update to the CCR Rule (40CFR257.95(h)(2))

Table 5-1. Special Status Species for Garrard and Mercer Counties, Kentucky
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

County	Scientific Name	Common Name	Class	State Status	Federal Status
Garrard	*Ammodramus henslowii*	Henslow's Sparrow	Aves	S	N
Garrard	*Junco hyemalis*	Dark-Eyed Junco	Aves	S	N
Garrard	*Tyto alba*	Barn Owl	Aves	S	N
Garrard	*Pleurobema clava*	Clubshell	Bivalvia	E	E
Garrard	*Pseudanophthalmus elongatus*	A Cave Obligate Beetle	Insecta	S	N
Garrard	*Myotis grisescens*	Gray Myotis	Mammalia	T	E
Garrard	*Nycticeius humeralis*	Evening Bat	Mammalia	S	N
Garrard	*Eumeces anthracinus*	Coal Skink	Reptilia	T	N
Mercer	*Rana pipiens*	Northern Leopard Frog	Amphibia	S	N
Mercer	*Accipiter striatus*	Sharp-Shinned Hawk	Aves	S	N
Mercer	*Actitis macularius*	Spotted Sandpiper	Aves	E	N
Mercer	*Ammodramus henslowii*	Henslow's Sparrow	Aves	S	N
Mercer	*Anas clypeata*	Northern Shoveler	Aves	E	N
Mercer	*Anas discors*	Blue-Winged Teal	Aves	T	N
Mercer	*Ardea alba*	Great Egret	Aves	T	N
Mercer	*Bartramia longicauda*	Upland Sandpiper	Aves	H	N
Mercer	*Cardellina canadensis*	Canada Warbler	Aves	S	N
Mercer	*Certhia americana*	Brown Creeper	Aves	E	N
Mercer	*Chondestes grammacus*	Lark Sparrow	Aves	T	N
Mercer	*Dolichonyx oryzivorus*	Bobolink	Aves	S	N
Mercer	*Empidonax minimus*	Least Flycatcher	Aves	E	N
Mercer	*Falco peregrinus*	Peregrine Falcon	Aves	E	N
Mercer	*Fulica americana*	American Coot	Aves	E	N
Mercer	*Junco hyemalis*	Dark-Eyed Junco	Aves	S	N
Mercer	*Passerculus sandwichensis*	Savannah Sparrow	Aves	S	N
Mercer	*Phalacrocorax auritus*	Double-Crested Cormorant	Aves	T	N
Mercer	*Pheucticus ludovicianus*	Rose-Breasted Grosbeak	Aves	S	N
Mercer	*Setophaga fusca*	Blackburnian Warbler	Aves	T	N
Mercer	*Sternula antillarum athalassos*	Interior Least Tern	Aves	E	E
Mercer	*Thryomanes bewickii*	Bewick's Wren	Aves	S	N
Mercer	*Tyto alba*	Barn Owl	Aves	S	N
Mercer	*Vermivora chrysoptera*	Golden-Winged Warbler	Aves	T	N
Mercer	*Callophrys irus*	Frosted Elfin	Insecta	E	N
Mercer	*Pseudanophthalmus elongatus*	A Cave Obligate Beetle	Insecta	S	N
Mercer	*Pseudanophthalmus puteanus*	Old Well Cave Beetle	Insecta	T	N
Mercer	*Mustela nivalis*	Least Weasel	Mammalia	S	N
Mercer	*Myotis grisescens*	Gray Myotis	Mammalia	T	E
Mercer	*Myotis leibii*	Eastern Small-Footed Myotis	Mammalia	T	N

Notes:

Source: Kentucky Department of Fish & Wildlife Resources
- E Endangered
- H Historic
- N Not listed
- S Special concern
- T Threatened

Table 5-2: Surface Water and Pore Water Ecological Screening Values
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Dissolved Surface Water ESVs											Preferred ESV	
		Kentucky Water Quality Criteria Acute (a)		Kentucky Water Quality Criteria - Chronic (a)			USEPA R4 - Acute (2018)			USEPA R4 - Chronic (2018)			Dissolved	
Chemical	**CASRN**	**µg/L**	**mg/L**	**µg/L**	**mg/L**		**µg/L**	**mg/L**		**µg/L**	**mg/L**		**mg/L**	**Source**
Arsenic	7440-38-2	3.40E+02	3.40E-01	1.50E+02	1.50E-01	--	3.40E+02	3.40E-01	(f)	1.50E+02	1.50E-01	(f)	1.50E-01	KY Chronic
Arsenic III	22541-54-4	NC		NC			3.40E+02	3.40E-01	(d)	1.48E+02	1.48E-01	(d)	1.48E-01	USEPA R4 Chronic
Arsenic V	17428-41-0	NC		NC			NC			NC			NC	
Cadmium	7440-43-9	3.35E+00	3.35E-03	3.76E-01	3.76E-04	(b)	2.72E+00	2.72E-03	(b)	1.00E+00	1.00E-03	(b)	3.76E-04	KY Chronic
Lead	7439-92-1	1.44E+02	1.44E-01	5.60E+00	5.60E-03	(b)	1.04E+02	1.04E-01	(b)	4.07E+00	4.07E-03	(b)	5.60E-03	KY Chronic
Mercury	7439-97-6	1.40E+00	1.40E-03	7.70E-01	7.70E-04	--	1.40E+00	1.40E-03	(f)	7.70E-01	7.70E-04	(f)	7.70E-04	KY Chronic
Methylmercury	22967-92-6	NC		NC			9.90E-02	9.90E-05	(f)	2.80E-03	2.80E-06	(f)	2.80E-06	USEPA R4 Chronic
Selenium (e)	7782-49-2	5.00E+00	5.00E-03	5.00E+00	5.00E-03	--	2.00E+01	2.00E-02	(d)	5.00E+00	5.00E-03	(d)	5.00E-03	KY Chronic
Selenium - Selenate (Se +6)	14124-68-6	NC		NC			1.30E+01	1.30E-02	--	9.00E+00	9.00E-03	--	9.00E-03	USEPA R4 Chronic
Selenium - Selenite (Se +4)	14124-67-5	NC		NC			1.86E+02	1.86E-01	--	2.80E+01	2.80E-02	--	2.80E-02	USEPA R4 Chronic
Selenocyanate	3425-46-5	NC		NC			NC			NC			NC	
Zinc	7440-66-6	1.75E+02	1.75E-01	1.75E+02	1.75E-01	--	1.71E+02	1.71E-01	--	1.72E+02	1.72E-01	(b)	1.75E-01	KY Chronic

		Total Surface Water ESVs											Preferred ESV	
		Kentucky Water Quality Criteria - Acute (a)		Kentucky Water Quality Criteria - Chronic (a)			USEPA R4 (2018) - Acute			USEPA R4 (2018) - Chronic			Dissolved	
Chemical	**CASRN**	**µg/L**	**mg/L**	**µg/L**	**mg/L**		**µg/L**	**mg/L**		**µg/L**	**mg/L**		**mg/L**	**Source**
Arsenic	7440-38-2	3.40E+02	3.40E-01	1.50E+02	1.50E-01	--	3.40E+02	3.40E-01	(f)	1.50E+02	1.50E-01	(f)	1.50E-01	KY Chronic
Arsenic III	22541-54-4	NC		NC			3.40E+02	3.40E-01	(d)	1.48E+02	1.48E-01	(d)	1.48E-01	USEPA R4 Chronic
Arsenic V	17428-41-0	NC		NC			NC			NC			NC	
Cadmium	7440-43-9	3.35E+00	3.35E-03	3.76E-01	3.76E-04	(b)	2.94E+00	2.94E-03	--	1.13E+00	1.13E-03	(b)	3.76E-04	KY Chronic
Lead	7439-92-1	1.44E+02	1.44E-01	5.60E+00	5.60E-03	(b)	1.44E+02	1.44E-01	--	5.60E+00	5.60E-03	(b)	5.60E-03	KY Chronic
Mercury	7439-97-6	1.40E+00	1.40E-03	7.70E-01	7.70E-04	--	1.40E+00	1.40E-03	(f)	7.70E-01	7.70E-04	(f)	7.70E-04	KY Chronic
Methylmercury	22967-92-6	NC		NC			9.90E-02	9.90E-05	(f)	2.80E-03	2.80E-06	(f)	2.80E-06	USEPA R4 Chronic
Selenium	7782-49-2	5.00E+00	5.00E-03	5.00E+00	5.00E-03	(c) (e)	2.00E+01	2.00E-02	--	5.00E+00	5.00E-03	--	5.00E-03	KY Chronic
Selenium - Selenate (Se +6)	14124-68-6	NC		NC			1.30E+01	1.30E-02	(f)	9.00E+00	9.00E-03	(f)	9.00E-03	USEPA R4 Chronic
Selenium - Selenite (Se +4)	14124-67-5	NC		NC			1.86E+02	1.86E-01	(f)	2.80E+01	2.80E-02	(f)	2.80E-02	USEPA R4 Chronic
Selenocyanate	3425-46-5	NC		NC			NC			NC			NC	
Zinc	7440-66-6	1.75E+02	1.75E-01	1.75E+02	1.75E-01	(b)	1.75E+02	1.75E-01	--	1.75E+02	1.75E-01	(b)	1.75E-01	KY Chronic

Table 5-2: Surface Water and Pore Water Ecological Screening Values
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Notes:
Surface water screening values to be reviewed for use in the ecological risk assessment were outlined in the Herrington Lake Corrective Action Plan: Phase I Technical Memorandum and Phase II Plan (June 2018). Kentucky chronic ESVs were given priority followed by USEPA R4 Chronic ESVs.

CASRN = Chemical Abstracts Service Registry Number
CC Conc. = Criterion Continuous Concentration
ESV = Ecological screening value
lnH = Line(Hardness)
mg/L = Milligram per liter
µg/L = Microgram per liter
USEPA R4 = United States Environmental Protection Agency Region 4

(a) Kentucky guidance indicates that water quality criteria are for unfiltered (or total) samples. As such, the total WQC for a metal is a used as a surrogate for the dissolved state.
(b) This ESV assumes a hardness of 156 mg/L, and the calculation is shown below. Kentucky guidance (KAR 10:031) says their water quality criteria are for unfiltered (total) samples and no conversion factor was given to convert from total to dissolved. As a conservative measure, the total hardness-based ESV was used as a surrogate for the dissolved ESV.

Table 5-2: Surface Water and Pore Water Ecological Screening Values
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

				Variables		Freshwater Conversion Factor (CF)	Hardness-Based CC Conc. (dissolved)	Hardness-Based CC Conc. (total)
CASRN	**Chemical**	**Source**	**Type**	**mC**	**bC**	**Criterion Continuous Concentration**	**µg/L**	**µg/L**
7440-43-9	Cadmium	USEPA R4	Chronic	0.7977	-3.909	1.101672-[(lnH) x (0.041838)]	1.003	1.127
			Acute	0.9789	-3.866	1.136672-[(lnH) x (0.041838)]	2.718	2.937
7440-43-9	Cadmium	KY AR 10:031	Chronic	0.7409	-4.719	--	--	0.376
			Acute	1.0166	-3.924	--	--	3.352
7439-92-1	Lead	USEPA R4	Chronic	1.273	-4.705	1.46203-0.145712(lnH)	4.070	5.604
			Acute	1.273	-1.46	1.46203-0.145712(lnH)	104.433	143.806
7439-92-1	Lead	KY AR 10:031	Chronic	1.273	-4.705	--	--	5.60
			Acute	1.273	-1.46	--	--	143.81
7440-66-6	Zinc	USEPA R4	Chronic	0.8473	0.884	0.986	172.2	174.6
			Acute	0.8473	0.884	0.978	170.8	174.6
7440-66-6	Zinc	KY AR 10:031	Chronic	0.8473	0.884	--	--	174.6
			Acute	0.8473	0.884	--	--	174.6

Hardness	156	mg/L	Dissolved
	156	mg/L	Total

Notes:
Criterion Continuous Concentration (dissolved) = exp {mC x [ln(hardness)]+ bC} x (CF) Criterion Continuous Concentration (total) = exp {mC x [ln(hardness)]+ bC}

(c) There is no acute value for selenium in the Kentucky guidance; as such, the chronic value was used as a surrogate.
(d) The USEPA R4 (2018) guidance only stated an ESV for unfiltered (total) selenium; as such, this value was used as a surrogate for dissolved selenium.
(e) According to Kentucky guidance, if there is fish tissue, that takes precedence over surface water column screening. Also, if the selenium concentration in the surface water column is greater than 5 ug/L, then additional sampling is warranted.
(f) Either the USEPA R4 (2018) guidance only stated ESVs for the dissolved phase; as such, the dissolved phase ESV is was used as a surrogate for the total phase, or the ESV depicted in the guidance was for both filtered (dissolved) and unfiltered (total) samples.
(g) There was no criterion for the total phase; as such, the dissolved phase was used as a surrogate for the total phase.
(h) There was no acute criterion for iron; as such, the chronic value was used as a surrogate.

Sources:
Kentucky Administrative Record (KAR) 10:031: Surface Water Standards. http://www.lrc.ky.gov/kar/401/010/031.pdf (Accessed 11/2/2018).
United States EPA Region 4. Region 4 Ecological Risk Assessment Supplemental Guidance. March 2018. https://www.epa.gov/risk/region-4-risk-assessment-contacts (Accessed 11/2/2018).

Table 5-3 Sediment Ecological Screening Values
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		USEPA R4 Sediment					
		ESV	RSV	USEPA R4 Protection of			
				ESV		RSV	
Chemical	CASRN	mg/kg	mg/kg	mg/kg		mg/kg	
Arsenic	7440-38-2	9.80E+00	3.30E+01	--		--	
Cadmium	7440-43-9	1.00E+00	5.00E+00	--		--	
Lead	7439-92-1	3.58E+01	1.28E+02	--		--	
Mercury	7439-97-6	1.80E-01	1.10E+00	1.70E-01	(a)	1.70E-01	(a)
Methylmercury	22967-92-6	4.50E-04	4.50E-03	--		--	
Selenium	7782-49-2	7.20E-01	2.90E+00	8.00E-01	(a)	1.20E+00	(a)
Zinc	7440-66-6	1.21E+02	4.59E+02	--		--	

Notes:
Sediment ESVs to be reviewed for use in the ecological risk assessment were outlined in the Herrington Lake Corrective Action Plan: Phase I Technical Memorandum and Phase II Plan (June 2018).

-- = No value
CASRN = Chemical Abstract Service Registration Number
ESV = Ecological screening value
mg/kg = Milligram per kilogram
NA = Not applicable
RSV = Refinement screening value
USEPA R4 = United States Environmental Protection Agency Region 4

Notes:
(a) The USEPA R4 guidance indicated this screening value was for the protection of wildlife.

Source:
United States EPA Region 4. Region 4 Ecological Risk Assessment Supplemental Guidance. March 2018. https://www.epa.gov/risk/region-4-risk-assessment-contacts (Accessed 11/2/2018).

Table 5-4: Surface Water Ecological Screening Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	Chemical Group	Chemical	Measurement Basis	Analyzed	Detected	Minimum Detected Concentration (mg/L)	Mean Detected Concentration (mg/L)	Maximum Detected Concentration (mg/L)	Location of Maximum Detected Concentration	Selected Surface Water Ecological Screening Value (Chronic ESV) (mg/L)	Ratio of Maximum Detected Concentration to Selected Surface Water Ecological Screening Value (Chronic ESV)
Curds Inlet	INORG	Arsenic	D	18	18	1.26E-03	1.86E-03	3.98E-03	CI4 (6/16/2018)	1.5E-01	3E-02
Curds Inlet	INORG	Arsenic	T	18	18	1.29E-03	2.40E-03	5.48E-03	CI2 (12/11/2017)	1.5E-01	4E-02
Curds Inlet	INORG	Boron	D	18	18	2.92E-01	8.40E-01	2.56E+00	CI1 (12/11/2017)	7.2E+00	4E-01
Curds Inlet	INORG	Boron	T	18	18	3.00E-01	8.28E-01	2.52E+00	CI1 (12/11/2017)	7.2E+00	4E-01
Curds Inlet	INORG	Cadmium	D	18	10	2.30E-05	8.97E-05	2.11E-04	CI1 (12/11/2017)	3.8E-04	6E-01
Curds Inlet	INORG	Cadmium	T	18	14	2.80E-05	1.28E-04	3.77E-04	CI2 (12/11/2017)	3.8E-04	1E+00
Curds Inlet	INORG	Iron	D	18	18	2.40E-03	2.30E-02	8.63E-02	CI2 (10/14/2017)	1.0E+00	9E-02
Curds Inlet	INORG	Iron	T	18	18	3.72E-02	1.56E-01	6.14E-01	CI2 (12/11/2017)	1.0E+00	6E-01
Curds Inlet	INORG	Lead	D	10	5	1.00E-05	4.38E-05	1.11E-04	CI2.2 (6/16/2018)	5.6E-03	2E-02
Curds Inlet	INORG	Lead	T	10	7	8.10E-05	3.00E-04	6.31E-04	CI2 (12/11/2017)	5.6E-03	1E-01
Curds Inlet	INORG	Magnesium	D	18	18	8.64E+00	1.36E+01	2.74E+01	CI1 (12/11/2017)	8.2E+01	3E-01
Curds Inlet	INORG	Magnesium	T	18	18	8.04E+00	1.37E+01	2.74E+01	CI1 (12/11/2017)	8.2E+01	3E-01
Curds Inlet	INORG	Mercury	D	18	11	6.80E-07	6.70E-04	1.71E-03	CI1 (10/14/2017)	7.7E-04	**2E+00**
Curds Inlet	INORG	Mercury	T	18	13	9.90E-07	2.88E-03	7.78E-03	CI1 (10/14/2017)	7.7E-04	**1E+01**
Curds Inlet	INORG	Methylmercury	D	18	11	3.00E-08	2.04E-07	5.90E-07	CI1 (10/14/2017)	2.8E-06	2E-01
Curds Inlet	INORG	Methylmercury	T	18	13	3.00E-08	2.72E-07	8.60E-07	CI1 (10/14/2017)	2.8E-06	3E-01
Curds Inlet	INORG	Selenium	D	18	18	8.00E-04	2.28E-03	5.50E-03	CI2.2 (6/16/2018)	5.0E-03	1E+00
Curds Inlet	INORG	Selenium	T	18	18	8.00E-04	2.28E-03	5.40E-03	CI2.2 (6/16/2018)	5.0E-03	1E+00
Curds Inlet	INORG	Zinc	D	18	8	4.00E-04	2.04E-03	3.40E-03	CI1 (12/11/2017)	1.7E-01	2E-02
Curds Inlet	INORG	Zinc	T	18	14	1.40E-03	4.01E-03	9.80E-03	CI1 (10/14/2017)	1.7E-01	6E-02
Dix Dam (LHL2)	INORG	Arsenic	D	4	4	1.03E-03	1.25E-03	1.46E-03	LHL2 (10/6/2017)	1.5E-01	1E-02
Dix Dam (LHL2)	INORG	Arsenic	T	4	4	1.08E-03	1.30E-03	1.51E-03	LHL2 (10/6/2017)	1.5E-01	1E-02
Dix Dam (LHL2)	INORG	Boron	D	4	4	2.00E-01	2.66E-01	4.14E-01	LHL2 (10/6/2017)	7.2E+00	6E-02
Dix Dam (LHL2)	INORG	Boron	T	4	4	2.07E-01	2.73E-01	4.19E-01	LHL2 (10/6/2017)	7.2E+00	6E-02
Dix Dam (LHL2)	INORG	Cadmium	D	4	1	1.10E-05	1.10E-05	1.10E-05	LHL2 (12/11/2017)	3.8E-04	3E-02
Dix Dam (LHL2)	INORG	Cadmium	T	4	1	2.40E-05	2.40E-05	2.40E-05	LHL2 (12/11/2017)	3.8E-04	6E-02
Dix Dam (LHL2)	INORG	Iron	D	4	4	2.10E-03	3.49E-02	1.28E-01	LHL2 (10/6/2017)	1.0E+00	1E-01
Dix Dam (LHL2)	INORG	Iron	T	4	4	9.10E-03	5.15E-02	1.47E-01	LHL2 (10/6/2017)	1.0E+00	1E-01
Dix Dam (LHL2)	INORG	Magnesium	D	4	4	9.28E+00	9.99E+00	1.08E+01	LHL2 (12/11/2017)	8.2E+01	1E-01
Dix Dam (LHL2)	INORG	Magnesium	T	4	4	9.27E+00	1.01E+01	1.10E+01	LHL2 (12/11/2017)	8.2E+01	1E-01
Dix Dam (LHL2)	INORG	Mercury	D	4	1	7.70E-07	7.70E-07	7.70E-07	LHL2 (10/6/2017)	7.7E-04	1E-03
Dix Dam (LHL2)	INORG	Methylmercury	D	4	2	4.00E-08	2.45E-07	4.50E-07	LHL2 (10/6/2017)	2.8E-06	2E-01
Dix Dam (LHL2)	INORG	Methylmercury	T	4	2	6.00E-08	1.20E-07	1.80E-07	LHL2 (10/6/2017)	2.8E-06	6E-02
Dix Dam (LHL2)	INORG	Selenium	D	4	3	3.00E-04	5.67E-04	8.00E-04	LHL2 (10/6/2017)	5.0E-03	2E-01
Dix Dam (LHL2)	INORG	Selenium	T	4	4	3.00E-04	5.00E-04	8.00E-04	LHL2 (10/6/2017)	5.0E-03	2E-01
Dix Dam (LHL2)	INORG	Zinc	D	4	3	5.00E-04	9.00E-04	1.60E-03	LHL2 (10/6/2017)	1.7E-01	9E-03
Dix Dam (LHL2)	INORG	Zinc	T	4	3	6.00E-04	7.00E-04	8.00E-04	LHL2 (10/6/2017)	1.7E-01	5E-03
Dix River	INORG	Arsenic	D	1	1	1.38E-03	1.38E-03	1.38E-03	DR1 (10/7/2017)	1.5E-01	9E-03
Dix River	INORG	Arsenic	T	1	1	1.54E-03	1.54E-03	1.54E-03	DR1 (10/7/2017)	1.5E-01	1E-02
Dix River	INORG	Boron	D	1	1	2.64E-01	2.64E-01	2.64E-01	DR1 (10/7/2017)	7.2E+00	4E-02
Dix River	INORG	Boron	T	1	1	2.46E-01	2.46E-01	2.46E-01	DR1 (10/7/2017)	7.2E+00	3E-02
Dix River	INORG	Cadmium	D	1	1	1.49E-04	1.49E-04	1.49E-04	DR1 (10/7/2017)	3.8E-04	4E-01
Dix River	INORG	Cadmium	T	1	1	1.22E-04	1.22E-04	1.22E-04	DR1 (10/7/2017)	3.8E-04	3E-01
Dix River	INORG	Iron	D	1	1	6.60E-03	6.60E-03	6.60E-03	DR1 (10/7/2017)	1.0E+00	7E-03

Table 5-4: Surface Water Ecological Screening Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	Chemical Group	Chemical	Measurement Basis	Analyzed	Detected	Minimum Detected Concentration (mg/L)	Mean Detected Concentration (mg/L)	Maximum Detected Concentration (mg/L)	Location of Maximum Detected Concentration	Selected Surface Water Ecological Screening Value (Chronic ESV) (mg/L)	Ratio of Maximum Detected Concentration to Selected Surface Water Ecological Screening Value (Chronic ESV)
Dix River	INORG	Iron	T	1	1	7.29E-02	7.29E-02	7.29E-02	DR1 (10/7/2017)	1.0E+00	7E-02
Dix River	INORG	Magnesium	D	1	1	9.44E+00	9.44E+00	9.44E+00	DR1 (10/7/2017)	8.2E+01	1E-01
Dix River	INORG	Magnesium	T	1	1	9.55E+00	9.55E+00	9.55E+00	DR1 (10/7/2017)	8.2E+01	1E-01
Dix River	INORG	Methylmercury	T	1	1	5.00E-08	5.00E-08	5.00E-08	DR1 (10/7/2017)	2.8E-06	2E-02
Dix River	INORG	Selenium	D	1	1	5.00E-04	5.00E-04	5.00E-04	DR1 (10/7/2017)	5.0E-03	1E-01
Dix River	INORG	Selenium	T	1	1	5.00E-04	5.00E-04	5.00E-04	DR1 (10/7/2017)	5.0E-03	1E-01
Dix River	INORG	Zinc	D	1	1	8.00E-04	8.00E-04	8.00E-04	DR1 (10/7/2017)	1.7E-01	5E-03
Dix River	INORG	Zinc	T	1	1	1.50E-03	1.50E-03	1.50E-03	DR1 (10/7/2017)	1.7E-01	9E-03
Hardin Inlet	INORG	Arsenic	D	2	2	1.07E-03	1.12E-03	1.17E-03	HI1 (12/11/2017)	1.5E-01	8E-03
Hardin Inlet	INORG	Arsenic	T	2	2	1.03E-03	1.12E-03	1.20E-03	HI1 (12/11/2017)	1.5E-01	8E-03
Hardin Inlet	INORG	Boron	D	2	2	1.90E-01	2.82E-01	3.74E-01	HI1 (10/5/2017)	7.2E+00	5E-02
Hardin Inlet	INORG	Boron	T	2	2	1.79E-01	2.88E-01	3.97E-01	HI1 (10/5/2017)	7.2E+00	6E-02
Hardin Inlet	INORG	Cadmium	D	2	1	1.00E-05	1.00E-05	1.00E-05	HI1 (12/11/2017)	3.8E-04	3E-02
Hardin Inlet	INORG	Cadmium	T	2	1	1.60E-05	1.60E-05	1.60E-05	HI1 (12/11/2017)	3.8E-04	4E-02
Hardin Inlet	INORG	Iron	D	2	2	2.50E-03	2.65E-03	2.80E-03	HI1 (12/11/2017)	1.0E+00	3E-03
Hardin Inlet	INORG	Iron	T	2	2	3.51E-02	4.32E-02	5.12E-02	HI1 (12/11/2017)	1.0E+00	5E-02
Hardin Inlet	INORG	Magnesium	D	2	2	1.00E+01	1.03E+01	1.05E+01	HI1 (12/11/2017)	8.2E+01	1E-01
Hardin Inlet	INORG	Magnesium	T	2	2	1.03E+01	1.05E+01	1.07E+01	HI1 (12/11/2017)	8.2E+01	1E-01
Hardin Inlet	INORG	Methylmercury	D	2	1	3.00E-08	3.00E-08	3.00E-08	HI1 (12/11/2017)	2.8E-06	1E-02
Hardin Inlet	INORG	Methylmercury	T	2	2	3.00E-08	3.50E-08	4.00E-08	HI1 (10/5/2017)	2.8E-06	1E-02
Hardin Inlet	INORG	Selenium	D	2	2	5.00E-04	6.50E-04	8.00E-04	HI1 (10/5/2017)	5.0E-03	2E-01
Hardin Inlet	INORG	Selenium	T	2	2	5.00E-04	6.00E-04	7.00E-04	HI1 (10/5/2017)	5.0E-03	1E-01
Hardin Inlet	INORG	Zinc	D	2	2	1.00E-03	4.05E-03	7.10E-03	HI1 (12/11/2017)	1.7E-01	4E-02
Hardin Inlet	INORG	Zinc	T	2	1	2.30E-03	2.30E-03	2.30E-03	HI1 (10/5/2017)	1.7E-01	1E-02
HQ Inlet	INORG	Arsenic	D	4	4	1.00E-03	1.23E-03	1.37E-03	HQ1 (12/11/2017)	1.5E-01	9E-03
HQ Inlet	INORG	Arsenic	T	4	4	1.12E-03	1.47E-03	2.26E-03	HQ (6/15/2018)	1.5E-01	2E-02
HQ Inlet	INORG	Boron	D	4	4	2.23E-01	3.12E-01	4.07E-01	HQ (6/15/2018)	7.2E+00	6E-02
HQ Inlet	INORG	Boron	T	4	4	2.30E-01	3.31E-01	4.17E-01	HQ (6/15/2018)	7.2E+00	6E-02
HQ Inlet	INORG	Cadmium	D	4	4	8.00E-06	1.35E-05	2.30E-05	HQ (6/15/2018)	3.8E-04	6E-02
HQ Inlet	INORG	Cadmium	T	4	3	1.70E-05	3.97E-05	7.90E-05	HQ (6/15/2018)	3.8E-04	2E-01
HQ Inlet	INORG	Iron	D	4	2	1.20E-03	1.17E-02	2.21E-02	HQ (6/15/2018)	1.0E+00	2E-02
HQ Inlet	INORG	Iron	T	4	4	1.89E-02	1.37E-01	4.66E-01	HQ (6/15/2018)	1.0E+00	5E-01
HQ Inlet	INORG	Lead	D	3	2	1.10E-05	5.00E-05	8.90E-05	HQ (6/15/2018)	5.6E-03	2E-02
HQ Inlet	INORG	Lead	T	3	2	3.60E-05	2.96E-04	5.55E-04	HQ (6/15/2018)	5.6E-03	1E-01
HQ Inlet	INORG	Magnesium	D	4	4	7.07E+00	9.58E+00	1.10E+01	HQ1 (12/11/2017)	8.2E+01	1E-01
HQ Inlet	INORG	Magnesium	T	4	4	7.98E+00	9.90E+00	1.11E+01	HQ1 (12/11/2017)	8.2E+01	1E-01
HQ Inlet	INORG	Mercury	D	4	1	6.80E-07	6.80E-07	6.80E-07	HQ1 (12/11/2017)	7.7E-04	9E-04
HQ Inlet	INORG	Mercury	T	4	2	5.80E-07	1.39E-06	2.20E-06	HQ (6/15/2018)	7.7E-04	3E-03
HQ Inlet	INORG	Methylmercury	D	4	2	3.00E-08	3.50E-08	4.00E-08	HQ1 (12/11/2017)	2.8E-06	1E-02
HQ Inlet	INORG	Methylmercury	T	4	3	4.00E-08	4.33E-08	5.00E-08	HQ (6/15/2018)	2.8E-06	2E-02
HQ Inlet	INORG	Selenium	D	4	4	6.00E-04	8.50E-04	1.30E-03	HQ (6/15/2018)	5.0E-03	3E-01
HQ Inlet	INORG	Selenium	T	4	4	6.00E-04	9.25E-04	1.40E-03	HQ (6/15/2018)	5.0E-03	3E-01
HQ Inlet	INORG	Zinc	D	4	1	6.00E-04	6.00E-04	6.00E-04	HQ1 (10/4/2017)	1.7E-01	3E-03
HQ Inlet	INORG	Zinc	T	4	3	5.00E-04	1.27E-03	2.30E-03	HQ (6/15/2018)	1.7E-01	1E-02

Table 5-4: Surface Water Ecological Screening Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	Chemical Group	Chemical	Measurement Basis	Analyzed	Detected	Minimum Detected Concentration (mg/L)	Mean Detected Concentration (mg/L)	Maximum Detected Concentration (mg/L)	Location of Maximum Detected Concentration	Selected Surface Water Ecological Screening Value (Chronic ESV) (mg/L)	Ratio of Maximum Detected Concentration to Selected Surface Water Ecological Screening Value (Chronic ESV)
LHL3	INORG	Arsenic	D	6	6	5.30E-04	1.12E-03	1.63E-03	LHL3 (10/6/2017)	1.5E-01	1E-02
LHL3	INORG	Arsenic	T	6	6	4.60E-04	1.17E-03	1.73E-03	LHL3 (10/6/2017)	1.5E-01	1E-02
LHL3	INORG	Boron	D	6	6	6.50E-02	2.74E-01	6.13E-01	LHL3 (6/15/2018)	7.2E+00	9E-02
LHL3	INORG	Boron	T	6	6	6.53E-02	2.72E-01	6.24E-01	LHL3 (6/15/2018)	7.2E+00	9E-02
LHL3	INORG	Cadmium	D	6	3	1.10E-05	1.23E-05	1.40E-05	LHL3 (6/15/2018)	3.8E-04	4E-02
LHL3	INORG	Cadmium	T	6	3	1.50E-05	3.57E-05	7.50E-05	LHL3 (6/15/2018)	3.8E-04	2E-01
LHL3	INORG	Iron	D	6	5	2.90E-03	4.68E-02	1.61E-01	LHL3 (10/6/2017)	1.0E+00	2E-01
LHL3	INORG	Iron	T	6	6	1.39E-02	7.35E-02	1.95E-01	LHL3 (10/6/2017)	1.0E+00	2E-01
LHL3	INORG	Lead	D	3	2	1.30E-05	1.60E-05	1.90E-05	LHL3 (6/15/2018)	5.6E-03	3E-03
LHL3	INORG	Lead	T	3	1	1.85E-04	1.85E-04	1.85E-04	LHL3 (6/15/2018)	5.6E-03	3E-02
LHL3	INORG	Magnesium	D	6	6	7.26E+00	9.30E+00	1.06E+01	LHL3 (10/6/2017)	8.2E+01	1E-01
LHL3	INORG	Magnesium	T	6	6	6.73E+00	9.59E+00	1.08E+01	LHL3 (10/6/2017)	8.2E+01	1E-01
LHL3	INORG	Mercury	D	6	2	5.60E-07	6.00E-07	6.40E-07	LHL3 (12/12/2017)	7.7E-04	8E-04
LHL3	INORG	Mercury	T	6	1	7.80E-07	7.80E-07	7.80E-07	LHL3 (6/15/2018)	7.7E-04	1E-03
LHL3	INORG	Methylmercury	D	6	4	3.00E-08	5.50E-08	9.00E-08	LHL3 (10/6/2017)	2.8E-06	3E-02
LHL3	INORG	Methylmercury	T	6	4	4.00E-08	7.50E-08	1.20E-07	LHL3 (10/6/2017)	2.8E-06	4E-02
LHL3	INORG	Selenium	D	6	6	2.00E-04	6.50E-04	1.90E-03	LHL3 (6/15/2018)	5.0E-03	4E-01
LHL3	INORG	Selenium	T	6	6	3.00E-04	7.00E-04	2.00E-03	LHL3 (6/15/2018)	5.0E-03	4E-01
LHL3	INORG	Zinc	D	6	4	5.00E-04	5.75E-04	8.00E-04	LHL3 (10/6/2017)	1.7E-01	5E-03
LHL3	INORG	Zinc	T	6	5	8.00E-04	1.50E-03	2.50E-03	LHL3 (12/12/2017)	1.7E-01	1E-02
LHL4	INORG	Arsenic	D	4	4	9.10E-04	1.07E-03	1.19E-03	LHL4 (12/12/2017)	1.5E-01	8E-03
LHL4	INORG	Arsenic	T	4	4	9.40E-04	1.11E-03	1.27E-03	LHL4 (10/7/2017)	1.5E-01	8E-03
LHL4	INORG	Boron	D	4	4	7.20E-02	1.87E-01	3.56E-01	LHL4 (10/7/2017)	7.2E+00	5E-02
LHL4	INORG	Boron	T	4	4	6.80E-02	1.77E-01	3.17E-01	LHL4 (10/7/2017)	7.2E+00	4E-02
LHL4	INORG	Cadmium	D	4	1	1.10E-05	1.10E-05	1.10E-05	LHL4 (12/12/2017)	3.8E-04	3E-02
LHL4	INORG	Cadmium	T	4	1	2.20E-05	2.20E-05	2.20E-05	LHL4 (12/12/2017)	3.8E-04	6E-02
LHL4	INORG	Iron	D	4	4	2.20E-03	5.51E-02	1.46E-01	LHL4 (10/7/2017)	1.0E+00	1E-01
LHL4	INORG	Iron	T	4	4	1.90E-02	7.25E-02	1.46E-01	LHL4 (10/7/2017)	1.0E+00	1E-01
LHL4	INORG	Magnesium	D	4	4	8.48E+00	9.38E+00	1.04E+01	LHL4 (12/12/2017)	8.2E+01	1E-01
LHL4	INORG	Magnesium	T	4	4	8.76E+00	9.55E+00	1.04E+01	LHL4 (12/12/2017)	8.2E+01	1E-01
LHL4	INORG	Mercury	D	4	3	8.30E-07	1.55E-06	2.83E-06	LHL4 (10/7/2017)	7.7E-04	4E-03
LHL4	INORG	Mercury	T	4	1	3.00E-05	3.00E-05	3.00E-05	LHL4 (10/7/2017)	7.7E-04	4E-02
LHL4	INORG	Methylmercury	D	4	4	3.00E-08	4.75E-08	6.00E-08	LHL4 (10/7/2017)	2.8E-06	2E-02
LHL4	INORG	Methylmercury	T	4	4	5.00E-08	1.23E-07	2.20E-07	LHL4 (10/7/2017)	2.8E-06	8E-02
LHL4	INORG	Selenium	D	4	3	2.00E-04	4.67E-04	7.00E-04	LHL4 (10/7/2017)	5.0E-03	1E-01
LHL4	INORG	Selenium	T	4	3	3.00E-04	5.00E-04	7.00E-04	LHL4 (10/7/2017)	5.0E-03	1E-01
LHL4	INORG	Zinc	D	4	4	1.00E-03	1.30E-03	2.00E-03	LHL4 (12/12/2017)	1.7E-01	1E-02
LHL4	INORG	Zinc	T	4	3	8.00E-04	8.00E-04	8.00E-04	LHL4 (10/7/2017)	1.7E-01	5E-03
Reference (LHL5 and LHL6)	INORG	Arsenic	D	12	12	4.60E-04	8.69E-04	1.19E-03	LHL5 (10/7/2017)	1.5E-01	8E-03
Reference (LHL5 and LHL6)	INORG	Arsenic	T	12	12	4.80E-04	9.01E-04	1.32E-03	LHL6 (10/7/2017)	1.5E-01	9E-03
Reference (LHL5 and LHL6)	INORG	Boron	D	12	12	1.65E-02	1.15E-01	3.53E-01	LHL5 (10/7/2017)	7.2E+00	5E-02
Reference (LHL5 and LHL6)	INORG	Boron	T	12	12	1.54E-02	1.13E-01	3.28E-01	LHL5 (10/7/2017)	7.2E+00	5E-02
Reference (LHL5 and LHL6)	INORG	Cadmium	D	12	6	5.00E-06	7.00E-06	1.00E-05	LHL6 (6/17/2018)	3.8E-04	3E-02
Reference (LHL5 and LHL6)	INORG	Cadmium	T	12	6	7.00E-06	1.27E-05	2.70E-05	LHL6 (6/17/2018)	3.8E-04	7E-02

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E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	Chemical Group	Chemical	Measurement Basis	Analyzed	Detected	Minimum Detected Concentration (mg/L)	Mean Detected Concentration (mg/L)	Maximum Detected Concentration (mg/L)	Location of Maximum Detected Concentration	Selected Surface Water Ecological Screening Value (Chronic ESV) (mg/L)	Ratio of Maximum Detected Concentration to Selected Surface Water Ecological Screening Value (Chronic ESV)
Reference (LHL5 and LHL6)	INORG	Iron	D	12	12	1.90E-03	2.47E-02	1.46E-01	LHL6 (10/7/2017)	1.0E+00	1E-01
Reference (LHL5 and LHL6)	INORG	Iron	T	12	12	7.30E-03	4.98E-02	2.11E-01	LHL6 (10/7/2017)	1.0E+00	2E-01
Reference (LHL5 and LHL6)	INORG	Lead	D	6	4	1.00E-05	1.45E-05	2.10E-05	LHL6 (6/17/2018)	5.6E-03	4E-03
Reference (LHL5 and LHL6)	INORG	Lead	T	6	4	4.60E-05	5.43E-05	7.20E-05	LHL6 (6/17/2018)	5.6E-03	1E-02
Reference (LHL5 and LHL6)	INORG	Magnesium	D	12	12	5.99E+00	8.17E+00	1.04E+01	LHL5 (12/12/2017)	8.2E+01	1E-01
Reference (LHL5 and LHL6)	INORG	Magnesium	T	12	12	6.61E+00	8.43E+00	1.05E+01	LHL5 (12/12/2017)	8.2E+01	1E-01
Reference (LHL5 and LHL6)	INORG	Mercury	D	12	6	8.40E-07	2.68E-06	4.49E-06	LHL5 (10/7/2017)	7.7E-04	6E-03
Reference (LHL5 and LHL6)	INORG	Mercury	T	12	5	8.30E-07	5.64E-05	1.40E-04	LHL6 (10/7/2017)	7.7E-04	2E-01
Reference (LHL5 and LHL6)	INORG	Methylmercury	D	12	8	4.00E-08	6.87E-08	1.30E-07	LHL6 (10/7/2017)	2.8E-06	5E-02
Reference (LHL5 and LHL6)	INORG	Methylmercury	T	12	8	4.00E-08	9.37E-08	1.90E-07	LHL5 (10/7/2017)	2.8E-06	7E-02
Reference (LHL5 and LHL6)	INORG	Selenium	D	12	7	2.00E-04	3.71E-04	6.00E-04	LHL5 (10/7/2017)	5.0E-03	1E-01
Reference (LHL5 and LHL6)	INORG	Selenium	T	12	7	2.00E-04	4.29E-04	7.00E-04	LHL5 (10/7/2017)	5.0E-03	1E-01
Reference (LHL5 and LHL6)	INORG	Zinc	D	12	10	6.00E-04	1.69E-03	5.40E-03	LHL5 (12/12/2017)	1.7E-01	3E-02
Reference (LHL5 and LHL6)	INORG	Zinc	T	12	10	6.00E-04	1.46E-03	3.10E-03	LHL5 (10/7/2017)	1.7E-01	2E-02
Rocky Run Embayment (LHL1)	INORG	Arsenic	D	5	5	8.90E-04	1.21E-03	1.83E-03	LHL1 (10/6/2017)	1.5E-01	1E-02
Rocky Run Embayment (LHL1)	INORG	Arsenic	T	5	5	9.30E-04	1.23E-03	1.81E-03	LHL1 (10/6/2017)	1.5E-01	1E-02
Rocky Run Embayment (LHL1)	INORG	Boron	D	5	5	1.71E-01	2.76E-01	4.03E-01	LHL1 (10/6/2017)	7.2E+00	6E-02
Rocky Run Embayment (LHL1)	INORG	Boron	T	5	5	1.60E-01	2.73E-01	4.15E-01	LHL1 (10/6/2017)	7.2E+00	6E-02
Rocky Run Embayment (LHL1)	INORG	Cadmium	D	5	3	8.00E-06	1.20E-05	1.80E-05	LHL1 (6/15/2018)	3.8E-04	5E-02
Rocky Run Embayment (LHL1)	INORG	Cadmium	T	5	3	1.50E-05	2.10E-05	3.20E-05	LHL1 (6/15/2018)	3.8E-04	9E-02
Rocky Run Embayment (LHL1)	INORG	Iron	D	5	5	1.40E-03	3.56E-02	1.57E-01	LHL1 (10/6/2017)	1.0E+00	2E-01
Rocky Run Embayment (LHL1)	INORG	Iron	T	5	5	9.80E-03	9.05E-02	2.26E-01	LHL1 (10/6/2017)	1.0E+00	2E-01
Rocky Run Embayment (LHL1)	INORG	Lead	D	3	2	1.00E-05	2.75E-05	4.50E-05	LHL1 (6/15/2018)	5.6E-03	8E-03
Rocky Run Embayment (LHL1)	INORG	Lead	T	3	2	1.40E-04	1.45E-04	1.50E-04	LHL1 (6/15/2018)	5.6E-03	3E-02
Rocky Run Embayment (LHL1)	INORG	Magnesium	D	5	5	7.10E+00	9.06E+00	1.07E+01	LHL1 (10/6/2017)	8.2E+01	1E-01
Rocky Run Embayment (LHL1)	INORG	Magnesium	T	5	5	6.86E+00	9.15E+00	1.12E+01	LHL1 (12/11/2017)	8.2E+01	1E-01
Rocky Run Embayment (LHL1)	INORG	Mercury	D	5	1	6.20E-07	6.20E-07	6.20E-07	LHL1 (12/11/2017)	7.7E-04	8E-04
Rocky Run Embayment (LHL1)	INORG	Mercury	T	5	2	7.20E-07	7.80E-07	8.40E-07	LHL1 (6/15/2018)	7.7E-04	1E-03
Rocky Run Embayment (LHL1)	INORG	Methylmercury	D	5	1	4.00E-08	4.00E-08	4.00E-08	LHL1 (12/11/2017)	2.8E-06	1E-02
Rocky Run Embayment (LHL1)	INORG	Methylmercury	T	5	3	3.00E-08	1.07E-07	2.40E-07	LHL1 (10/6/2017)	2.8E-06	9E-02
Rocky Run Embayment (LHL1)	INORG	Selenium	D	5	5	2.00E-04	6.40E-04	1.10E-03	LHL1 (6/15/2018)	5.0E-03	2E-01
Rocky Run Embayment (LHL1)	INORG	Selenium	T	5	5	2.00E-04	6.20E-04	1.10E-03	LHL1 (6/15/2018)	5.0E-03	2E-01
Rocky Run Embayment (LHL1)	INORG	Zinc	D	5	4	9.00E-04	2.78E-03	6.70E-03	LHL1 (6/15/2018)	1.7E-01	4E-02
Rocky Run Embayment (LHL1)	INORG	Zinc	T	5	3	7.00E-04	1.70E-03	2.50E-03	LHL1 (10/6/2017)	1.7E-01	1E-02

Notes:
Only constituents detected in each area are shown.
Concentration/screening level ratios greater than 1 are shaded in bold.
Measurement basis; T = total, D = dissolved

LHL Lower Herrington Lake
mg/L Milligrams per Liter
INORG Inorganic

Table 5-5: Pore Water Ecological Screening Results
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	Chemical Group	Chemical	Measurement Basis	Analyzed	Detected	Minimum Detected Concentration (mg/L)	Mean Detected Concentration (mg/L)	Maximum Detected Concentration (mg/L)	Location of Maximum Detected Concentration	Selected Surface Water Ecological Screening Value (Chronic ESV) (mg/L)	Ratio of Maximum Detected Concentration to Selected Surface Water Ecological Screening Value (Chronic ESV)
Curds Inlet	INORG	Arsenic	D	36	36	5.15E-04	1.38E-01	1.50E+00	CI3.1A (7/19/2018)	1.5E-01	**1E+01**
Curds Inlet	INORG	Arsenic	D	18	18	2.71E-03	3.07E-01	2.13E+00	CI3.1A (7/19/2018)	1.5E-01	**1E+01**
Curds Inlet	INORG	Boron	D	27	27	4.57E-01	1.93E+00	5.97E+00	CI1A (7/19/2018)	7.2E+00	8E-01
Curds Inlet	INORG	Cadmium	D	27	14	8.00E-06	1.76E-04	2.04E-03	CI3B (7/19/2018)	3.8E-04	**5E+00**
Curds Inlet	INORG	Iron	D	27	27	8.70E-03	1.46E+00	8.17E+00	CI3A (7/20/2018)	1.0E+00	**8E+00**
Curds Inlet	INORG	Lead	D	18	18	9.00E-06	2.27E-04	3.11E-03	CI3B (7/19/2018)	5.6E-03	6E-01
Curds Inlet	INORG	Magnesium	D	27	27	1.11E+01	2.33E+01	4.57E+01	CI2.1A (7/19/2018)	8.2E+01	6E-01
Curds Inlet	INORG	Mercury	D	54	27	8.00E-07	6.22E-06	9.00E-05	CURDS2C (11/3/2017)	7.7E-04	1E-01
Curds Inlet	INORG	Methylmercury	D	27	11	3.00E-08	6.45E-08	1.30E-07	CI1A (7/19/2018)	2.8E-06	5E-02
Curds Inlet	INORG	Selenium	D	27	27	7.00E-04	2.51E-03	8.80E-03	CI1A (7/19/2018)	5.0E-03	**2E+00**
Curds Inlet	INORG	Zinc	D	27	25	2.10E-03	1.01E-02	1.07E-01	CURDS2A (11/4/2017)	1.7E-01	6E-01
Hardin Inlet	INORG	Arsenic	D	8	8	5.24E-04	4.54E-03	9.07E-03	HI1B (11/3/2017)	1.5E-01	6E-02
Hardin Inlet	INORG	Boron	D	4	4	1.73E-01	2.27E-01	3.10E-01	HI1C (11/4/2017)	7.2E+00	4E-02
Hardin Inlet	INORG	Iron	D	4	4	2.09E-02	7.51E-01	2.51E+00	HI1B (11/3/2017)	1.0E+00	**3E+00**
Hardin Inlet	INORG	Magnesium	D	4	4	1.04E+01	1.20E+01	1.36E+01	HI1C (11/1/2017)	8.2E+01	2E-01
Hardin Inlet	INORG	Mercury	D	7	3	9.50E-07	1.26E-06	1.55E-06	HI1B (11/3/2017)	7.7E-04	2E-03
Hardin Inlet	INORG	Methylmercury	D	4	3	6.00E-08	9.33E-08	1.20E-07	HI1C (11/1/2017)	2.8E-06	4E-02
Hardin Inlet	INORG	Selenium	D	4	4	2.00E-04	4.00E-04	8.00E-04	HI1C (11/4/2017)	5.0E-03	2E-01
Hardin Inlet	INORG	Zinc	D	4	4	2.50E-03	3.48E-03	4.80E-03	HI1C (11/4/2017)	1.7E-01	3E-02
HQ Inlet	INORG	Arsenic	D	6	6	5.55E-04	1.19E-02	3.88E-02	HQ1B (11/4/2017)	1.5E-01	3E-01
HQ Inlet	INORG	Boron	D	3	3	1.71E-01	2.74E-01	3.46E-01	HQ1B (11/4/2017)	7.2E+00	5E-02
HQ Inlet	INORG	Cadmium	D	3	1	6.00E-06	6.00E-06	6.00E-06	HQ1A (11/4/2017)	3.8E-04	2E-02
HQ Inlet	INORG	Iron	D	3	3	3.04E-02	6.94E-01	2.02E+00	HQ1B (11/4/2017)	1.0E+00	**2E+00**
HQ Inlet	INORG	Magnesium	D	3	3	5.84E+00	1.08E+01	1.65E+01	HQ1B (11/4/2017)	8.2E+01	2E-01
HQ Inlet	INORG	Mercury	D	6	3	1.03E-06	1.20E-06	1.39E-06	HQ1B (11/4/2017)	7.7E-04	2E-03
HQ Inlet	INORG	Selenium	D	3	3	6.00E-04	8.67E-04	1.20E-03	HQ1A (11/4/2017)	5.0E-03	2E-01
HQ Inlet	INORG	Zinc	D	3	3	2.10E-03	2.27E-03	2.50E-03	HQ1C (11/4/2017)	1.7E-01	1E-02

Notes:
Only constituents detected in each area are shown.
Concentration/screening level ratios greater than 1 are shaded in bold.
Measurement basis; T = total, D = dissolved

LHL Lower Herrington Lake
mg/L Milligrams per Liter
INORG Inorganic

Table 5-6: Sediment Ecological Screening Summary
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	Chemical Group	Chemical	Analyzed	Detected	Minimum Detected Concentration (mg/kg)	Mean Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Concentration	Selected (USEPA Region 4) Sediment Ecological Screening Values (ESVs) (mg/kg)	Ratio of Maximum Detected Concentration to USEPA Region 4 Sediment Ecological Screening Values (ESVs)
Curds Inlet	INORG	Arsenic	37	37	1.30E+01	1.16E+02	4.15E+02	CI2.2A (0-0.5 ft)	9.8E+00	**4E+01**
Curds Inlet	INORG	Boron	31	31	2.95E+00	1.61E+01	7.23E+01	CI1A (0-0.5 ft)		
Curds Inlet	INORG	Cadmium	31	31	2.92E-01	1.94E+00	1.01E+01	CI1A (0-0.5 ft)	1.0E+00	**1E+01**
Curds Inlet	INORG	Iron	37	37	1.03E+04	3.51E+04	6.85E+04	CI3B (0-0.5 ft)	2.0E+04	**3E+00**
Curds Inlet	INORG	Lead	37	37	2.20E+00	2.22E+01	3.83E+01	CI1C (0-0.5 ft)	3.6E+01	1E+00
Curds Inlet	INORG	Magnesium	31	31	1.72E+03	4.09E+03	8.86E+03	CI4B (0-0.5 ft)		
Curds Inlet	INORG	Mercury	31	30	2.00E-03	5.20E-02	1.22E-01	CI2.1A (0-0.5 ft)	1.8E-01	7E-01
Curds Inlet	INORG	Methylmercury	31	5	9.00E-05	3.16E-04	5.80E-04	CI2.1A (0-0.5 ft)	4.5E-04	1E+00
Curds Inlet	INORG	Selenium	37	37	6.60E-01	5.82E+00	2.41E+01	CI3A (0-0.5 ft)	7.2E-01	**3E+01**
Curds Inlet	INORG	Zinc	31	31	1.88E+01	9.37E+01	2.45E+02	CI1A (0-0.5 ft)	1.2E+02	**2E+00**
Dix Dam (LHL2)	INORG	Arsenic	2	2	2.69E+01	2.79E+01	2.89E+01	LHL2C (0-0.5 ft)	9.8E+00	**3E+00**
Dix Dam (LHL2)	INORG	Boron	2	2	6.86E+00	7.38E+00	7.89E+00	LHL2B (0-0.5 ft)		
Dix Dam (LHL2)	INORG	Cadmium	2	2	4.65E-01	5.56E-01	6.46E-01	LHL2C (0-0.5 ft)	1.0E+00	6E-01
Dix Dam (LHL2)	INORG	Iron	2	2	2.83E+04	3.12E+04	3.41E+04	LHL2C (0-0.5 ft)	2.0E+04	**2E+00**
Dix Dam (LHL2)	INORG	Lead	2	2	9.70E+00	1.29E+01	1.61E+01	LHL2C (0-0.5 ft)	3.6E+01	4E-01
Dix Dam (LHL2)	INORG	Magnesium	2	2	4.94E+03	6.95E+03	8.95E+03	LHL2C (0-0.5 ft)		
Dix Dam (LHL2)	INORG	Mercury	2	2	2.94E-02	3.12E-02	3.30E-02	LHL2B (0-0.5 ft)	1.8E-01	2E-01
Dix Dam (LHL2)	INORG	Selenium	2	2	1.57E+00	2.59E+00	3.61E+00	LHL2C (0-0.5 ft)	7.2E-01	**5E+00**
Dix Dam (LHL2)	INORG	Zinc	2	2	3.86E+01	5.01E+01	6.15E+01	LHL2C (0-0.5 ft)	1.2E+02	5E-01
Dix River	INORG	Arsenic	1	1	1.20E+01	1.20E+01	1.20E+01	DR1 (0-0.5 ft)	9.8E+00	1E+00
Dix River	INORG	Boron	1	1	3.40E+00	3.40E+00	3.40E+00	DR1 (0-0.5 ft)		
Dix River	INORG	Cadmium	1	1	3.27E-01	3.27E-01	3.27E-01	DR1 (0-0.5 ft)	1.0E+00	3E-01
Dix River	INORG	Iron	1	1	2.96E+04	2.96E+04	2.96E+04	DR1 (0-0.5 ft)	2.0E+04	1E+00
Dix River	INORG	Lead	1	1	1.80E+01	1.80E+01	1.80E+01	DR1 (0-0.5 ft)	3.6E+01	5E-01
Dix River	INORG	Magnesium	1	1	3.77E+03	3.77E+03	3.77E+03	DR1 (0-0.5 ft)		
Dix River	INORG	Mercury	1	1	2.90E-02	2.90E-02	2.90E-02	DR1 (0-0.5 ft)	1.8E-01	2E-01
Dix River	INORG	Methylmercury	1	1	5.00E-05	5.00E-05	5.00E-05	DR1 (0-0.5 ft)	4.5E-04	1E-01
Dix River	INORG	Selenium	1	1	5.00E-01	5.00E-01	5.00E-01	DR1 (0-0.5 ft)	7.2E-01	7E-01
Dix River	INORG	Zinc	1	1	6.72E+01	6.72E+01	6.72E+01	DR1 (0-0.5 ft)	1.2E+02	6E-01
Hardin Inlet	INORG	Arsenic	4	4	9.10E+00	1.91E+01	3.40E+01	HARDIN1B (0-0 ft)	9.8E+00	**3E+00**
Hardin Inlet	INORG	Iron	4	4	2.30E+04	2.90E+04	3.40E+04	HARDIN1B (0-0 ft)	2.0E+04	**2E+00**
Hardin Inlet	INORG	Lead	4	4	2.00E+01	2.95E+01	3.70E+01	HARDIN1B (0-0 ft)	3.6E+01	1E+00
Hardin Inlet	INORG	Selenium	4	4	6.10E-01	1.33E+00	2.00E+00	HARDIN1B (0-0 ft)	7.2E-01	**3E+00**
HQ Inlet	INORG	Arsenic	3	3	1.91E+01	3.41E+01	5.02E+01	HQ1B (0-0.5 ft)	9.8E+00	**5E+00**
HQ Inlet	INORG	Boron	3	3	8.63E+00	2.61E+01	4.84E+01	HQ1A (0-0.5 ft)		
HQ Inlet	INORG	Cadmium	3	3	2.68E-01	1.21E+00	2.36E+00	HQ1A (0-0.5 ft)	1.0E+00	**2E+00**
HQ Inlet	INORG	Iron	3	3	1.74E+04	2.27E+04	2.76E+04	HQ1C (0-0.5 ft)	2.0E+04	1E+00
HQ Inlet	INORG	Lead	3	3	1.50E+01	1.77E+01	2.00E+01	HQ1B (0-0.5 ft)	3.6E+01	6E-01
HQ Inlet	INORG	Magnesium	3	3	3.56E+03	4.20E+03	4.72E+03	HQ1A (0-0.5 ft)		
HQ Inlet	INORG	Mercury	3	3	3.40E-02	4.23E-02	5.90E-02	HQ1A (0-0.5 ft)	1.8E-01	3E-01
HQ Inlet	INORG	Methylmercury	3	3	4.10E-04	8.57E-04	1.70E-03	HQ1A (0-0.5 ft)	4.5E-04	**4E+00**
HQ Inlet	INORG	Selenium	3	3	9.00E-01	7.83E+00	1.55E+01	HQ1A (0-0.5 ft)	7.2E-01	**2E+01**
HQ Inlet	INORG	Zinc	3	3	4.47E+01	5.63E+01	6.76E+01	HQ1A (0-0.5 ft)	1.2E+02	6E-01

Table 5-6: Sediment Ecological Screening Summary
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Area	Chemical Group	Chemical	Analyzed	Detected	Minimum Detected Concentration (mg/kg)	Mean Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Concentration	Selected (USEPA Region 4) Sediment Ecological Screening Values (ESVs) (mg/kg)	Ratio of Maximum Detected Concentration to USEPA Region 4 Sediment Ecological Screening Values (ESVs)
LHL3	INORG	Arsenic	2	2	8.58E+00	1.17E+01	1.49E+01	LHL3B (0-0.5 ft)	9.8E+00	**2E+00**
LHL3	INORG	Boron	2	2	1.11E+01	1.48E+01	1.85E+01	LHL3C (0-0.5 ft)		
LHL3	INORG	Cadmium	2	2	4.36E-01	4.53E-01	4.70E-01	LHL3C (0-0.5 ft)	1.0E+00	5E-01
LHL3	INORG	Iron	2	2	1.04E+04	1.20E+04	1.36E+04	LHL3B (0-0.5 ft)	2.0E+04	7E-01
LHL3	INORG	Lead	2	2	8.00E+00	1.10E+01	1.40E+01	LHL3B (0-0.5 ft)	3.6E+01	4E-01
LHL3	INORG	Magnesium	2	2	8.18E+03	1.02E+04	1.22E+04	LHL3B (0-0.5 ft)		
LHL3	INORG	Mercury	2	2	1.80E-02	1.85E-02	1.90E-02	LHL3B (0-0.5 ft)	1.8E-01	1E-01
LHL3	INORG	Methylmercury	2	2	3.40E-04	5.25E-04	7.10E-04	LHL3B (0-0.5 ft)	4.5E-04	**2E+00**
LHL3	INORG	Selenium	2	2	1.70E+00	2.75E+00	3.80E+00	LHL3C (0-0.5 ft)	7.2E-01	**5E+00**
LHL3	INORG	Zinc	2	2	2.46E+01	4.74E+01	7.02E+01	LHL3B (0-0.5 ft)	1.2E+02	6E-01
LHL4	INORG	Arsenic	2	2	6.44E+00	1.17E+01	1.69E+01	LHL4B (0-0.5 ft)	9.8E+00	**2E+00**
LHL4	INORG	Boron	2	2	3.52E+00	7.11E+00	1.07E+01	LHL4C (0-0.5 ft)		
LHL4	INORG	Cadmium	2	2	1.28E-01	1.83E-01	2.37E-01	LHL4C (0-0.5 ft)	1.0E+00	2E-01
LHL4	INORG	Iron	2	2	1.07E+04	1.48E+04	1.88E+04	LHL4B (0-0.5 ft)	2.0E+04	9E-01
LHL4	INORG	Lead	2	2	8.00E+00	8.50E+00	9.00E+00	LHL4B (0-0.5 ft)	3.6E+01	3E-01
LHL4	INORG	Magnesium	2	2	5.14E+03	1.17E+04	1.82E+04	LHL4C (0-0.5 ft)		
LHL4	INORG	Mercury	2	2	6.00E-03	1.10E-02	1.60E-02	LHL4C (0-0.5 ft)	1.8E-01	9E-02
LHL4	INORG	Methylmercury	2	1	1.30E-04	1.30E-04	1.30E-04	LHL4B (0-0.5 ft)	4.5E-04	3E-01
LHL4	INORG	Selenium	2	2	5.00E-01	1.35E+00	2.20E+00	LHL4C (0-0.5 ft)	7.2E-01	**3E+00**
LHL4	INORG	Zinc	2	2	2.43E+01	3.10E+01	3.77E+01	LHL4C (0-0.5 ft)	1.2E+02	3E-01
Reference (LHL5 and LHL6)	INORG	Arsenic	4	4	1.73E+00	1.01E+01	2.22E+01	LHL5C (0-0.5 ft)	9.8E+00	**2E+00**
Reference (LHL5 and LHL6)	INORG	Boron	4	4	6.38E+00	1.06E+01	2.03E+01	LHL6C (0-0.5 ft)		
Reference (LHL5 and LHL6)	INORG	Cadmium	4	4	5.70E-02	2.73E-01	3.94E-01	LHL6C (0-0.5 ft)	1.0E+00	4E-01
Reference (LHL5 and LHL6)	INORG	Iron	4	4	4.94E+03	1.63E+04	2.66E+04	LHL5C (0-0.5 ft)	2.0E+04	1E+00
Reference (LHL5 and LHL6)	INORG	Lead	4	3	9.00E+00	1.66E+01	2.80E+01	LHL5C (0-0.5 ft)	3.6E+01	8E-01
Reference (LHL5 and LHL6)	INORG	Magnesium	4	4	5.36E+03	1.07E+04	2.36E+04	LHL6B (0-0.5 ft)		
Reference (LHL5 and LHL6)	INORG	Mercury	4	4	4.00E-03	2.10E-02	3.10E-02	LHL6C (0-0.5 ft)	1.8E-01	2E-01
Reference (LHL5 and LHL6)	INORG	Methylmercury	4	4	4.00E-05	5.13E-04	1.74E-03	LHL6C (0-0.5 ft)	4.5E-04	**4E+00**
Reference (LHL5 and LHL6)	INORG	Selenium	4	4	4.00E-01	1.74E+00	4.10E+00	LHL6C (0-0.5 ft)	7.2E-01	**6E+00**
Reference (LHL5 and LHL6)	INORG	Zinc	4	4	1.09E+01	4.18E+01	6.39E+01	LHL5C (0-0.5 ft)	1.2E+02	5E-01
Rocky Run Embayment (LHL1)	INORG	Arsenic	2	2	9.30E+00	1.00E+01	1.07E+01	LHL1C (0-0.5 ft)	9.8E+00	1E+00
Rocky Run Embayment (LHL1)	INORG	Boron	2	2	1.72E+01	1.87E+01	2.02E+01	LHL1C (0-0.5 ft)		
Rocky Run Embayment (LHL1)	INORG	Cadmium	2	2	8.53E-01	8.82E-01	9.10E-01	LHL1B (0-0.5 ft)	1.0E+00	9E-01
Rocky Run Embayment (LHL1)	INORG	Iron	2	2	1.72E+04	1.73E+04	1.73E+04	LHL1B (0-0.5 ft)	2.0E+04	9E-01
Rocky Run Embayment (LHL1)	INORG	Lead	2	2	1.30E+01	1.50E+01	1.70E+01	LHL1C (0-0.5 ft)	3.6E+01	5E-01
Rocky Run Embayment (LHL1)	INORG	Magnesium	2	2	1.76E+04	1.77E+04	1.78E+04	LHL1C (0-0.5 ft)		
Rocky Run Embayment (LHL1)	INORG	Mercury	2	2	4.10E-02	5.10E-02	6.10E-02	LHL1C (0-0.5 ft)	1.8E-01	3E-01
Rocky Run Embayment (LHL1)	INORG	Methylmercury	2	2	4.60E-04	4.70E-04	4.80E-04	LHL1C (0-0.5 ft)	4.5E-04	1E+00
Rocky Run Embayment (LHL1)	INORG	Selenium	2	2	4.70E+00	4.80E+00	4.90E+00	LHL1B (0-0.5 ft)	7.2E-01	**7E+00**
Rocky Run Embayment (LHL1)	INORG	Zinc	2	2	5.91E+01	6.56E+01	7.20E+01	LHL1B (0-0.5 ft)	1.2E+02	6E-01

Notes:
Only constituents detected in each area are shown.
Concentration/screening level ratios greater than 1 are shaded in bold.
Sediment concentrations are in dry weight.

LHL Lower Herrington Lake
mg/L Milligrams per Liter
INORG Inorganic

Table 5-7A: Surface Water Evaluation for the Protection of Aquatic Organisms (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Surface Water ESV	Site-wide EPC	Site-wide Total Potential Risk for Aquatic Organisms (Aquatic Plants, Inverts, and Fish)	Reference EPC	Reference Total Potential Risk for Aquatic Organisms (Aquatic Plants, Inverts, and Fish)
			95th UCL (a)	95th UCL	95th UCL (a)	95th UCL
Dissolved Concentration	CASRN	mg/L	mg/L	HQ	mg/L	HQ
Arsenic	7440-38-2	1.50E-01	1.47E-03	0.01	1.01E-03	0.007
Cadmium	7440-43-9	3.76E-04	5.19E-05	0.1	6.84E-06	0.02
Lead	7439-92-1	5.60E-03	4.09E-05	0.007	1.66E-05	0.003
Mercury	7439-97-6	7.70E-04	3.50E-04	0.5	2.44E-06	0.003
Methylmercury	22967-92-6	2.80E-06	5.90E-07	0.2	8.14E-08	0.03
Selenium	7782-49-2	5.00E-03	1.39E-03	0.3	3.69E-04	0.07
Zinc	7440-66-6	1.75E-01	2.50E-03	0.01	2.89E-03	0.02
Total Concentration						
Arsenic	7440-38-2	1.50E-01	1.77E-03	0.01	1.04E-03	0.007
Cadmium	7440-43-9	3.76E-04	6.39E-05	0.2	1.23E-05	0.03
Lead	7439-92-1	5.60E-03	1.78E-04	0.03	6.14E-05	0.01
Mercury	7439-97-6	7.70E-04	1.74E-03	2	7.91E-05	0.1
Methylmercury	22967-92-6	2.80E-06	8.60E-07	0.3	1.11E-07	0.04
Selenium	7782-49-2	5.00E-03	1.38E-03	0.3	4.23E-04	0.08
Zinc	7440-66-6	1.75E-01	2.22E-03	0.01	1.85E-03	0.01

Notes:
CASRN = Chemical Abstracts Service Registry Number
DL = Detection limit
EPC = Environmental point concentration
ESV = Ecological screening value
HQ = Hazard quotient
mg/L = Milligram per liter
ND = Non-detects
UCL = Upper confidence limit

1	HQs are 1 and below 1.
5	HQs are between 1 and 5.
10	HQs are between 6 and 100.
100	HQs are above 100.

(a) 95th% UCLs calculated with USEPA ProUCL Software Version 5.1.00 (on-line). https://www.epa.gov/land-research/proucl-software (Accessed February 2019).

Table 5-7B: Surface Water Evaluation for the Protection of Aquatic Organisms (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Surface Water ESV	Curds Inlet EPC	Curds Inlet Total Potential Risk for Aquatic Organisms (Aquatic Plants, Inverts, and Fish)	Reference EPC	Reference Total Potential Risk for Aquatic Organisms (Aquatic Plants, Inverts, and Fish)
			95th UCL (a)	95th UCL	95th UCL (a)	95th UCL
Dissolved Concentration	CASRN	mg/L	mg/L	HQ	mg/L	HQ
Arsenic	7440-38-2	1.50E-01	2.19E-03	0.01	1.01E-03	0.007
Cadmium	7440-43-9	3.76E-04	8.07E-05	0.2	6.84E-06	0.02
Lead	7439-92-1	5.60E-03	4.60E-05	0.008	1.66E-05	0.003
Mercury	7439-97-6	7.70E-04	6.47E-04	0.8	2.44E-06	0.003
Methylmercury	22967-92-6	2.80E-06	2.01E-07	0.07	8.14E-08	0.03
Selenium	7782-49-2	5.00E-03	3.13E-03	0.6	3.69E-04	0.07
Zinc	7440-66-6	1.75E-01	1.49E-03	0.009	2.89E-03	0.02
Total Concentration						
Arsenic	7440-38-2	1.50E-01	2.95E-03	0.02	1.04E-03	0.007
Cadmium	7440-43-9	3.76E-04	1.77E-04	0.5	1.23E-05	0.03
Lead	7439-92-1	5.60E-03	3.31E-04	0.06	6.14E-05	0.01
Mercury	7439-97-6	7.70E-04	3.20E-03	4	7.91E-05	0.1
Methylmercury	22967-92-6	2.80E-06	3.08E-07	0.1	1.11E-07	0.04
Selenium	7782-49-2	5.00E-03	3.12E-03	0.6	4.23E-04	0.08
Zinc	7440-66-6	1.75E-01	4.20E-03	0.02	1.85E-03	0.01

Notes:
CASRN = Chemical Abstracts Service Registry Number
DL = Detection limit
EPC = Environmental point concentration
ESV = Ecological screening value
HQ = Hazard quotient
mg/L = Milligram per liter
ND = Non-detects
UCL = Upper confidence limit

1	HQs are 1 and below 1.
5	HQs are between 1 and 5.
10	HQs are between 6 and 100.
100	HQs are above 100.

(a) 95th% UCLs calculated with USEPA ProUCL Software Version 5.1.00 (on-line). https://www.epa.gov/land-research/proucl-software (Accessed February 2019).

Table 5-7C: Surface Water Evaluation for the Protection of Aquatic Organisms (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Surface Water ESV	Site without Curds Inlet EPC	Site without Curds Inlet Total Potential Risk for Aquatic Organisms (Aquatic Plants, Inverts, and Fish)	Reference EPC	Reference Total Potential Risk for Aquatic Organisms (Aquatic Plants, Inverts, and Fish)
			95th UCL (a)	95th UCL	95th UCL (a)	95th UCL
Dissolved Concentration	CASRN	mg/L	mg/L	HQ	mg/L	HQ
Arsenic	7440-38-2	1.50E-01	1.16E-03	0.008	1.01E-03	0.007
Cadmium	7440-43-9	3.76E-04	2.82E-05	0.07	6.84E-06	0.02
Lead	7439-92-1	5.60E-03	2.45E-05	0.004	1.66E-05	0.003
Mercury	7439-97-6	7.70E-04	1.34E-06	0.002	2.44E-06	0.003
Methylmercury	22967-92-6	2.80E-06	5.90E-08	0.02	8.14E-08	0.03
Selenium	7782-49-2	5.00E-03	6.31E-04	0.1	3.69E-04	0.07
Zinc	7440-66-6	1.75E-01	2.46E-03	0.01	2.89E-03	0.02
Total Concentration						
Arsenic	7440-38-2	1.50E-01	1.24E-03	0.008	1.04E-03	0.007
Cadmium	7440-43-9	3.76E-04	2.09E-05	0.06	1.23E-05	0.03
Lead	7439-92-1	5.60E-03	1.93E-04	0.03	6.14E-05	0.01
Mercury	7439-97-6	7.70E-04	7.26E-05	0.09	7.91E-05	0.1
Methylmercury	22967-92-6	2.80E-06	1.13E-07	0.04	1.11E-07	0.04
Selenium	7782-49-2	5.00E-03	6.61E-04	0.1	4.23E-04	0.08
Zinc	7440-66-6	1.75E-01	1.28E-03	0.007	1.85E-03	0.01

Notes:
CASRN = Chemical Abstracts Service Registry Number
DL = Detection limit
EPC = Environmental point concentration
ESV = Ecological screening value
HQ = Hazard quotient
mg/L = Milligram per liter
ND = Non-detects
UCL = Upper confidence limit

1	HQs are 1 and below 1.
5	HQs are between 1 and 5.
10	HQs are between 6 and 100.
100	HQs are above 100.

(a) 95th% UCLs calculated with USEPA ProUCL Software Version 5.1.00 (on-line). https://www.epa.gov/land-research/proucl-software (Accessed February 2019).

Table 5-7D: Arsenic Spiked Sediment Studies
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Sediment Toxicity Study-Based Benchmarks	Arsenic (mg/kg)	Reference
Midge (*Chironomus tentans*) NOEC	130	Martinez et al. 2006
Midge (*Chironomus tentans*) NOEC	260	Martinez et al. 2006
Amphipod (*Hyalella azteca*) NOEC	462	Liber et al 2011
Amphipod (*Hyalella azteca*) LC25	521	Liber et al 2011
Midge (*Chironomus dilutus*) LC25	675	Liber et al 2011
Midge (*Chironomus dilutus*) LC25	675	Liber et al 2011

Notes:

Average All	450
Average Midge NOECs and Amphipods	340
Geomean NOECs	250

LC25	Lethal concentration for 25 percent of organisms in testing group
NOEC	No observable effects concentration

Sources:

Liber K., L.E. Doig, and S.L. White-Sobey. 2011. Toxicity of uranium, molybdenum, nickel, and arsenic to Hyalella azteca and Chironomus dilutus in water-only and spiked-sediment toxicity tests. Eoctoxicology and Environmental Safety 74: 1171-1179.

Martinez E., L. Wold, B. Moore, J. Schaumloffel, and N. Dasgupta. Morphologic and Growth Responses in Chironomus tentans to Arsenic Exposure. Archives of environmental contamination and toxicology. 51. 529-36.

Table 5-8: Reference Ecological Data
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Reference Total Surface Water	Reference Dissolved Surface Water	Reference Sediment	Reference Aquatic Plant Tissue	Reference Benthic Invertebrate Tissue	Reference Fish Tissue
		95th UCL (a)	95th UCL (a)	95th UCL (a)	Max	Max	95th UCL (a)
Chemical	CASRN	mg/L	mg/L	mg/kg	mg/kg ww	mg/kg ww	mg/kg ww
Arsenic	7440-38-2	1.04E-03	1.01E-03	2.22E+01	1.02E+00	4.80E-01	3.13E-01
Cadmium	7440-43-9	1.23E-05	6.84E-06	3.94E-01	6.74E-02	6.72E-02	1.03E-02
Lead	7439-92-1	6.14E-05	1.66E-05	2.80E+01	7.45E-01	4.91E-02	1.90E-02
Mercury	7439-97-6	7.91E-05	2.44E-06	3.10E-02	4.60E-03	1.18E-02	7.73E-02
Methylmercury	22967-92-6	1.11E-07	8.14E-08	1.74E-03	4.00E-03	1.29E-02	9.79E-02
Selenium	7782-49-2	4.23E-04	3.69E-04	4.10E+00	7.40E-01	7.40E-01	7.61E-01
Zinc	7440-66-6	1.85E-03	2.89E-03	6.39E+01	4.13E+00	2.47E+01	2.11E+01

Notes:
CASRN = Chemical Abstracts Service Registry Number
mg/kg = Milligrams per kilogram
mg/L = Milligram per liter
UCL = Upper confidence limit
ww = Wet weight

Upgradient reference area data are those from LHL5 and LHL6 for surface water and sediment and from LHL5, LHL6, MHL1 and MHL3, for fish tissues.
(a) 95th% UCLs could not be calculated due to insufficient number of data points.

Table 5-9A: Ecological Food Web Model Input Data (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Total Surface Water	Dissolved Surface Water	Sediment	Aquatic Plant Tissue	Benthic Invertebrate Tissue	Fish Tissue
		95th UCL (a)	95th UCL (a)	95th UCL (a)	95th UCL (a)	95th UCL (a)	95th UCL (a)
Chemical	CASRN	mg/L	mg/L	mg/kg	mg/kg ww	mg/kg ww	mg/kg ww
Arsenic	7440-38-2	1.77E-03	1.47E-03	1.51E+02	1.71E+00	4.66E-01	2.46E-01
Cadmium	7440-43-9	6.39E-05	5.19E-05	2.82E+00	1.58E-01	1.93E-01	1.81E-02
Lead	7439-92-1	1.78E-04	4.09E-05	2.25E+01	1.23E+00	7.44E-02	1.81E-02
Mercury	7439-97-6	1.74E-03	3.50E-04	5.90E-02	5.74E-03	1.17E-02	8.02E-02
Methylmercury	22967-92-6	8.60E-07	5.90E-07	3.04E-04	1.23E-03	1.25E-02	8.28E-02
Selenium	7782-49-2	1.38E-03	1.39E-03	1.05E+01	5.33E-01	6.97E-01	9.37E-01
Zinc	7440-66-6	2.22E-03	2.50E-03	9.97E+01	5.97E+00	2.33E+01	2.11E+01

Notes:
CASRN = Chemical Abstracts Service Registry Number
mg/kg = Milligrams per kilogram
mg/L = Milligram per liter
UCL = Upper confidence limit
ww = Wet weight

(a) 95th% UCLs calculated with USEPA ProUCL Software Version 5.1.00 (on-line). https://www.epa.gov/land-research/proucl-software (Accessed February 2019).

Table 5-9B: Ecological Food Web Model Input Data (Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Total Surface Water	Dissolved Surface Water	Sediment	Aquatic Plant Tissue	Benthic Invertebrate Tissue	Fish Tissue
		95th UCL (a)	95th UCL (a)	95th UCL (a)	95th UCL (a)	95th UCL (a)	95th UCL (a)
Chemical	CASRN	mg/L	mg/L	mg/kg	mg/kg ww	mg/kg ww	mg/kg ww
Arsenic	7440-38-2	2.95E-03	2.19E-03	1.80E+02	1.01E+00	4.12E-01	2.42E-01
Cadmium	7440-43-9	1.77E-04	8.07E-05	3.67E+00	3.06E-01	3.44E-01	6.46E-02
Lead	7439-92-1	3.31E-04	4.60E-05	2.44E+01	1.21E+00	5.52E-02	3.20E-02
Mercury	7439-97-6	3.20E-03	6.47E-04	7.08E-02	3.76E-03	1.08E-02	6.81E-02
Methylmercury	22967-92-6	3.08E-07	2.01E-07	1.21E-04	2.00E-03	1.11E-02	7.56E-02
Selenium	7782-49-2	3.12E-03	3.13E-03	1.36E+01	3.22E-01	7.63E-01	1.58E+00
Zinc	7440-66-6	4.20E-03	1.49E-03	1.13E+02	6.42E+00	2.23E+01	1.98E+01

Notes:
CASRN = Chemical Abstracts Service Registry Number
mg/kg = Milligrams per kilogram
mg/L = Milligram per liter
UCL = Upper confidence limit
ww = Wet weight

(a) 95th% UCLs calculated with USEPA ProUCL Software Version 5.1.00 (on-line). https://www.epa.gov/land-research/proucl-software (Accessed February 2019).

Table 5-9C: Ecological Food Web Model Input Data (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Total Surface Water	Dissolved Surface Water	Sediment	Aquatic Plant Tissue	Benthic Invertebrate Tissue	Fish Tissue
		95th UCL (a)	95th UCL (a)	95th UCL (a)	95th UCL (a)	95th UCL (a)	95th UCL (a)
Chemical	CASRN	mg/L	mg/L	mg/kg	mg/kg ww	mg/kg ww	mg/kg ww
Arsenic	7440-38-2	1.24E-03	1.16E-03	2.24E+01	2.04E+00	5.24E-01	2.53E-01
Cadmium	7440-43-9	2.09E-05	2.82E-05	8.87E-01	1.05E-01	1.05E-01	1.25E-02
Lead	7439-92-1	1.93E-04	2.45E-05	2.03E+01	1.47E+00	8.58E-02	1.71E-02
Mercury	7439-97-6	7.26E-05	1.34E-06	3.59E-02	6.76E-03	1.30E-02	8.42E-02
Methylmercury	22967-92-6	1.13E-07	5.90E-08	8.79E-04	2.00E-03	1.42E-02	1.03E-01
Selenium	7782-49-2	6.61E-04	6.31E-04	4.59E+00	6.75E-01	7.10E-01	8.45E-01
Zinc	7440-66-6	1.28E-03	2.46E-03	5.76E+01	6.31E+00	2.43E+01	2.16E+01

Notes:
CASRN = Chemical Abstracts Service Registry Number
mg/kg = Milligrams per kilogram
mg/L = Milligram per liter
UCL = Upper confidence limit
ww = Wet weight

(a) 95th% UCLs calculated with USEPA ProUCL Software Version 5.1.00 (on-line). https://www.epa.gov/land-research/proucl-software (Accessed February 2019).

Table 5-10A: Uptake From Sediment To Small Mammals (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Sediment to Small Mammal Uptake (a)			95th UCL			
					Site		Reference	
CASRN	Constituent				Site-wide Sediment EPC	Site-wide Baseline Mammal Tissue Concentration	Reference Sediment EPC	Reference Mammal Tissue Concentration
					mg/kg	mg/kg ww	mg/kg	mg/kg ww
7440-38-2	Arsenic	ln(Cm) = 0.8188 * ln(Cs) - 4.8471	dw	(b)	1.51E+02	1.53E-01	2.22E+01	3.18E-02
7440-43-9	Cadmium	ln(Cm) = 0.4723 * ln(Cs) - 1.2571	dw	(b)	2.82E+00	1.49E-01	3.94E-01	5.86E-02
7439-92-1	Lead	ln(Cm) = 0.4422 * ln(Cs) + 0.0761	dw	(b)	2.25E+01	1.37E+00	2.80E+01	1.51E+00
7439-97-6	Mercury	0.000071	dw	(d)	5.90E-02	3.64E-04	3.10E-02	7.04E-07
22967-92-6	Methylmercury	0.0000106	dw	(d)	3.04E-04	6.52E-08	1.74E-03	5.90E-09
7782-49-2	Selenium	ln(Cm) = 0.3764 * ln(Cs) - 0.4158	dw	(b)	1.05E+01	5.12E-01	4.10E+00	3.59E-01
7440-66-6	Zinc	ln(Cm) = 0.0706 * ln(Cs) + 4.3632	dw	(b)	9.97E+01	3.48E+01	6.39E+01	3.37E+01

Notes:

If the original source had values in dry weight, the values were converted to wet weight.

Small mammals are assumed to be 32% solids. The dry weight concentration is multiplied by 0.32 to convert to wet weight.

(a) Soil to small mammal uptake factors were used as a surrogate for sediment to small mammal uptake factors.

(b) Eco-SSL 2007 Attachment 4-1. Equation is for soil to mammal uptake but it was used as a surrogate for sediment to mammal uptake.

(c) Assumed 1 as a conservative measure since an uptake factor could not be found.

(d) USEPA Region 6. 1999. (R6 1999). Screening level ecological risk assessment protocol for hazardous waste combustion facilities. Volume One. EPA530-D-99-001A. August. Table D-3. BCF for soil to least shrew was used.

CASRN Chemical Abstracts Service Registry Number
dw Dry weight
EPC Exposure Point Concentration
mg/kg Milligrams per kilograms
UCL Upper Confidence Limit
ww Wet weight

Table 5-10B: Uptake From Sediment To Small Mammals (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Sediment to Small Mammal Uptake (a)			95th UCL			
					Site		Reference	
					Curds Inlet Sediment EPC	Curds Inlet Baseline Mammal Tissue Concentration	Reference Sediment EPC	Reference Mammal Tissue Concentration
CASRN	Constituent				mg/kg	mg/kg ww	mg/kg	mg/kg ww
7440-38-2	Arsenic	ln(Cm) = 0.8188 * ln(Cs) - 4.8471	dw	(b)	1.80E+02	1.76E-01	2.22E+01	3.18E-02
7440-43-9	Cadmium	ln(Cm) = 0.4723 * ln(Cs) - 1.2571	dw	(b)	3.67E+00	1.68E-01	3.94E-01	5.86E-02
7439-92-1	Lead	ln(Cm) = 0.4422 * ln(Cs) + 0.0761	dw	(b)	2.44E+01	1.42E+00	2.80E+01	1.51E+00
7439-97-6	Mercury	0.000071	dw	(d)	7.08E-02	4.37E-04	3.10E-02	7.04E-07
22967-92-6	Methylmercury	0.0000106	dw	(d)	1.21E-04	2.59E-08	1.74E-03	5.90E-09
7782-49-2	Selenium	ln(Cm) = 0.3764 * ln(Cs) - 0.4158	dw	(b)	1.36E+01	5.64E-01	4.10E+00	3.59E-01
7440-66-6	Zinc	ln(Cm) = 0.0706 * ln(Cs) + 4.3632	dw	(b)	1.13E+02	3.51E+01	6.39E+01	3.37E+01

Notes:
If the original source had values in dry weight, the values were converted to wet weight.
Small mammals are assumed to be 32% solids. The dry weight concentration is multiplied by 0.32 to convert to wet weight.

(a) Soil to small mammal uptake factors were used as a surrogate for sediment to small mammal uptake factors.
(b) Eco-SSL 2007 Attachment 4-1. Equation is for soil to mammal uptake but it was used as a surrogate for sediment to mammal uptake.
(c) Assumed 1 as a conservative measure since an uptake factor could not be found.
(d) USEPA Region 6. 1999. (R6 1999). Screening level ecological risk assessment protocol for hazardous waste combustion facilities. Volume One. EPA530-D-99-001A. August. Table D-3. BCF for soil to least shrew was used.

CASRN Chemical Abstracts Service Registry Number
dw Dry weight
EPC Exposure Point Concentration
mg/kg Milligrams per kilograms
UCL Upper Confidence Limit
ww Wet weight

Table 5-10C: Uptake From Sediment To Small Mammals (Site-wide without Curds Inlet) Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Sediment to Small Mammal Uptake (a)			95th UCL			
					Site		Reference	
					Site without Curds Inlet Sediment EPC	Site without Curds Inlet Baseline Mammal Tissue Concentration	Reference Sediment EPC	Reference Mammal Tissue Concentration
CASRN	Constituent				mg/kg	mg/kg ww	mg/kg	mg/kg ww
7440-38-2	Arsenic	ln(Cm) = 0.8188 * ln(Cs) - 4.8471	dw	(b)	2.24E+01	3.20E-02	2.22E+01	3.18E-02
7440-43-9	Cadmium	ln(Cm) = 0.4723 * ln(Cs) - 1.2571	dw	(b)	8.87E-01	8.60E-02	3.94E-01	5.86E-02
7439-92-1	Lead	ln(Cm) = 0.4422 * ln(Cs) + 0.0761	dw	(b)	2.03E+01	1.31E+00	2.80E+01	1.51E+00
7439-97-6	Mercury	0.000071	dw	(d)	3.59E-02	2.22E-04	3.10E-02	7.04E-07
22967-92-6	Methylmercury	0.0000106	dw	(d)	8.79E-04	1.88E-07	1.74E-03	5.90E-09
7782-49-2	Selenium	ln(Cm) = 0.3764 * ln(Cs) - 0.4158	dw	(b)	4.59E+00	3.75E-01	4.10E+00	3.59E-01
7440-66-6	Zinc	ln(Cm) = 0.0706 * ln(Cs) + 4.3632	dw	(b)	5.76E+01	3.34E+01	6.39E+01	3.37E+01

Notes:
If the original source had values in dry weight, the values were converted to wet weight.
Small mammals are assumed to be 32% solids. The dry weight concentration is multiplied by 0.32 to convert to wet weight.

(a) Soil to small mammal uptake factors were used as a surrogate for sediment to small mammal uptake factors.
(b) Eco-SSL 2007 Attachment 4-1. Equation is for soil to mammal uptake but it was used as a surrogate for sediment to mammal uptake.
(c) Assumed 1 as a conservative measure since an uptake factor could not be found.
(d) USEPA Region 6. 1999. (R6 1999). Screening level ecological risk assessment protocol for hazardous waste combustion facilities. Volume One. EPA530-D-99-001A. August. Table D-3. BCF for soil to least shrew was used.

CASRN Chemical Abstracts Service Registry Number
dw Dry weight
EPC Exposure Point Concentration
mg/kg Milligrams per kilograms
UCL Upper Confidence Limit
ww Wet weight

Table 5-11 Summary Of Wildlife Food Web Input Variables And Receptor Parameters
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Name	Species	Ingestion Rates					Diet (%) (d)					BW (e)	AUF (f)	Range (g)	Behavioral Use AUF for Curds Inlet (h)	Comment
		IR w (a)	IR f (b)		IR sd (c)		Aquatic Plants	Aquatic Inverte-brates	Benthic Inverte-brates	Fish	Small Mammal					
		(L/day)	(kg DW/day)	kg WW/day	%	(kg dw/day)	Proportion	Proportion	Proportion	Proportion	Proportion	(kg)	(unitless)	(acre)	(unitless)	
Mallard Duck	*Anas platyrhynchos*	0.0646	0.059	0.296	3.3	0.00195	0.4	0.3	0.3	0	0	1.134	1	1433	0.004	Migratory bird
Wood Duck	*Aix sponsa*	0.0446	0.0394	0.1968	11	0.00433	0.7	0.1	0.2	0	0	0.66	1	1433	0.004	Migratory bird
Osprey	*Pandion haliaetus*	0.0772	0.062	0.312	0	0.00000	0	0	0	1	0	1.49	1	2,241	0.003	Eat large fish; migratory bird
Great Blue Heron	*Ardea herodias*	0.1051	0.084	0.421	2	0.00168	0	0	0.5	0.5	0	2.34	1	11	1	Eat small fish; migratory bird
Gray Bat	*Myotis grisescens*	0.0014	0.0017	0.0087	0	0.00000	0	0.75	0	0	0	0.0115	1	776	0.0073	Hibernate in winter. Eats approximately 1/2 aquatic and 1/2 terrestrial insects.
Raccoon	*Procyon lotor*	0.4800	0.2907	1.453	9.4	0.02733	0.48	0	0.42	0.1	0	5.78	1	128	0.04	Omnivore - equal time in terrestrial and aquatic habitats.
Mink	*Mustela vison*	0.0969	0.039	0.196	9.4	0.00369	0	0	0	0.75	0.25	1.23	1	35	0.2	Diet could change depending on season. Assumed only aquatic components for diet.
River Otter	*Lutra canadensis*	0.6018	0.357	1.786	2	0.00714	0	0	0.1	0.9	0	7.4	1	858	0.01	
Muskrat	*Ondatra zibethicus*	0.1317	0.081	0.403	2.4	0.00194	1	0	0	0	0	1.344	1	0.42	1	

Notes:

Curds Inlet Area (acres) = 5.66

%	Percent	IRw	Ingestion Rate of water
AUF	Area use factor	kg	Kilograms
BW	Body weight	kg DW/day	Kilograms of dry weight per day
ED	Exposure duration	kg WW/day	Kilograms of wet weight per day
IRf	Ingestion Rate of food	L/day	Liters per day
IRsd	Ingestion Rate of sediment		

(a) Receptor-specific water ingestion rates were taken from USEPA (1993) except for wood duck, which was calculated using the allometric equation for water intake for all birds found in Section 3.2.1 in USEPA 1993 and gray bat, which was taken from Kroner and Cozzie (2003) using little brown bat as a surrogate.

(b) Receptor-specific food ingestion rates were taken from Chapter 2 in USEPA (1993) for osprey, great blue heron, mink and muskrat. For the remaining receptors (mallards, wood ducks, raccoons, gray bat, and river otters), food ingestion rates were calculated using the allometric equation for either birds or mammals (Chapter 3 in USEPA 1993) and a 80% moisture rate to convert from dry weight to wet weight.

(c) The percent incidental sediment ingestion reported in Table 4-4 in USEPA (1993) was used for wood duck and raccoon. For mallards, Beyer (1994; source of USEPA 1993) indicated a sediment ingestion of 3.3% and that was used instead of 2% reported in USEPA 1993. Since osprey are piscivores, they are assumed to ingest no sediment. As an aerial insectivore, soil ingestion is assumed to be negligible for gray bats. Raccoon sediment ingestion was used as a surrogate for mink. Meadow vole is used as a surrogate for muskrat. Although river otter and great blue heron are predominantly piscivores, as a conservative measure a 2% sediment ingestion rate was used as they do ingest some benthic invertebrates.

(d) The diet proportions reported in USEPA (1993) were taken into consideration for the food web model, except for the diet proportions for wood ducks, which were taken from Cornell Lab of Ornithology Birds of North America: https://www.allaboutbirds.org/guide/Wood_Duck/id. For gray bat, Ramboll reviewed gray bat specific literature to designate diet proportions for the food web model (Harriman 2003; KBWG 1999; USFWS 2018). For mallards, the diet proportions for ducks during their breeding season was used in the FWM as a conservative estimate of potential exposure.

(e) Receptor body weight for all receptors were taken from USEPA 1993 except for wood duck and gray bat. The body weight of wood duck is the average calculated from the two weights presented in Cornell Lab of Ornithology Birds of North America: https://www.allaboutbirds.org/guide/Wood_Duck/id. The body weight of gray bat is the average of the range presented in USFWS (2018).

(f) AUF and ED are assigned a 1 as a conservative measure which assumes that a receptor spends 100% of its time at the site and obtains all its food from the site.

(g) The home range is from USEPA (1993) except for wood duck and gray bat. The home range of mallard was used as a surrogate for wood duck. For gray bat, different sources were reviewed which stated that gray bats home range could vary from 1 km to 81 km (KYBWG 1999; USFWS 2009; Harriman 2003). As a conservative measure, Ramboll assumed 1 km of shoreline and converted it to acres, as previously described. For those species where home range is given in kilometers instead of hectares, Ramboll assumed this correlated to the diameter of a circle (assuming that the species was not restricted to one direction) and converted it to acres using the area of a circle formula (area = $\pi * radius^2$).

(h) Behavioral use scenario AUFs takes into account a receptors home range and are calculated by dividing the size size (in hectares) by a species range (in hectares). Receptors whose home range is less than the size (in hectares) of the site are assigned an AUF1 of 1. The AUF of the gray bat was assigned a 0.5 to represent that 50% of its diet is terrestrial and 50% of its diet is aquatic.

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USEPA R4 (2016) United States Environmental Protection Agency (USEPA) Region 4. 2016. EPA Region 4 Preferred Parameters to be used in Ecological Risk Assessments in Region 4 - Version 9 - Last Revised November 01, 2016. DRAFT.

USFWS (2009) United States Fish and Wildlife Service (USFWS). 2009. Gray Bat (Myotis grisescens), 5-Year Review: Summary and Evaluation. https://www.fws.gov/midwest///////endangered/recovery/5yr_rev/completed5yrs.html (Accessed February 11, 2019).

USFWS (2018) United States Fish and Wildlife Service (USFWS). 2018. "Gray Bat (Myotis grisescens) Fact Sheet." USFWS Endangered Species website.

Table 5-11: Summary Of Wildlife Food Web Input Variables And Receptor Parameters
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Sources:

Beyer (1994)	Beyer WN, EE Connor, and S Gerould. 1994. Estimates of Soil Ingestion by Wildlife. Journal of Wildlife Management 58(2): 375-382.
Harriman (2003)	Harriman V. 2003. "Myotis grisescens" (On-line). Animal Diversity Web - University of Michigan Department of Zoology. https://animaldiversity.org/accounts/Myotis_grisescens/ (Accessed February 11, 2019).
KBWG (1999)	Kentucky Bat Working Group. "Gray Bat" (On-line). https://biology.eku.edu/bats/graybat.htm (Accessed February 11, 2019).
Kroner and Cozzie (2003)	Kroner S. and D. Cozzie. 2003. Data Collection for the Hazardous Waste Identification Rule. Section 12: Ecological Exposure Factors. https://archive.epa.gov/epawaste/hazard/web/pdf/s0042.pdf
USEPA (1993)	United States Environmental Protection Agency (USEPA). 1993. Wildlife Exposure Factors Handbook. Office of Research and Development. EPA/600/R-93/187. http://cfpub.epa.gov/ncea/cfm/wefh.cfm.
USEPA R4 (2016)	United States Environmental Protection Agency (USEPA) Region 4. 2016. EPA Region 4 Preferred Parameters to be used in Ecological Risk Assessments in Region 4 - Version 9 - Last Revised November 01, 2016. DRAFT.
USFWS (2009)	United States Fish and Wildlife Service (USFWS). 2009. Gray Bat (Myotis grisescens), 5-Year Review: Summary and Evaluation. https://www.fws.gov/midwest//////endangered/recovery/5yr rev/completed5yrs.html (Accessed February 11, 2019).
USFWS (2018)	United States Fish and Wildlife Service (USFWS). 2018. "Gray Bat (Myotis grisescens) Fact Sheet." USFWS Endangered Species website.

Table 5-12A Dietary Intake for Wildlife Receptors (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Mallard Duck			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total TDI (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.77E-03	1.51E+02	1.71E+00	4.66E-01	4.66E-01	2.46E-01	1.53E-01	1.01E-04	2.60E-01	1.79E-01	3.65E-02	3.65E-02	0.00E+00	0.00E+00	5.12E-01	5.12E-01
	Cadmium	7440-43-9	6.39E-05	2.82E+00	1.58E-01	1.93E-01	1.93E-01	1.81E-02	1.49E-01	3.64E-06	4.86E-03	1.65E-02	1.51E-02	1.51E-02	0.00E+00	0.00E+00	5.16E-02	5.16E-02
	Lead	7439-92-1	1.78E-04	2.25E+01	1.23E+00	7.44E-02	7.44E-02	1.81E-02	1.37E+00	1.01E-05	3.88E-02	1.28E-01	5.83E-03	5.83E-03	0.00E+00	0.00E+00	1.79E-01	1.79E-01
	Mercury	7439-97-6	1.74E-03	5.90E-02	5.74E-03	1.17E-02	1.17E-02	8.02E-02	3.64E-04	9.92E-05	1.02E-04	6.00E-04	9.17E-04	9.17E-04	0.00E+00	0.00E+00	2.63E-03	2.63E-03
	Methylmercury	22967-92-6	8.60E-07	3.04E-04	1.23E-03	1.25E-02	1.25E-02	8.28E-02	6.52E-08	4.90E-08	5.24E-07	1.28E-04	9.79E-04	9.79E-04	0.00E+00	0.00E+00	2.09E-03	2.09E-03
	Selenium	7782-49-2	1.38E-03	1.05E+01	5.33E-01	6.97E-01	6.97E-01	9.37E-01	5.12E-01	7.87E-05	1.81E-02	5.57E-02	5.46E-02	5.46E-02	0.00E+00	0.00E+00	1.83E-01	1.83E-01
	Zinc	7440-66-6	2.22E-03	9.97E+01	5.97E+00	2.33E+01	2.33E+01	2.11E+01	3.48E+01	1.27E-04	1.72E-01	6.24E-01	1.83E+00	1.83E+00	0.00E+00	0.00E+00	4.45E+00	4.45E+00

Wood Duck			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total TDI (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.77E-03	1.51E+02	1.71E+00	4.66E-01	4.66E-01	2.46E-01	1.53E-01	1.20E-04	9.94E-01	3.58E-01	1.39E-02	2.79E-02	0.00E+00	0.00E+00	1.39E+00	1.39E+00
	Cadmium	7440-43-9	6.39E-05	2.82E+00	1.58E-01	1.93E-01	1.93E-01	1.81E-02	1.49E-01	4.33E-06	1.86E-02	3.31E-02	5.77E-03	1.15E-02	0.00E+00	0.00E+00	6.90E-02	6.90E-02
	Lead	7439-92-1	1.78E-04	2.25E+01	1.23E+00	7.44E-02	7.44E-02	1.81E-02	1.37E+00	1.21E-05	1.48E-01	2.58E-01	2.23E-03	4.45E-03	0.00E+00	0.00E+00	4.12E-01	4.12E-01
	Mercury	7439-97-6	1.74E-03	5.90E-02	5.74E-03	1.17E-02	1.17E-02	8.02E-02	3.64E-04	1.18E-04	3.88E-04	1.20E-03	3.50E-04	7.00E-04	0.00E+00	0.00E+00	2.76E-03	2.76E-03
	Methylmercury	22967-92-6	8.60E-07	3.04E-04	1.23E-03	1.25E-02	1.25E-02	8.28E-02	6.52E-08	5.83E-08	2.00E-06	2.58E-04	3.74E-04	7.48E-04	0.00E+00	0.00E+00	1.38E-03	1.38E-03
	Selenium	7782-49-2	1.38E-03	1.05E+01	5.33E-01	6.97E-01	6.97E-01	9.37E-01	5.12E-01	9.35E-05	6.91E-02	1.12E-01	2.08E-02	4.17E-02	0.00E+00	0.00E+00	2.43E-01	2.43E-01
	Zinc	7440-66-6	2.22E-03	9.97E+01	5.97E+00	2.33E+01	2.33E+01	2.11E+01	3.48E+01	1.50E-04	6.56E-01	1.25E+00	6.97E-01	1.39E+00	0.00E+00	0.00E+00	4.00E+00	4.00E+00

Osprey			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total TDI (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.77E-03	1.51E+02	1.71E+00	4.66E-01	4.66E-01	2.46E-01	1.53E-01	9.20E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.17E-02	0.00E+00	5.18E-02	5.18E-02
	Cadmium	7440-43-9	6.39E-05	2.82E+00	1.58E-01	1.93E-01	1.93E-01	1.81E-02	1.49E-01	3.32E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.80E-03	0.00E+00	3.80E-03	3.80E-03
	Lead	7439-92-1	1.78E-04	2.25E+01	1.23E+00	7.44E-02	7.44E-02	1.81E-02	1.37E+00	9.26E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.80E-03	0.00E+00	3.81E-03	3.81E-03
	Mercury	7439-97-6	1.74E-03	5.90E-02	5.74E-03	1.17E-02	1.17E-02	8.02E-02	3.64E-04	9.05E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-02	0.00E+00	1.69E-02	1.69E-02
	Methylmercury	22967-92-6	8.60E-07	3.04E-04	1.23E-03	1.25E-02	1.25E-02	8.28E-02	6.52E-08	4.47E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.74E-02	0.00E+00	1.74E-02	1.74E-02
	Selenium	7782-49-2	1.38E-03	1.05E+01	5.33E-01	6.97E-01	6.97E-01	9.37E-01	5.12E-01	7.18E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E-01	0.00E+00	1.97E-01	1.97E-01
	Zinc	7440-66-6	2.22E-03	9.97E+01	5.97E+00	2.33E+01	2.33E+01	2.11E+01	3.48E+01	1.15E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.43E+00	0.00E+00	4.43E+00	4.43E+00

Great Blue Heron			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total TDI (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.77E-03	1.51E+02	1.71E+00	4.66E-01	4.66E-01	2.46E-01	1.53E-01	7.97E-05	1.09E-01	0.00E+00	0.00E+00	4.19E-02	2.21E-02	0.00E+00	1.73E-01	1.73E-01
	Cadmium	7440-43-9	6.39E-05	2.82E+00	1.58E-01	1.93E-01	1.93E-01	1.81E-02	1.49E-01	2.88E-06	2.03E-03	0.00E+00	0.00E+00	1.74E-02	1.63E-03	0.00E+00	2.10E-02	2.10E-02
	Lead	7439-92-1	1.78E-04	2.25E+01	1.23E+00	7.44E-02	7.44E-02	1.81E-02	1.37E+00	8.01E-06	1.62E-02	0.00E+00	0.00E+00	6.70E-03	1.63E-03	0.00E+00	2.45E-02	2.45E-02
	Mercury	7439-97-6	1.74E-03	5.90E-02	5.74E-03	1.17E-02	1.17E-02	8.02E-02	3.64E-04	7.83E-05	4.25E-05	0.00E+00	0.00E+00	1.05E-03	7.22E-03	0.00E+00	8.39E-03	8.39E-03
	Methylmercury	22967-92-6	8.60E-07	3.04E-04	1.23E-03	1.25E-02	1.25E-02	8.28E-02	6.52E-08	3.87E-08	2.19E-07	0.00E+00	0.00E+00	1.13E-03	7.45E-03	0.00E+00	8.58E-03	8.58E-03
	Selenium	7782-49-2	1.38E-03	1.05E+01	5.33E-01	6.97E-01	6.97E-01	9.37E-01	5.12E-01	6.21E-05	7.56E-03	0.00E+00	0.00E+00	6.27E-02	8.43E-02	0.00E+00	1.55E-01	1.55E-01
	Zinc	7440-66-6	2.22E-03	9.97E+01	5.97E+00	2.33E+01	2.33E+01	2.11E+01	3.48E+01	9.99E-05	7.18E-02	0.00E+00	0.00E+00	2.10E+00	1.90E+00	0.00E+00	4.07E+00	4.07E+00

Table 5-12A Dietary Intake for Wildlife Receptors (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Gray Bat	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total TDI (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.77E-03	1.51E+02	1.71E+00	4.66E-01	4.66E-01	2.46E-01	1.53E-01	2.15E-04	0.00E+00	0.00E+00	2.66E-01	0.00E+00	0.00E+00	0.00E+00	2.66E-01	1.33E-01
	Cadmium	7440-43-9	6.39E-05	2.82E+00	1.58E-01	1.93E-01	1.93E-01	1.81E-02	1.49E-01	7.76E-06	0.00E+00	0.00E+00	1.10E-01	0.00E+00	0.00E+00	0.00E+00	1.10E-01	5.50E-02
	Lead	7439-92-1	1.78E-04	2.25E+01	1.23E+00	7.44E-02	7.44E-02	1.81E-02	1.37E+00	2.16E-05	0.00E+00	0.00E+00	4.24E-02	0.00E+00	0.00E+00	0.00E+00	4.25E-02	2.12E-02
	Mercury	7439-97-6	1.74E-03	5.90E-02	5.74E-03	1.17E-02	1.17E-02	8.02E-02	3.64E-04	2.11E-04	0.00E+00	0.00E+00	6.67E-03	0.00E+00	0.00E+00	0.00E+00	6.89E-03	3.44E-03
	Methylmercury	22967-92-6	8.60E-07	3.04E-04	1.23E-03	1.25E-02	1.25E-02	8.28E-02	6.52E-08	1.04E-07	0.00E+00	0.00E+00	7.13E-03	0.00E+00	0.00E+00	0.00E+00	7.13E-03	3.57E-03
	Selenium	7782-49-2	1.38E-03	1.05E+01	5.33E-01	6.97E-01	6.97E-01	9.37E-01	5.12E-01	1.68E-04	0.00E+00	0.00E+00	3.98E-01	0.00E+00	0.00E+00	0.00E+00	3.98E-01	1.99E-01
	Zinc	7440-66-6	2.22E-03	9.97E+01	5.97E+00	2.33E+01	2.33E+01	2.11E+01	3.48E+01	2.70E-04	0.00E+00	0.00E+00	1.33E+01	0.00E+00	0.00E+00	0.00E+00	1.33E+01	6.65E+00

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Raccoon	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total TDI (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.77E-03	1.51E+02	1.71E+00	4.66E-01	4.66E-01	2.46E-01	1.53E-01	1.47E-04	7.14E-01	2.06E-01	0.00E+00	4.92E-02	6.18E-03	0.00E+00	9.75E-01	9.75E-01
	Cadmium	7440-43-9	6.39E-05	2.82E+00	1.58E-01	1.93E-01	1.93E-01	1.81E-02	1.49E-01	5.30E-06	1.33E-02	1.91E-02	0.00E+00	2.04E-02	4.55E-04	0.00E+00	5.32E-02	5.32E-02
	Lead	7439-92-1	1.78E-04	2.25E+01	1.23E+00	7.44E-02	7.44E-02	1.81E-02	1.37E+00	1.48E-05	1.06E-01	1.48E-01	0.00E+00	7.85E-03	4.55E-04	0.00E+00	2.63E-01	2.63E-01
	Mercury	7439-97-6	1.74E-03	5.90E-02	5.74E-03	1.17E-02	1.17E-02	8.02E-02	3.64E-04	1.44E-04	2.79E-04	6.92E-04	0.00E+00	1.24E-03	2.02E-03	0.00E+00	4.37E-03	4.37E-03
	Methylmercury	22967-92-6	8.60E-07	3.04E-04	1.23E-03	1.25E-02	1.25E-02	8.28E-02	6.52E-08	7.14E-08	1.44E-06	1.48E-04	0.00E+00	1.32E-03	2.08E-03	0.00E+00	3.55E-03	3.55E-03
	Selenium	7782-49-2	1.38E-03	1.05E+01	5.33E-01	6.97E-01	6.97E-01	9.37E-01	5.12E-01	1.15E-04	4.96E-02	6.43E-02	0.00E+00	7.36E-02	2.36E-02	0.00E+00	2.11E-01	2.11E-01
	Zinc	7440-66-6	2.22E-03	9.97E+01	5.97E+00	2.33E+01	2.33E+01	2.11E+01	3.48E+01	1.84E-04	4.71E-01	7.20E-01	0.00E+00	2.46E+00	5.30E-01	0.00E+00	4.18E+00	4.18E+00

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Mink	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total TDI (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.77E-03	1.51E+02	1.71E+00	4.66E-01	4.66E-01	2.46E-01	1.53E-01	1.40E-04	4.54E-01	0.00E+00	0.00E+00	0.00E+00	2.95E-02	6.11E-03	4.90E-01	4.90E-01
	Cadmium	7440-43-9	6.39E-05	2.82E+00	1.58E-01	1.93E-01	1.93E-01	1.81E-02	1.49E-01	5.05E-06	8.48E-03	0.00E+00	0.00E+00	0.00E+00	2.17E-03	5.94E-03	1.66E-02	1.66E-02
	Lead	7439-92-1	1.78E-04	2.25E+01	1.23E+00	7.44E-02	7.44E-02	1.81E-02	1.37E+00	1.41E-05	6.77E-02	0.00E+00	0.00E+00	0.00E+00	2.17E-03	5.47E-02	1.25E-01	1.25E-01
	Mercury	7439-97-6	1.74E-03	5.90E-02	5.74E-03	1.17E-02	1.17E-02	8.02E-02	3.64E-04	1.37E-04	1.77E-04	0.00E+00	0.00E+00	0.00E+00	9.62E-03	1.46E-05	9.95E-03	9.95E-03
	Methylmercury	22967-92-6	8.60E-07	3.04E-04	1.23E-03	1.25E-02	1.25E-02	8.28E-02	6.52E-08	6.79E-08	9.14E-07	0.00E+00	0.00E+00	0.00E+00	9.94E-03	2.61E-09	9.94E-03	9.94E-03
	Selenium	7782-49-2	1.38E-03	1.05E+01	5.33E-01	6.97E-01	6.97E-01	9.37E-01	5.12E-01	1.09E-04	3.16E-02	0.00E+00	0.00E+00	0.00E+00	1.12E-01	2.05E-02	1.65E-01	1.65E-01
	Zinc	7440-66-6	2.22E-03	9.97E+01	5.97E+00	2.33E+01	2.33E+01	2.11E+01	3.48E+01	1.75E-04	3.00E-01	0.00E+00	0.00E+00	0.00E+00	2.53E+00	1.39E+00	4.22E+00	4.22E+00

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
River Otter	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total TDI (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.77E-03	1.51E+02	1.71E+00	4.66E-01	4.66E-01	2.46E-01	1.53E-01	1.43E-04	1.45E-01	0.00E+00	0.00E+00	1.12E-02	5.32E-02	0.00E+00	2.10E-01	2.10E-01
	Cadmium	7440-43-9	6.39E-05	2.82E+00	1.58E-01	1.93E-01	1.93E-01	1.81E-02	1.49E-01	5.18E-06	2.71E-03	0.00E+00	0.00E+00	4.64E-03	3.92E-03	0.00E+00	1.13E-02	1.13E-02
	Lead	7439-92-1	1.78E-04	2.25E+01	1.23E+00	7.44E-02	7.44E-02	1.81E-02	1.37E+00	1.44E-05	2.16E-02	0.00E+00	0.00E+00	1.79E-03	3.92E-03	0.00E+00	2.74E-02	2.74E-02
	Mercury	7439-97-6	1.74E-03	5.90E-02	5.74E-03	1.17E-02	1.17E-02	8.02E-02	3.64E-04	1.41E-04	5.67E-05	0.00E+00	0.00E+00	2.81E-04	1.74E-02	0.00E+00	1.78E-02	1.78E-02
	Methylmercury	22967-92-6	8.60E-07	3.04E-04	1.23E-03	1.25E-02	1.25E-02	8.28E-02	6.52E-08	6.97E-08	2.92E-07	0.00E+00	0.00E+00	3.00E-04	1.79E-02	0.00E+00	1.82E-02	1.82E-02
	Selenium	7782-49-2	1.38E-03	1.05E+01	5.33E-01	6.97E-01	6.97E-01	9.37E-01	5.12E-01	1.12E-04	1.01E-02	0.00E+00	0.00E+00	1.68E-02	2.03E-01	0.00E+00	2.30E-01	2.30E-01
	Zinc	7440-66-6	2.22E-03	9.97E+01	5.97E+00	2.33E+01	2.33E+01	2.11E+01	3.48E+01	1.80E-04	9.59E-02	0.00E+00	0.00E+00	5.60E-01	4.56E+00	0.00E+00	5.22E+00	5.22E+00

Table 5-12A Dietary Intake for Wildlife Receptors (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Muskrat	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total TDI (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.77E-03	1.51E+02	1.71E+00	4.66E-01	4.66E-01	2.46E-01	1.53E-01	1.73E-04	2.17E-01	5.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.31E-01	7.31E-01
	Cadmium	7440-43-9	6.39E-05	2.82E+00	1.58E-01	1.93E-01	1.93E-01	1.81E-02	1.49E-01	6.26E-06	4.06E-03	4.74E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.15E-02	5.15E-02
	Lead	7439-92-1	1.78E-04	2.25E+01	1.23E+00	7.44E-02	7.44E-02	1.81E-02	1.37E+00	1.74E-05	3.24E-02	3.69E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.01E-01	4.01E-01
	Mercury	7439-97-6	1.74E-03	5.90E-02	5.74E-03	1.17E-02	1.17E-02	8.02E-02	3.64E-04	1.71E-04	8.50E-05	1.72E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-03	1.98E-03
	Methylmercury	22967-92-6	8.60E-07	3.04E-04	1.23E-03	1.25E-02	1.25E-02	8.28E-02	6.52E-08	8.43E-08	4.38E-07	3.69E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.70E-04	3.70E-04
	Selenium	7782-49-2	1.38E-03	1.05E+01	5.33E-01	6.97E-01	6.97E-01	9.37E-01	5.12E-01	1.35E-04	1.51E-02	1.60E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E-01	1.75E-01
	Zinc	7440-66-6	2.22E-03	9.97E+01	5.97E+00	2.33E+01	2.33E+01	2.11E+01	3.48E+01	2.18E-04	1.44E-01	1.79E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E+00	1.93E+00

Notes:

(a) Total phase was used for surface water intake.
(b) Benthic invertebrate concentration used as a surrogate for aquatic invertebrate concentration.
(c) AUF is equal to 1 assuming that an organism spends all its time living and feeding at the site.
(d) Behavior use AUFs are calculated by dividing the size size (in hectares) by a species range (in hectares). Receptors whose home range is less than the size (in hectares) of the site are assigned an AUF1 of 1. The area of Site-Wide is larger than the home range of receptors; therefore, the behavioral use AUF is a 1 for all except gray bat, which was assigned a 0.5 to represent that 50% of its diet is terrestrial and 50% of its diet is aquatic.

CASRN Chemical Abstracts Service Registry Number
mg/kg Milligram per kilogram
mg/kg bw-d Milligram per kilogram of body weight per day
mg/L Milligram per liter
mg/L bw-d Milligram per liter of body weight per day
TDI Total Daily Intake
ww Wet weight

Table 5-12B Dietary Intake for Wildlife Receptors (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Mallard Duck	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total Dietary Intake (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	2.95E-03	1.80E+02	1.01E+00	4.12E-01	4.12E-01	2.42E-01	1.76E-01	1.68E-04	3.10E-01	1.06E-01	3.23E-02	3.23E-02	0.00E+00	0.00E+00	4.81E-01	1.90E-03
	Cadmium	7440-43-9	1.77E-04	3.67E+00	3.06E-01	3.44E-01	3.44E-01	6.46E-02	1.68E-01	1.01E-05	6.33E-03	3.20E-02	2.70E-02	2.70E-02	0.00E+00	0.00E+00	9.22E-02	3.64E-04
	Lead	7439-92-1	3.31E-04	2.44E+01	1.21E+00	5.52E-02	5.52E-02	3.20E-02	1.42E+00	1.89E-05	4.21E-02	1.26E-01	4.33E-03	4.33E-03	0.00E+00	0.00E+00	1.77E-01	7.00E-04
	Mercury	7439-97-6	3.20E-03	7.08E-02	3.76E-03	1.08E-02	1.08E-02	6.81E-02	4.37E-04	1.82E-04	1.22E-04	3.93E-04	8.46E-04	8.46E-04	0.00E+00	0.00E+00	2.39E-03	9.44E-06
	Methylmercury	22967-92-6	3.08E-07	1.21E-04	2.00E-03	1.11E-02	1.11E-02	7.56E-02	2.59E-08	1.76E-08	2.09E-07	2.09E-04	8.70E-04	8.70E-04	0.00E+00	0.00E+00	1.95E-03	7.70E-06
	Selenium	7782-49-2	3.12E-03	1.36E+01	3.22E-01	7.63E-01	7.63E-01	1.58E+00	5.64E-01	1.78E-04	2.34E-02	3.36E-02	5.98E-02	5.98E-02	0.00E+00	0.00E+00	1.77E-01	6.99E-04

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Wood Duck	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total Dietary Intake (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	2.95E-03	1.80E+02	1.01E+00	4.12E-01	4.12E-01	2.42E-01	1.76E-01	2.00E-04	1.18E+00	2.11E-01	1.23E-02	2.46E-02	0.00E+00	0.00E+00	1.43E+00	5.66E-03
	Cadmium	7440-43-9	1.77E-04	3.67E+00	3.06E-01	3.44E-01	3.44E-01	6.46E-02	1.68E-01	1.20E-05	2.41E-02	6.41E-02	1.03E-02	2.06E-02	0.00E+00	0.00E+00	1.19E-01	4.71E-04
	Lead	7439-92-1	3.31E-04	2.44E+01	1.21E+00	5.52E-02	5.52E-02	3.20E-02	1.42E+00	2.24E-05	1.61E-01	2.53E-01	1.65E-03	3.30E-03	0.00E+00	0.00E+00	4.19E-01	1.65E-03
	Mercury	7439-97-6	3.20E-03	7.08E-02	3.76E-03	1.08E-02	1.08E-02	6.81E-02	4.37E-04	2.17E-04	4.66E-04	7.87E-04	3.23E-04	6.46E-04	0.00E+00	0.00E+00	2.44E-03	9.64E-06
	Methylmercury	22967-92-6	3.08E-07	1.21E-04	2.00E-03	1.11E-02	1.11E-02	7.56E-02	2.59E-08	2.09E-08	7.96E-07	4.19E-04	3.32E-04	6.64E-04	0.00E+00	0.00E+00	1.42E-03	5.59E-06
	Selenium	7782-49-2	3.12E-03	1.36E+01	3.22E-01	7.63E-01	7.63E-01	1.58E+00	5.64E-01	2.11E-04	8.95E-02	6.74E-02	2.28E-02	4.56E-02	0.00E+00	0.00E+00	2.26E-01	8.91E-04

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Osprey	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total Dietary Intake (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	2.95E-03	1.80E+02	1.01E+00	4.12E-01	4.12E-01	2.42E-01	1.76E-01	1.53E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.08E-02	0.00E+00	5.10E-02	1.29E-04
	Cadmium	7440-43-9	1.77E-04	3.67E+00	3.06E-01	3.44E-01	3.44E-01	6.46E-02	1.68E-01	9.20E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-02	0.00E+00	1.36E-02	3.43E-05
	Lead	7439-92-1	3.31E-04	2.44E+01	1.21E+00	5.52E-02	5.52E-02	3.20E-02	1.42E+00	1.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.72E-03	0.00E+00	6.74E-03	1.70E-05
	Mercury	7439-97-6	3.20E-03	7.08E-02	3.76E-03	1.08E-02	1.08E-02	6.81E-02	4.37E-04	1.66E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-02	0.00E+00	1.45E-02	3.65E-05
	Methylmercury	22967-92-6	3.08E-07	1.21E-04	2.00E-03	1.11E-02	1.11E-02	7.56E-02	2.59E-08	1.60E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-02	0.00E+00	1.59E-02	4.01E-05
	Selenium	7782-49-2	3.12E-03	1.36E+01	3.22E-01	7.63E-01	7.63E-01	1.58E+00	5.64E-01	1.62E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.32E-01	0.00E+00	3.32E-01	8.38E-04

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Great Blue Heron	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total Dietary Intake (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	2.95E-03	1.80E+02	1.01E+00	4.12E-01	4.12E-01	2.42E-01	1.76E-01	1.33E-04	1.30E-01	0.00E+00	0.00E+00	3.71E-02	2.18E-02	0.00E+00	1.89E-01	9.60E-02
	Cadmium	7440-43-9	1.77E-04	3.67E+00	3.06E-01	3.44E-01	3.44E-01	6.46E-02	1.68E-01	7.97E-06	2.64E-03	0.00E+00	0.00E+00	3.10E-02	5.81E-03	0.00E+00	3.94E-02	2.01E-02
	Lead	7439-92-1	3.31E-04	2.44E+01	1.21E+00	5.52E-02	5.52E-02	3.20E-02	1.42E+00	1.49E-05	1.76E-02	0.00E+00	0.00E+00	4.97E-03	2.88E-03	0.00E+00	2.54E-02	1.29E-02
	Mercury	7439-97-6	3.20E-03	7.08E-02	3.76E-03	1.08E-02	1.08E-02	6.81E-02	4.37E-04	1.44E-04	5.10E-05	0.00E+00	0.00E+00	9.72E-04	6.13E-03	0.00E+00	7.30E-03	3.72E-03
	Methylmercury	22967-92-6	3.08E-07	1.21E-04	2.00E-03	1.11E-02	1.11E-02	7.56E-02	2.59E-08	1.39E-08	8.71E-08	0.00E+00	0.00E+00	9.99E-04	6.80E-03	0.00E+00	7.80E-03	3.97E-03
	Selenium	7782-49-2	3.12E-03	1.36E+01	3.22E-01	7.63E-01	7.63E-01	1.58E+00	5.64E-01	1.40E-04	9.79E-03	0.00E+00	0.00E+00	6.87E-02	1.42E-01	0.00E+00	2.21E-01	1.12E-01

Table 5-12B Dietary Intake for Wildlife Receptors (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Gray Bat			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total Dietary Intake (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	2.95E-03	1.80E+02	1.01E+00	4.12E-01	4.12E-01	2.42E-01	1.76E-01	3.58E-04	0.00E+00	0.00E+00	2.35E-01	0.00E+00	0.00E+00	0.00E+00	2.35E-01	1.72E-03
	Cadmium	7440-43-9	1.77E-04	3.67E+00	3.06E-01	3.44E-01	3.44E-01	6.46E-02	1.68E-01	2.15E-05	0.00E+00	0.00E+00	1.96E-01	0.00E+00	0.00E+00	0.00E+00	1.96E-01	1.43E-03
	Lead	7439-92-1	3.31E-04	2.44E+01	1.21E+00	5.52E-02	5.52E-02	3.20E-02	1.42E+00	4.02E-05	0.00E+00	0.00E+00	3.15E-02	0.00E+00	0.00E+00	0.00E+00	3.15E-02	2.30E-04
	Mercury	7439-97-6	3.20E-03	7.08E-02	3.76E-03	1.08E-02	1.08E-02	6.81E-02	4.37E-04	3.89E-04	0.00E+00	0.00E+00	6.16E-03	0.00E+00	0.00E+00	0.00E+00	6.55E-03	4.78E-05
	Methylmercury	22967-92-6	3.08E-07	1.21E-04	2.00E-03	1.11E-02	1.11E-02	7.56E-02	2.59E-08	3.74E-08	0.00E+00	0.00E+00	6.33E-03	0.00E+00	0.00E+00	0.00E+00	6.33E-03	4.62E-05
	Selenium	7782-49-2	3.12E-03	1.36E+01	3.22E-01	7.63E-01	7.63E-01	1.58E+00	5.64E-01	3.79E-04	0.00E+00	0.00E+00	4.35E-01	0.00E+00	0.00E+00	0.00E+00	4.36E-01	3.18E-03

Raccoon			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total Dietary Intake (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	2.95E-03	1.80E+02	1.01E+00	4.12E-01	4.12E-01	2.42E-01	1.76E-01	2.45E-04	8.51E-01	1.22E-01	0.00E+00	4.35E-02	6.08E-03	0.00E+00	1.02E+00	4.50E-02
	Cadmium	7440-43-9	1.77E-04	3.67E+00	3.06E-01	3.44E-01	3.44E-01	6.46E-02	1.68E-01	1.47E-05	1.73E-02	3.69E-02	0.00E+00	3.63E-02	1.62E-03	0.00E+00	9.22E-02	4.06E-03
	Lead	7439-92-1	3.31E-04	2.44E+01	1.21E+00	5.52E-02	5.52E-02	3.20E-02	1.42E+00	2.75E-05	1.15E-01	1.46E-01	0.00E+00	5.83E-03	8.04E-04	0.00E+00	2.68E-01	1.18E-02
	Mercury	7439-97-6	3.20E-03	7.08E-02	3.76E-03	1.08E-02	1.08E-02	6.81E-02	4.37E-04	2.66E-04	3.35E-04	4.54E-04	0.00E+00	1.14E-03	1.71E-03	0.00E+00	3.91E-03	1.72E-04
	Methylmercury	22967-92-6	3.08E-07	1.21E-04	2.00E-03	1.11E-02	1.11E-02	7.56E-02	2.59E-08	2.56E-08	5.72E-07	2.41E-04	0.00E+00	1.17E-03	1.90E-03	0.00E+00	3.31E-03	1.46E-04
	Selenium	7782-49-2	3.12E-03	1.36E+01	3.22E-01	7.63E-01	7.63E-01	1.58E+00	5.64E-01	2.59E-04	6.43E-02	3.88E-02	0.00E+00	8.05E-02	3.97E-02	0.00E+00	2.24E-01	9.85E-03

Mink			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total Dietary Intake (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	2.95E-03	1.80E+02	1.01E+00	4.12E-01	4.12E-01	2.42E-01	1.76E-01	2.33E-04	5.41E-01	0.00E+00	0.00E+00	0.00E+00	2.90E-02	7.06E-03	5.78E-01	9.39E-02
	Cadmium	7440-43-9	1.77E-04	3.67E+00	3.06E-01	3.44E-01	3.44E-01	6.46E-02	1.68E-01	1.40E-05	1.10E-02	0.00E+00	0.00E+00	0.00E+00	7.75E-03	6.73E-03	2.55E-02	4.15E-03
	Lead	7439-92-1	3.31E-04	2.44E+01	1.21E+00	5.52E-02	5.52E-02	3.20E-02	1.42E+00	2.61E-05	7.34E-02	0.00E+00	0.00E+00	0.00E+00	3.84E-03	5.67E-02	1.34E-01	2.18E-02
	Mercury	7439-97-6	3.20E-03	7.08E-02	3.76E-03	1.08E-02	1.08E-02	6.81E-02	4.37E-04	2.53E-04	2.13E-04	0.00E+00	0.00E+00	0.00E+00	8.17E-03	1.75E-05	8.66E-03	1.41E-03
	Methylmercury	22967-92-6	3.08E-07	1.21E-04	2.00E-03	1.11E-02	1.11E-02	7.56E-02	2.59E-08	2.43E-08	3.64E-07	0.00E+00	0.00E+00	0.00E+00	9.07E-03	1.04E-09	9.07E-03	1.47E-03
	Selenium	7782-49-2	3.12E-03	1.36E+01	3.22E-01	7.63E-01	7.63E-01	1.58E+00	5.64E-01	2.46E-04	4.09E-02	0.00E+00	0.00E+00	0.00E+00	1.90E-01	2.26E-02	2.53E-01	4.12E-02

River Otter			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total Dietary Intake (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	2.95E-03	1.80E+02	1.01E+00	4.12E-01	4.12E-01	2.42E-01	1.76E-01	2.39E-04	1.73E-01	0.00E+00	0.00E+00	9.90E-03	5.24E-02	0.00E+00	2.36E-01	1.55E-03
	Cadmium	7440-43-9	1.77E-04	3.67E+00	3.06E-01	3.44E-01	3.44E-01	6.46E-02	1.68E-01	1.43E-05	3.53E-03	0.00E+00	0.00E+00	8.27E-03	1.40E-02	0.00E+00	2.58E-02	1.70E-04
	Lead	7439-92-1	3.31E-04	2.44E+01	1.21E+00	5.52E-02	5.52E-02	3.20E-02	1.42E+00	2.68E-05	2.35E-02	0.00E+00	0.00E+00	1.33E-03	6.92E-03	0.00E+00	3.17E-02	2.09E-04
	Mercury	7439-97-6	3.20E-03	7.08E-02	3.76E-03	1.08E-02	1.08E-02	6.81E-02	4.37E-04	2.59E-04	6.81E-05	0.00E+00	0.00E+00	2.60E-04	1.47E-02	0.00E+00	1.53E-02	1.01E-04
	Methylmercury	22967-92-6	3.08E-07	1.21E-04	2.00E-03	1.11E-02	1.11E-02	7.56E-02	2.59E-08	2.49E-08	1.16E-07	0.00E+00	0.00E+00	2.67E-04	1.64E-02	0.00E+00	1.66E-02	1.10E-04
	Selenium	7782-49-2	3.12E-03	1.36E+01	3.22E-01	7.63E-01	7.63E-01	1.58E+00	5.64E-01	2.53E-04	1.31E-02	0.00E+00	0.00E+00	1.83E-02	3.42E-01	0.00E+00	3.73E-01	2.46E-03

Table 5-12B Dietary Intake for Wildlife Receptors (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Muskrat	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total Dietary Intake (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	2.95E-03	1.80E+02	1.01E+00	4.12E-01	4.12E-01	2.42E-01	1.76E-01	2.89E-04	2.59E-01	3.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.62E-01	5.62E-01
	Cadmium	7440-43-9	1.77E-04	3.67E+00	3.06E-01	3.44E-01	3.44E-01	6.46E-02	1.68E-01	1.73E-05	5.28E-03	9.18E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.71E-02	9.71E-02
	Lead	7439-92-1	3.31E-04	2.44E+01	1.21E+00	5.52E-02	5.52E-02	3.20E-02	1.42E+00	3.24E-05	3.51E-02	3.63E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.98E-01	3.98E-01
	Mercury	7439-97-6	3.20E-03	7.08E-02	3.76E-03	1.08E-02	1.08E-02	6.81E-02	4.37E-04	3.14E-04	1.02E-04	1.13E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-03	1.54E-03
	Methylmercury	22967-92-6	3.08E-07	1.21E-04	2.00E-03	1.11E-02	1.11E-02	7.56E-02	2.59E-08	3.02E-08	1.74E-07	6.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.00E-04	6.00E-04
	Selenium	7782-49-2	3.12E-03	1.36E+01	3.22E-01	7.63E-01	7.63E-01	1.58E+00	5.64E-01	3.06E-04	1.96E-02	9.66E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-01	1.16E-01

Notes:

(a)	Total phase was used for surface water intake.
(b)	Benthic invertebrate concentration used as a surrogate for aquatic invertebrate concentration.
(c)	As a conservative measure, the AUF is assumed to be 1 assuming that an organism spends all its time living and feeding at the site.
(d)	Assumes receptors may spend some portion of their time living and eating off-site.
CASRN	Chemical Abstracts Service Registry Number
mg/kg	Milligram per kilogram
mg/kg bw-d	Milligram per kilogram of body weight per day
mg/L	Milligram per liter
mg/L bw-d	Milligram per liter of body weight per day
TDI	Total Dietary Intake
UCL	Upper Confidence Level
ww	Wet weight

Table 5-12C Dietary Intake for Wildlife Receptors (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Mallard Duck	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total Dietary Intake (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.24E-03	2.24E+01	2.04E+00	5.24E-01	5.24E-01	2.53E-01	3.20E-02	7.07E-05	3.86E-02	2.13E-01	4.11E-02	4.11E-02	0.00E+00	0.00E+00	3.34E-01	3.34E-01
	Cadmium	7440-43-9	2.09E-05	8.87E-01	1.05E-01	1.05E-01	1.05E-01	1.25E-02	8.60E-02	1.19E-06	1.53E-03	1.10E-02	8.23E-03	8.23E-03	0.00E+00	0.00E+00	2.90E-02	2.90E-02
	Lead	7439-92-1	1.93E-04	2.03E+01	1.47E+00	8.58E-02	8.58E-02	1.71E-02	1.31E+00	1.10E-05	3.50E-02	1.54E-01	6.72E-03	6.72E-03	0.00E+00	0.00E+00	2.02E-01	2.02E-01
	Mercury	7439-97-6	7.26E-05	3.59E-02	6.76E-03	1.30E-02	1.30E-02	8.42E-02	2.22E-04	4.14E-06	6.19E-05	7.06E-04	1.02E-03	1.02E-03	0.00E+00	0.00E+00	2.81E-03	2.81E-03
	Methylmercury	22967-92-6	1.13E-07	8.79E-04	2.00E-03	1.42E-02	1.42E-02	1.03E-01	1.88E-07	6.44E-09	1.52E-06	2.09E-04	1.11E-03	1.11E-03	0.00E+00	0.00E+00	2.44E-03	2.44E-03
	Selenium	7782-49-2	6.61E-04	4.59E+00	6.75E-01	7.10E-01	7.10E-01	8.45E-01	3.75E-01	3.77E-05	7.91E-03	7.05E-02	5.56E-02	5.56E-02	0.00E+00	0.00E+00	1.90E-01	1.90E-01
	Zinc	7440-66-6	1.28E-03	5.76E+01	6.31E+00	2.43E+01	2.43E+01	2.16E+01	3.34E+01	7.30E-05	9.93E-02	6.59E-01	1.90E+00	1.90E+00	0.00E+00	0.00E+00	4.57E+00	4.57E+00

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Wood Duck	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total Dietary Intake (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.24E-03	2.24E+01	2.04E+00	5.24E-01	5.24E-01	2.53E-01	3.20E-02	8.40E-05	1.47E-01	4.27E-01	1.57E-02	3.13E-02	0.00E+00	0.00E+00	6.22E-01	6.22E-01
	Cadmium	7440-43-9	2.09E-05	8.87E-01	1.05E-01	1.05E-01	1.05E-01	1.25E-02	8.60E-02	1.42E-06	5.84E-03	2.20E-02	3.14E-03	6.28E-03	0.00E+00	0.00E+00	3.72E-02	3.72E-02
	Lead	7439-92-1	1.93E-04	2.03E+01	1.47E+00	8.58E-02	8.58E-02	1.71E-02	1.31E+00	1.31E-05	1.34E-01	3.08E-01	2.57E-03	5.13E-03	0.00E+00	0.00E+00	4.49E-01	4.49E-01
	Mercury	7439-97-6	7.26E-05	3.59E-02	6.76E-03	1.30E-02	1.30E-02	8.42E-02	2.22E-04	4.92E-06	2.36E-04	1.42E-03	3.89E-04	7.78E-04	0.00E+00	0.00E+00	2.82E-03	2.82E-03
	Methylmercury	22967-92-6	1.13E-07	8.79E-04	2.00E-03	1.42E-02	1.42E-02	1.03E-01	1.88E-07	7.65E-09	5.78E-06	4.19E-04	4.25E-04	8.49E-04	0.00E+00	0.00E+00	1.70E-03	1.70E-03
	Selenium	7782-49-2	6.61E-04	4.59E+00	6.75E-01	7.10E-01	7.10E-01	8.45E-01	3.75E-01	4.48E-05	3.02E-02	1.41E-01	2.12E-02	4.25E-02	0.00E+00	0.00E+00	2.35E-01	2.35E-01
	Zinc	7440-66-6	1.28E-03	5.76E+01	6.31E+00	2.43E+01	2.43E+01	2.16E+01	3.34E+01	8.67E-05	3.79E-01	1.32E+00	7.27E-01	1.45E+00	0.00E+00	0.00E+00	3.88E+00	3.88E+00

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Osprey	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total Dietary Intake (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.24E-03	2.24E+01	2.04E+00	5.24E-01	5.24E-01	2.53E-01	3.20E-02	6.45E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.31E-02	0.00E+00	5.32E-02	5.32E-02
	Cadmium	7440-43-9	2.09E-05	8.87E-01	1.05E-01	1.05E-01	1.05E-01	1.25E-02	8.60E-02	1.09E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-03	0.00E+00	2.63E-03	2.63E-03
	Lead	7439-92-1	1.93E-04	2.03E+01	1.47E+00	8.58E-02	8.58E-02	1.71E-02	1.31E+00	1.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.59E-03	0.00E+00	3.60E-03	3.60E-03
	Mercury	7439-97-6	7.26E-05	3.59E-02	6.76E-03	1.30E-02	1.30E-02	8.42E-02	2.22E-04	3.78E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-02	0.00E+00	1.77E-02	1.77E-02
	Methylmercury	22967-92-6	1.13E-07	8.79E-04	2.00E-03	1.42E-02	1.42E-02	1.03E-01	1.88E-07	5.88E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-02	0.00E+00	2.16E-02	2.16E-02
	Selenium	7782-49-2	6.61E-04	4.59E+00	6.75E-01	7.10E-01	7.10E-01	8.45E-01	3.75E-01	3.44E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-01	0.00E+00	1.77E-01	1.77E-01
	Zinc	7440-66-6	1.28E-03	5.76E+01	6.31E+00	2.43E+01	2.43E+01	2.16E+01	3.34E+01	6.66E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.54E+00	0.00E+00	4.54E+00	4.54E+00

Table 5-12C Dietary Intake for Wildlife Receptors (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Great Blue Heron			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total Dietary Intake (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.24E-03	2.24E+01	2.04E+00	5.24E-01	5.24E-01	2.53E-01	3.20E-02	5.58E-05	1.61E-02	0.00E+00	0.00E+00	4.72E-02	2.28E-02	0.00E+00	8.61E-02	8.61E-02
	Cadmium	7440-43-9	2.09E-05	8.87E-01	1.05E-01	1.05E-01	1.05E-01	1.25E-02	8.60E-02	9.41E-07	6.39E-04	0.00E+00	0.00E+00	9.45E-03	1.13E-03	0.00E+00	1.12E-02	1.12E-02
	Lead	7439-92-1	1.93E-04	2.03E+01	1.47E+00	8.58E-02	8.58E-02	1.71E-02	1.31E+00	8.69E-06	1.46E-02	0.00E+00	0.00E+00	7.72E-03	1.54E-03	0.00E+00	2.39E-02	2.39E-02
	Mercury	7439-97-6	7.26E-05	3.59E-02	6.76E-03	1.30E-02	1.30E-02	8.42E-02	2.22E-04	3.27E-06	2.58E-05	0.00E+00	0.00E+00	1.17E-03	7.58E-03	0.00E+00	8.78E-03	8.78E-03
	Methylmercury	22967-92-6	1.13E-07	8.79E-04	2.00E-03	1.42E-02	1.42E-02	1.03E-01	1.88E-07	5.09E-09	6.33E-07	0.00E+00	0.00E+00	1.28E-03	9.27E-03	0.00E+00	1.05E-02	1.05E-02
	Selenium	7782-49-2	6.61E-04	4.59E+00	6.75E-01	7.10E-01	7.10E-01	8.45E-01	3.75E-01	2.97E-05	3.30E-03	0.00E+00	0.00E+00	6.39E-02	7.61E-02	0.00E+00	1.43E-01	1.43E-01
	Zinc	7440-66-6	1.28E-03	5.76E+01	6.31E+00	2.43E+01	2.43E+01	2.16E+01	3.34E+01	5.76E-05	4.15E-02	0.00E+00	0.00E+00	2.19E+00	1.94E+00	0.00E+00	4.17E+00	4.17E+00

Gray Bat			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total Dietary Intake (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.24E-03	2.24E+01	2.04E+00	5.24E-01	5.24E-01	2.53E-01	3.20E-02	1.51E-04	0.00E+00	0.00E+00	2.99E-01	0.00E+00	0.00E+00	0.00E+00	2.99E-01	1.50E-01
	Cadmium	7440-43-9	2.09E-05	8.87E-01	1.05E-01	1.05E-01	1.05E-01	1.25E-02	8.60E-02	2.54E-06	0.00E+00	0.00E+00	5.99E-02	0.00E+00	0.00E+00	0.00E+00	5.99E-02	2.99E-02
	Lead	7439-92-1	1.93E-04	2.03E+01	1.47E+00	8.58E-02	8.58E-02	1.71E-02	1.31E+00	2.34E-05	0.00E+00	0.00E+00	4.89E-02	0.00E+00	0.00E+00	0.00E+00	4.90E-02	2.45E-02
	Mercury	7439-97-6	7.26E-05	3.59E-02	6.76E-03	1.30E-02	1.30E-02	8.42E-02	2.22E-04	8.82E-06	0.00E+00	0.00E+00	7.42E-03	0.00E+00	0.00E+00	0.00E+00	7.42E-03	3.71E-03
	Methylmercury	22967-92-6	1.13E-07	8.79E-04	2.00E-03	1.42E-02	1.42E-02	1.03E-01	1.88E-07	1.37E-08	0.00E+00	0.00E+00	8.10E-03	0.00E+00	0.00E+00	0.00E+00	8.10E-03	4.05E-03
	Selenium	7782-49-2	6.61E-04	4.59E+00	6.75E-01	7.10E-01	7.10E-01	8.45E-01	3.75E-01	8.03E-05	0.00E+00	0.00E+00	4.05E-01	0.00E+00	0.00E+00	0.00E+00	4.05E-01	2.03E-01
	Zinc	7440-66-6	1.28E-03	5.76E+01	6.31E+00	2.43E+01	2.43E+01	2.16E+01	3.34E+01	1.55E-04	0.00E+00	0.00E+00	1.39E+01	0.00E+00	0.00E+00	0.00E+00	1.39E+01	6.93E+00

Raccoon			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total Dietary Intake (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.24E-03	2.24E+01	2.04E+00	5.24E-01	5.24E-01	2.53E-01	3.20E-02	1.03E-04	1.06E-01	2.46E-01	0.00E+00	5.53E-02	6.36E-03	0.00E+00	4.14E-01	4.14E-01
	Cadmium	7440-43-9	2.09E-05	8.87E-01	1.05E-01	1.05E-01	1.05E-01	1.25E-02	8.60E-02	1.73E-06	4.19E-03	1.27E-02	0.00E+00	1.11E-02	3.14E-04	0.00E+00	2.83E-02	2.83E-02
	Lead	7439-92-1	1.93E-04	2.03E+01	1.47E+00	8.58E-02	8.58E-02	1.71E-02	1.31E+00	1.60E-05	9.59E-02	1.77E-01	0.00E+00	9.06E-03	4.30E-04	0.00E+00	2.83E-01	2.83E-01
	Mercury	7439-97-6	7.26E-05	3.59E-02	6.76E-03	1.30E-02	1.30E-02	8.42E-02	2.22E-04	6.03E-06	1.70E-04	8.16E-04	0.00E+00	1.37E-03	2.12E-03	0.00E+00	4.48E-03	4.48E-03
	Methylmercury	22967-92-6	1.13E-07	8.79E-04	2.00E-03	1.42E-02	1.42E-02	1.03E-01	1.88E-07	9.38E-09	4.15E-06	2.41E-04	0.00E+00	1.50E-03	2.59E-03	0.00E+00	4.33E-03	4.33E-03
	Selenium	7782-49-2	6.61E-04	4.59E+00	6.75E-01	7.10E-01	7.10E-01	8.45E-01	3.75E-01	5.49E-05	2.17E-02	8.14E-02	0.00E+00	7.50E-02	2.12E-02	0.00E+00	1.99E-01	1.99E-01
	Zinc	7440-66-6	1.28E-03	5.76E+01	6.31E+00	2.43E+01	2.43E+01	2.16E+01	3.34E+01	1.06E-04	2.72E-01	7.61E-01	0.00E+00	2.57E+00	5.43E-01	0.00E+00	4.14E+00	4.14E+00

Table 5-12C Dietary Intake for Wildlife Receptors (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Mink			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total Dietary Intake (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.24E-03	2.24E+01	2.04E+00	5.24E-01	5.24E-01	2.53E-01	3.20E-02	9.80E-05	6.74E-02	0.00E+00	0.00E+00	0.00E+00	3.04E-02	1.28E-03	9.91E-02	9.91E-02
	Cadmium	7440-43-9	2.09E-05	8.87E-01	1.05E-01	1.05E-01	1.05E-01	1.25E-02	8.60E-02	1.65E-06	2.67E-03	0.00E+00	0.00E+00	0.00E+00	1.50E-03	3.44E-03	7.61E-03	7.61E-03
	Lead	7439-92-1	1.93E-04	2.03E+01	1.47E+00	8.58E-02	8.58E-02	1.71E-02	1.31E+00	1.52E-05	6.11E-02	0.00E+00	0.00E+00	0.00E+00	2.05E-03	5.23E-02	1.15E-01	1.15E-01
	Mercury	7439-97-6	7.26E-05	3.59E-02	6.76E-03	1.30E-02	1.30E-02	8.42E-02	2.22E-04	5.74E-06	1.08E-04	0.00E+00	0.00E+00	0.00E+00	1.01E-02	8.87E-06	1.02E-02	1.02E-02
	Methylmercury	22967-92-6	1.13E-07	8.79E-04	2.00E-03	1.42E-02	1.42E-02	1.03E-01	1.88E-07	8.93E-09	2.64E-06	0.00E+00	0.00E+00	0.00E+00	1.24E-02	7.54E-09	1.24E-02	1.24E-02
	Selenium	7782-49-2	6.61E-04	4.59E+00	6.75E-01	7.10E-01	7.10E-01	8.45E-01	3.75E-01	5.22E-05	1.38E-02	0.00E+00	0.00E+00	0.00E+00	1.01E-01	1.50E-02	1.30E-01	1.30E-01
	Zinc	7440-66-6	1.28E-03	5.76E+01	6.31E+00	2.43E+01	2.43E+01	2.16E+01	3.34E+01	1.01E-04	1.73E-01	0.00E+00	0.00E+00	0.00E+00	2.59E+00	1.34E+00	4.10E+00	4.10E+00

River Otter			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total Dietary Intake (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.24E-03	2.24E+01	2.04E+00	5.24E-01	5.24E-01	2.53E-01	3.20E-02	1.00E-04	2.15E-02	0.00E+00	0.00E+00	1.26E-02	5.47E-02	0.00E+00	8.90E-02	8.90E-02
	Cadmium	7440-43-9	2.09E-05	8.87E-01	1.05E-01	1.05E-01	1.05E-01	1.25E-02	8.60E-02	1.69E-06	8.53E-04	0.00E+00	0.00E+00	2.52E-03	2.70E-03	0.00E+00	6.08E-03	6.08E-03
	Lead	7439-92-1	1.93E-04	2.03E+01	1.47E+00	8.58E-02	8.58E-02	1.71E-02	1.31E+00	1.56E-05	1.95E-02	0.00E+00	0.00E+00	2.06E-03	3.70E-03	0.00E+00	2.53E-02	2.53E-02
	Mercury	7439-97-6	7.26E-05	3.59E-02	6.76E-03	1.30E-02	1.30E-02	8.42E-02	2.22E-04	5.88E-06	3.45E-05	0.00E+00	0.00E+00	3.12E-04	1.82E-02	0.00E+00	1.86E-02	1.86E-02
	Methylmercury	22967-92-6	1.13E-07	8.79E-04	2.00E-03	1.42E-02	1.42E-02	1.03E-01	1.88E-07	9.15E-09	8.45E-07	0.00E+00	0.00E+00	3.41E-04	2.23E-02	0.00E+00	2.26E-02	2.26E-02
	Selenium	7782-49-2	6.61E-04	4.59E+00	6.75E-01	7.10E-01	7.10E-01	8.45E-01	3.75E-01	5.35E-05	4.41E-03	0.00E+00	0.00E+00	1.71E-02	1.83E-01	0.00E+00	2.04E-01	2.04E-01
	Zinc	7440-66-6	1.28E-03	5.76E+01	6.31E+00	2.43E+01	2.43E+01	2.16E+01	3.34E+01	1.04E-04	5.54E-02	0.00E+00	0.00E+00	5.84E-01	4.67E+00	0.00E+00	5.31E+00	5.31E+00

Table 5-12C Dietary Intake for Wildlife Receptors (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

			Media Concentration (95th UCL)							Potential Dietary Intake (Using 95th UCL)								
Muskrat	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total Dietary Intake (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.24E-03	2.24E+01	2.04E+00	5.24E-01	5.24E-01	2.53E-01	3.20E-02	1.22E-04	3.23E-02	6.12E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.44E-01	6.44E-01
	Cadmium	7440-43-9	2.09E-05	8.87E-01	1.05E-01	1.05E-01	1.05E-01	1.25E-02	8.60E-02	2.05E-06	1.28E-03	3.15E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.28E-02	3.28E-02
	Lead	7439-92-1	1.93E-04	2.03E+01	1.47E+00	8.58E-02	8.58E-02	1.71E-02	1.31E+00	1.89E-05	2.92E-02	4.41E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.70E-01	4.70E-01
	Mercury	7439-97-6	7.26E-05	3.59E-02	6.76E-03	1.30E-02	1.30E-02	8.42E-02	2.22E-04	7.11E-06	5.17E-05	2.03E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E-03	2.09E-03
	Methylmercury	22967-92-6	1.13E-07	8.79E-04	2.00E-03	1.42E-02	1.42E-02	1.03E-01	1.88E-07	1.11E-08	1.27E-06	6.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.01E-04	6.01E-04
	Selenium	7782-49-2	6.61E-04	4.59E+00	6.75E-01	7.10E-01	7.10E-01	8.45E-01	3.75E-01	6.48E-05	6.61E-03	2.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E-01	2.09E-01
	Zinc	7440-66-6	1.28E-03	5.76E+01	6.31E+00	2.43E+01	2.43E+01	2.16E+01	3.34E+01	1.25E-04	8.29E-02	1.89E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E+00	1.98E+00

Notes:

(a) Total phase was used for surface water intake.
(b) Benthic invertebrate concentration used as a surrogate for aquatic invertebrate concentration.
(c) AUF is equal to 1 assuming that an organism spends all its time living and feeding at the site.
(d) AUF takes into account a receptor's home range and feeding habits; however, given the acreage of the site, all behavioral use AUFs are equivalent to the maximum scenario with the exception of the gray bat which takes into account its feeding habits (one-half terrestrial insects and one-half aquatic insects).

CASRN Chemical Abstracts Service Registry Number
mg/kg Milligram per kilogram
mg/kg bw-d Milligram per kilogram of body weight per day
mg/L Milligram per liter
mg/L bw-d Milligram per liter of body weight per day
ww Wet weight

Table 5-13 Dietary Intake for Wildlife Receptors - Reference
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Mallard Duck			Reference Media Concentration (95th UCL)							Reference Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total TDI (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.04E-03	2.22E+01	1.02E+00	4.80E-01	4.80E-01	3.13E-01	3.18E-02	5.93E-05	3.83E-02	1.07E-01	3.76E-02	3.76E-02	0.00E+00	0.00E+00	2.20E-01	2.20E-01
	Cadmium	7440-43-9	1.23E-05	3.94E-01	6.74E-02	6.72E-02	6.72E-02	1.03E-02	5.86E-02	7.01E-07	6.79E-04	7.04E-03	5.27E-03	5.27E-03	0.00E+00	0.00E+00	1.83E-02	1.83E-02
	Lead	7439-92-1	6.14E-05	2.80E+01	7.45E-01	4.91E-02	4.91E-02	1.90E-02	1.51E+00	3.50E-06	4.83E-02	7.78E-02	3.85E-03	3.85E-03	0.00E+00	0.00E+00	1.34E-01	1.34E-01
	Mercury	7439-97-6	7.91E-05	3.10E-02	4.60E-03	1.18E-02	1.18E-02	7.73E-02	7.04E-07	4.51E-06	5.34E-05	4.81E-04	9.25E-04	9.25E-04	0.00E+00	0.00E+00	2.39E-03	2.39E-03
	Methylmercury	22967-92-6	1.11E-07	1.74E-03	4.00E-03	1.29E-02	1.29E-02	9.79E-02	5.90E-09	6.33E-09	3.00E-06	4.18E-04	1.01E-03	1.01E-03	0.00E+00	0.00E+00	2.44E-03	2.44E-03
	Selenium	7782-49-2	4.23E-04	4.10E+00	7.40E-01	7.40E-01	7.40E-01	7.61E-01	3.59E-01	2.41E-05	7.07E-03	7.73E-02	5.80E-02	5.80E-02	0.00E+00	0.00E+00	2.00E-01	2.00E-01
	Zinc	7440-66-6	1.85E-03	6.39E+01	4.13E+00	2.47E+01	2.47E+01	2.11E+01	3.37E+01	1.05E-04	1.10E-01	4.31E-01	1.94E+00	1.94E+00	0.00E+00	0.00E+00	4.41E+00	4.41E+00

Wood Duck			Reference Media Concentration (95th UCL)							Reference Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total TDI (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.04E-03	2.22E+01	1.02E+00	4.80E-01	4.80E-01	3.13E-01	3.18E-02	7.04E-05	1.46E-01	2.14E-01	1.44E-02	2.87E-02	0.00E+00	0.00E+00	4.03E-01	4.03E-01
	Cadmium	7440-43-9	1.23E-05	3.94E-01	6.74E-02	6.72E-02	6.72E-02	1.03E-02	5.86E-02	8.33E-07	2.59E-03	1.41E-02	2.01E-03	4.02E-03	0.00E+00	0.00E+00	2.27E-02	2.27E-02
	Lead	7439-92-1	6.14E-05	2.80E+01	7.45E-01	4.91E-02	4.91E-02	1.90E-02	1.51E+00	4.16E-06	1.84E-01	1.56E-01	1.47E-03	2.94E-03	0.00E+00	0.00E+00	3.45E-01	3.45E-01
	Mercury	7439-97-6	7.91E-05	3.10E-02	4.60E-03	1.18E-02	1.18E-02	7.73E-02	7.04E-07	5.36E-06	2.04E-04	9.63E-04	3.53E-04	7.06E-04	0.00E+00	0.00E+00	2.23E-03	2.23E-03
	Methylmercury	22967-92-6	1.11E-07	1.74E-03	4.00E-03	1.29E-02	1.29E-02	9.79E-02	5.90E-09	7.52E-09	1.14E-05	8.37E-04	3.86E-04	7.72E-04	0.00E+00	0.00E+00	2.01E-03	2.01E-03
	Selenium	7782-49-2	4.23E-04	4.10E+00	7.40E-01	7.40E-01	7.40E-01	7.61E-01	3.59E-01	2.87E-05	2.70E-02	1.55E-01	2.21E-02	4.43E-02	0.00E+00	0.00E+00	2.48E-01	2.48E-01
	Zinc	7440-66-6	1.85E-03	6.39E+01	4.13E+00	2.47E+01	2.47E+01	2.11E+01	3.37E+01	1.25E-04	4.20E-01	8.65E-01	7.39E-01	1.48E+00	0.00E+00	0.00E+00	3.50E+00	3.50E+00

Osprey			Reference Media Concentration (95th UCL)							Reference Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total TDI (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.04E-03	2.22E+01	1.02E+00	4.80E-01	4.80E-01	3.13E-01	3.18E-02	5.41E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.57E-02	0.00E+00	6.58E-02	6.58E-02
	Cadmium	7440-43-9	1.23E-05	3.94E-01	6.74E-02	6.72E-02	6.72E-02	1.03E-02	5.86E-02	6.40E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.17E-03	0.00E+00	2.17E-03	2.17E-03
	Lead	7439-92-1	6.14E-05	2.80E+01	7.45E-01	4.91E-02	4.91E-02	1.90E-02	1.51E+00	3.19E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.99E-03	0.00E+00	3.99E-03	3.99E-03
	Mercury	7439-97-6	7.91E-05	3.10E-02	4.60E-03	1.18E-02	1.18E-02	7.73E-02	7.04E-07	4.11E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-02	0.00E+00	1.62E-02	1.62E-02
	Methylmercury	22967-92-6	1.11E-07	1.74E-03	4.00E-03	1.29E-02	1.29E-02	9.79E-02	5.90E-09	5.77E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-02	0.00E+00	2.05E-02	2.05E-02
	Selenium	7782-49-2	4.23E-04	4.10E+00	7.40E-01	7.40E-01	7.40E-01	7.61E-01	3.59E-01	2.20E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-01	0.00E+00	1.60E-01	1.60E-01
	Zinc	7440-66-6	1.85E-03	6.39E+01	4.13E+00	2.47E+01	2.47E+01	2.11E+01	3.37E+01	9.62E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.42E+00	0.00E+00	4.42E+00	4.42E+00

Great Blue Heron			Reference Media Concentration (95th UCL)							Reference Potential Dietary Intake (Using 95th UCL)								
	Chemical	CASRN	Surface Water (mg/L) (a)	Sediment (mg/kg)	Aquatic Plants (mg/kg ww)	Aquatic Invertebrates (mg/kg ww) (b)	Benthic Invertebrates (mg/kg ww)	Fish (mg/kg ww)	Small Mammals (mg/kg ww)	Surface Water (mg/kg bw-d)	Sediment (mg/kg bw-d)	Aquatic Plants (mg/kg bw-d)	Aquatic Invertebrates (mg/kg bw-d)	Benthic Invertebrates (mg/kg bw-d)	Fish (mg/kg bw-d)	Small Mammals (mg/kg ww)	Total Dietary Intake (Maximum Use Scenario) (c)	Total TDI (Behavioral Use Scenario) (d)
	Arsenic	7440-38-2	1.04E-03	2.22E+01	1.02E+00	4.80E-01	4.80E-01	3.13E-01	3.18E-02	4.68E-05	1.60E-02	0.00E+00	0.00E+00	4.32E-02	2.82E-02	0.00E+00	8.74E-02	8.74E-02
	Cadmium	7440-43-9	1.23E-05	3.94E-01	6.74E-02	6.72E-02	6.72E-02	1.03E-02	5.86E-02	5.54E-07	2.84E-04	0.00E+00	0.00E+00	6.05E-03	9.29E-04	0.00E+00	7.26E-03	7.26E-03
	Lead	7439-92-1	6.14E-05	2.80E+01	7.45E-01	4.91E-02	4.91E-02	1.90E-02	1.51E+00	2.76E-06	2.02E-02	0.00E+00	0.00E+00	4.42E-03	1.71E-03	0.00E+00	2.63E-02	2.63E-02
	Mercury	7439-97-6	7.91E-05	3.10E-02	4.60E-03	1.18E-02	1.18E-02	7.73E-02	7.04E-07	3.56E-06	2.23E-05	0.00E+00	0.00E+00	1.06E-03	6.95E-03	0.00E+00	8.04E-03	8.04E-03
	Methylmercury	22967-92-6	1.11E-07	1.74E-03	4.00E-03	1.29E-02	1.29E-02	9.79E-02	5.90E-09	5.00E-09	1.25E-06	0.00E+00	0.00E+00	1.16E-03	8.81E-03	0.00E+00	9.97E-03	9.97E-03
	Selenium	7782-49-2	4.23E-04	4.10E+00	7.40E-01	7.40E-01	7.40E-01	7.61E-01	3.59E-01	1.90E-05	2.95E-03	0.00E+00	0.00E+00	6.66E-02	6.85E-02	0.00E+00	1.38E-01	1.38E-01
	Zinc	7440-66-6	1.85E-03	6.39E+01	4.13E+00	2.47E+01	2.47E+01	2.11E+01	3.37E+01	8.33E-05	4.60E-02	0.00E+00	0.00E+00	2.22E+00	1.90E+00	0.00E+00	4.16E+00	4.16E+00

Table 5-13 Dietary Intake for Wildlife Receptors - Reference
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

			Reference Media Concentration (95th UCL)							Reference Potential Dietary Intake (Using 95th UCL)								
Gray Bat	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total TDI (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.04E-03	2.22E+01	1.02E+00	4.80E-01	4.80E-01	3.13E-01	3.18E-02	1.26E-04	0.00E+00	0.00E+00	2.74E-01	0.00E+00	0.00E+00	0.00E+00	2.74E-01	1.37E-01
	Cadmium	7440-43-9	1.23E-05	3.94E-01	6.74E-02	6.72E-02	6.72E-02	1.03E-02	5.86E-02	1.49E-06	0.00E+00	0.00E+00	3.83E-02	0.00E+00	0.00E+00	0.00E+00	3.83E-02	1.92E-02
	Lead	7439-92-1	6.14E-05	2.80E+01	7.45E-01	4.91E-02	4.91E-02	1.90E-02	1.51E+00	7.46E-06	0.00E+00	0.00E+00	2.80E-02	0.00E+00	0.00E+00	0.00E+00	2.80E-02	1.40E-02
	Mercury	7439-97-6	7.91E-05	3.10E-02	4.60E-03	1.18E-02	1.18E-02	7.73E-02	7.04E-07	9.61E-06	0.00E+00	0.00E+00	6.73E-03	0.00E+00	0.00E+00	0.00E+00	6.74E-03	3.37E-03
	Methylmercury	22967-92-6	1.11E-07	1.74E-03	4.00E-03	1.29E-02	1.29E-02	9.79E-02	5.90E-09	1.35E-08	0.00E+00	0.00E+00	7.36E-03	0.00E+00	0.00E+00	0.00E+00	7.36E-03	3.68E-03
	Selenium	7782-49-2	4.23E-04	4.10E+00	7.40E-01	7.40E-01	7.40E-01	7.61E-01	3.59E-01	5.14E-05	0.00E+00	0.00E+00	4.22E-01	0.00E+00	0.00E+00	0.00E+00	4.22E-01	2.11E-01
	Zinc	7440-66-6	1.85E-03	6.39E+01	4.13E+00	2.47E+01	2.47E+01	2.11E+01	3.37E+01	2.25E-04	0.00E+00	0.00E+00	1.41E+01	0.00E+00	0.00E+00	0.00E+00	1.41E+01	7.04E+00

			Reference Media Concentration (95th UCL)							Reference Potential Dietary Intake (Using 95th UCL)								
Raccoon	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total TDI (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.04E-03	2.22E+01	1.02E+00	4.80E-01	4.80E-01	3.13E-01	3.18E-02	8.63E-05	1.05E-01	1.23E-01	0.00E+00	5.07E-02	7.86E-03	0.00E+00	2.87E-01	2.87E-01
	Cadmium	7440-43-9	1.23E-05	3.94E-01	6.74E-02	6.72E-02	6.72E-02	1.03E-02	5.86E-02	1.02E-06	1.86E-03	8.13E-03	0.00E+00	7.09E-03	2.59E-04	0.00E+00	1.73E-02	1.73E-02
	Lead	7439-92-1	6.14E-05	2.80E+01	7.45E-01	4.91E-02	4.91E-02	1.90E-02	1.51E+00	5.10E-06	1.32E-01	8.99E-02	0.00E+00	5.18E-03	4.77E-04	0.00E+00	2.28E-01	2.28E-01
	Mercury	7439-97-6	7.91E-05	3.10E-02	4.60E-03	1.18E-02	1.18E-02	7.73E-02	7.04E-07	6.57E-06	1.46E-04	5.55E-04	0.00E+00	1.25E-03	1.94E-03	0.00E+00	3.90E-03	3.90E-03
	Methylmercury	22967-92-6	1.11E-07	1.74E-03	4.00E-03	1.29E-02	1.29E-02	9.79E-02	5.90E-09	9.21E-09	8.22E-06	4.83E-04	0.00E+00	1.36E-03	2.46E-03	0.00E+00	4.31E-03	4.31E-03
	Selenium	7782-49-2	4.23E-04	4.10E+00	7.40E-01	7.40E-01	7.40E-01	7.61E-01	3.59E-01	3.51E-05	1.94E-02	8.93E-02	0.00E+00	7.81E-02	1.91E-02	0.00E+00	2.06E-01	2.06E-01
	Zinc	7440-66-6	1.85E-03	6.39E+01	4.13E+00	2.47E+01	2.47E+01	2.11E+01	3.37E+01	1.54E-04	3.02E-01	4.98E-01	0.00E+00	2.61E+00	5.29E-01	0.00E+00	3.94E+00	3.94E+00

			Reference Media Concentration (95th UCL)							Reference Potential Dietary Intake (Using 95th UCL)								
Mink	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total TDI (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.04E-03	2.22E+01	1.02E+00	4.80E-01	4.80E-01	3.13E-01	3.18E-02	8.22E-05	6.68E-02	0.00E+00	0.00E+00	0.00E+00	3.75E-02	1.27E-03	1.06E-01	1.06E-01
	Cadmium	7440-43-9	1.23E-05	3.94E-01	6.74E-02	6.72E-02	6.72E-02	1.03E-02	5.86E-02	9.72E-07	1.19E-03	0.00E+00	0.00E+00	0.00E+00	1.24E-03	2.35E-03	4.77E-03	4.77E-03
	Lead	7439-92-1	6.14E-05	2.80E+01	7.45E-01	4.91E-02	4.91E-02	1.90E-02	1.51E+00	4.85E-06	8.42E-02	0.00E+00	0.00E+00	0.00E+00	2.28E-03	6.03E-02	1.47E-01	1.47E-01
	Mercury	7439-97-6	7.91E-05	3.10E-02	4.60E-03	1.18E-02	1.18E-02	7.73E-02	7.04E-07	6.25E-06	9.32E-05	0.00E+00	0.00E+00	0.00E+00	9.27E-03	2.82E-08	9.37E-03	9.37E-03
	Methylmercury	22967-92-6	1.11E-07	1.74E-03	4.00E-03	1.29E-02	1.29E-02	9.79E-02	5.90E-09	8.77E-09	5.23E-06	0.00E+00	0.00E+00	0.00E+00	1.17E-02	2.36E-10	1.17E-02	1.17E-02
	Selenium	7782-49-2	4.23E-04	4.10E+00	7.40E-01	7.40E-01	7.40E-01	7.61E-01	3.59E-01	3.34E-05	1.23E-02	0.00E+00	0.00E+00	0.00E+00	9.14E-02	1.44E-02	1.18E-01	1.18E-01
	Zinc	7440-66-6	1.85E-03	6.39E+01	4.13E+00	2.47E+01	2.47E+01	2.11E+01	3.37E+01	1.46E-04	1.92E-01	0.00E+00	0.00E+00	0.00E+00	2.53E+00	1.35E+00	4.07E+00	4.07E+00

			Reference Media Concentration (95th UCL)							Reference Potential Dietary Intake (Using 95th UCL)								
River Otter	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total TDI (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.04E-03	2.22E+01	1.02E+00	4.80E-01	4.80E-01	3.13E-01	3.18E-02	8.42E-05	2.13E-02	0.00E+00	0.00E+00	1.15E-02	6.77E-02	0.00E+00	1.01E-01	1.01E-01
	Cadmium	7440-43-9	1.23E-05	3.94E-01	6.74E-02	6.72E-02	6.72E-02	1.03E-02	5.86E-02	9.96E-07	3.79E-04	0.00E+00	0.00E+00	1.62E-03	2.23E-03	0.00E+00	4.23E-03	4.23E-03
	Lead	7439-92-1	6.14E-05	2.80E+01	7.45E-01	4.91E-02	4.91E-02	1.90E-02	1.51E+00	4.97E-06	2.69E-02	0.00E+00	0.00E+00	1.18E-03	4.11E-03	0.00E+00	3.22E-02	3.22E-02
	Mercury	7439-97-6	7.91E-05	3.10E-02	4.60E-03	1.18E-02	1.18E-02	7.73E-02	7.04E-07	6.41E-06	2.98E-05	0.00E+00	0.00E+00	2.84E-04	1.67E-02	0.00E+00	1.70E-02	1.70E-02
	Methylmercury	22967-92-6	1.11E-07	1.74E-03	4.00E-03	1.29E-02	1.29E-02	9.79E-02	5.90E-09	8.99E-09	1.67E-06	0.00E+00	0.00E+00	3.10E-04	2.12E-02	0.00E+00	2.15E-02	2.15E-02
	Selenium	7782-49-2	4.23E-04	4.10E+00	7.40E-01	7.40E-01	7.40E-01	7.61E-01	3.59E-01	3.43E-05	3.94E-03	0.00E+00	0.00E+00	1.78E-02	1.65E-01	0.00E+00	1.86E-01	1.86E-01
	Zinc	7440-66-6	1.85E-03	6.39E+01	4.13E+00	2.47E+01	2.47E+01	2.11E+01	3.37E+01	1.50E-04	6.14E-02	0.00E+00	0.00E+00	5.94E-01	4.56E+00	0.00E+00	5.21E+00	5.21E+00

Table 5-13 Dietary Intake for Wildlife Receptors - Reference
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

			Reference Media Concentration (95th UCL)							Reference Potential Dietary Intake (Using 95th UCL)								
Muskrat	**Chemical**	**CASRN**	**Surface Water (mg/L) (a)**	**Sediment (mg/kg)**	**Aquatic Plants (mg/kg ww)**	**Aquatic Invertebrates (mg/kg ww) (b)**	**Benthic Invertebrates (mg/kg ww)**	**Fish (mg/kg ww)**	**Small Mammals (mg/kg ww)**	**Surface Water (mg/kg bw-d)**	**Sediment (mg/kg bw-d)**	**Aquatic Plants (mg/kg bw-d)**	**Aquatic Invertebrates (mg/kg bw-d)**	**Benthic Invertebrates (mg/kg bw-d)**	**Fish (mg/kg bw-d)**	**Small Mammals (mg/kg ww)**	**Total Dietary Intake (Maximum Use Scenario) (c)**	**Total TDI (Behavioral Use Scenario) (d)**
	Arsenic	7440-38-2	1.04E-03	2.22E+01	1.02E+00	4.80E-01	4.80E-01	3.13E-01	3.18E-02	1.02E-04	3.20E-02	3.06E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.38E-01	3.38E-01
	Cadmium	7440-43-9	1.23E-05	3.94E-01	6.74E-02	6.72E-02	6.72E-02	1.03E-02	5.86E-02	1.21E-06	5.67E-04	2.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-02	2.08E-02
	Lead	7439-92-1	6.14E-05	2.80E+01	7.45E-01	4.91E-02	4.91E-02	1.90E-02	1.51E+00	6.02E-06	4.03E-02	2.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.64E-01	2.64E-01
	Mercury	7439-97-6	7.91E-05	3.10E-02	4.60E-03	1.18E-02	1.18E-02	7.73E-02	7.04E-07	7.75E-06	4.46E-05	1.38E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-03	1.43E-03
	Methylmercury	22967-92-6	1.11E-07	1.74E-03	4.00E-03	1.29E-02	1.29E-02	9.79E-02	5.90E-09	1.09E-08	2.51E-06	1.20E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-03	1.20E-03
	Selenium	7782-49-2	4.23E-04	4.10E+00	7.40E-01	7.40E-01	7.40E-01	7.61E-01	3.59E-01	4.15E-05	5.90E-03	2.22E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.28E-01	2.28E-01
	Zinc	7440-66-6	1.85E-03	6.39E+01	4.13E+00	2.47E+01	2.47E+01	2.11E+01	3.37E+01	1.81E-04	9.20E-02	1.24E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E+00	1.33E+00

Notes:

(a) Total phase was used for surface water intake.
(b) Benthic invertebrate concentration used as a surrogate for aquatic invertebrate concentration.
(c) AUF is equal to 1 assuming that an organism spends all its time living and feeding at the site.
(d) Behavior use AUFs are calculated by dividing the size size (in hectares) by a species range (in hectares). Receptors whose home range is less than the size (in hectares) of the site are assigned an AUF1 of 1. Due to the size of the reference area, all behavioral use AUFs are 1 with the exception of the gray bat. The AUF of the gray bat was assigned a 0.5 for the behavioral use AUF to represent that 50% of its diet is terrestrial and 50% of its diet is aquatic.

CASRN Chemical Abstracts Service Registry Number
mg/kg Milligram per kilogram
mg/kg bw-d Milligram per kilogram of body weight per day
mg/L Milligram per liter
mg/L bw-d Milligram per liter of body weight per day
TDI Total Daily Intake
UCL Upper Confidence Level
ww Wet weight

Table 5-14: Potential Risks to Fish Using Critical Body Residue (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

CASRN	Chemical	Critical Body Residue (CBR)		95th UCL (a)				Reference Area	
		Adult CBR (NOAEL)	Early-Life Stage CBR (NOAEL)	Curds Inlet Measured Adult Fish Tissue Concentration	Curds Inlet Measured YOY Fish Tissue Concentration	Adult NOAEL HQ	Early life stage NOAEL HQ	Reference Area Measured Adult Fish Tissue Concentration	Adult NOAEL HQ
		(mg/kg ww)	(mg/kg ww)	(mg/kg ww)	(mg/kg ww)	(unitless)	(unitless)	(mg/kg ww)	(unitless)
7440-38-2	Arsenic	5.5 (a)	1 (b)	2.42E-01	NA	0.04	not calc	3.13E-01	0.06
7440-43-9	Cadmium	0.09 (c)	0.09 (d)	6.46E-02	NA	0.7	not calc	1.03E-02	0.1
7439-92-1	Lead	0.34 (e)	2.6 (f)	3.20E-02	NA	0.09	not calc	1.90E-02	0.06
7439-97-6	Mercury	0.77 (g)	0.2 (h)	6.81E-02	NA	0.09	not calc	7.73E-02	0.1
22967-92-6	Methylmercury	0.77 (g)	0.2 (h)	7.56E-02	NA	0.1	not calc	9.79E-02	0.1
7440-66-6	Zinc	34 (j)	NC	1.98E+01	NA	0.6	not calc	2.11E+01	0.6

Notes:

(a) Gilderhus, P.A. 1966. Some effects of sublethal concentrations of sodium arsenite on bluegills and the aquatic environment. Transactions of the American Fisheres Society 95: 289-296 (In: Jarvinen and Ankley 1999).

(b) McGeachy SM, DG Dixon. 1990. Effect of temperature on the chronic toxicity of arsenate to rainbow trout (Oncorhynchus mykiss). Canadian Journal of Fisheries and Aquatic Sciences 47: 2228-2234 (In: Jarvinen and Ankley 1999).

(c) Pascoe, D., and F.L. Mattey J. 1977. Fish. Biol. 11, 207-215

(d) Rombough PJ, Garside 1982. ET Can J Zool 60:2006–2014 (In Jarvinen and Ankley 1999)

(e) Holcombe GW, DA Benoit, EN Leonard, JM McKim 1976 J Fish Res Board Can 33:1731-1741 (In Jarvinen and Ankley 1999)

(f) Holcombe, G.W., D.A. Benoit, E.N. Leonard and J.M. Mckim. 1976. J Fish Res Bd Can 33:1731-1741 (In Jarvinen and Ankley 1999)

(g) Dillon, T., N. Beckvar and J. Kern. 2010. Residue-based mercury dose-response in fish: An analysis using lethality-equivalent test endpoints. Environmental Toxicology and Chemistry 29: 2559-2565.

(h) Beckvar, N., T.M. Dillon and L.B. Read. 2005. Approaches for linking whole-body fish tissue residues of mercury or DDT to biological effect thresholds. Environmental Toxicology and Chemistry 24: 2094-2105.

Table 5-14: Potential Risks to Fish Using Critical Body Residue (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

(i)	Kentucky Administrative Record (KAR) 10:031: Surface Water Standards. http://www.lrc.ky.gov/kar/401/010/031.pdf (Accessed 11/2/2018). Kentucky Eco Whole Body Criterion of 8.6 mg/kg dry weight in whole body fish multiplied by 0.25 to convert dry weight to wet weight.
(j)	Spehar R.L. 1976. Cadmium and zinc toxicity to flagfish (Jordanella floridae). Journal of the Fisheries Research Board of Canada 33: 1939–1945 (In: Jarvinen and Ankley 1999).
CBR	Critical Body Residue
HQ	HQ Inlet
mg/kg ww	Milligram per kilogram wet weight
NA	Not Available
NC	Not Calculated
NOAEL	No Observed Adverse Effect Level
UCL	Upper Confidence Level

References:

Jarvinen and Ankley 1999	Jarvinen, A. W. and G. T. Ankley. 1999. Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals. Society for Environmental Toxicology and Chemistry (SETAC). SETAC Press: Pensacola, FL.

Table 5-15 Toxicity Reference Values for Wildlife Receptors
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

		Mammal TRV (mg/kg-bw/day)				Avian TRV (mg/kg-bw/day)			
Chemical	**CASRN**	**NOAEL**		**LOAEL**		**NOAEL**		**LOAEL**	
Arsenic	7440-38-2	1.04	(a)	1.66	(a)	2.24	(b)	3.55	(c)
Cadmium	7440-43-9	0.77	(d)	7.7	(d)	1.47	(e)	6.35	(f)
Lead	7439-92-1	4.7	(g)	8.9	(g)	1.63	(h)	3.26	(h)
Mercury	7439-97-6	1.01	(i)	10.1	(i)	3.25	(i)	32.5	(i)
					Fish Eating Birds:	0.29	(j)	2.9	(j)
Methylmercury	22967-92-6	0.032	(i)	0.32	(i)	0.0064	(i)	0.064	(i)
					Fish Eating Birds:	0.29	(j)	2.9	(j)
Selenium	7782-49-2	0.143	(k)	0.215	(l)	0.29	(m)	0.64	(n)
Zinc	7440-66-6	75.4	(e)	298	(f)	66.1	(e)	170	(f)

Notes:

CASRN	Chemical Abstracts Service Registry Number
EC20	20% effect concentration
LOAEL	Lowest Observed Adverse Effect Level
mg/kg bw-d	Milligram per kilogram of body weight per day
NOAEL	No Observed Adverse Effect Level
TRV	Toxicity reference value

(a)	Nieger and Osweiler (1989), as cited in USEPA (2007).
(b)	Hocman and Stibilj (1997), as cited in USEPA (2007).
(c)	Howell and Hill (1978), as cited in USEPA (2007).
(d)	Yuhas et al. (1979), as cited in USEPA (2007).
(e)	USEPA (2007) calculated the geometric mean of the reproduction and growth studies.
(f)	Ramboll calculated the geometric mean of the reproduction and growth studies listed in USEPA (2007).
(g)	Kimmel et al. (1980), as cited in USEPA (2007).

Table 5-15 Toxicity Reference Values for Wildlife Receptors
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

(h)	Edens and Garlich (1983), as cited in USEPA (2007).
(i)	USEPA R6 1999. The LOAEL is 10x the NOAEL presented in the original source document.
(j)	The NOAEL TRV is from a study by DesGranges (1998, 1999) for osprey, as cited in Fuchsman et al. (2017). The NOAEL TRV is converted to a LOAEL TRV using a factor of 10. Avian Methylmercury TRVs were used as a surrogate for mercury TRVs as Methylmercury TRVs are more conservative in general and there is some percentage of mercury that exists as Methylmercury in diet: plants (25% Hg and 75% MeHg); invertebrates (50% Hg and 50% MeHg); and fish (0% Hg and 100% MeHg).
(k)	Mahan and Moxon (1984), as cited in USEPA (2007).
(l)	Mahan and Moxon (1984), as cited in USEPA (2007).
(m)	El-Begearmi and Combs (1982), as cited in USEPA (2007).
(n)	The EC20 value calculated from a dose-response analysis of seven mallard studies Heinz et al. 1987, Heinz et al. 1989, Heinz and Hoffman 1996, Heinz and Hoffman 1998, Hoffman and Heinz 1988, Stanley et al. 1994, and Stanley et al. 1996).

References:

Fuchsman et al. (2017):	Fuchsman PC, Brown LB, Henning MH, Bock MJ, and VS Magar. 2017. Toxicity Reference Values for Methylmercury Effects on Avian Reproduction: Critical Review and Analysis. Environmental Toxicology and Chemistry 36(2): 294-319.
USEPA (2007):	United States Environmental Protection Agency (USEPA). 2007. "Ecological Soil Screening Level (Eco-SSL) Guidance and Documents." https://www.epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents.
USEPA R6 (1999):	Screening Level USEPA Region 6. 1999. Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (EPA530-D-99-001A). August.

Table 5-16A Hazard Quotients for Wildlife Receptors (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site-wide	Site-wide Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
Mallard Duck			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	5.12E-01	0.2	0.1	2.20E-01	0.1	0.06
	Cadmium	7440-43-9	NA	NA	1.47	6.35	5.16E-02	0.04	0.008	1.83E-02	0.01	0.003
	Lead	7439-92-1	NA	NA	1.63	3.26	1.79E-01	0.1	0.05	1.34E-01	0.08	0.04
	Mercury	7439-97-6	NA	NA	3.25	32.5	2.63E-03	0.0008	0.00008	2.39E-03	0.0007	0.00007
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	2.09E-03	0.3	0.03	2.44E-03	0.4	0.04
	Selenium	7782-49-2	NA	NA	0.29	0.64	1.83E-01	0.6	0.3	2.00E-01	0.7	0.3
	Zinc	7440-66-6	NA	NA	66.1	170	4.45E+00	0.07	0.03	4.41E+00	0.07	0.03

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site-wide	Site-wide Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
Wood Duck			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	1.39E+00	0.6	0.4	4.03E-01	0.2	0.1
	Cadmium	7440-43-9	NA	NA	1.47	6.35	6.90E-02	0.05	0.01	2.27E-02	0.02	0.004
	Lead	7439-92-1	NA	NA	1.63	3.26	4.12E-01	0.3	0.1	3.45E-01	0.2	0.1
	Mercury	7439-97-6	NA	NA	3.25	32.5	2.76E-03	0.0008	0.00008	2.23E-03	0.0007	0.00007
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	1.38E-03	0.2	0.02	2.01E-03	0.3	0.03
	Selenium	7782-49-2	NA	NA	0.29	0.64	2.43E-01	0.8	0.4	2.48E-01	0.9	0.4
	Zinc	7440-66-6	NA	NA	66.1	170	4.00E+00	0.06	0.02	3.50E+00	0.05	0.02

Table 5-16A Hazard Quotients for Wildlife Receptors (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site-wide	Site-wide Using 95th UCL DI (unitless)		Reference Area	Reference Area Using 95th UCL DI (unitless)	
			Mammal		Avian		(mg/kg bw-d)			(mg/kg bw-d)		
Osprey			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	5.18E-02	0.02	0.01	6.58E-02	0.03	0.02
	Cadmium	7440-43-9	NA	NA	1.47	6.35	3.80E-03	0.003	0.0006	2.17E-03	0.001	0.0003
	Lead	7439-92-1	NA	NA	1.63	3.26	3.81E-03	0.002	0.001	3.99E-03	0.002	0.001
	Mercury	7439-97-6	NA	NA	0.29	2.9	1.69E-02	0.06	0.006	1.62E-02	0.06	0.006
	Methylmercury	22967-92-6	NA	NA	0.29	2.9	1.74E-02	0.06	0.006	2.05E-02	0.07	0.007
	Selenium	7782-49-2	NA	NA	0.29	0.64	1.97E-01	0.7	0.3	1.60E-01	0.6	0.2
	Zinc	7440-66-6	NA	NA	66.1	170	4.43E+00	0.07	0.03	4.42E+00	0.07	0.03

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site-wide	Site-wide Using 95th UCL DI (unitless)		Reference Area	Reference Area Using 95th UCL DI (unitless)	
			Mammal		Avian		(mg/kg bw-d)			(mg/kg bw-d)		
Great Blue Heron			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	1.73E-01	0.08	0.05	8.74E-02	0.04	0.02
	Cadmium	7440-43-9	NA	NA	1.47	6.35	2.10E-02	0.01	0.003	7.26E-03	0.005	0.001
	Lead	7439-92-1	NA	NA	1.63	3.26	2.45E-02	0.02	0.008	2.63E-02	0.02	0.008
	Mercury	7439-97-6	NA	NA	0.29	2.9	8.39E-03	0.03	0.003	8.04E-03	0.03	0.003
	Methylmercury	22967-92-6	NA	NA	0.29	2.9	8.58E-03	0.03	0.003	9.97E-03	0.03	0.003
	Selenium	7782-49-2	NA	NA	0.29	0.64	1.55E-01	0.5	0.2	1.38E-01	0.5	0.2
	Zinc	7440-66-6	NA	NA	66.1	170	4.07E+00	0.06	0.02	4.16E+00	0.06	0.02

Table 5-16A Hazard Quotients for Wildlife Receptors (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site-wide	Site-wide Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
Gray Bat			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL		
	Arsenic	7440-38-2	1.04	1.66	NA	NA	1.33E-01	0.1	0.08	1.37E-01	0.1	0.08
	Cadmium	7440-43-9	0.77	7.7	NA	NA	5.50E-02	0.07	0.007	1.92E-02	0.02	0.002
	Lead	7439-92-1	4.7	8.9	NA	NA	2.12E-02	0.005	0.002	1.40E-02	0.003	0.002
	Mercury	7439-97-6	1.01	10.1	NA	NA	3.44E-03	0.003	0.0003	3.37E-03	0.003	0.0003
	Methylmercury	22967-92-6	0.032	0.32	NA	NA	3.57E-03	0.1	0.01	3.68E-03	0.1	0.01
	Selenium	7782-49-2	0.143	0.215	NA	NA	1.99E-01	1	0.9	2.11E-01	1	1
	Zinc	7440-66-6	75.4	298	NA	NA	6.65E+00	0.09	0.02	7.04E+00	0.09	0.02

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site-wide	Site-wide Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
Raccoon			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	1.04	1.66	NA	NA	9.75E-01	0.9	0.6	2.87E-01	0.3	0.2
	Cadmium	7440-43-9	0.77	7.7	NA	NA	5.32E-02	0.07	0.007	1.73E-02	0.02	0.002
	Lead	7439-92-1	4.7	8.9	NA	NA	2.63E-01	0.06	0.03	2.28E-01	0.05	0.03
	Mercury	7439-97-6	1.01	10.1	NA	NA	4.37E-03	0.004	0.0004	3.90E-03	0.004	0.0004
	Methylmercury	22967-92-6	0.032	0.32	NA	NA	3.55E-03	0.1	0.01	4.31E-03	0.1	0.01
	Selenium	7782-49-2	0.143	0.215	NA	NA	2.11E-01	1	1	2.06E-01	1	1
	Zinc	7440-66-6	75.4	298	NA	NA	4.18E+00	0.06	0.01	3.94E+00	0.05	0.01

Table 5-16A Hazard Quotients for Wildlife Receptors (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site-wide	Site-wide Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
Mink			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	1.04	1.66	NA	NA	4.90E-01	0.5	0.3	1.06E-01	0.1	0.06
	Cadmium	7440-43-9	0.77	7.7	NA	NA	1.66E-02	0.02	0.002	4.77E-03	0.006	0.0006
	Lead	7439-92-1	4.7	8.9	NA	NA	1.25E-01	0.03	0.01	1.47E-01	0.03	0.02
	Mercury	7439-97-6	1.01	10.1	NA	NA	9.95E-03	0.01	0.001	9.37E-03	0.009	0.0009
	Methylmercury	22967-92-6	0.032	0.32	NA	NA	9.94E-03	0.3	0.03	1.17E-02	0.4	0.04
	Selenium	7782-49-2	0.143	0.215	NA	NA	1.65E-01	1	0.8	1.18E-01	0.8	0.5
	Zinc	7440-66-6	75.4	298	NA	NA	4.22E+00	0.06	0.01	4.07E+00	0.05	0.01

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site-wide	Site-wide Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
River Otter			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	1.04	1.66	NA	NA	2.10E-01	0.2	0.1	1.01E-01	0.1	0.06
	Cadmium	7440-43-9	0.77	7.7	NA	NA	1.13E-02	0.01	0.001	4.23E-03	0.005	0.0005
	Lead	7439-92-1	4.7	8.9	NA	NA	2.74E-02	0.006	0.003	3.22E-02	0.007	0.004
	Mercury	7439-97-6	1.01	10.1	NA	NA	1.78E-02	0.02	0.002	1.70E-02	0.02	0.002
	Methylmercury	22967-92-6	0.032	0.32	NA	NA	1.82E-02	0.6	0.06	2.15E-02	0.7	0.07
	Selenium	7782-49-2	0.143	0.215	NA	NA	2.30E-01	2	1	1.86E-01	1	0.9
	Zinc	7440-66-6	75.4	298	NA	NA	5.22E+00	0.07	0.02	5.21E+00	0.07	0.02

Table 5-16A Hazard Quotients for Wildlife Receptors (Site-Wide)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site-wide	Site-wide Using 95th UCL DI (unitless)		Reference Area	Reference Area Using 95th UCL DI (unitless)	
			Mammal		Avian		(mg/kg bw-d)			(mg/kg bw-d)		
Muskrat			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	1.04	1.66	NA	NA	7.31E-01	0.7	0.4	3.38E-01	0.3	0.2
	Cadmium	7440-43-9	0.77	7.7	NA	NA	5.15E-02	0.07	0.007	2.08E-02	0.03	0.003
	Lead	7439-92-1	4.7	8.9	NA	NA	4.01E-01	0.09	0.05	2.64E-01	0.06	0.03
	Mercury	7439-97-6	1.01	10.1	NA	NA	1.98E-03	0.002	0.0002	1.43E-03	0.001	0.0001
	Methylmercury	22967-92-6	0.032	0.32	NA	NA	3.70E-04	0.01	0.001	1.20E-03	0.04	0.004
	Selenium	7782-49-2	0.143	0.215	NA	NA	1.75E-01	1	0.8	2.28E-01	2	1
	Zinc	7440-66-6	75.4	298	NA	NA	1.93E+00	0.03	0.006	1.33E+00	0.02	0.004

Notes:

Highlighted cell indicates hazard quotient above 1.

CASRN	Chemical Abstracts Service Registry Number
DI	Dietary Intake
HQ	Hazard Quotient
LOAEL	Lowest Observed Adverse Effect Level
mg/kg bw-d	Milligram per kilogram of body weight per day
NOAEL	No Observed Adverse Effect Level
TRV	Toxicity Reference Value
UCL	Upper Confidence Limit

Table 5-16B Hazard Quotients for Wildlife Receptors (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

			TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario Curds Inlet (mg/kg bw-d)	HQ - Behavioral Use Scenario Curds Inlet Using 95th UCL DI (unitless)		Dietary Intake - Behavioral Use Scenario Reference Area (mg/kg bw-d)	HQ - Behavioral Use Scenario Reference Area Using 95th UCL DI (unitless)	
			Mammal		Avian							
Mallard Duck	**Chemical**	**CASRN**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**
	Arsenic	7440-38-2	NA	NA	2.24	3.55	1.90E-03	0.0008	0.0005	2.20E-01	0.1	0.06
	Cadmium	7440-43-9	NA	NA	1.47	6.35	3.64E-04	0.0002	0.00006	1.83E-02	0.01	0.003
	Lead	7439-92-1	NA	NA	1.63	3.26	7.00E-04	0.0004	0.0002	1.34E-01	0.08	0.04
	Mercury	7439-97-6	NA	NA	3.25	32.5	9.44E-06	0.000003	3E-07	2.39E-03	0.0007	0.00007
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	7.70E-06	0.001	0.0001	2.44E-03	0.4	0.04
	Selenium	7782-49-2	NA	NA	0.29	0.64	6.99E-04	0.002	0.001	2.00E-01	0.7	0.3
	Zinc	7440-66-6	NA	NA	66.1	170	1.72E-02	0.0003	0.0001	4.41E+00	0.07	0.03

			TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario Curds Inlet (mg/kg bw-d)	HQ - Behavioral Use Scenario Curds Inlet Using 95th UCL DI (unitless)		Dietary Intake - Behavioral Use Scenario Reference Area (mg/kg bw-d)	HQ - Behavioral Use Scenario Reference Area Using 95th UCL DI (unitless)	
			Mammal		Avian							
Wood Duck	**Chemical**	**CASRN**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**
	Arsenic	7440-38-2	NA	NA	2.24	3.55	5.66E-03	0.003	0.002	4.03E-01	0.2	0.1
	Cadmium	7440-43-9	NA	NA	1.47	6.35	4.71E-04	0.0003	0.00007	2.27E-02	0.02	0.004
	Lead	7439-92-1	NA	NA	1.63	3.26	1.65E-03	0.001	0.0005	3.45E-01	0.2	0.1
	Mercury	7439-97-6	NA	NA	3.25	32.5	9.64E-06	0.000003	3E-07	2.23E-03	0.0007	0.00007
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	5.59E-06	0.0009	0.00009	2.01E-03	0.3	0.03
	Selenium	7782-49-2	NA	NA	0.29	0.64	8.91E-04	0.003	0.001	2.48E-01	0.9	0.4
	Zinc	7440-66-6	NA	NA	66.1	170	1.62E-02	0.0002	0.0001	3.50E+00	0.05	0.02

Table 5-16B Hazard Quotients for Wildlife Receptors (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario Curds Inlet (mg/kg bw-d)	HQ - Behavioral Use Scenario Curds Inlet Using 95th UCL DI (unitless)		Dietary Intake - Behavioral Use Scenario Reference Area (mg/kg bw-d)	HQ - Behavioral Use Scenario Reference Area Using 95th UCL DI (unitless)	
			Mammal		Avian							
			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
Osprey	Arsenic	7440-38-2	NA	NA	2.24	3.55	1.29E-04	0.00006	0.00004	6.58E-02	0.03	0.02
	Cadmium	7440-43-9	NA	NA	1.47	6.35	3.43E-05	0.00002	0.000005	2.17E-03	0.001	0.0003
	Lead	7439-92-1	NA	NA	1.63	3.26	1.70E-05	0.00001	0.000005	3.99E-03	0.002	0.001
	Mercury	7439-97-6	NA	NA	3.25	32.5	3.65E-05	0.0001	0.00001	1.62E-02	0.06	0.006
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	4.01E-05	0.0001	0.00001	2.05E-02	0.07	0.007
	Selenium	7782-49-2	NA	NA	0.29	0.64	8.38E-04	0.003	0.001	1.60E-01	0.6	0.2
	Zinc	7440-66-6	NA	NA	66.1	170	1.05E-02	0.0002	0.00006	4.42E+00	0.07	0.03

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario Curds Inlet (mg/kg bw-d)	HQ - Behavioral Use Scenario Curds Inlet Using 95th UCL DI (unitless)		Dietary Intake - Behavioral Use Scenario Reference Area (mg/kg bw-d)	HQ - Behavioral Use Scenario Reference Area Using 95th UCL DI (unitless)	
			Mammal		Avian							
			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
Great Blue Heron	Arsenic	7440-38-2	NA	NA	2.24	3.55	9.60E-02	0.04	0.03	8.74E-02	0.04	0.02
	Cadmium	7440-43-9	NA	NA	1.47	6.35	2.01E-02	0.01	0.003	7.26E-03	0.005	0.001
	Lead	7439-92-1	NA	NA	1.63	3.26	1.29E-02	0.008	0.004	2.63E-02	0.02	0.008
	Mercury	7439-97-6	NA	NA	3.25	32.5	3.72E-03	0.01	0.001	8.04E-03	0.03	0.003
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	3.97E-03	0.01	0.001	9.97E-03	0.03	0.003
	Selenium	7782-49-2	NA	NA	0.29	0.64	1.12E-01	0.4	0.2	1.38E-01	0.5	0.2
	Zinc	7440-66-6	NA	NA	66.1	170	1.97E+00	0.03	0.01	4.16E+00	0.06	0.02

Table 5-16B Hazard Quotients for Wildlife Receptors (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
			Mammal		Avian		Curds Inlet (mg/kg bw-d)	Curds Inlet Using 95th UCL DI (unitless)		Reference Area (mg/kg bw-d)	Reference Area Using 95th UCL DI (unitless)	
Gray Bat			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	1.72E-03	0.002	0.001	1.37E-01	0.15	0.1
	Cadmium	7440-43-9	NA	NA	1.47	6.35	1.43E-03	0.002	0.0002	1.92E-02	0.025	0.0025
	Lead	7439-92-1	NA	NA	1.63	3.26	2.30E-04	0.00005	0.00003	1.40E-02	0.003	0.0015
	Mercury	7439-97-6	NA	NA	3.25	32.5	4.78E-05	0.00005	0.000005	3.37E-03	0.0035	0.00035
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	4.62E-05	0.001	0.0001	3.68E-03	0.1	0.01
	Selenium	7782-49-2	NA	NA	0.29	0.64	3.18E-03	0.02	0.01	2.11E-01	1.5	1
	Zinc	7440-66-6	NA	NA	66.1	170	9.28E-02	0.001	0.0003	7.04E+00	0.1	0.025

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
			Mammal		Avian		Curds Inlet (mg/kg bw-d)	Curds Inlet Using 95th UCL DI (unitless)		Reference Area (mg/kg bw-d)	Reference Area Using 95th UCL DI (unitless)	
Raccoon			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	4.50E-02	0.04	0.03	2.87E-01	0.3	0.2
	Cadmium	7440-43-9	NA	NA	1.47	6.35	4.06E-03	0.005	0.0005	1.73E-02	0.02	0.002
	Lead	7439-92-1	NA	NA	1.63	3.26	1.18E-02	0.003	0.001	2.28E-01	0.05	0.03
	Mercury	7439-97-6	NA	NA	3.25	32.5	1.72E-04	0.0002	0.00002	3.90E-03	0.004	0.0004
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	1.46E-04	0.005	0.0005	4.31E-03	0.1	0.01
	Selenium	7782-49-2	NA	NA	0.29	0.64	9.85E-03	0.07	0.05	2.06E-01	1	1
	Zinc	7440-66-6	NA	NA	66.1	170	1.83E-01	0.002	0.0006	3.94E+00	0.05	0.01

Table 5-16B Hazard Quotients for Wildlife Receptors (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

			TRVs				Dietary Intake- Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
			(mg/kg bw-d)				Curds Inlet	Curds Inlet Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
Mink	**Chemical**	**CASRN**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**
	Arsenic	7440-38-2	NA	NA	2.24	3.55	9.39E-02	0.09	0.06	1.06E-01	0.1	0.06
	Cadmium	7440-43-9	NA	NA	1.47	6.35	4.15E-03	0.005	0.0005	4.77E-03	0.006	0.0006
	Lead	7439-92-1	NA	NA	1.63	3.26	2.18E-02	0.005	0.002	1.47E-01	0.03	0.02
	Mercury	7439-97-6	NA	NA	3.25	32.5	1.41E-03	0.001	0.0001	9.37E-03	0.009	0.0009
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	1.47E-03	0.05	0.005	1.17E-02	0.4	0.04
	Selenium	7782-49-2	NA	NA	0.29	0.64	4.12E-02	0.3	0.2	1.18E-01	0.8	0.5
	Zinc	7440-66-6	NA	NA	66.1	170	6.69E-01	0.009	0.002	4.07E+00	0.05	0.01

			TRVs				Dietary Intake- Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
			(mg/kg bw-d)				Curds Inlet	Curds Inlet Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
River Otter	**Chemical**	**CASRN**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**
	Arsenic	7440-38-2	NA	NA	2.24	3.55	1.55E-03	0.001	0.0009	1.01E-01	0.1	0.06
	Cadmium	7440-43-9	NA	NA	1.47	6.35	1.70E-04	0.0002	0.00002	4.23E-03	0.005	0.0005
	Lead	7439-92-1	NA	NA	1.63	3.26	2.09E-04	0.00004	0.00002	3.22E-02	0.007	0.004
	Mercury	7439-97-6	NA	NA	3.25	32.5	1.01E-04	0.0001	0.00001	1.70E-02	0.02	0.002
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	1.10E-04	0.003	0.0003	2.15E-02	0.7	0.07
	Selenium	7782-49-2	NA	NA	0.29	0.64	2.46E-03	0.02	0.01	1.86E-01	1	0.9
	Zinc	7440-66-6	NA	NA	66.1	170	3.25E-02	0.0004	0.0001	5.21E+00	0.07	0.02

Table 5-16B Hazard Quotients for Wildlife Receptors (Curds Inlet Only)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Muskrat	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
			Mammal		Avian		Curds Inlet	Curds Inlet Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			NOAEL	LOAEL	NOAEL	LOAEL	(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
							95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	5.62E-01	0.5	0.3	3.38E-01	0.3	0.2
	Cadmium	7440-43-9	NA	NA	1.47	6.35	9.71E-02	0.1	0.01	2.08E-02	0.03	0.003
	Lead	7439-92-1	NA	NA	1.63	3.26	3.98E-01	0.08	0.04	2.64E-01	0.06	0.03
	Mercury	7439-97-6	NA	NA	3.25	32.5	1.54E-03	0.002	0.0002	1.43E-03	0.001	0.0001
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	6.00E-04	0.02	0.002	1.20E-03	0.04	0.004
	Selenium	7782-49-2	NA	NA	0.29	0.64	1.16E-01	0.8	0.5	2.28E-01	2	1
	Zinc	7440-66-6	NA	NA	66.1	170	2.09E+00	0.03	0.007	1.33E+00	0.02	0.004

Notes:
Highlighted cell indicates hazard quotient above 1.

CASRN	Chemical Abstracts Service Registry Number
DI	Dietary Intake
HQ	Hazard Quotient
LOAEL	Lowest Observed Adverse Effect Level
mg/kg bw-d	Milligram per kilogram of body weight per day
NA	Not Available
NOAEL	No Observed Adverse Effect Level
TRV	Toxicity Reference Value
UCL	Upper Confidence Limit

Table 5-16C Hazard Quotients for Wildlife Receptors (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Mallard Duck	**Chemical**	**CASRN**	**TRVs**				**Dietary Intake-Behavioral Use Scenario**	**HQ - Behavioral Use Scenario**		**Dietary Intake - Behavioral Use Scenario**	**HQ - Behavioral Use Scenario**	
							Site without Curds Inlet	**Site without Curds Inlet**		**Reference Area**	**Reference Area**	
			(mg/kg bw-d)					**Using 95th UCL DI**			**Using 95th UCL DI**	
			Mammal		**Avian**		**(mg/kg bw-d)**	**(unitless)**		**(mg/kg bw-d)**	**(unitless)**	
			NOAEL	**LOAEL**	**NOAEL**	**LOAEL**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**
	Arsenic	7440-38-2	NA	NA	2.24	3.55	3.34E-01	0.1	0.09	2.20E-01	0.1	0.06
	Cadmium	7440-43-9	NA	NA	1.47	6.35	2.90E-02	0.02	0.005	1.83E-02	0.01	0.003
	Lead	7439-92-1	NA	NA	1.63	3.26	2.02E-01	0.1	0.06	1.34E-01	0.08	0.04
	Mercury	7439-97-6	NA	NA	3.25	32.5	2.81E-03	0.0009	0.00009	2.39E-03	0.0007	0.00007
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	2.44E-03	0.4	0.04	2.44E-03	0.4	0.04
	Selenium	7782-49-2	NA	NA	0.29	0.64	1.90E-01	0.7	0.3	2.00E-01	0.7	0.3
	Zinc	7440-66-6	NA	NA	66.1	170	4.57E+00	0.07	0.03	4.41E+00	0.07	0.03

Wood Duck	**Chemical**	**CASRN**	**TRVs**				**Dietary Intake-Behavioral Use Scenario**	**HQ - Behavioral Use Scenario**		**Dietary Intake - Behavioral Use Scenario**	**HQ - Behavioral Use Scenario**	
							Site without Curds Inlet	**Site without Curds Inlet**		**Reference Area**	**Reference Area**	
			(mg/kg bw-d)					**Using 95th UCL DI**			**Using 95th UCL DI**	
			Mammal		**Avian**		**(mg/kg bw-d)**	**(unitless)**		**(mg/kg bw-d)**	**(unitless)**	
			NOAEL	**LOAEL**	**NOAEL**	**LOAEL**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**	**95th UCL**	**NOAEL HQ**	**LOAEL HQ**
	Arsenic	7440-38-2	NA	NA	2.24	3.55	6.22E-01	0.3	0.2	4.03E-01	0.2	0.1
	Cadmium	7440-43-9	NA	NA	1.47	6.35	3.72E-02	0.03	0.006	2.27E-02	0.02	0.004
	Lead	7439-92-1	NA	NA	1.63	3.26	4.49E-01	0.3	0.1	3.45E-01	0.2	0.1
	Mercury	7439-97-6	NA	NA	3.25	32.5	2.82E-03	0.0009	0.00009	2.23E-03	0.0007	0.00007
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	1.70E-03	0.3	0.03	2.01E-03	0.3	0.03
	Selenium	7782-49-2	NA	NA	0.29	0.64	2.35E-01	0.8	0.4	2.48E-01	0.9	0.4
	Zinc	7440-66-6	NA	NA	66.1	170	3.88E+00	0.06	0.02	3.50E+00	0.05	0.02

Table 5-16C Hazard Quotients for Wildlife Receptors (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Osprey	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site without Curds Inlet	Site without Curds Inlet Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	5.32E-02	0.02	0.01	6.58E-02	0.03	0.02
	Cadmium	7440-43-9	NA	NA	1.47	6.35	2.63E-03	0.002	0.0004	2.17E-03	0.001	0.0003
	Lead	7439-92-1	NA	NA	1.63	3.26	3.60E-03	0.002	0.001	3.99E-03	0.002	0.001
	Mercury	7439-97-6	NA	NA	3.25	32.5	1.77E-02	0.06	0.006	1.62E-02	0.06	0.006
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	2.16E-02	0.07	0.007	2.05E-02	0.07	0.007
	Selenium	7782-49-2	NA	NA	0.29	0.64	1.77E-01	0.6	0.3	1.60E-01	0.6	0.2
	Zinc	7440-66-6	NA	NA	66.1	170	4.54E+00	0.07	0.03	4.42E+00	0.07	0.03

Great Blue Heron	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site without Curds Inlet	Site without Curds Inlet Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	8.61E-02	0.04	0.02	8.74E-02	0.04	0.02
	Cadmium	7440-43-9	NA	NA	1.47	6.35	1.12E-02	0.008	0.002	7.26E-03	0.005	0.001
	Lead	7439-92-1	NA	NA	1.63	3.26	2.39E-02	0.01	0.007	2.63E-02	0.02	0.008
	Mercury	7439-97-6	NA	NA	3.25	32.5	8.78E-03	0.03	0.003	8.04E-03	0.03	0.003
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	1.05E-02	0.04	0.004	9.97E-03	0.03	0.003
	Selenium	7782-49-2	NA	NA	0.29	0.64	1.43E-01	0.5	0.2	1.38E-01	0.5	0.2
	Zinc	7440-66-6	NA	NA	66.1	170	4.17E+00	0.06	0.02	4.16E+00	0.06	0.02

Table 5-16C Hazard Quotients for Wildlife Receptors (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site without Curds Inlet	Site without Curds Inlet Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
Gray Bat			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	1.50E-01	0.1	0.09	1.37E-01	0.1	0.08
	Cadmium	7440-43-9	NA	NA	1.47	6.35	2.99E-02	0.04	0.004	1.92E-02	0.02	0.002
	Lead	7439-92-1	NA	NA	1.63	3.26	2.45E-02	0.005	0.003	1.40E-02	0.003	0.002
	Mercury	7439-97-6	NA	NA	3.25	32.5	3.71E-03	0.004	0.0004	3.37E-03	0.003	0.0003
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	4.05E-03	0.1	0.01	3.68E-03	0.1	0.01
	Selenium	7782-49-2	NA	NA	0.29	0.64	2.03E-01	1	0.9	2.11E-01	1	1
	Zinc	7440-66-6	NA	NA	66.1	170	6.93E+00	0.09	0.02	7.04E+00	0.09	0.02

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site without Curds Inlet	Site without Curds Inlet Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
Raccoon			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	4.14E-01	0.4	0.2	2.87E-01	0.3	0.2
	Cadmium	7440-43-9	NA	NA	1.47	6.35	2.83E-02	0.04	0.004	1.73E-02	0.02	0.002
	Lead	7439-92-1	NA	NA	1.63	3.26	2.83E-01	0.06	0.03	2.28E-01	0.05	0.03
	Mercury	7439-97-6	NA	NA	3.25	32.5	4.48E-03	0.004	0.0004	3.90E-03	0.004	0.0004
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	4.33E-03	0.1	0.01	4.31E-03	0.1	0.01
	Selenium	7782-49-2	NA	NA	0.29	0.64	1.99E-01	1	0.9	2.06E-01	1	1
	Zinc	7440-66-6	NA	NA	66.1	170	4.14E+00	0.05	0.01	3.94E+00	0.05	0.01

Table 5-16C Hazard Quotients for Wildlife Receptors (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site without Curds Inlet	Site without Curds Inlet Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
Mink			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	9.91E-02	0.1	0.06	1.06E-01	0.1	0.06
	Cadmium	7440-43-9	NA	NA	1.47	6.35	7.61E-03	0.01	0.001	4.77E-03	0.006	0.0006
	Lead	7439-92-1	NA	NA	1.63	3.26	1.15E-01	0.02	0.01	1.47E-01	0.03	0.02
	Mercury	7439-97-6	NA	NA	3.25	32.5	1.02E-02	0.01	0.001	9.37E-03	0.009	0.0009
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	1.24E-02	0.4	0.04	1.17E-02	0.4	0.04
	Selenium	7782-49-2	NA	NA	0.29	0.64	1.30E-01	0.9	0.6	1.18E-01	0.8	0.5
	Zinc	7440-66-6	NA	NA	66.1	170	4.10E+00	0.05	0.01	4.07E+00	0.05	0.01

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site without Curds Inlet	Site without Curds Inlet Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
River Otter			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	8.90E-02	0.09	0.05	1.01E-01	0.1	0.06
	Cadmium	7440-43-9	NA	NA	1.47	6.35	6.08E-03	0.008	0.0008	4.23E-03	0.005	0.0005
	Lead	7439-92-1	NA	NA	1.63	3.26	2.53E-02	0.005	0.003	3.22E-02	0.007	0.004
	Mercury	7439-97-6	NA	NA	3.25	32.5	1.86E-02	0.02	0.002	1.70E-02	0.02	0.002
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	2.26E-02	0.7	0.07	2.15E-02	0.7	0.07
	Selenium	7782-49-2	NA	NA	0.29	0.64	2.04E-01	1	1	1.86E-01	1	0.9
	Zinc	7440-66-6	NA	NA	66.1	170	5.31E+00	0.07	0.02	5.21E+00	0.07	0.02

Table 5-16C Hazard Quotients for Wildlife Receptors (Site without Curds Inlet)
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

	Chemical	CASRN	TRVs (mg/kg bw-d)				Dietary Intake-Behavioral Use Scenario	HQ - Behavioral Use Scenario		Dietary Intake - Behavioral Use Scenario	HQ - Behavioral Use Scenario	
							Site without Curds Inlet	Site without Curds Inlet Using 95th UCL DI		Reference Area	Reference Area Using 95th UCL DI	
			Mammal		Avian		(mg/kg bw-d)	(unitless)		(mg/kg bw-d)	(unitless)	
Muskrat			NOAEL	LOAEL	NOAEL	LOAEL	95th UCL	NOAEL HQ	LOAEL HQ	95th UCL	NOAEL HQ	LOAEL HQ
	Arsenic	7440-38-2	NA	NA	2.24	3.55	6.44E-01	0.6	0.4	3.38E-01	0.3	0.2
	Cadmium	7440-43-9	NA	NA	1.47	6.35	3.28E-02	0.04	0.004	2.08E-02	0.03	0.003
	Lead	7439-92-1	NA	NA	1.63	3.26	4.70E-01	0.1	0.05	2.64E-01	0.06	0.03
	Mercury	7439-97-6	NA	NA	3.25	32.5	2.09E-03	0.002	0.0002	1.43E-03	0.001	0.0001
	Methylmercury	22967-92-6	NA	NA	0.0064	0.064	6.01E-04	0.02	0.002	1.20E-03	0.04	0.004
	Selenium	7782-49-2	NA	NA	0.29	0.64	2.09E-01	1	1	2.28E-01	2	1
	Zinc	7440-66-6	NA	NA	66.1	170	1.98E+00	0.03	0.007	1.33E+00	0.02	0.004

Notes:
Highlighted cell indicates hazard quotient above 1.

CASRN	Chemical Abstracts Service Registry Number
DI	Dietary Intake
HQ	Hazard Quotient
LOAEL	Lowest Observed Adverse Effect Level
mg/kg bw-d	Milligram per kilogram of body weight per day
NOAEL	No Observed Adverse Effect Level
TRV	Toxicity Reference Value
UCL	Upper Confidence Limit

Table 5-17: Uncertainty in Ecological Risk Assessment
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Investigation Data	
Source of Uncertainty	ERA Management Approach
Focused sampling in study area for pore water	Only a limited number of pore water samples were collected to target the more contaminated areas. This type of sampling often lacks statistical power and does not likely represent the concentrations in the entire environment in which wildlife exposure occurs.
Non detects, with detection limits that exceed ecotoxicity screening values	There are occasions when analytical detection limits exceed ecotoxicity screening values (ESVs). This can be due to instrument and method limitations and/or due to interference from unrelated chemicals (e.g., dilutions required to bring some other chemical within a calibration range).

Characterization of Exposure	
Source of Uncertainty	ERA Management Approach
Use of maximum and 95% UCL concentrations	Using maximum detected concentrations (in the SLERA) and 95% upper confidence limits (in the BERA) are likely to overestimate intakes since actual exposure is likely at lower concentrations.
Use of measured sediment concentrations to estimate tissue concentrations in muskrats	Tissue uptake modeling is complex. Measured sediment concentrations were used along with literature-derived uptake factors to estimate uptake of chemicals from sediment to tissue in muskrats only; site-specific, measured tissue concentrations were used for all other tissue exposure inputs in the food web model. Bioavailability and uptake depends on a myriad of biotic and abiotic factors, including lipid content, organic carbon content, pH, physicochemical properties of different media, and biological characteristics of different wildlife species. Therefore, use of abiotic media concentrations for tissue modeling may overestimate risk by not accurately accounting for the bioavailable fraction.
Use of literature derived exposure assumptions	There are numerous, often conservative, assumptions made in the exposure assessment, including the selection of exposure routes, scenarios, and factors (*e.g.* , contact rates, exposure frequency, body weight, dietary composition) used to estimate exposure doses. The calculated conservative exposure dose for any given constituent, which results from a multiplication of all of these variables, represents a high end value and is a conservative estimate of the actual exposure dose and likelihood of adverse effects.
Area use factors	The AUF accounts for the fraction of the diet that an organism actually obtains from the site. The AUF takes into consideration the dietary fraction derived from a site based on the organism's foraging/feeding range (i.e., the mobility factor, which is the ratio between the site surface area and the foraging/feeding range), and seasonal exposure that limits exposure to certain periods of the year. High mobility animals, such as birds, have extensive foraging ranges and are known to obtain their diet from multiple locations, while low-mobility organisms, such as invertebrates and small mammals, have a higher degree of exposure, because most or all of their diet is derived from a smaller area.
Adaptation and tolerance	Consideration of bioavailability (and, thereby, diminished toxicity) tolerance and adaptation are intentionally not considered directly in a BERA. Further, there is little consistency and no quantitative methodology for the consideration of the bioavailability (and, thereby, diminished toxicity) even though this process is well documented (e.g. Alexander 2000). Similarly, tolerance and adaptation is well documented (Millward and Klerks 2002; Grant 2002).

Table 5-17: Uncertainty in Ecological Risk Assessment
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Characterization of Effects	
Source of Uncertainty	ERA Management Approach
Laboratory toxicity testing	Simplistic extrapolations from laboratory species to wildlife species and testing conditions to field conditions are not likely accurate, and are rarely, if ever, validated against natural conditions (Power 1996; Tannenbaum 2003).
Toxicity data	Toxicity data are only available for a limited number of species (most of them laboratory test species) under a strictly defined set of test conditions that deviate from natural conditions (Sample et al. 1996; Suter 1995).
Use of extrapolated toxicity data to evaluate site specific effects	Toxicity data used to evaluate potential effects to measurement endpoints provide a source of uncertainty in the effects analysis. Toxicity data which has been extrapolated from laboratory settings, different species to wildlife provides a source of uncertainty. Toxicity values with low confidence ratings and high uncertainty factors overestimates risk.
Use of extrapolated toxicity data to evaluate site specific effects	Extrapolations between species and between chemicals with similar structure when specific data is not available may increase uncertainty.

Risk Characterization	
Source of Uncertainty	ERA Management Approach
Bird and mammal HQs based on maximum AUFs	Compounding conservative assumptions in the risk assessment likely yields extremely conservative (overestimated) risk estimates. Using an AUF = 1, the HQ values for the mammals and birds are based on the presumption that they live their entire lives within their exposure unit, consume food only from within their exposure unit, and food items live entirely within their exposure unit.
Elevated HQs for background concentrations	HQs may exceed a value of 1 for background concentrations of naturally occurring metals (Tannenbaum 2003). This is due to many of the toxicology and ESV uncertainties already discussed. Also, background HQs greater than 1 indicate that indigenous wildlife would have adapted to these COPCs.
Interpretation of HQs	An HQ less than or equal to a value of 1 indicates that adverse impacts to wildlife are considered unlikely (USEPA 2001). However, there is no clear guidance for interpreting the HQs that exceed a value of 1, except that this point of departure may indicate that adverse effects of some kind may have occurred or may occur in the future.
HQs with unrealistic magnitudes	HQs are seen at magnitudes that suggest acute toxicity. Often, conditions at a site document that this is not the case. There are occasions where HQs are >>1 suggesting acute toxicity could be predicted but then no evidence of toxicity is actually found (such as no significant toxicity in sediment toxicity tests or no evidence of toxicity in benthic community analyses).
HQs for individual used to evaluate risks to populations	HQs are based on the types of impacts that could occur to individuals (i.e., those individuals exposed to maximum concentrations), and they completely fail to address ecological exposure and risk at spatial scale of populations (Tannenbaum 2003; Durda and Preziosi 1999).

Notes:

%	Percent
AUF	Area use factor
BERA	Baseline ecological risk assessment
ERA	Ecological risk assessment
ESV	Ecotoxicity screening value
HQ	Hazard quotient
SLERA	screening-level ecological risk assessment
TRV	Toxicity reference value
UCL	Upper confidence level

Table 5-17: Uncertainty in Ecological Risk Assessment
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W.
Brown Station, Herrington Lake, Mercer County, Kentucky

Alexander, M. 2000. Aging, Bioavailability, and Overestimation of Risk from Environmental Pollutants. Environmental Science and Technology 34(20): 4259-4265.

Durda, J.L., and D.V. Preziosi. 1999. Where's the population in your risk assessment? SETAC News, Volume 19, Number 6, November.

Grant, A. 2002. Pollution-tolerant Species and Communities: Intriguing Toys or Invaluable Monitoring Tools? Human and Ecological Risk Assessment 8(5): 95-970.

Power, M. 1996. Probability concepts in ecological risk assessment. Human and Ecological Risk Assessment, 2(4):650-654.

Millward R. N., and Klerks P. L. 2002. Contaminant adaptation and community tolerance in ecological risk assessment: introduction. Human and Ecological Risk Assessment: An International Journal 8:921–932.

Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision (ES/ER/TM-86/R3). Oak Ridge, Tennessee: Risk Assessment Program, Health Sciences Research Division. June.

Suter, G.W., B.W. Cornaby, C.T. Hadden, R.N. Hull, M. Stack, and F.A. Zafran. 1995. An Approach for Balancing Health and Ecological Risks at Hazardous Waste Facilities. Risk Analysis 15(2): 221-231.

Tannenbaum L., M. Johnson, and M. Bazar. 2003. Application of the Hazard Quotient Method in Remedial Decisions: A Comparison of Human and Ecological Risk Assessments. Human and Ecological Risk Assessment: An International Journal 9: 387-401.

USEPA. 2001: ECO-Update: Role of Screening-level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments (EPA 540/F-01/014; Publication 9345.0-14). Washington, D.C.: USEPA, Office of Solid Waste and Emergency Response. June.

Table 5-18: Summary of Cobalt, Molybdenum, and Lithium Concentrations in HQ Spring and Briar Patch Spring in Comparison with Ecological Risk-Based Screening Levels
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Spring Sampled	Sampling Date	Spring Flow Rate (gpm)	Cobalt Concentration (mg/L)	Molydenum Concentration (mg/L)	Lithium Concentration (mg/L)
HQ Spring	June 27, 2017	380	<0.00200	0.0429	0.0446
	February 27, 2018	75	<0.00200	0.0350	0.0447
	March 26, 2018	50	<0.00200	0.0386	0.0353
	May 23, 2018	20	<0.00200	0.147	0.0814
Briar Patch Spring	June 13, 2017	7.5	<0.00200	0.064	0.0435
	June 20, 2017	20	<0.00200	0.0903	0.036
	June 27, 2017	271	<0.00200	0.0735	0.0489
	July 5, 2017	500	<0.00200	0.0586	0.0522
	July 12, 2017	180	<0.00200	0.0637	0.0464
	July 20, 2017	50	<0.00200	0.0642	0.0431
	July 26, 2017	93	<0.00200	0.0766	0.0336
	August 1, 2017	100	<0.00200	0.0701	0.0393
	August 9, 2017	100	<0.00200	0.0555	0.0496
	August 17, 2017	50	<0.00200	0.0588	0.0433
	September 14, 2017	100	0.00103	0.0403	0.0537
	September 28, 2017	40	<0.00200	0.0567	0.0393
	October 18, 2017	100	<0.00200	0.0592	0.0384
	November 15, 2017	30	<0.00200	0.0501	0.0364
	December 19, 2017	30	<0.00200	0.0623	0.0366
	January 29, 2018	75	<0.00200	0.0652	0.0563
	February 27, 2018	50	<0.00200	0.0353	0.0343
	March 26, 2018	75	<0.00200	0.0366	0.0312
	April 18, 2018	75	<0.00200	0.0351	0.0383
	May 23, 2018	100	<0.00200	0.136	0.0817
	June 11, 2018	35	<0.00200	0.0663	0.0496
	July 18, 2018	20	<0.00200	0.0627	<0.0150
	August 9, 2018	25	<0.00200	0.0469	0.0372
	October 30, 2018	15	<0.0010	0.043	0.031
		Ecological Screening Level[a]	0.019	0.8	0.44

Notes:

gpm Gallons per minute

L Liter

mg Milligrams

Sources: "2018-08-09 Analytical Summary Tables - EW Brown Wastewater.xlsx" received from KU on November 14, 2018.

"2018-12-12 Report for EWB 2018Q3Q4 GW Spring Sampling.pdf" received from Dinsmore & Shohl on January 7, 2019.

"EWB-Monitor.xlsx"

a Ecological screening levels (ESVs) are USEPA Region 4 chronic freshwater ecological screening values (USEPA 2018); no Kentucky water quality criteria values are available (KAR 2018)

Table 5-19: Summary of Cobalt, Molybdenum, and Lithium Concentrations in FORM C TABLES in Comparison with Ecological Risk-Based Screening Levels
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Year	Aux Pond Outfall BRN 001	Measurement Type	Cobalt Concentration (mg/L)	Molybdenum Concentration (mg/L)
2006		Maximum[a]	ND	ND
2014		Maximum[b]	ND	0.43
2019		Result[c]	0.0062	0.45
Ecological Screening Levels[d]			0.019	0.8

Notes:

mg/L Milligrams per Liter

ND Not Detected

[a] The 2006 single measurement type is indicated as "Maximum Daily Value" in the source data.

[b] The 2014 maximum measurement type is indicated as "Max" in the source data from three analytical reports.

[c] The 2019 single measurement type is indicated as "Result" in the source data.

[d] Ecological screening levels (ESVs) are USEPA Region 4 chronic freshwater ecological screening values (USEPA 2018); no Kentucky water quality criteria values are available (KAR 2018)

Aux Pond Outfall BRN 001 for 2006 is described as "Effluent" in the source data.

Sources:

11 Brown 2006 KPDES Form C (Ashpond).pdf

"KU-BR-528-4051699.pdf"

"KU-BR-625-4061697"

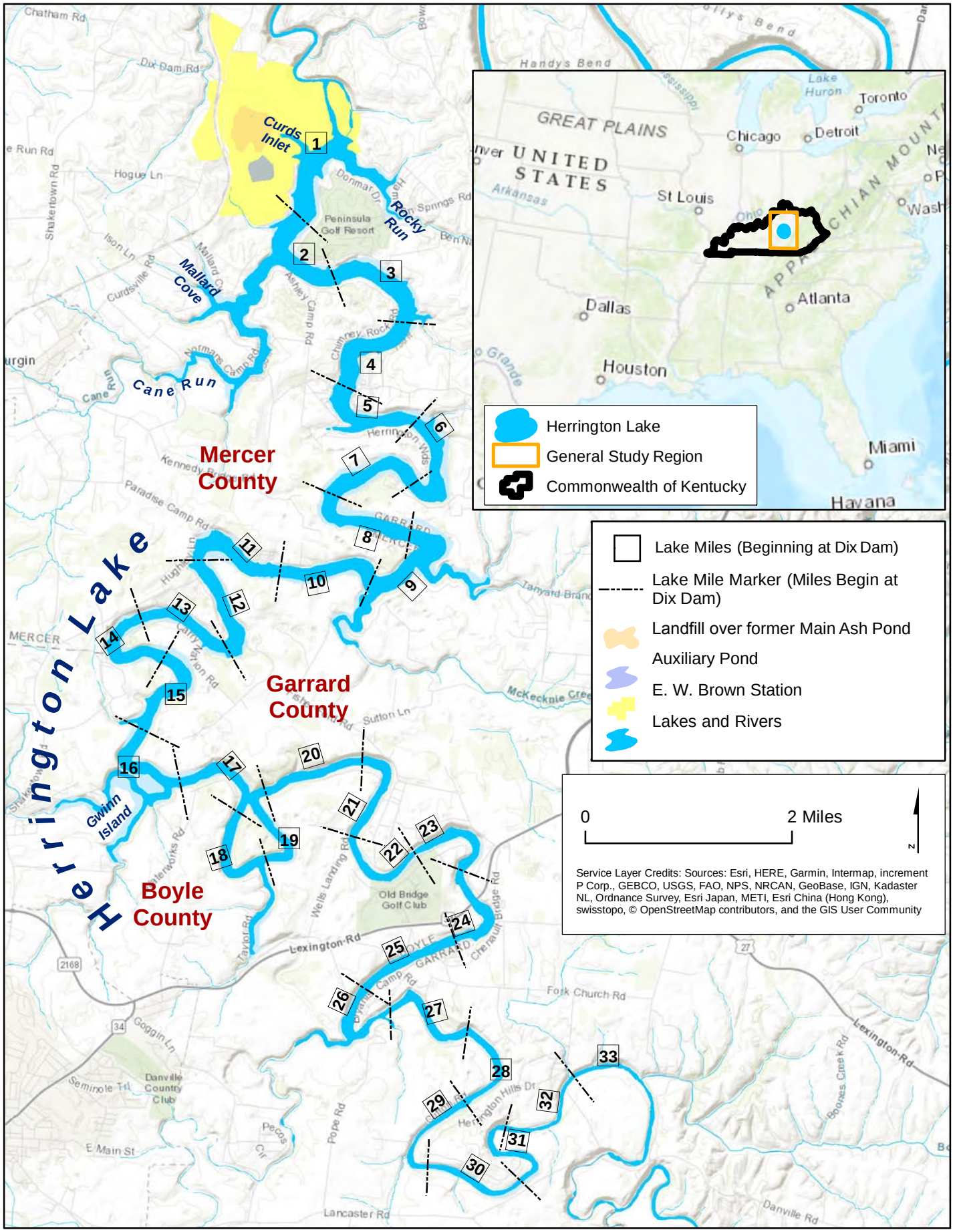
"KU-BR-273-4071539_2_A_EDF 08 06 2014 1720.prf"

"KU-BR-PP2014-Summary.xlsx."

"KU-BR-KPDES-WaterData-PP+DMR2yrs-May11-2019.xlsx"

"L9A1312_1 MB_Level_1_simple 02 04 2019 1241.pdf"

FIGURES



RAMBOLL

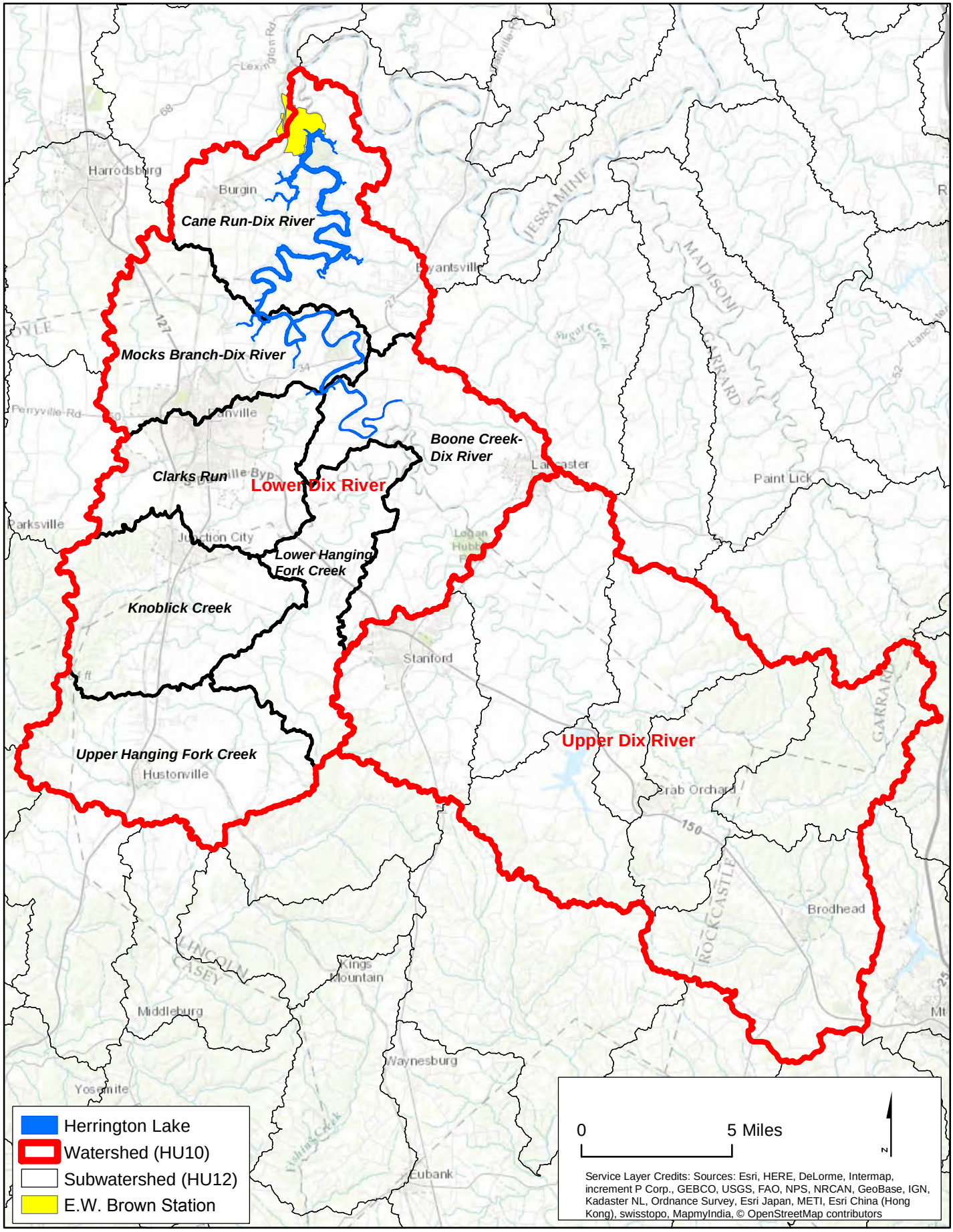
Map Design: AJS, Date: Jan 16, 2019

E.W. Brown Station Location Map

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 1-1A

Project Code:



RAMBOLL

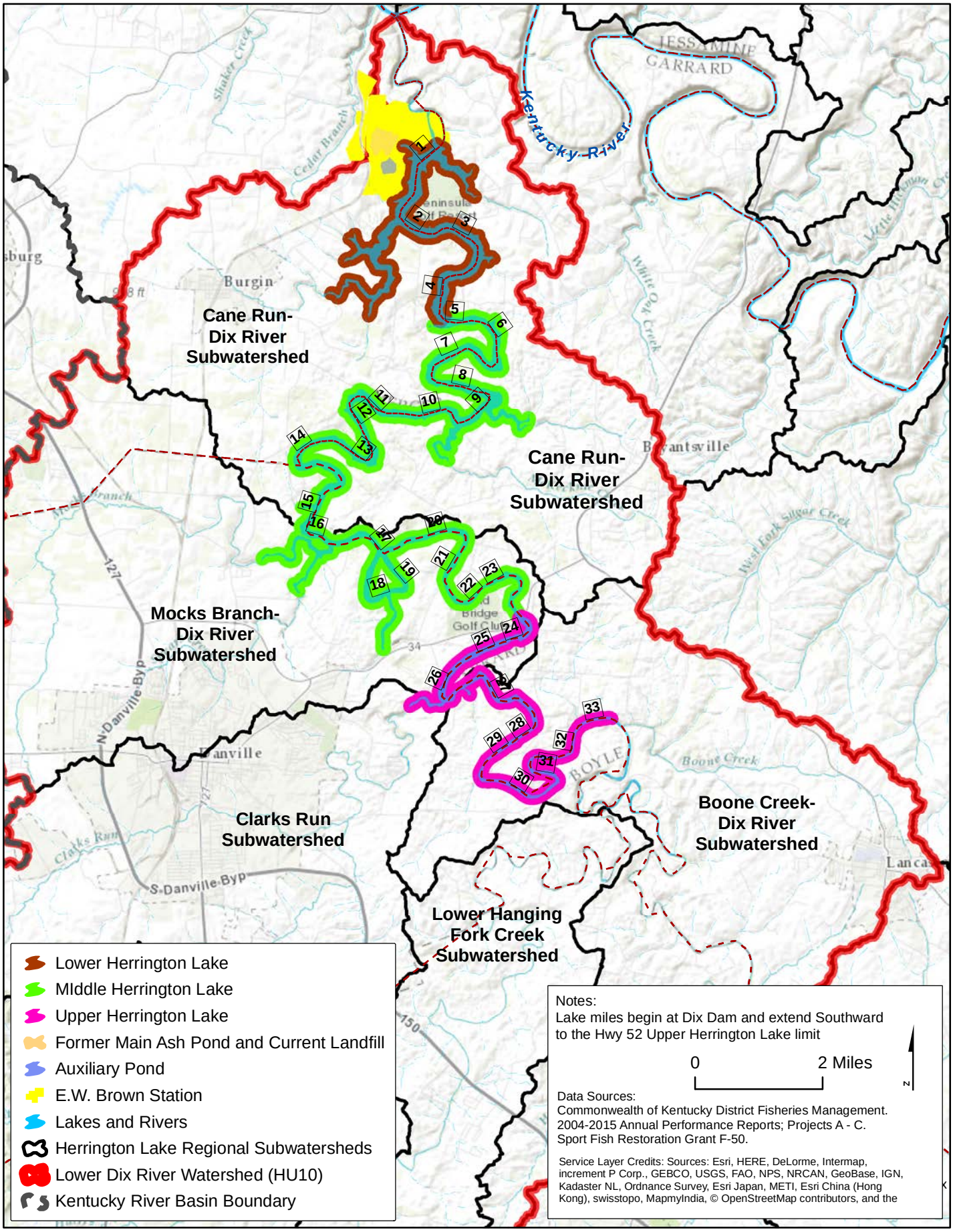
Map Design: AJS, Date: March 22, 2017

Upper and Lower Dix River Watershed Map

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
1-1B

Project Code:



RAMBOLL

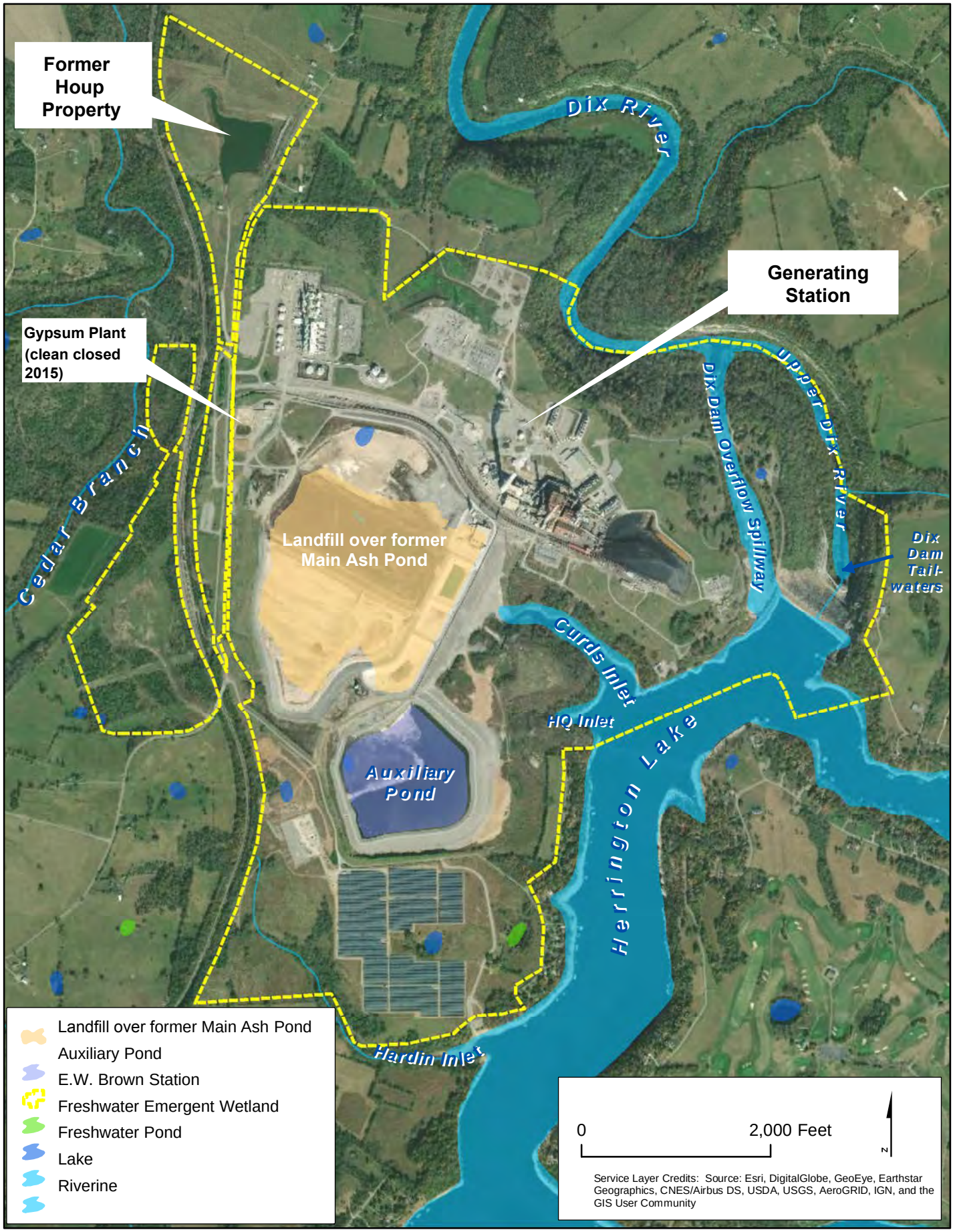
Map Design: AJS Date: March 20,

Herrington Lake Sections for CAP Sampling Program

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 1-1C

Project Code:



RAMBOLL

Map Design: AJS, Date: Jan 16, 2019

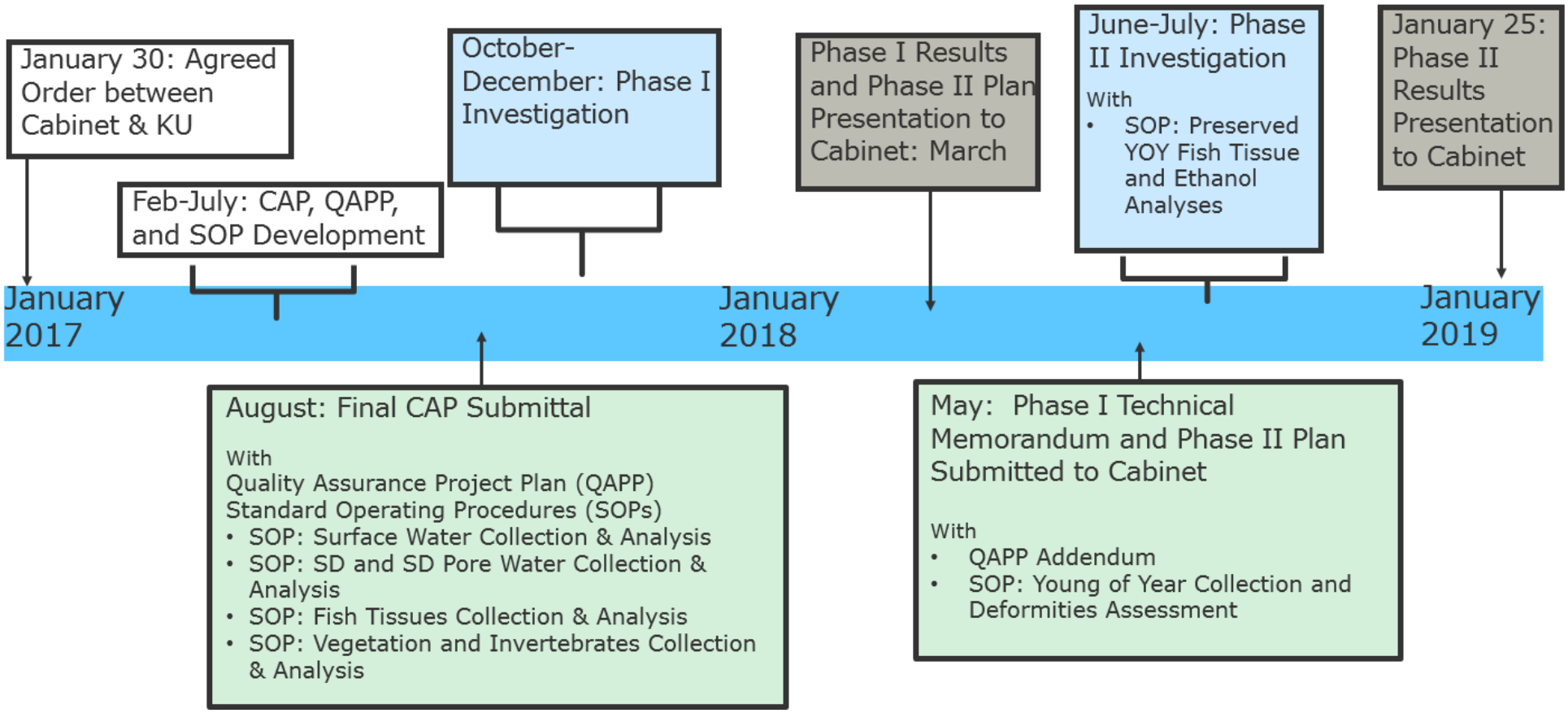
Site (E.W. Brown Station) Layout Map

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 1-1D

Project Code:

CAP-RELATED EFFORTS 2017-2019



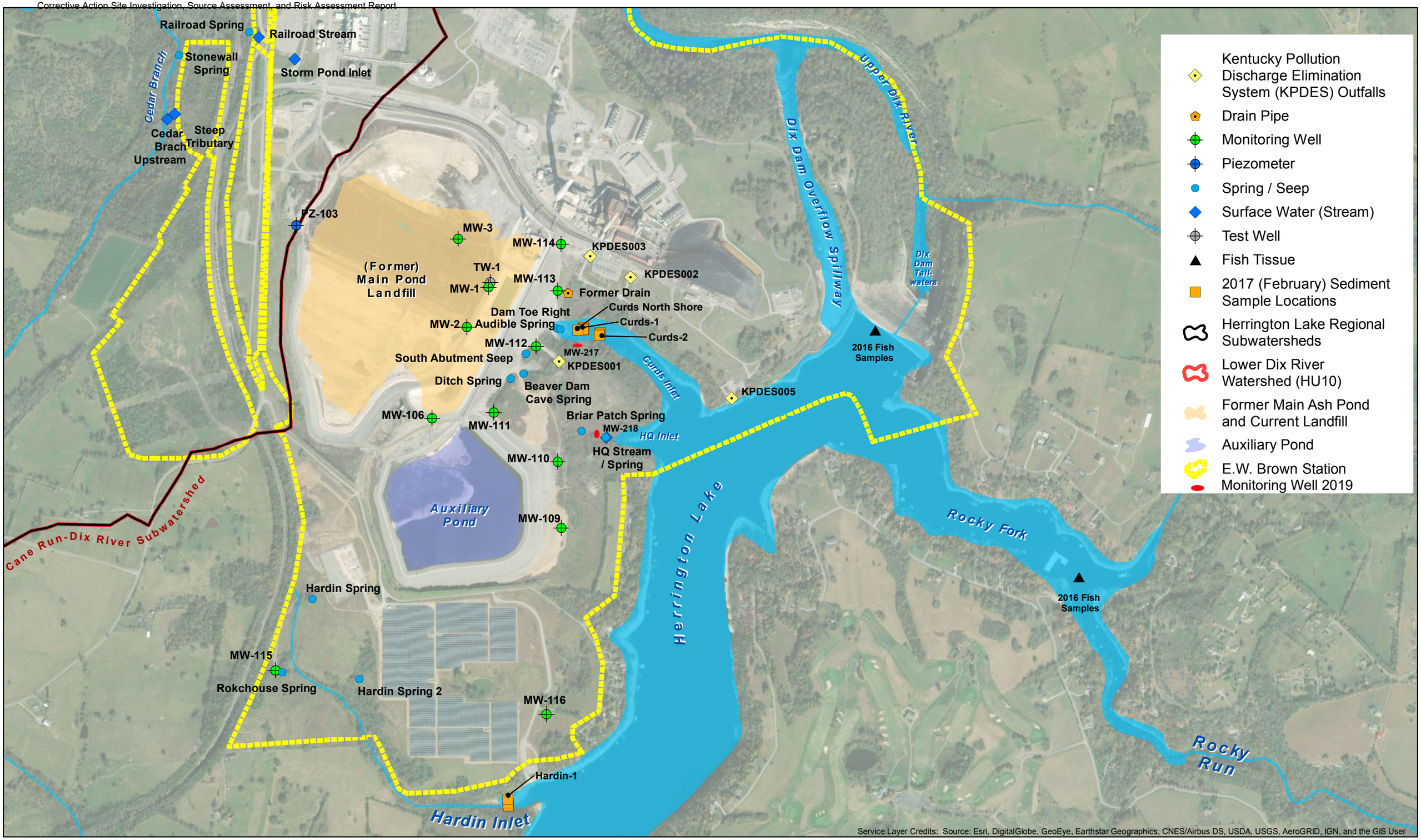
RAMBOLL

DRAFTED BY: AJS | DATE: 1/15/2019

CAP PROJECT TIMELINE

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
1-1E



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User

RAMBOLL

Map Design: AJS, Date: Jan 10, 2019

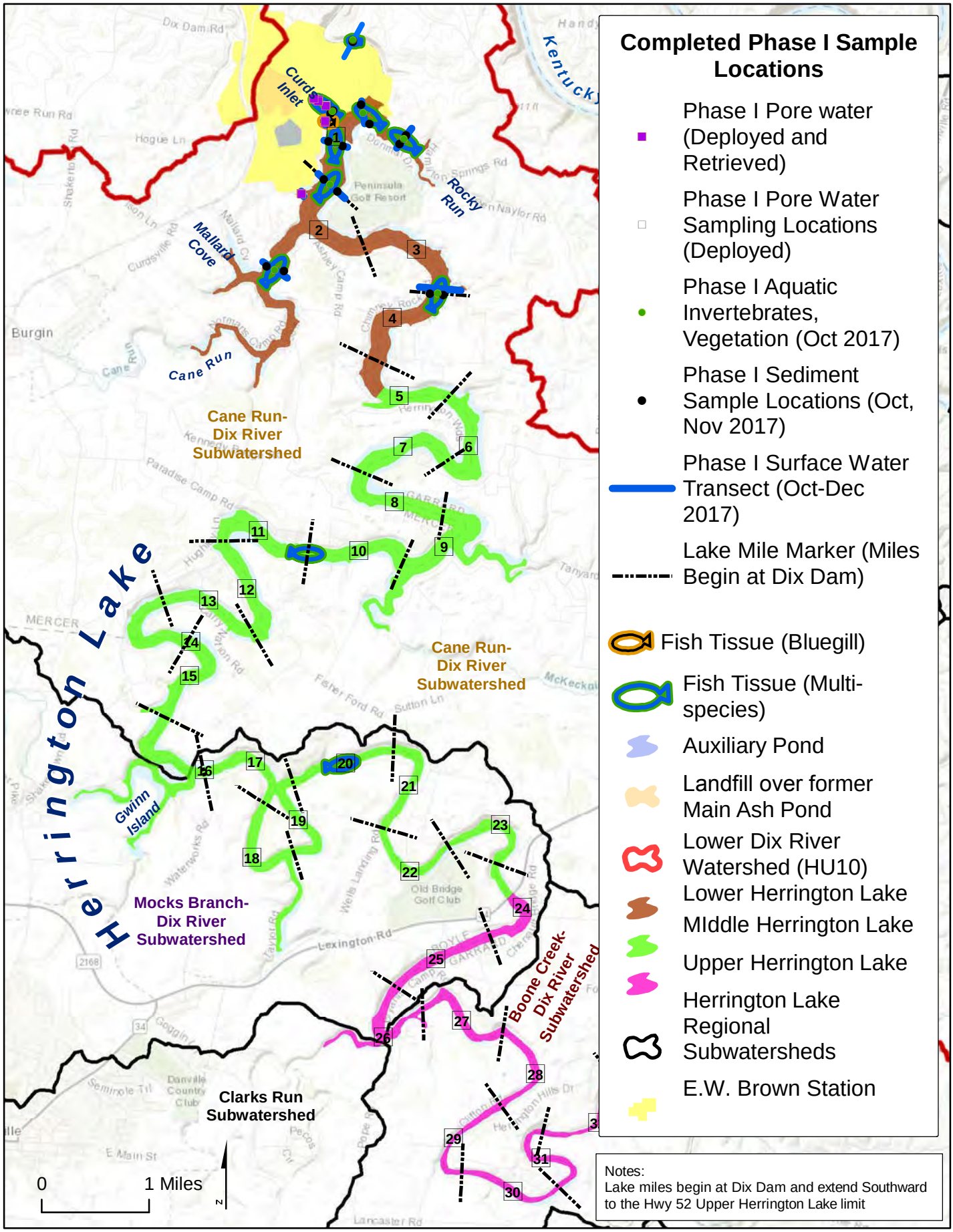
0 1,000 Feet N

E.W. Brown Station and Herrington Lake Historical Sampling Locations

Corrective Action Site Investigation, Source Assessment, and Risk Assessment
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 1-2

Project:



RAMBOLL

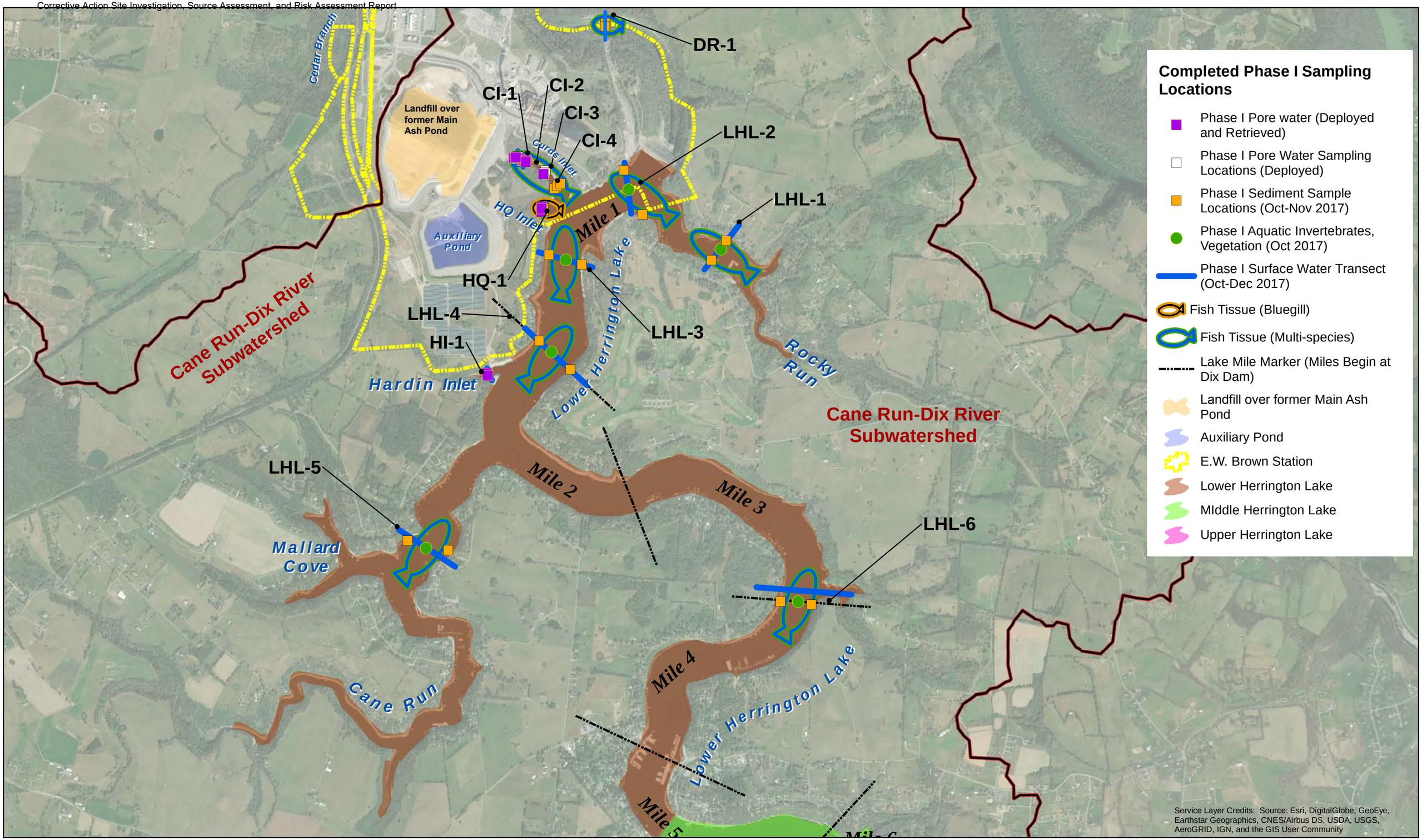
Map Design: AJS, Date: Jan 23, 2019

Phase I Sample Collection Overview

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 1-3A

Project Code:



RAMBOLL

Map Design: AJS, Date: Jan 16,2019

0 2,000 Feet N

Notes:
Lake miles begin at Dix Dam and extend Southward to the Hwy 52 Upper Herrington Lake limit

Phase I Completed Sampling for Lower Herrington Lake

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 1-3B

Project:

Completed Phase I Sampling Locations

- Phase I Pore water (Deployed and Retrieved)
- Phase I Pore Water Sampling Locations (Deployed)
- Phase I Aquatic Invertebrates, Vegetation (Oct 2017)
- AMEC Sediment Sample Locations (Feb 2017)
- Phase I Sediment Sample Locations (Oct, Nov 2017)
- Phase I Surface Water Transect (Oct-Dec 2017)
- Fish Tissue (Bluegill)
- Fish Tissue (Multi-Species)
- E.W. Brown Station

Curds-1
Curds-2
CI-2
Curds North Bank
CI-1
CI-3
Curds Inlet
CI-4
HQ-1
HQ Inlet
Text

Example:
Curds Inlet Cross-section

NOTES:
Location A:
Subaqueous, close to the deepest point (thalweg) of the channel.
Location B:
Subaqueous ~ 3-5 feet below the water line at the time of sampling.
Location C:
Above winter pool elevation (~725 feet msl) and below summer pool elevation (~740 feet msl).

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User

RAMBOLL

Map Design: AJS, Date: Jan 16, 2019

0 100 Feet

N

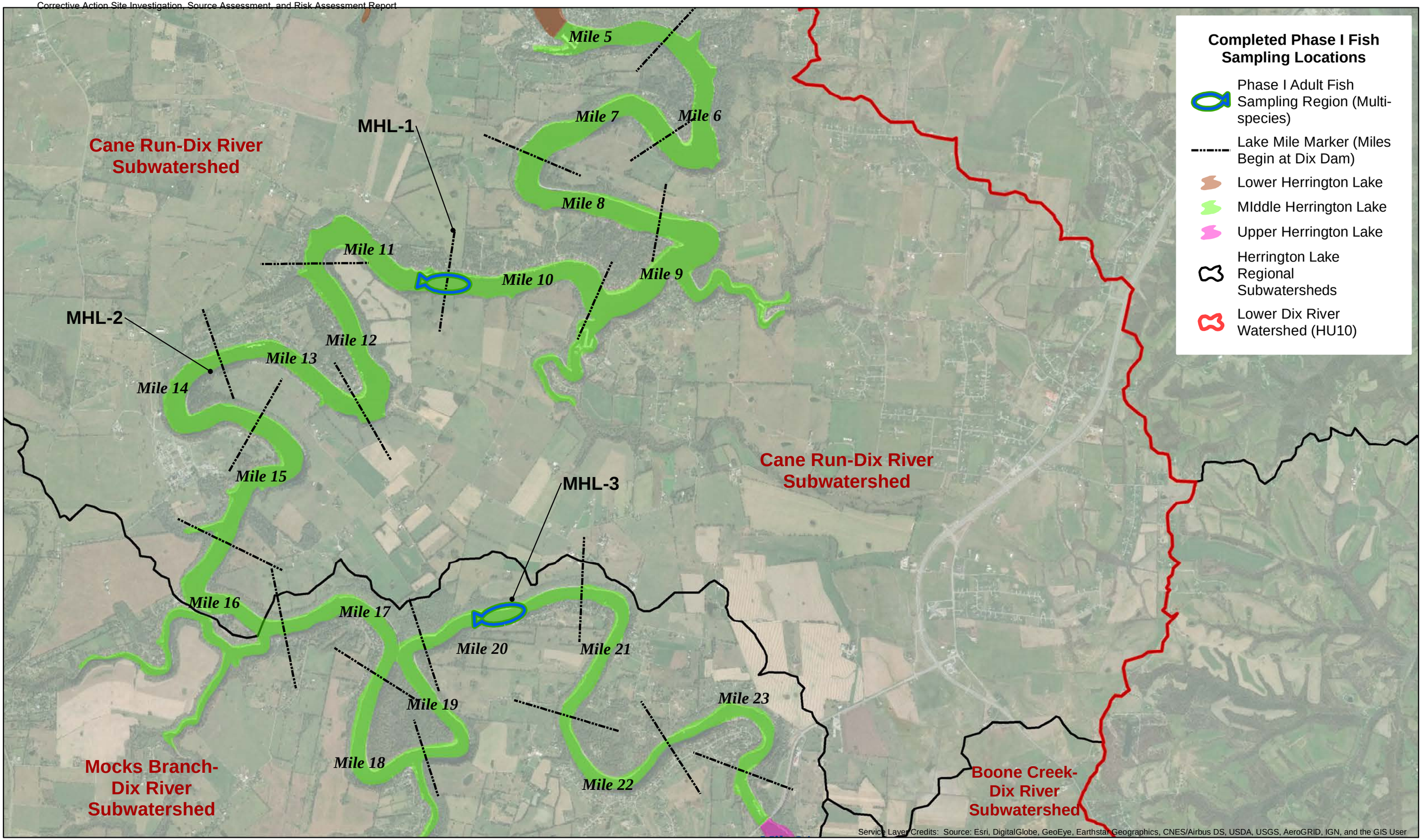
Notes:
Initial Curds North Bank, Curds-1, and Curds-2 sampling was completed in February 2017.

Phase I Completed Sampling for Curds Inlet and HQ Inlet

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
1-3C

Project:



RAMBOLL

Map Design: AJS, Date: Jan 16, 2019

0 0.5 Miles

N

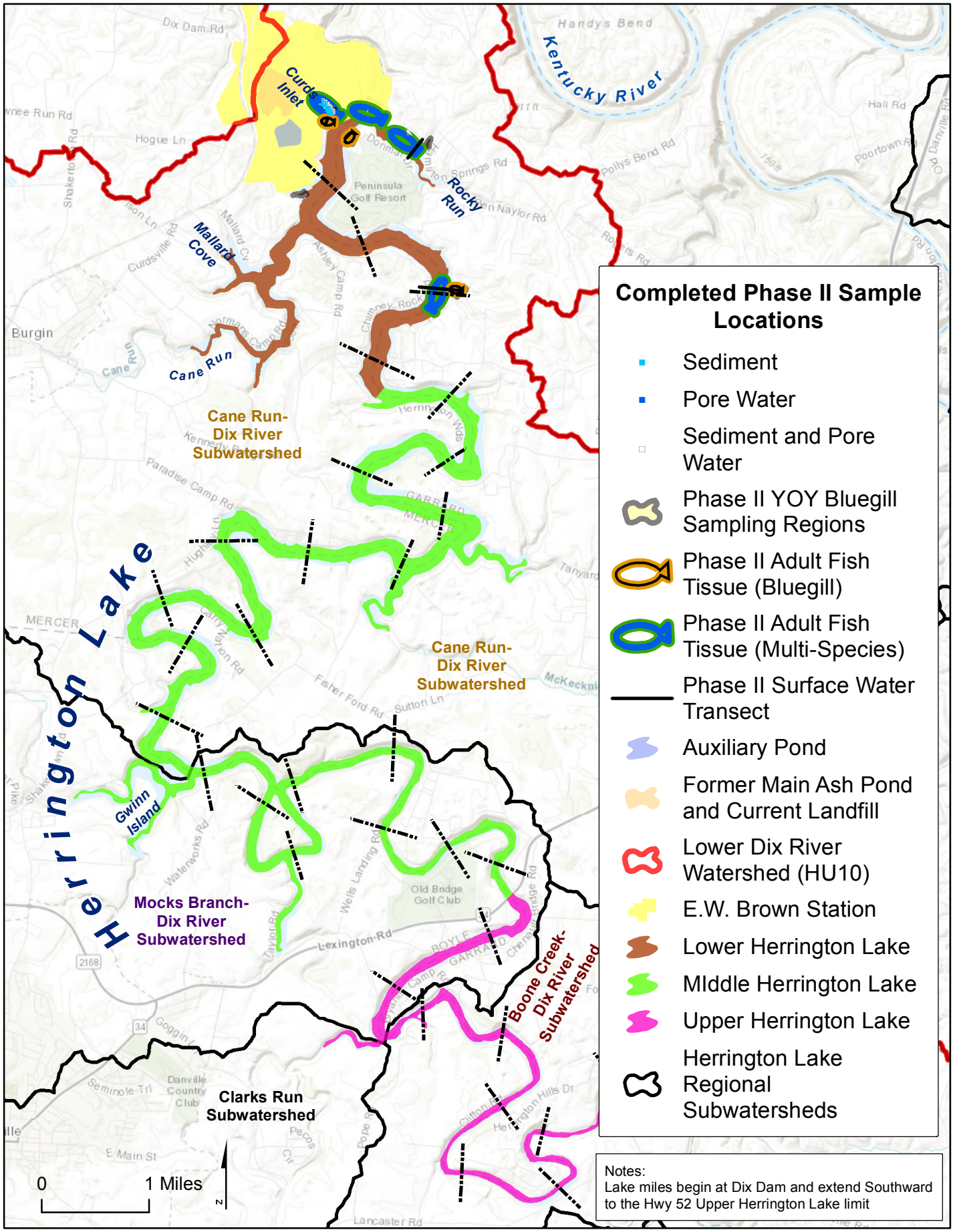
Notes:
Lake miles begin at Dix Dam and extend Southward to the Hwy 52 Upper Herrington Lake limit

Phase I Completed Adult Fish Sampling for Middle Herrington Lake

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
1-3D

Project:



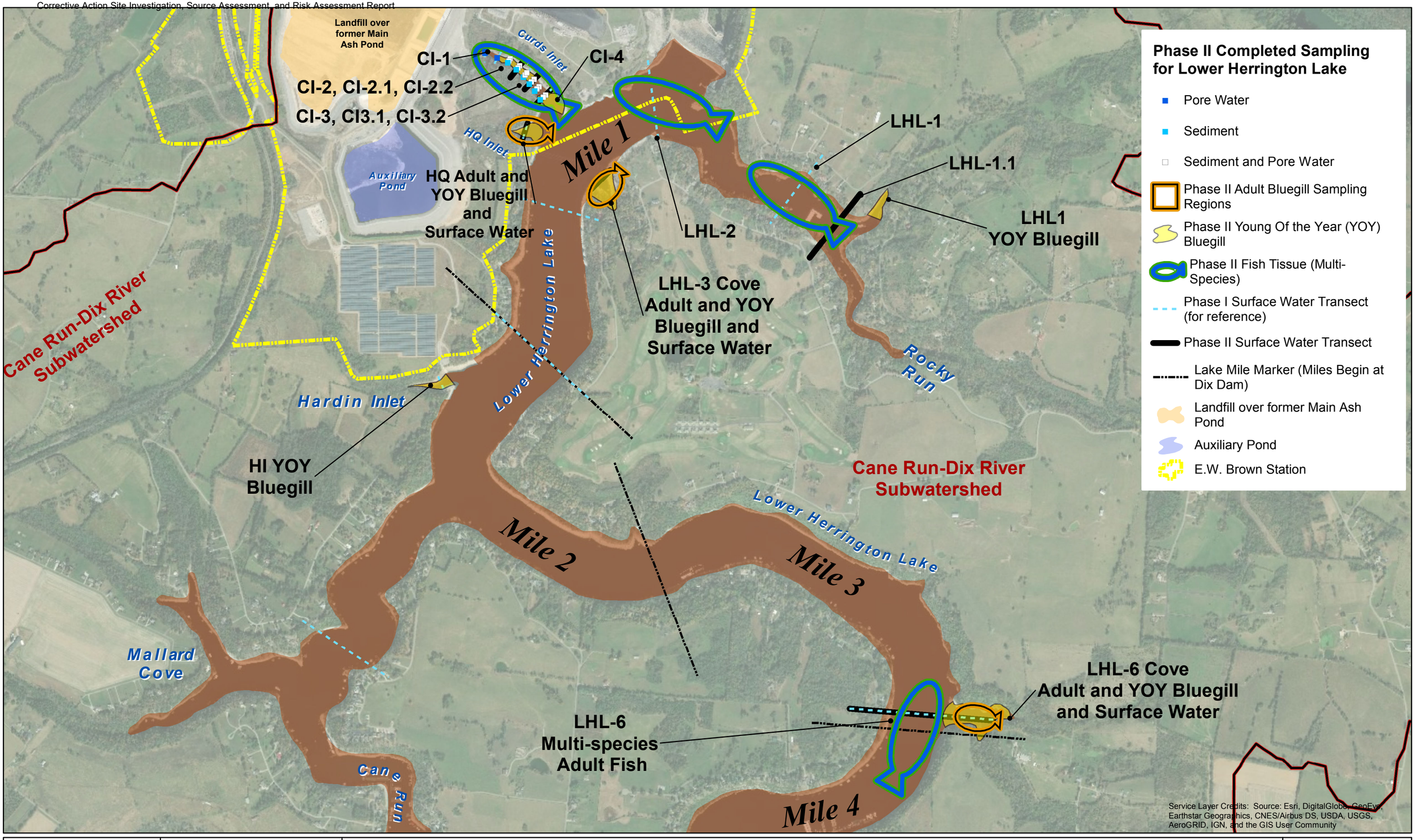
RAMBOLL

Map Design: AJS, Date: Jan 21, 2019

Phase II Sample Collection Overview
Corrective Action Investigation, Source Assessment, and Risk Assessment Report
E. W. Brown, Herrington Lake, Mercer County, Kentucky

FIGURE 1-4A

Project Code:



RAMBOLL

Map Design: AJS, Date: Jan 23, 2019

0 1,000 Feet

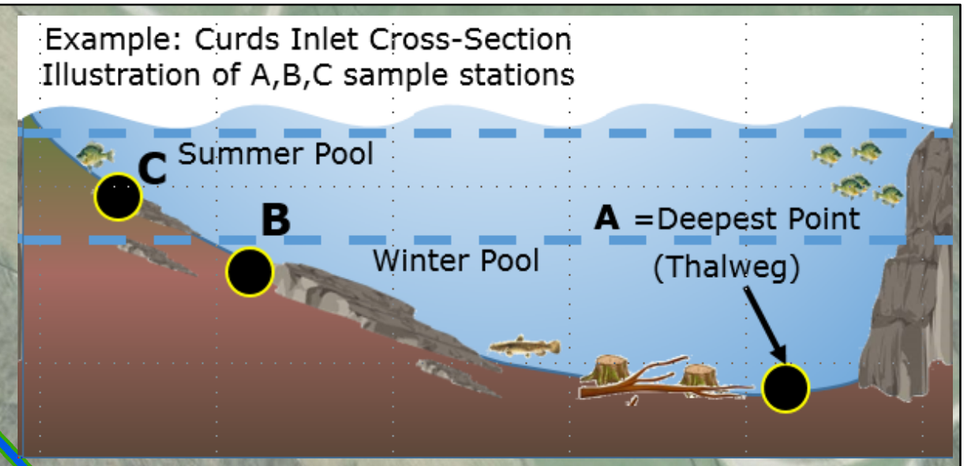
N

Notes:
Lake miles begin at Dix Dam and extend Southward to the Hwy 52 Upper Herrington Lake limit

Phase II Completed Sampling for Lower Herrington Lake
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 1-4B

Project:



NOTES:
Location A:
Subaqueous, close to the deepest point (thalweg) of the channel.
Location B:
Subaqueous ~ 3-5 feet below the water line at the time of sampling.
Location C:
Above winter pool elevation (~725 feet msl) and below summer pool elevation (~740 feet msl).

Upper Curds Inlet
Middle Curds Inlet
Lower Curds Inlet
HQ Inlet

CI-1
CI-2
CI-2.1
CI-2.2
CI-3
CI-3.1
CI-3.2
CI-4
HQ-1

Phase II Sample Locations

- Phase II Sediment Samples
- Phase II Pore Water Samples
- Phase II Sediment and Pore Water Samples
- Phase I Surface Water Transect (for reference)
- Phase II Surface Water Transect
- Phase II Young Of the Year (YOY) Bass
- Phase II Fish Tissue (Bluegill)
- Phase II Fish Tissue (Multi-Species)

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User

RAMBOLL

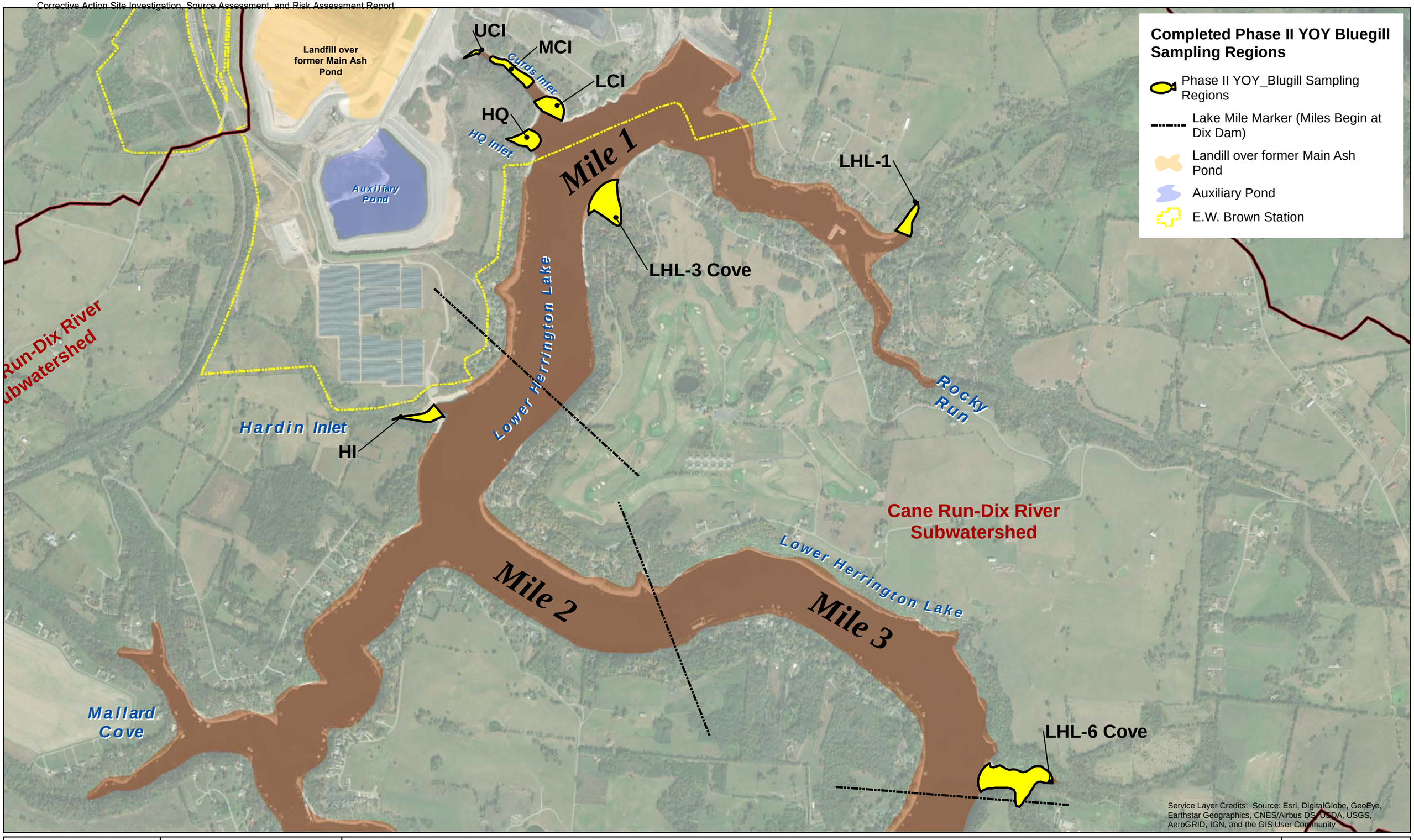
Map Design: AJS, Date: Jan 21, 2019

0 200 Feet N

Phase II Completed Sampling for Curds Inlet and HQ Inlet
Corrective Action Investigation, Source Assessment, and Risk Assessment Report
E. W. Brown, Herrington Lake, Mercer County, Kentucky

FIGURE
1-4C

Project:



RAMBOLL

Map Design: AJS, Date: Jan 22, 2019

0 1,000 Feet

N

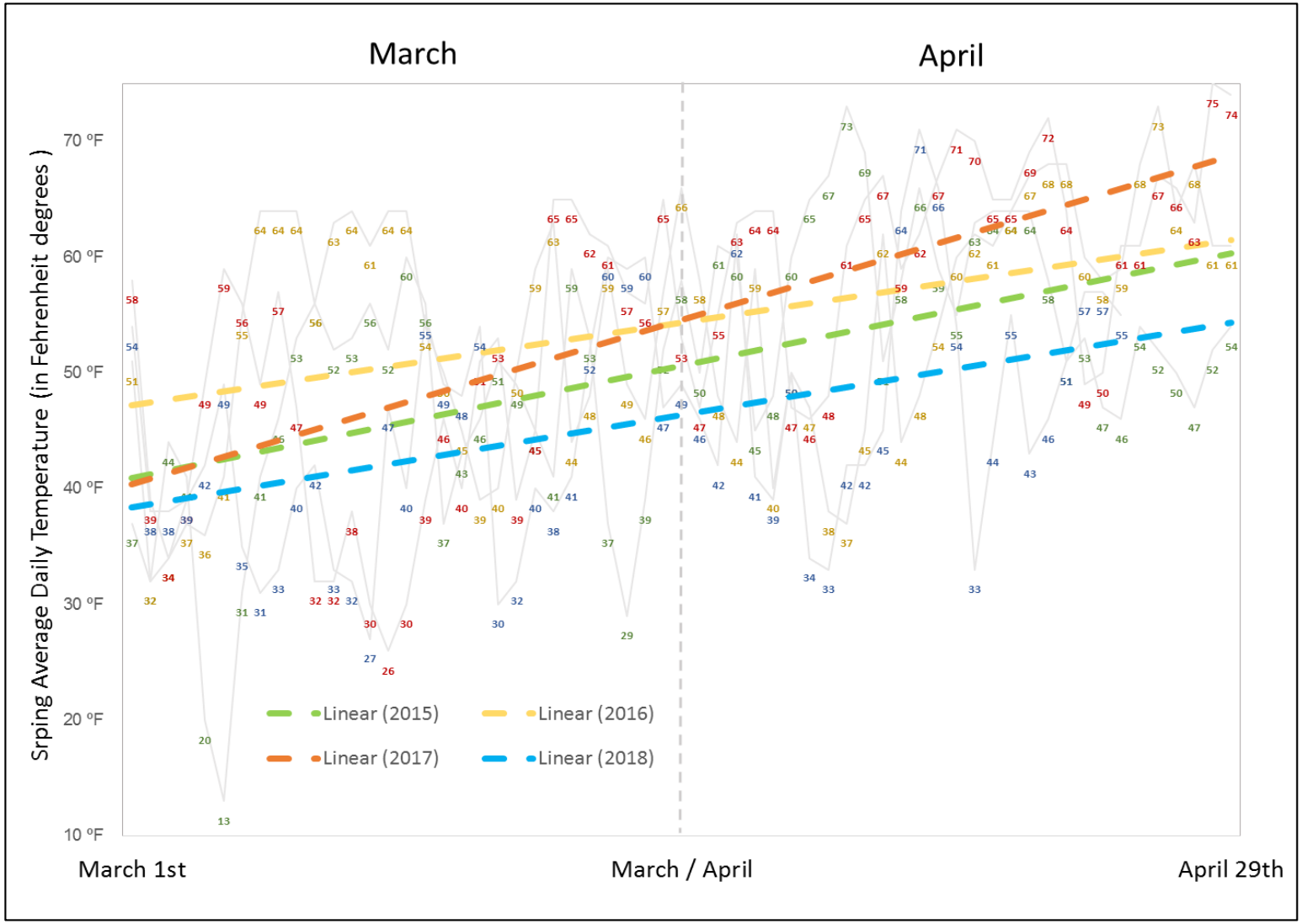
Notes:
Lake miles begin at Dix Dam and extend Southward to the Hwy 52 Upper Herrington Lake limit

Phase II Young-of-the-Year (YOY) Bluegill Sampling Regions

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
1-4D

Project:



Notes:
These data document the colder spring 2018 conditions that affected the timing of Herrington Lake fish spawning.

The linear time-averaged March and April 2015–2018 spring-season average daily air temperatures reveal the ecological timing in Herrington Lake that informed the Phase I and II sampling effort and interpretation of field collection results.

°F Degree Fahrenheit

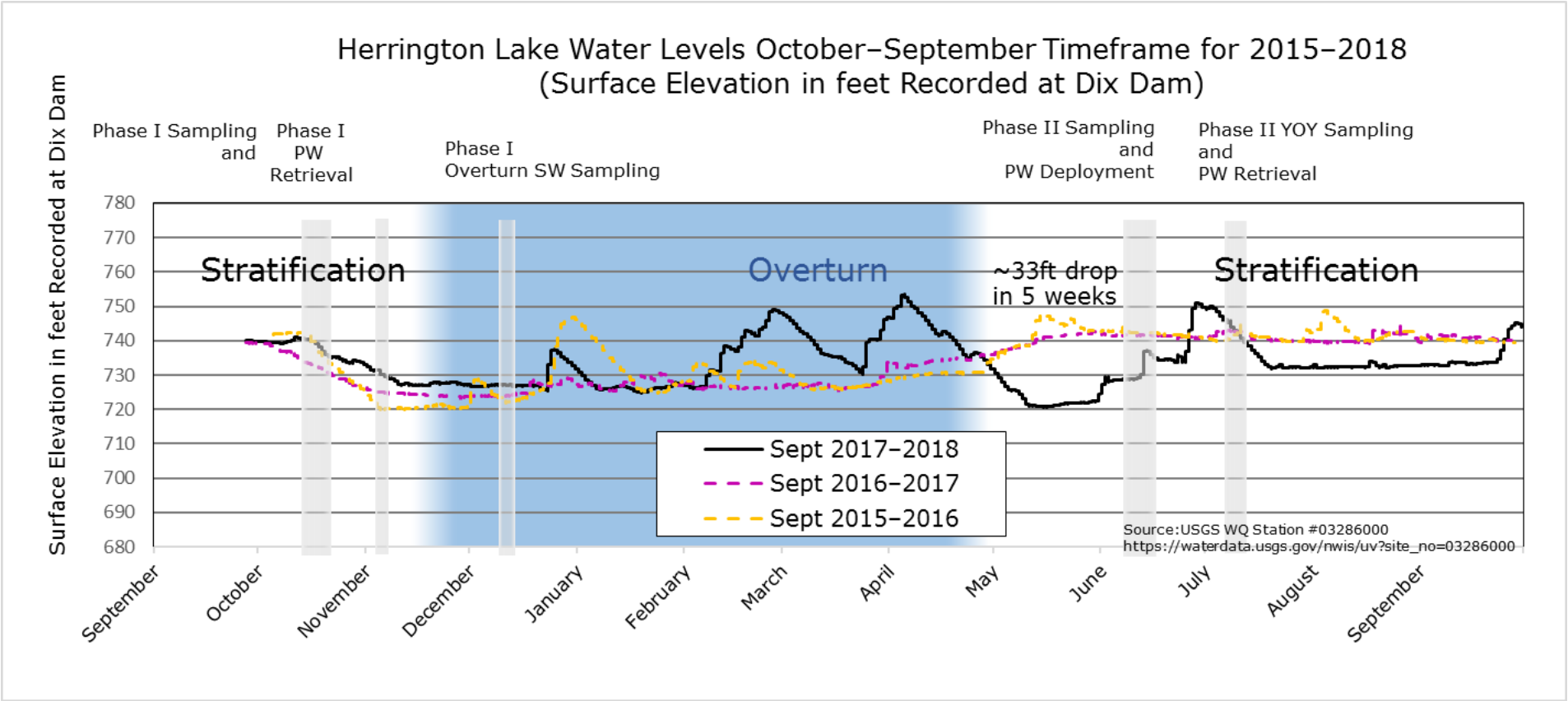
RAMBOLL

DRAFTED BY: AJS, 2/20/2019

Spring-Season Average Daily Air Temperatures for the Years of 2015–2018 Recorded at Dix Dam

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

Figure 2-1A



Notes:

~	Approximately
PW	Pore Water
SW	Surface Water
USGS	United States Geological Survey
WQ	Water Quality
YOY	Young-of-the-Year

RAMBOLL

DRAFTED BY: AJS

DATE: 2/20/2019

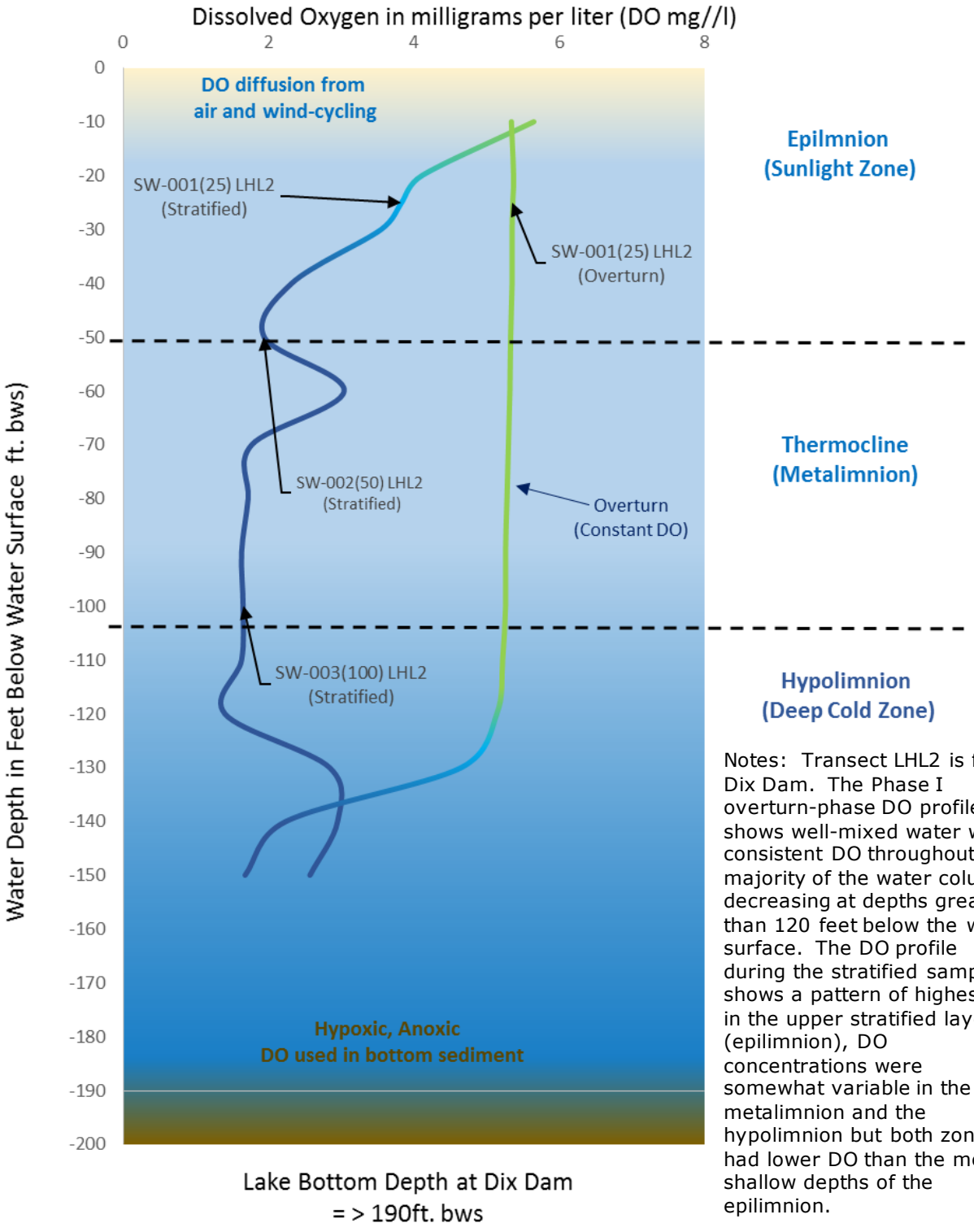
HERRINGTON LAKE WATER LEVELS OCTOBER–SEPTEMBER 2015–2018

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-1B

Water depth greater than 190 feet below water surface (bws)



Notes: Transect LHL2 is from Dix Dam. The Phase I overturn-phase DO profile shows well-mixed water with consistent DO throughout the majority of the water column, decreasing at depths greater than 120 feet below the water surface. The DO profile during the stratified sampling shows a pattern of highest DO in the upper stratified layer (epilimnion), DO concentrations were somewhat variable in the metalimnion and the hypolimnion but both zones had lower DO than the most shallow depths of the epilimnion.

RAMBOLL

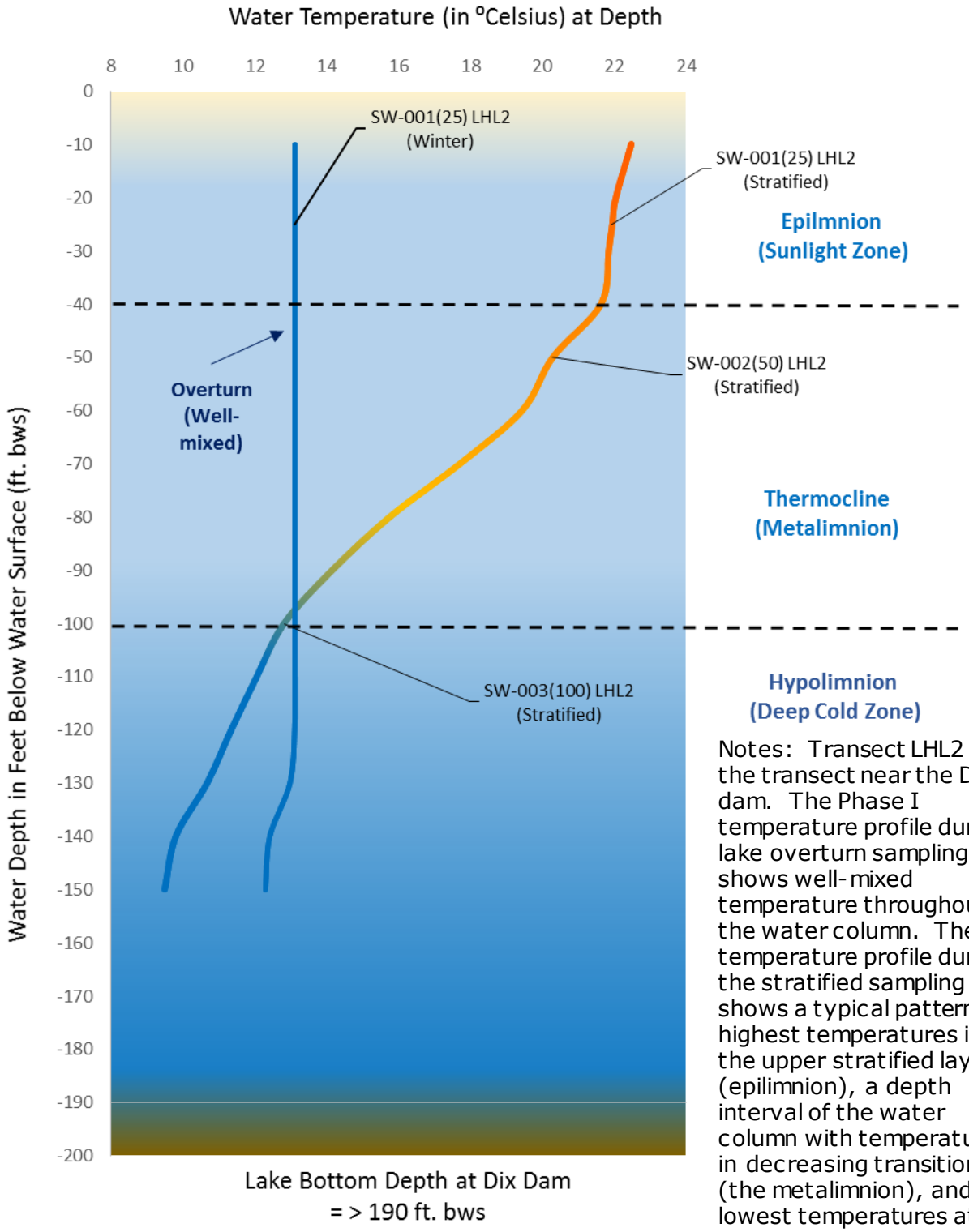
DRAFTED BY: AJS | DATE: 2/20/2019

PHASE I STRATIFICATION VS. OVERTURN DISSOLVED OXYGEN (DO) PROFILES RECORDED AT DIX DAM (LHL2) IN 2017

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 2-2A

Water depth greater than 190 feet below water surface (bws)



Notes: Transect LHL2 is the transect near the Dix dam. The Phase I temperature profile during lake overturn sampling shows well-mixed temperature throughout the water column. The temperature profile during the stratified sampling shows a typical pattern of highest temperatures in the upper stratified layer (epilimnion), a depth interval of the water column with temperatures in decreasing transition (the metalimnion), and the lowest temperatures at depth.

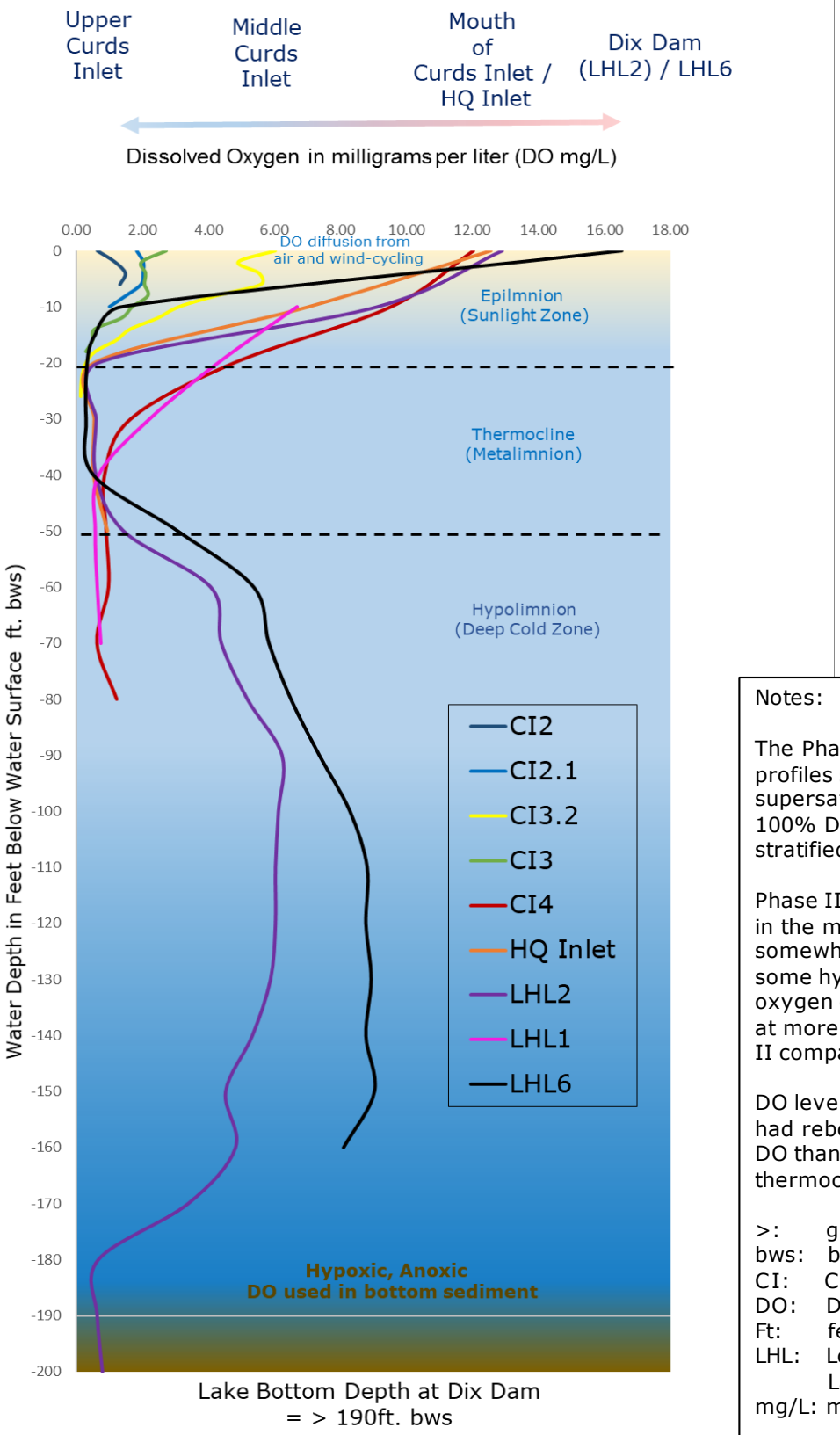
RAMBOLL

DRAFTED BY: AJS | DATE: 2/20/2019

PHASE I STRATIFICATION VS. OVERTURN THERMAL STRATIFICATION (IN CELCIUS DEGREES) PROFILES RECORDED AT DIX DAM (LHL2) IN 2017

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 2-2B



Notes:

The Phase II stratification DO profiles show a pattern of supersaturation (higher than 100% DO) DO in the upper stratified layer (epilimnion).

Phase II (June 2018) DO levels in the metalimnion were somewhat variable, exhibiting some hypoxic conditions and oxygen depletion was observed at more shallow depths in Phase II compared to Phase I.

DO levels in the hypolimnion had rebounding (higher again) DO than were observed in the thermocline (metalimnion).

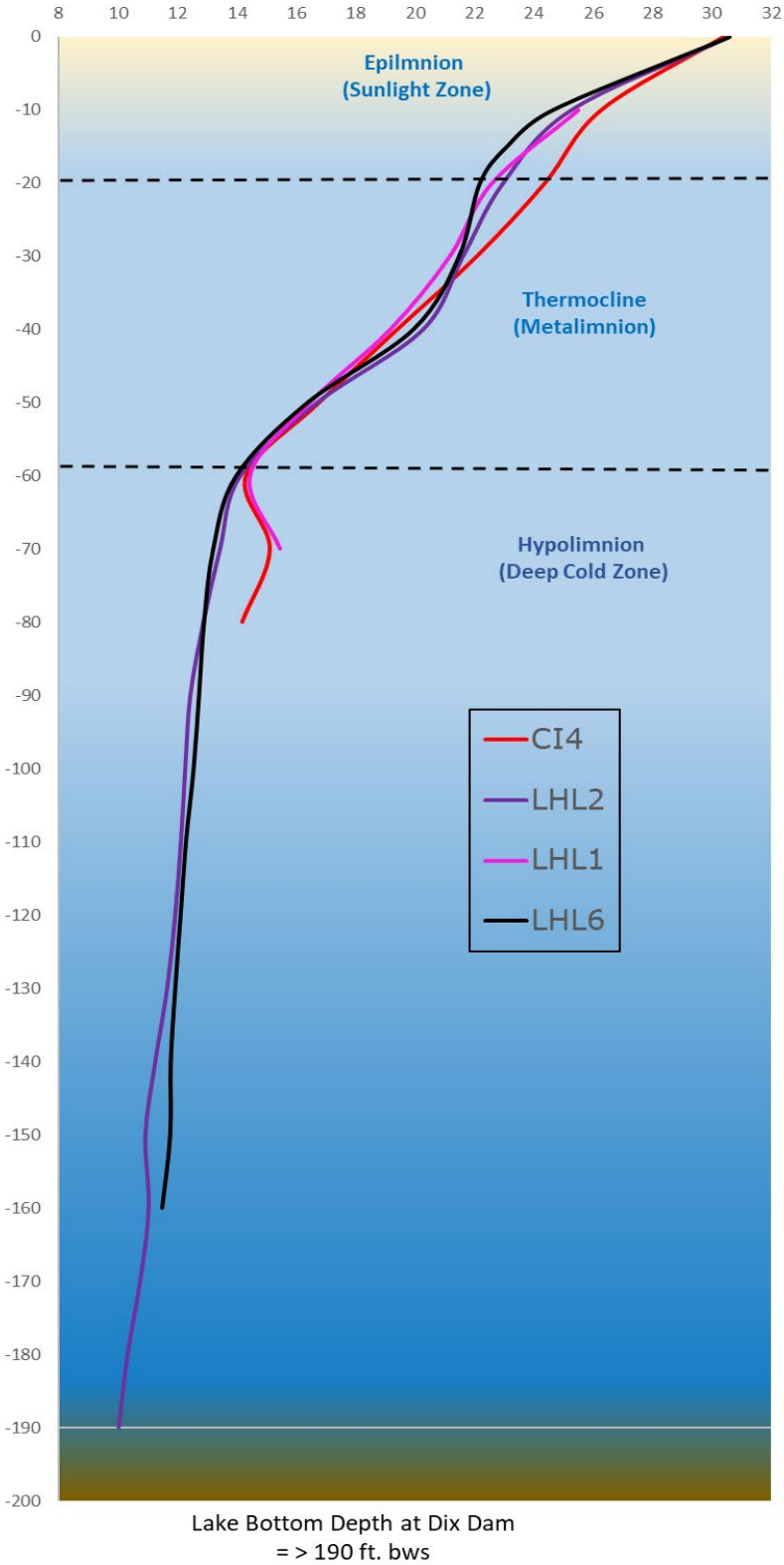
>: greater than
bws: below water surface
CI: Curds Inlet
DO: Dissolved Oxygen
Ft: feet
LHL: Lower Herrington Lake
mg/L: milligrams per Liter

RAMBOLL

DRAFTED BY: AJS | DATE: 2/20/2019

PHASE II STRATIFICATION DISSOLVED OXYGEN (DO) PROFILES RECORDED AT MULTIPLE LOWER HERRINGTON LAKE SAMPLING LOCATIONS IN 2018
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
2-2C



Notes:

The Phase II Lake temperature profiles for multiple sites illustrate similar profiles, suggesting that summer temperature profiles are fairly consistent throughout Lower Herrington Lake.

Similar to Phase I, the Phase II stratification-phase temperature profiles illustrate a typical pattern of highest temperatures in the upper layer (epilimnion) with decreasing temperatures with increasing depth through the thermocline (metalimnion).

Temperature remained colder and more stable in the Hypolimnion for all of the deeper profiled sites.

>: greater than
bws: below water surface
CI: Curds Inlet
ft: feet
LHL: Lower Herrington Lake

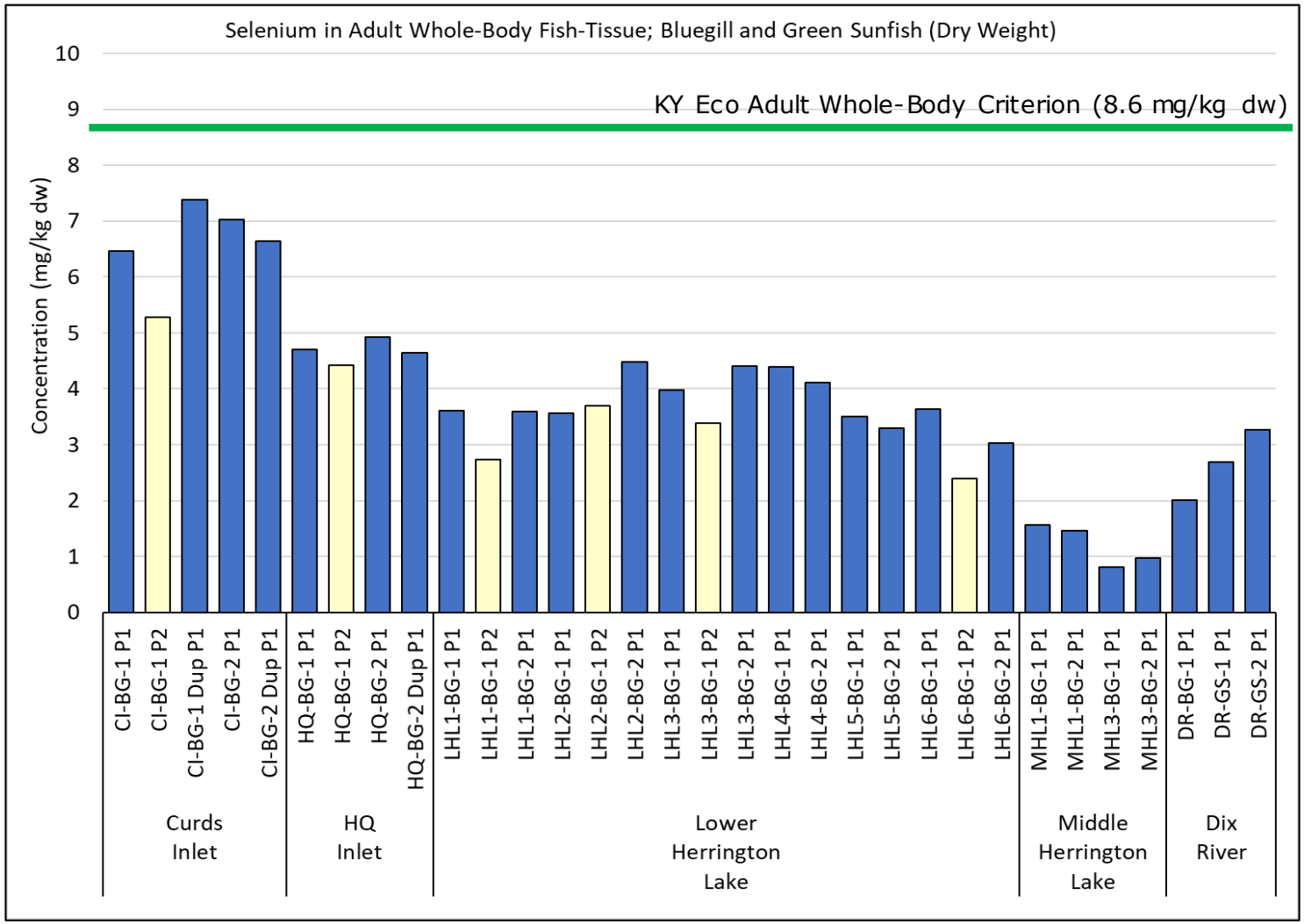
RAMBOLL

DRAFTED BY: AJS | DATE: 2/20/2019

PHASE II STRATIFICATION THERMAL STRATIFICATION (IN CELCIUS DEGREES) PROFILES RECORDED AT MULTIPLE LOWER HERRINGTON LAKE SAMPLING LOCATIONS IN 2018

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
2-2D



Bluegill (BG), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Green Sunfish (GS), HQ Inlet (HQ), Kentucky Ecological Criterion (KY Eco Criterion), Lower Curds Inlet (LCI), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram dry weight (mg/kg dw), Phase I (P1), Phase II (P2)

Observations

The dry weight is consistent with Kentucky Ecological Chronic Criterion.

Phase 1 and Phase 2 selenium concentrations are less than the KY criterion for whole body fish tissues. Concentrations are highest in Curds Inlet, with gradient away from Curds Inlet.

Field duplicates show similar results (Curds Inlet).

Concentrations are lowest in MHL locations.

RAMBOLL

DRAFTED BY: PAL

DATE: 02/01/2019

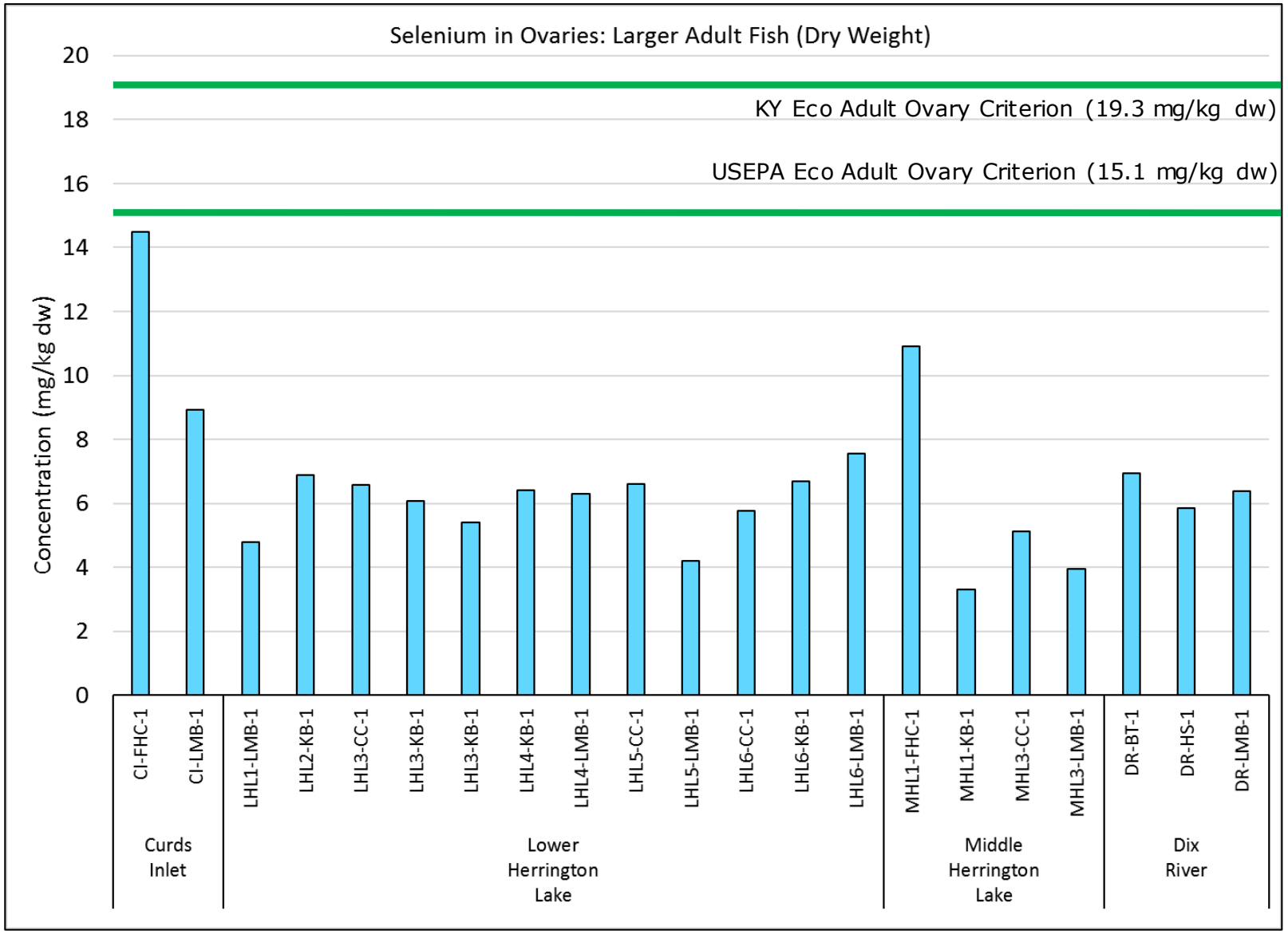
SELENIUM IN WHOLE-BODY FISH-TISSUE: ADULT BLUEGILL AND GREEN SUNFISH (DRY WEIGHT) (PHASE I AND PHASE II)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report

E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-3A



Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Field Duplicate (FD), Flathead Catfish (FHC), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram dry weight (mg/kg dw), Northern Hogsucker (HS), Spotted Sucker (SS), United States Environmental Protection Agency (USEPA), Young-of-Year (YOY)

Observations

Measured selenium concentrations are less than the KY and USEPA ovary criteria.

The Curds Inlet catfish ovary sample had the highest measured value of selenium in ovary tissues among for the locations sampled.

RAMBOLL

DRAFTED BY: PAL

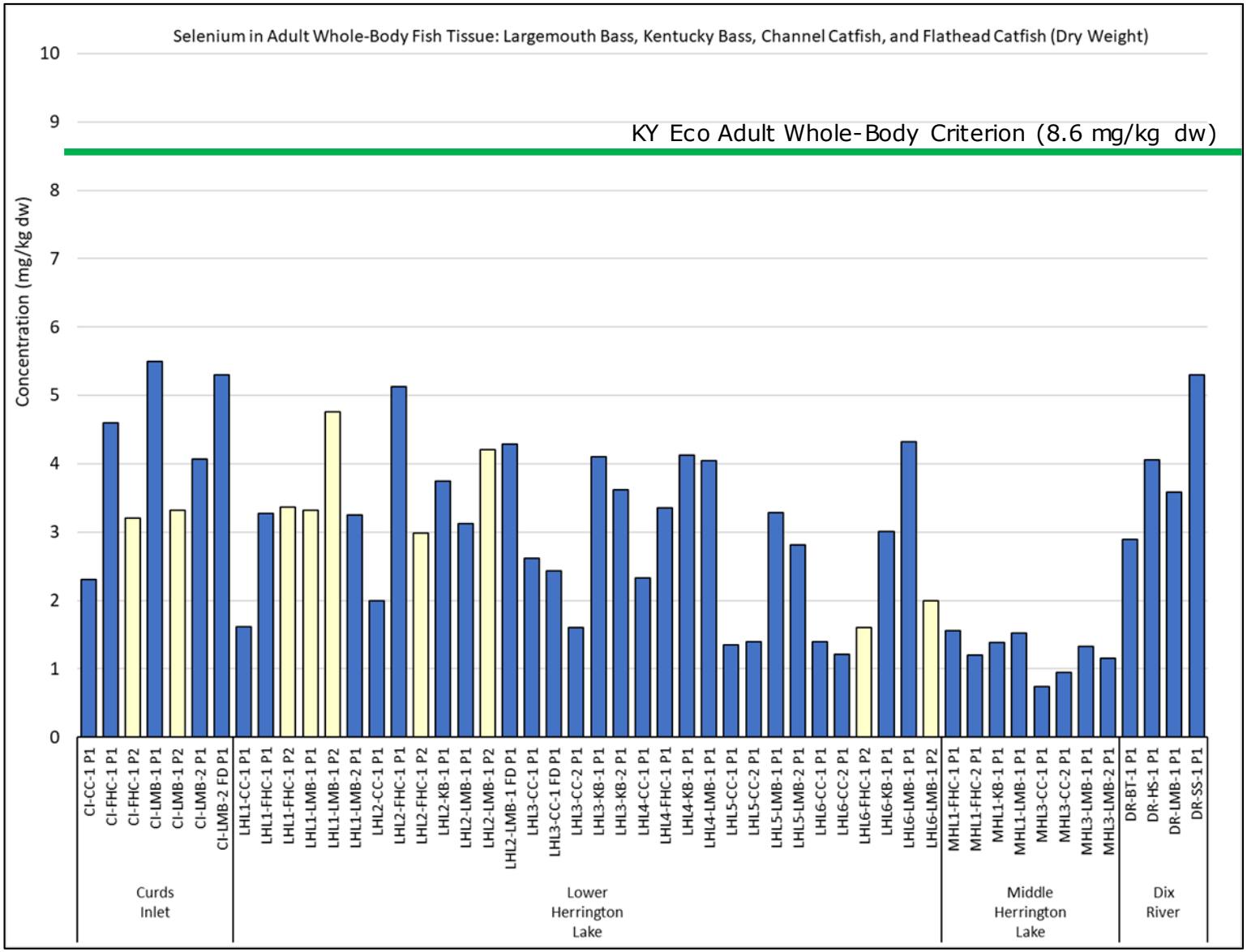
DATE: 02/01/2019

SELENIUM IN ADULT FISH OVARIES: LARGER FISH (DRY WEIGHT) (PHASE I)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-3B



Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), dry weight (dw), Field Duplicate (FD), Flathead Catfish (FHC), Kentucky Bass (KB), Kentucky Ecological Criterion (KY Eco Criterion), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram dry weight (mg/kg dw), Northern Hogsucker (HS), Phase I (P1), Phase II (P2), Spotted Sucker (SS)

Observation
Dry weight is consistent with Kentucky Ecological Chronic Criterion.
Selenium concentrations in adult whole body bass and catfish are less than the KY criterion.

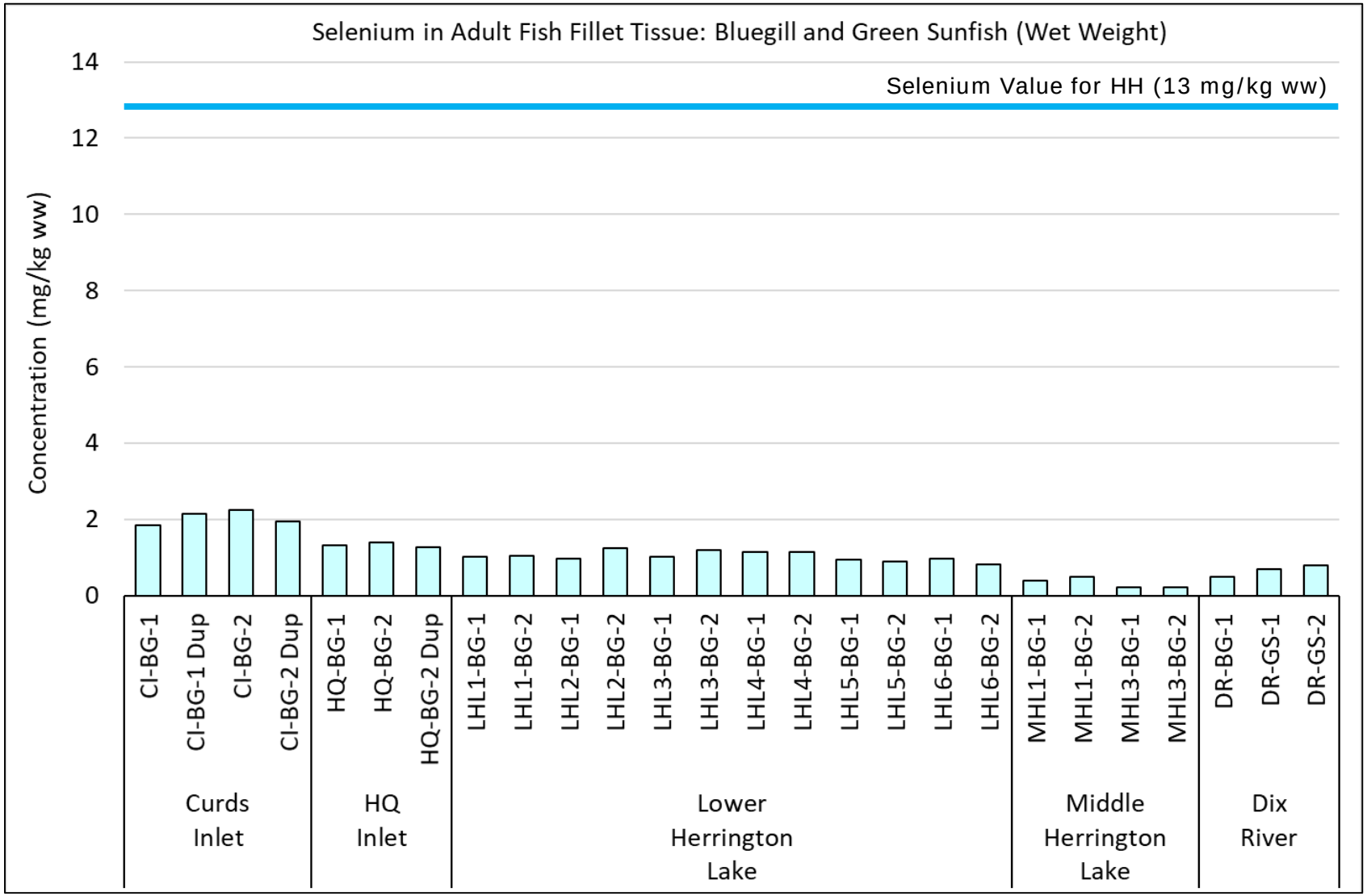
RAMBOLL

DRAFTED BY: PAL | DATE: 02/01/2019

SELENIUM IN ADULT WHOLE-BODY FISH-TISSUE: LARGER FISH (DRY WEIGHT)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
2-3C



Bluegill (BG), Curds Inlet (CI), Dix River (DR), Green Sunfish (GS), Human Health (HH), HQ Inlet (HQ), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), wet weight (ww)

Observations

Wet weight for human health considerations.

Risk based concentration of 13 mg/kg derived assuming 50 meals per year for an adult.

- Consumption rate is consistent with state-wide mercury advisory for panfish.

RAMBOLL

DRAFTED BY: PAL

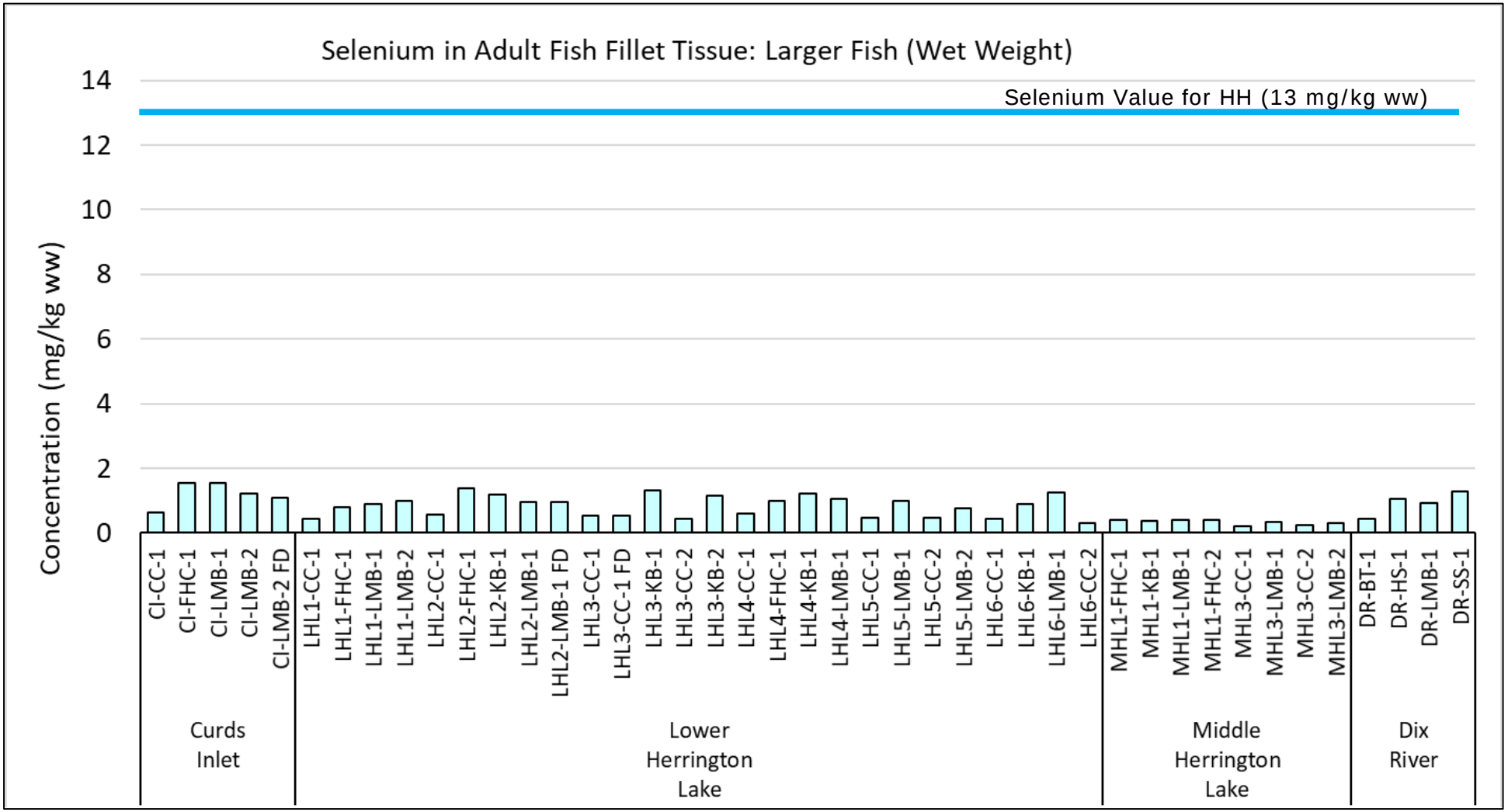
DATE: 02/01/2019

SELENIUM IN ADULT FISH FILLET TISSUE: BLUEGILL AND GREEN SUNFISH (WET WEIGHT) (PHASE I)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-3D



Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Field Duplicate (FD), Flathead Catfish (FHC), Human Health (HH), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram wet weight (mg/kg ww), Northern Hogsucker (HS), Spotted Sucker (SS)

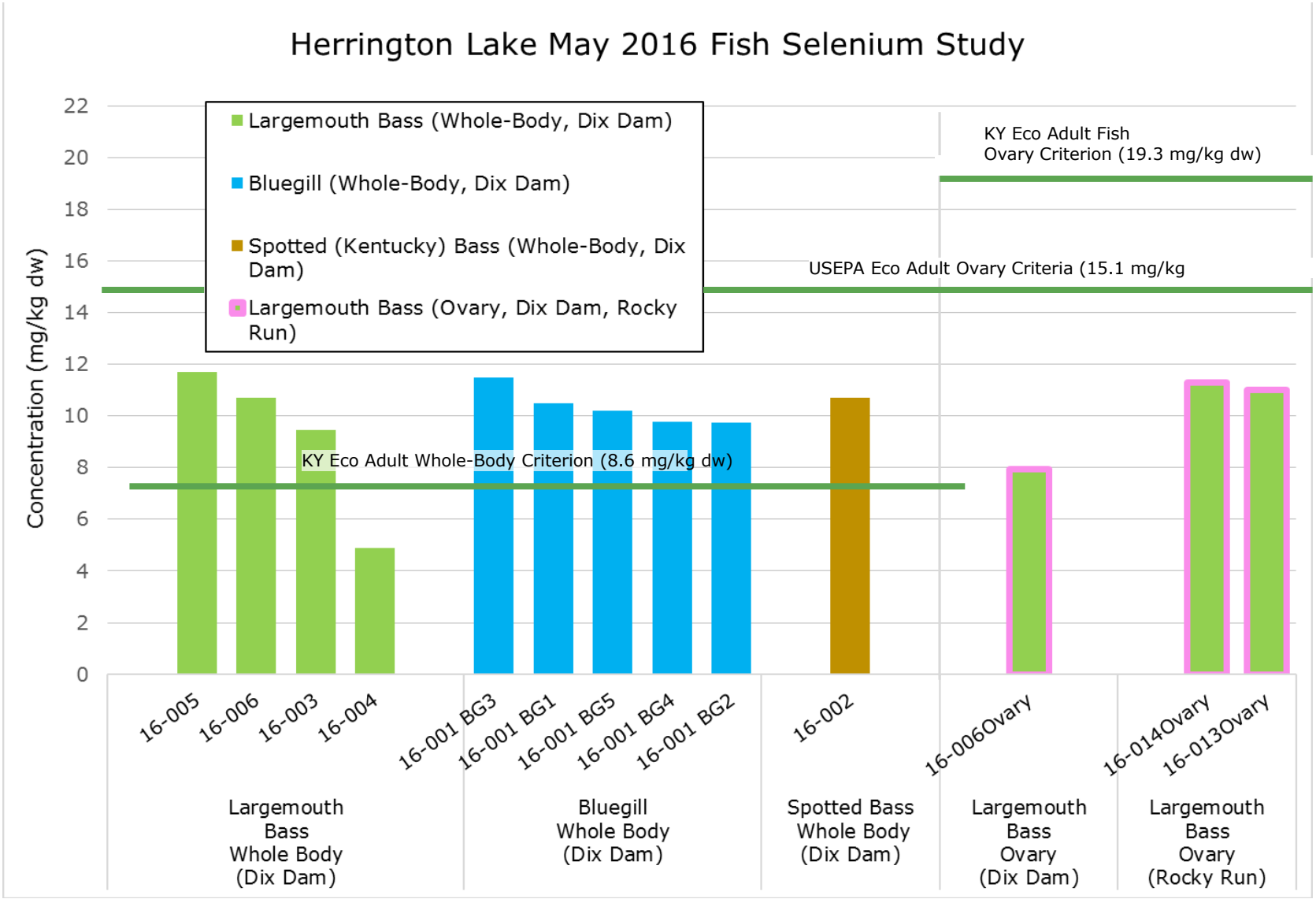
Observations

Wet weight for human health considerations.

Risk based concentration of 13 mg/kg derived assuming 50 meals per year for an adult.

- Consumption rate is consistent with state-wide mercury advisory for panfish.

RAMBOLL	**SELENIUM IN ADULT FILLET TISSUE: LARGER FISH (WET WEIGHT) (PHASE I)**		FIGURE
	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky		2-3E
DRAFTED BY: PAL	DATE: 02/01/2019		



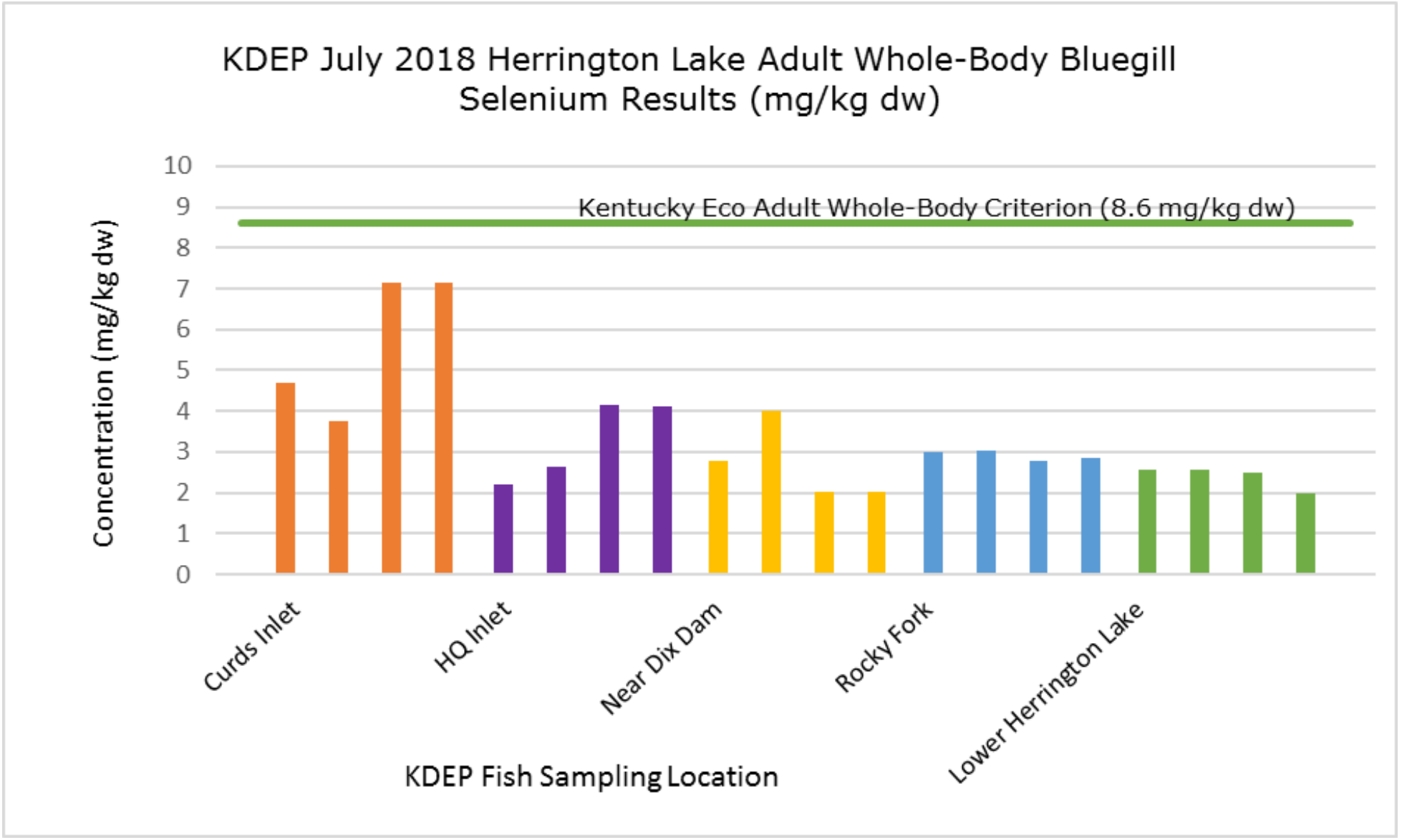
Bluegill (BG), dry weight (dw), Kentucky Ecological Whole Body Criterion (KY Eco Whole-Body Criterion), Kentucky Division of Water (KDOW), milligrams per kilogram (mg/kg)

Observations

Sampling denoted at Dix Dam could be 1 to 2 miles upgradient from the dam, per Kentucky Division of Water staff involved with May 2016 sampling effort. Dry weight is consistent with Kentucky Ecological Chronic Criterion.

Kentucky Ecological Whole-Body Criterion is 8.6 mg/kg dw.

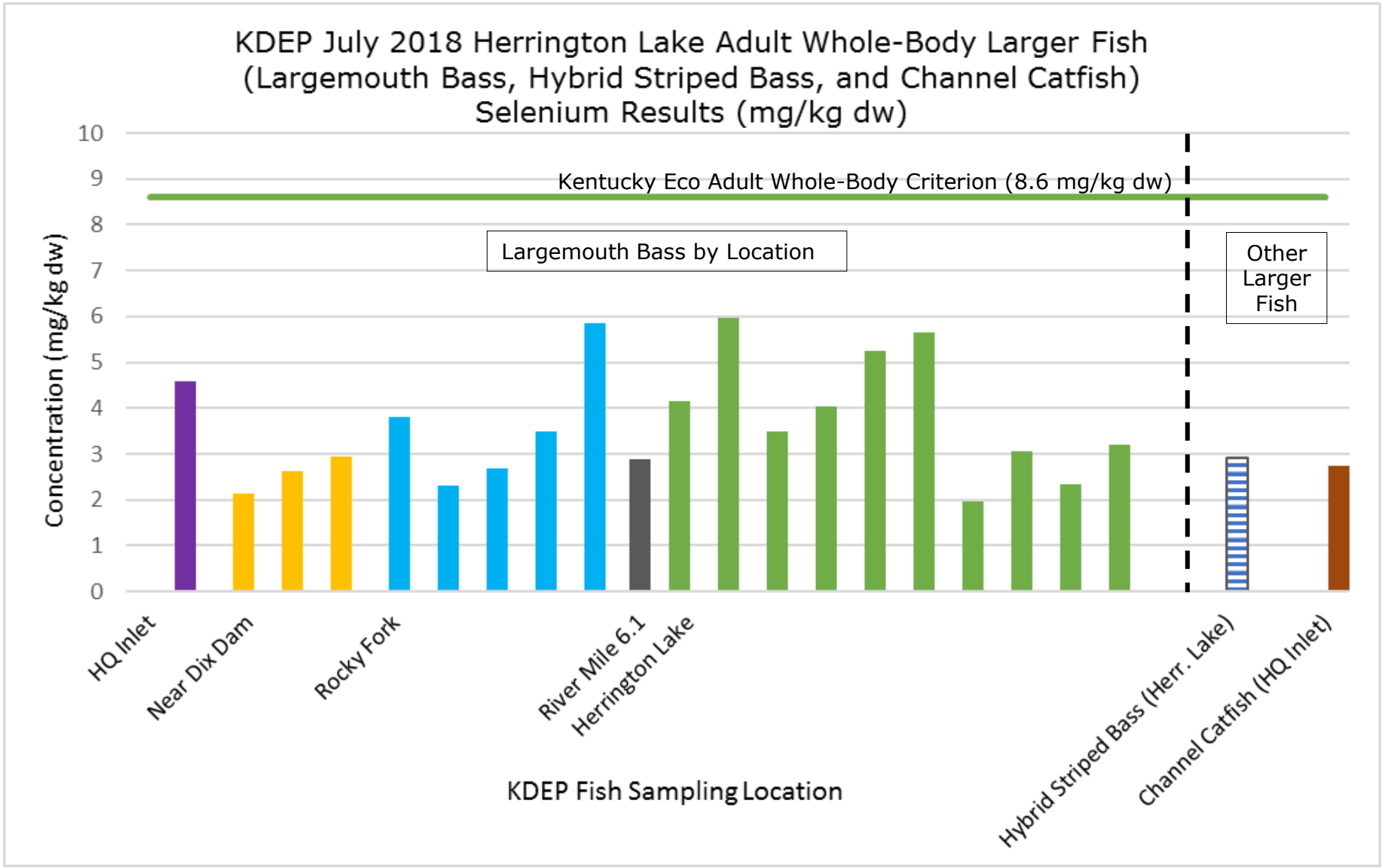
RAMBOLL	**SELENIUM IN KDOW MAY 2016 STUDY ADULT WHOLE-BODY AND OVARY FISH-TISSUE** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report F.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-3F1
DRAFTED BY: PAL	DATE: 02/01/2019	



Bluegill (BG), dry weight (dw), Kentucky Ecological Whole Body Criterion (KY Eco Whole-Body Criterion), milligrams per kilogram (mg/kg)

Observations
Sampling denoted at Dix Dam could be 1 to 2 miles upgradient from the dam, per Kentucky Division of Water staff involved with May 2016 sampling effort.
Dry weight is consistent with Kentucky Ecological Chronic Criterion.
Kentucky Ecological Whole Body Criterion is 8.6 mg/kg dw.

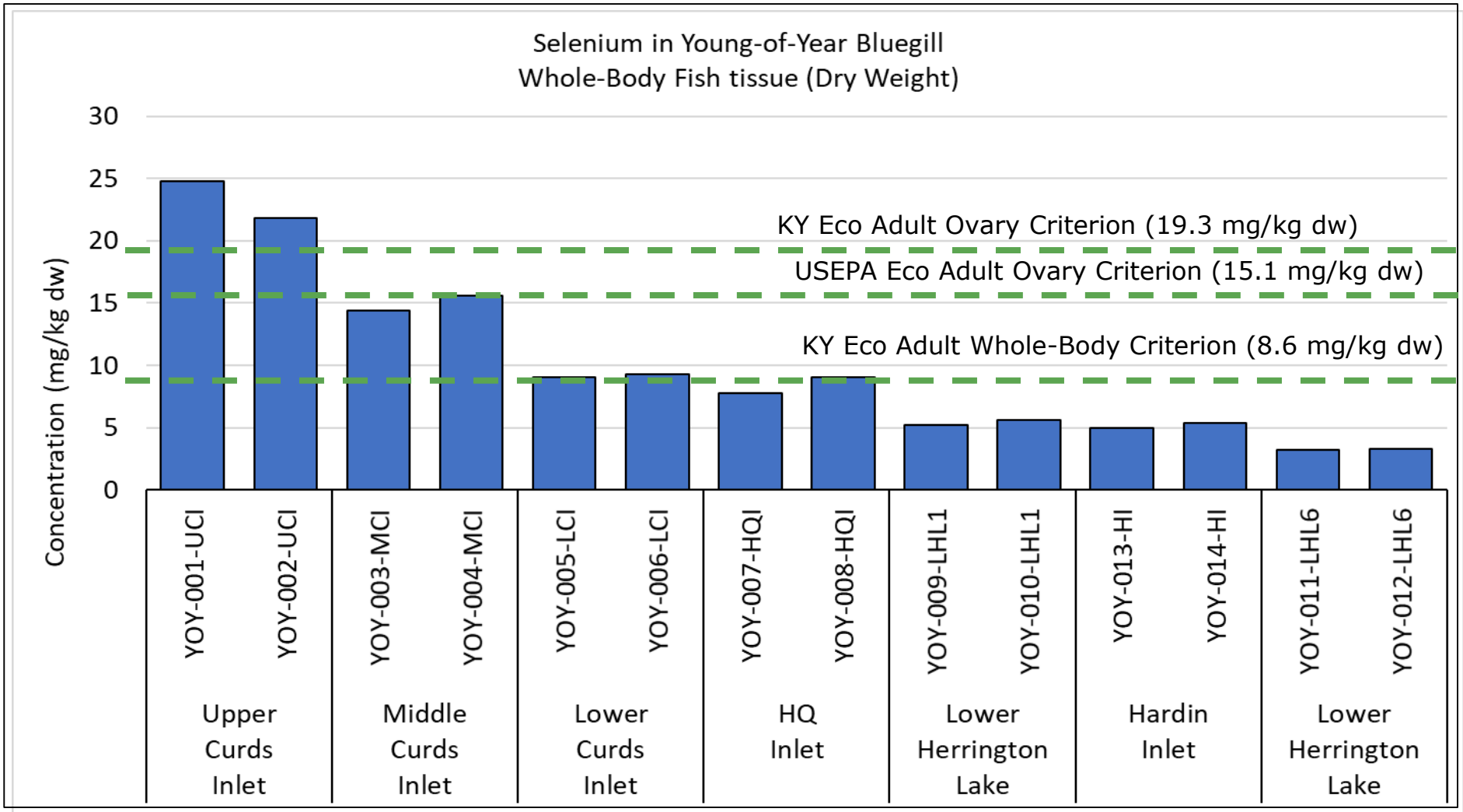
RAMBOLL		**SELENIUM IN KDEP JULY 2018 ADULT WHOLE-BODY BLUEGILL TISSUE** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-3F2
DRAFTED BY: PAL	DATE: 02/01/2019		



Bluegill (BG), dry weight (dw), Kentucky Ecological Whole Body Criterion (KY Eco Whole-Body Criterion), milligrams per kilogram (mg/kg)

Observations
Sampling denoted at Dix Dam could be 1 to 2 miles upgradient from the dam, per Kentucky Division of Water staff involved with May 2016 sampling effort.
Dry weight is consistent with Kentucky Ecological Chronic Criterion.
Kentucky Ecological Whole Body Criterion is 8.6 mg/kg dw.

RAMBOLL		**SELENIUM IN KDEP JULY 2018 ADULT WHOLE-BODY LARGER FISH TISSUE** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-3F3
DRAFTED BY: PAL	DATE: 02/01/2019		

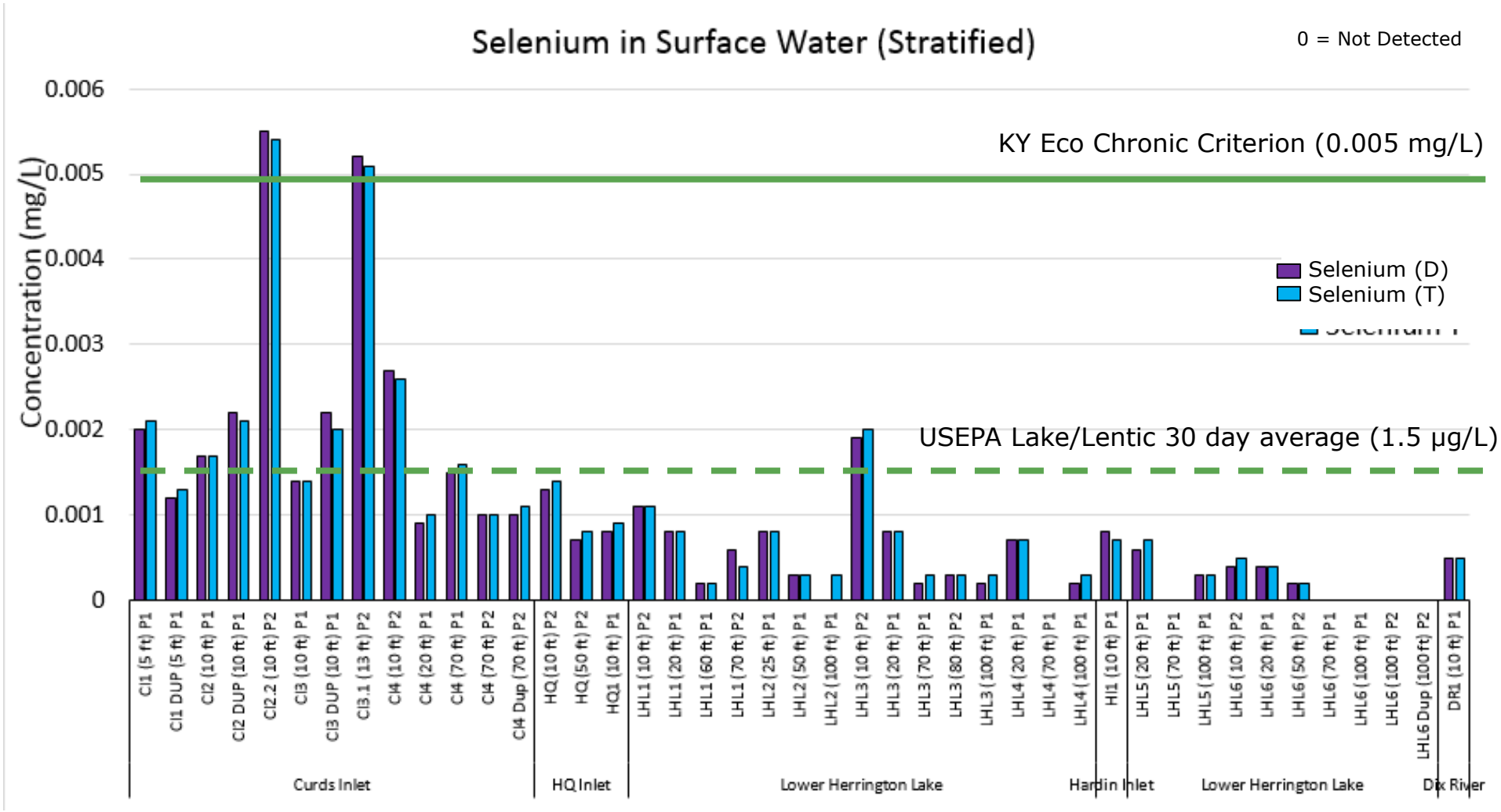


Hardin Inlet (HI), HQ Inlet (HQI), Kentucky Ecological (KY Eco), Lower Curds Inlet (LCI), Lower Herrington Lake (LHL), Middle Curds Inlet (MCI), milligram per kilogram dry weight (mg/kg dw), United States Environmental Protection Agency (USEPA), Upper Curds Inlet (UCI), Young-of-Year (YOY)

Observation

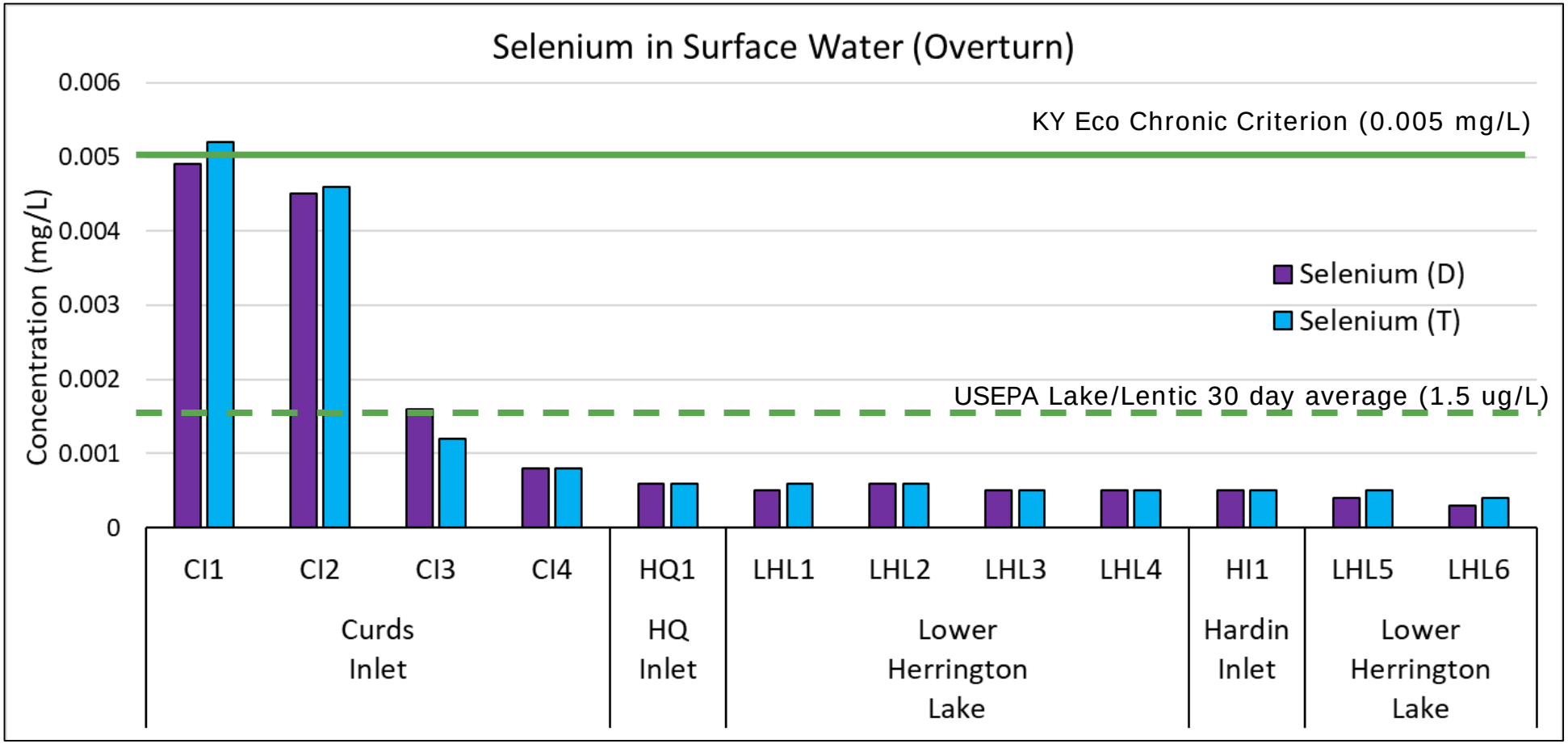
Dry weight is consistent with Kentucky Ecological Chronic Criterion.

RAMBOLL		**SELENIUM IN YOUNG-OF-THE-YEAR (YOY) WHOLE-BODY BLUEGILL TISSUE (PHASE II YOY STUDY)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-3G
DRAFTED BY: PAL	DATE: 02/01/2019		



Curds Inlet (CI), Dissolved (D), Dix River (DR), Duplicate (DUP), feet (ft), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Criterion (KY Eco Chronic Criterion), Lower Herrington Lake (LHL), micrograms per liter (µg/L), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

RAMBOLL		**SELENIUM IN STRATIFIED SURFACE WATER (PHASE I AND PHASE II)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-3H
DRAFTED BY: PAL	DATE: 02/01/2019		



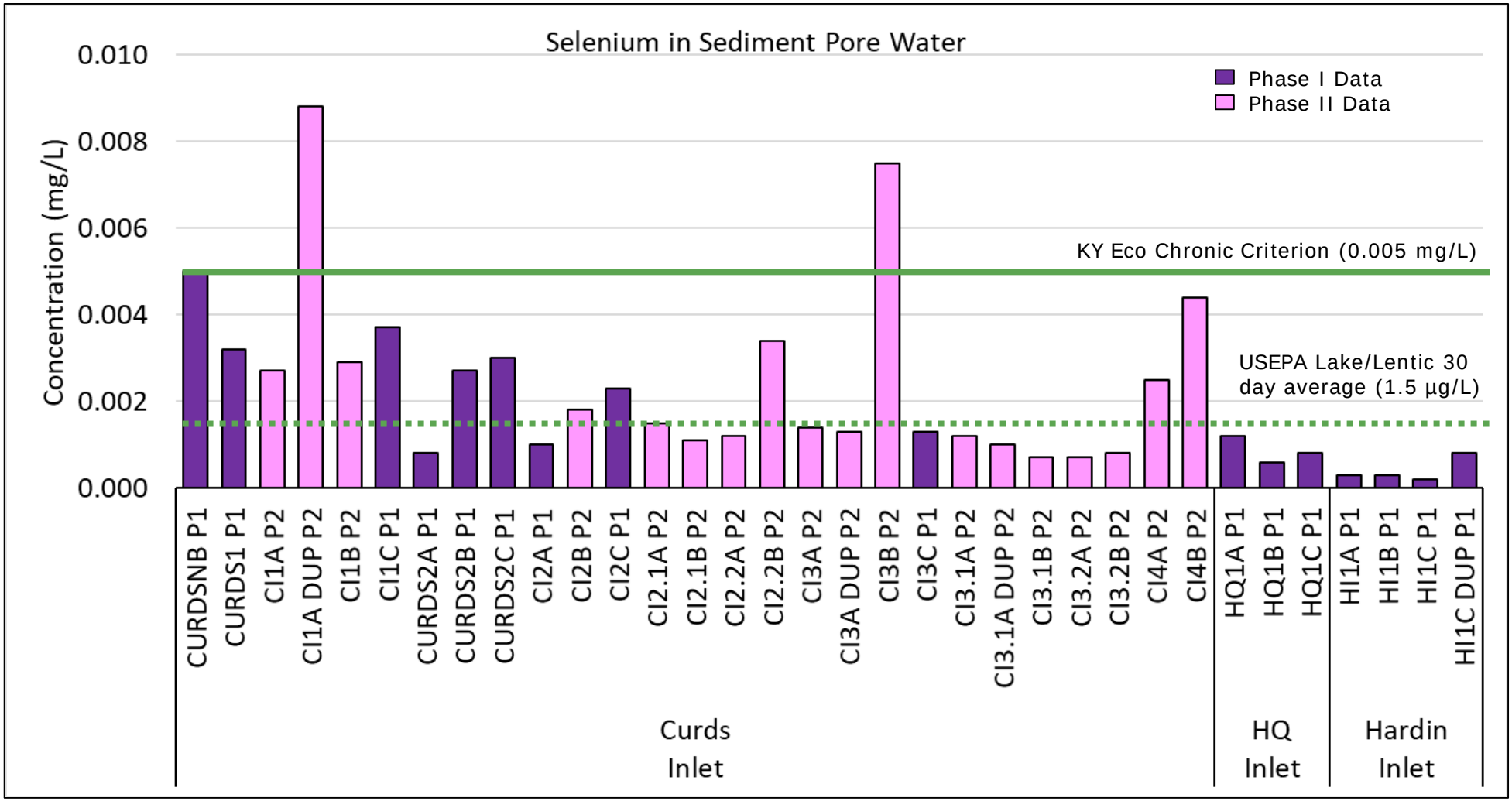
Curds Inlet (CI), Dissolved (D), Hardin Inlet (HI), Human Health (HH), HQ Inlet (HQ), Lower Herrington Lake (LHL), micrograms per liter (µg/L), milligram per liter (mg/L), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

Observations

Human health water quality criterion for Kentucky and USEPA are higher than the scale allows.

- KY HH water quality criterion for Selenium is 0.17 mg/L
- USEPA Maximum Contaminant Level for Selenium is 0.05 mg/L

RAMBOLL		**SELENIUM IN OVERTURN SURFACE WATER (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-31



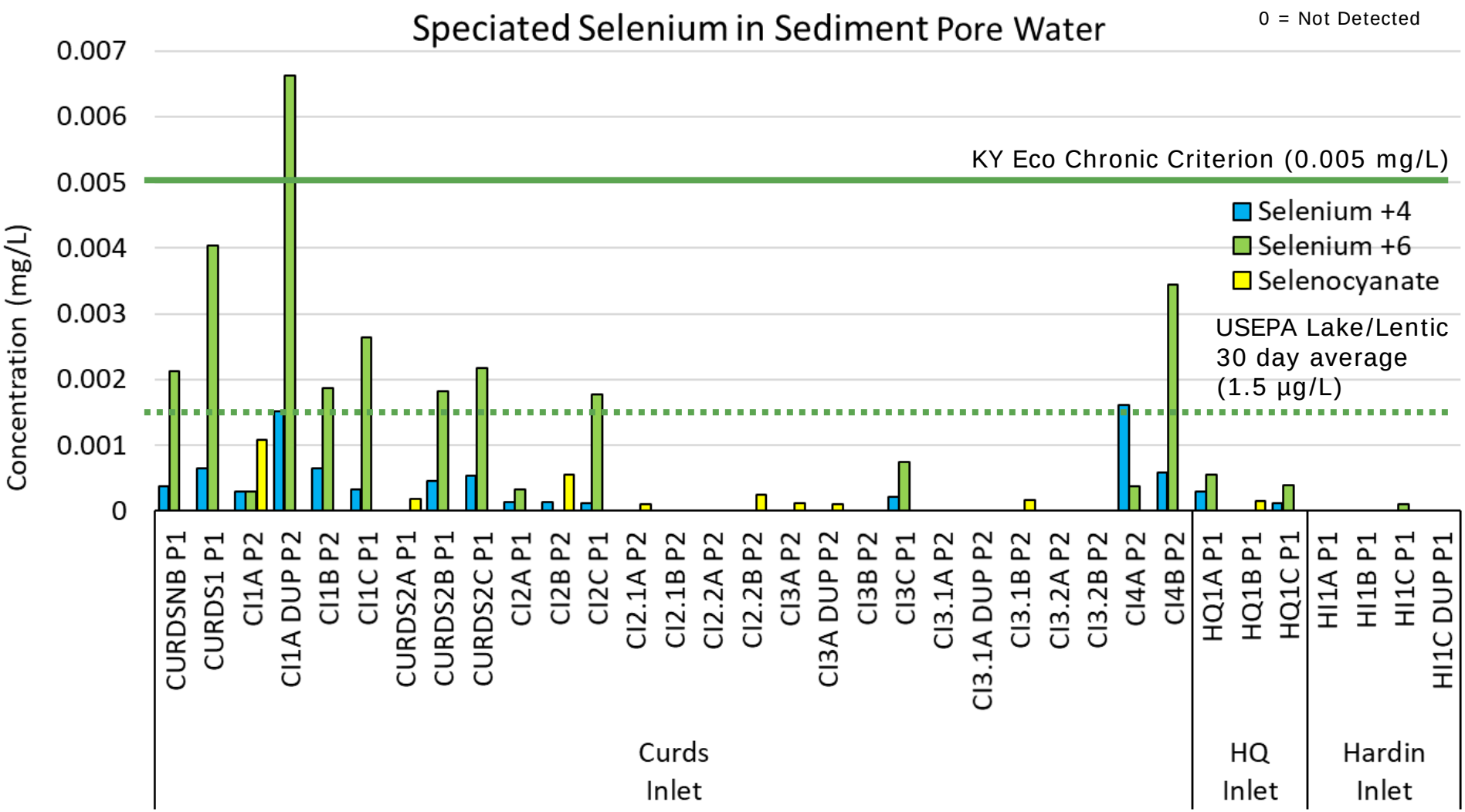
Curds Inlet (CI), Dissolved (D), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Criterion (KY Eco Chronic Criterion), micrograms per liter (µg/L), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

Observations

Speciated selenium allows an understanding of the forms of selenium because not all forms are toxic screening values are often based on the assumption that selenium is present in the most toxic form.

USEPA Region 4 Criteria for selenite (SeIV or Se4+) (0.028 mg/L chronic) and selenate (SeVI or Se6+) (0.009 mg/L chronic) are not shown because they are higher than the scale allows.

RAMBOLL	**SELENIUM IN SEDIMENT PORE WATER (PHASE I AND PHASE II)**	FIGURE
	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-3J
DRAFTED BY: PAL	DATE: 02/01/2019	



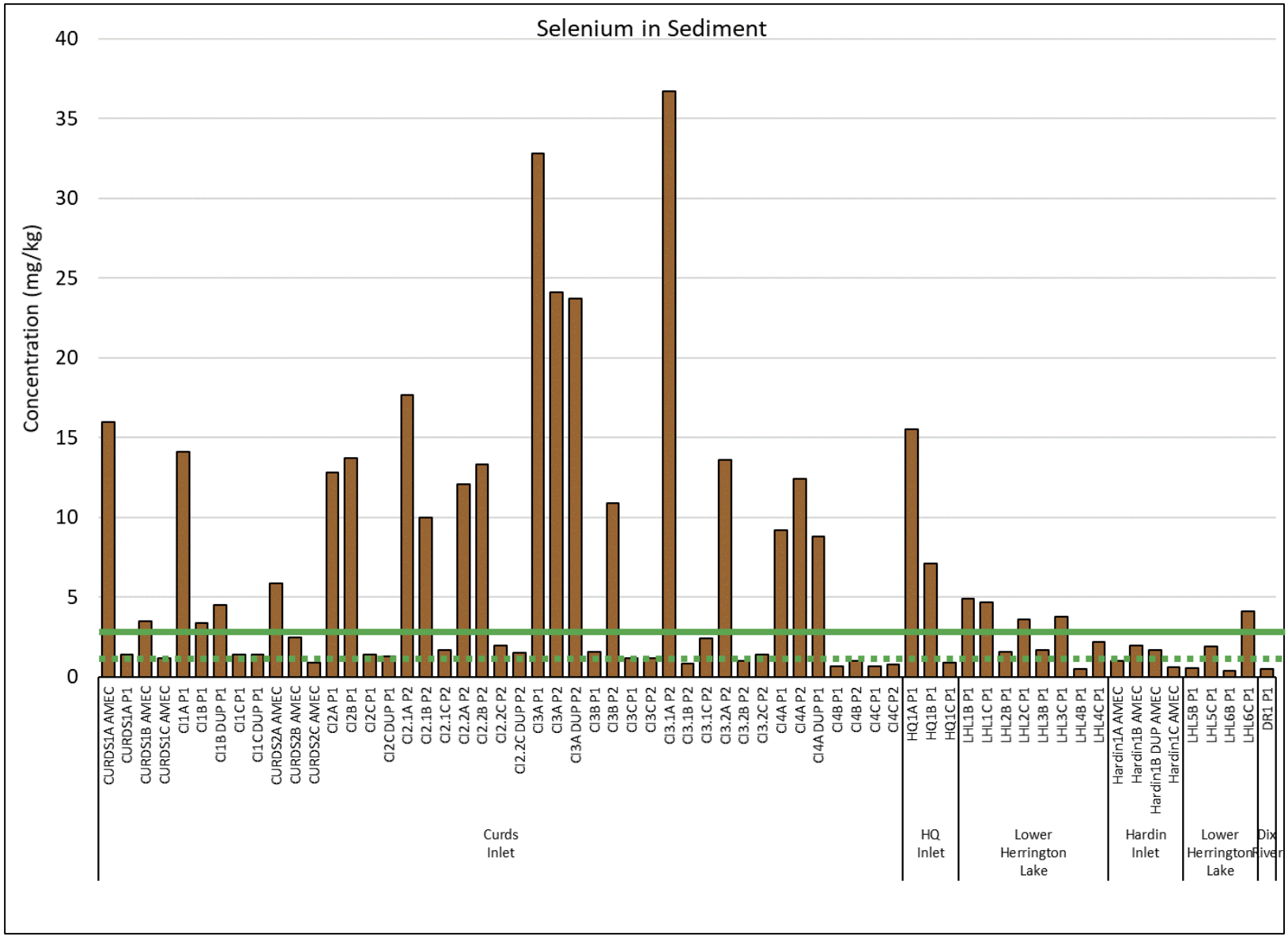
Curds Inlet (CI), Duplicate (DUP), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Criterion (KY Eco Chronic Criterion), micrograms per liter (µg/L), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Observations

Speciated selenium allows an understanding of the forms of selenium because not all forms are toxic screening values are often based on the assumption that selenium is present in the most toxic form.

USEPA Region 4 Value for selenite (SeIV or Se4+) (0.028 mg/L chronic) and selenate (SeVI or Se6+) (0.009 mg/L chronic are not shown because they are higher than the scale allows.

RAMBOLL	**SPECIATED SELENIUM IN SEDIMENT PORE WATER (PHASE I AND PHASE II)**	FIGURE
	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-3K
DRAFTED BY: PAL	DATE: 02/01/2019	

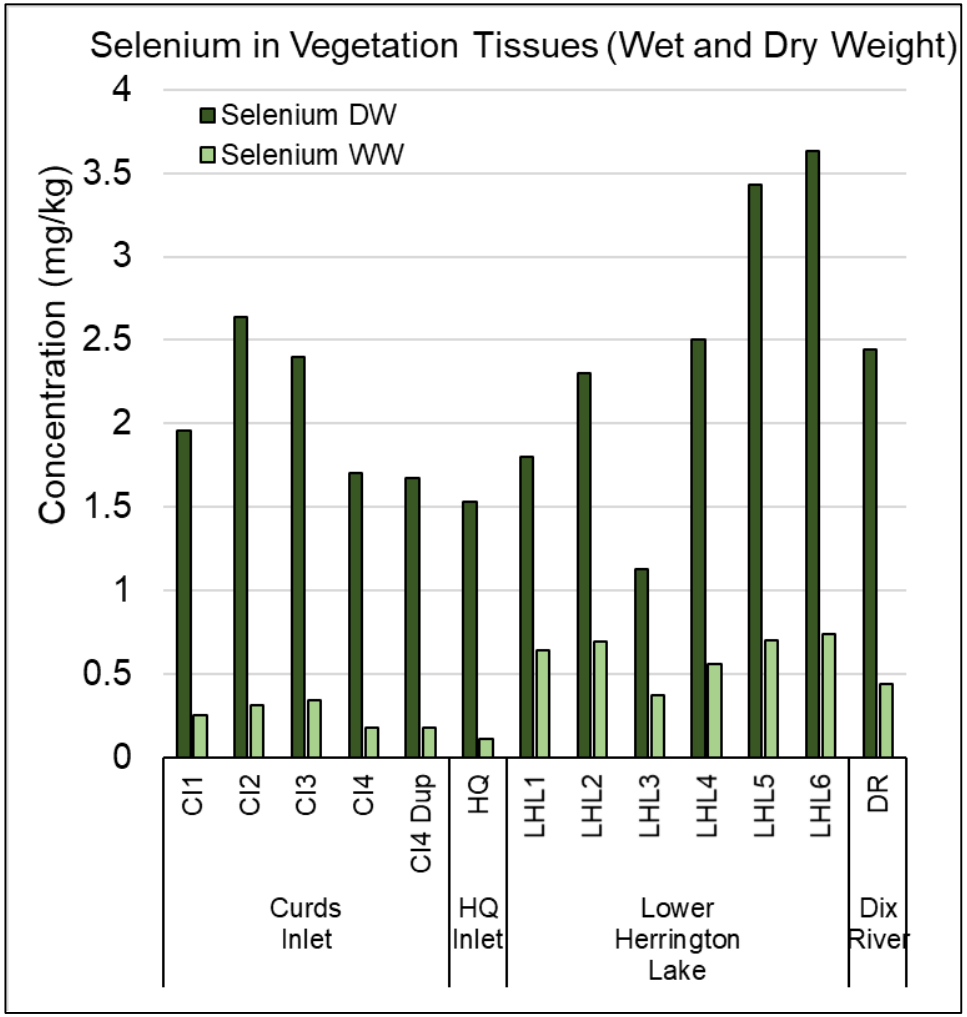


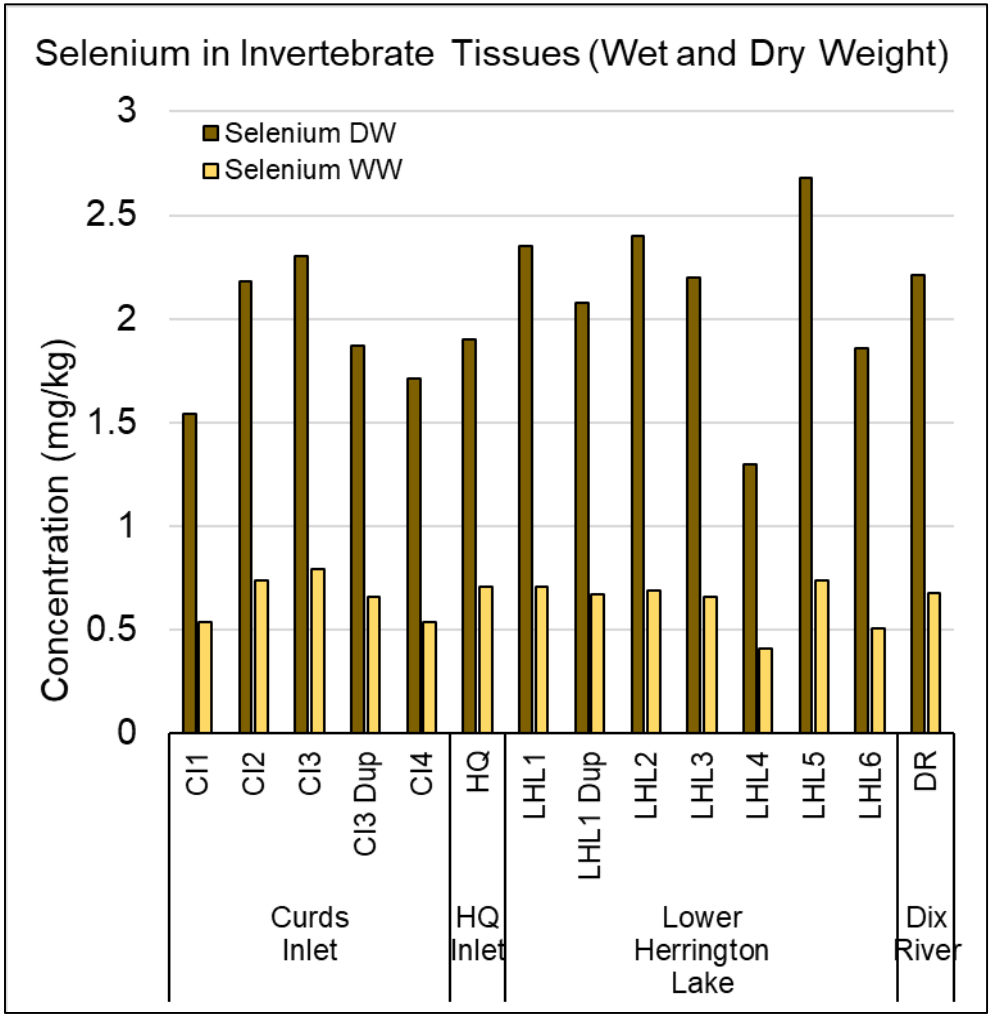
Curds Inlet (CI), Data from AMEC (AMEC), Dix River (DR), Duplicate (DUP), Hardin Inlet (Hardin), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Observation

Selenium screening value for human health is 390 mg/kg for exposure to residential soil (value not shown on the figure because concentrations are below this screening value).

RAMBOLL	**SELENIUM IN SEDIMENT (AMEC FEBRUARY 2017, PHASE I AND PHASE II)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-3L



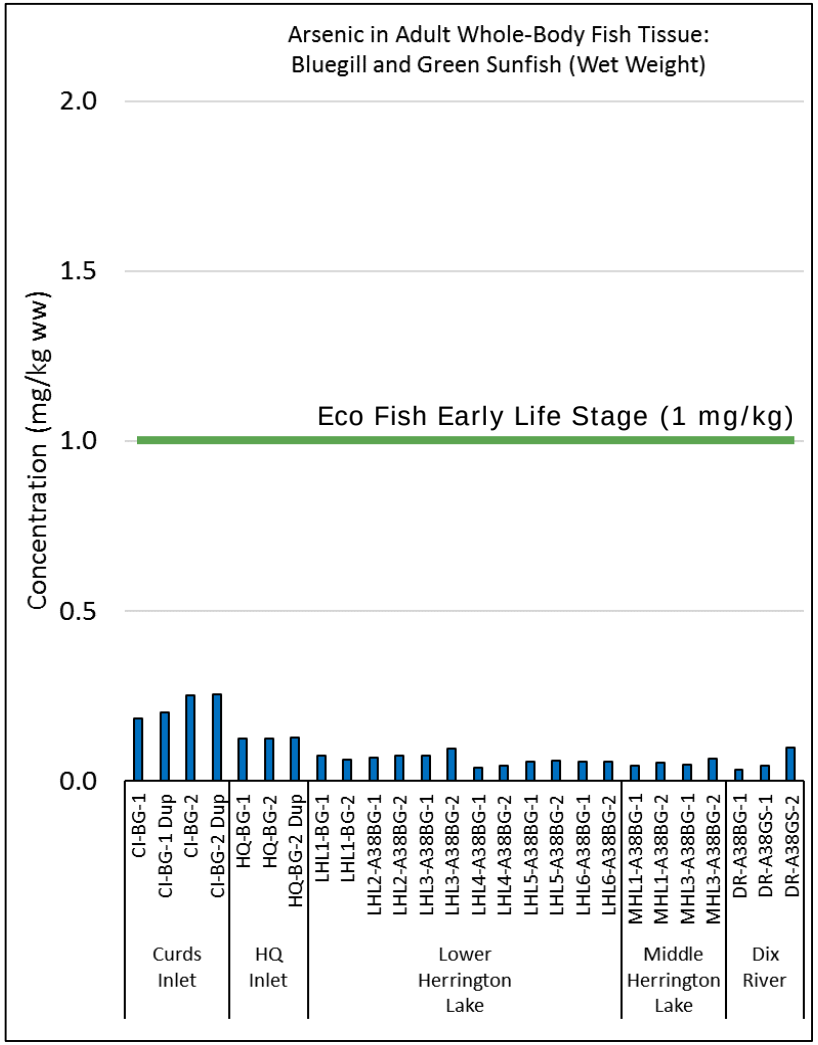


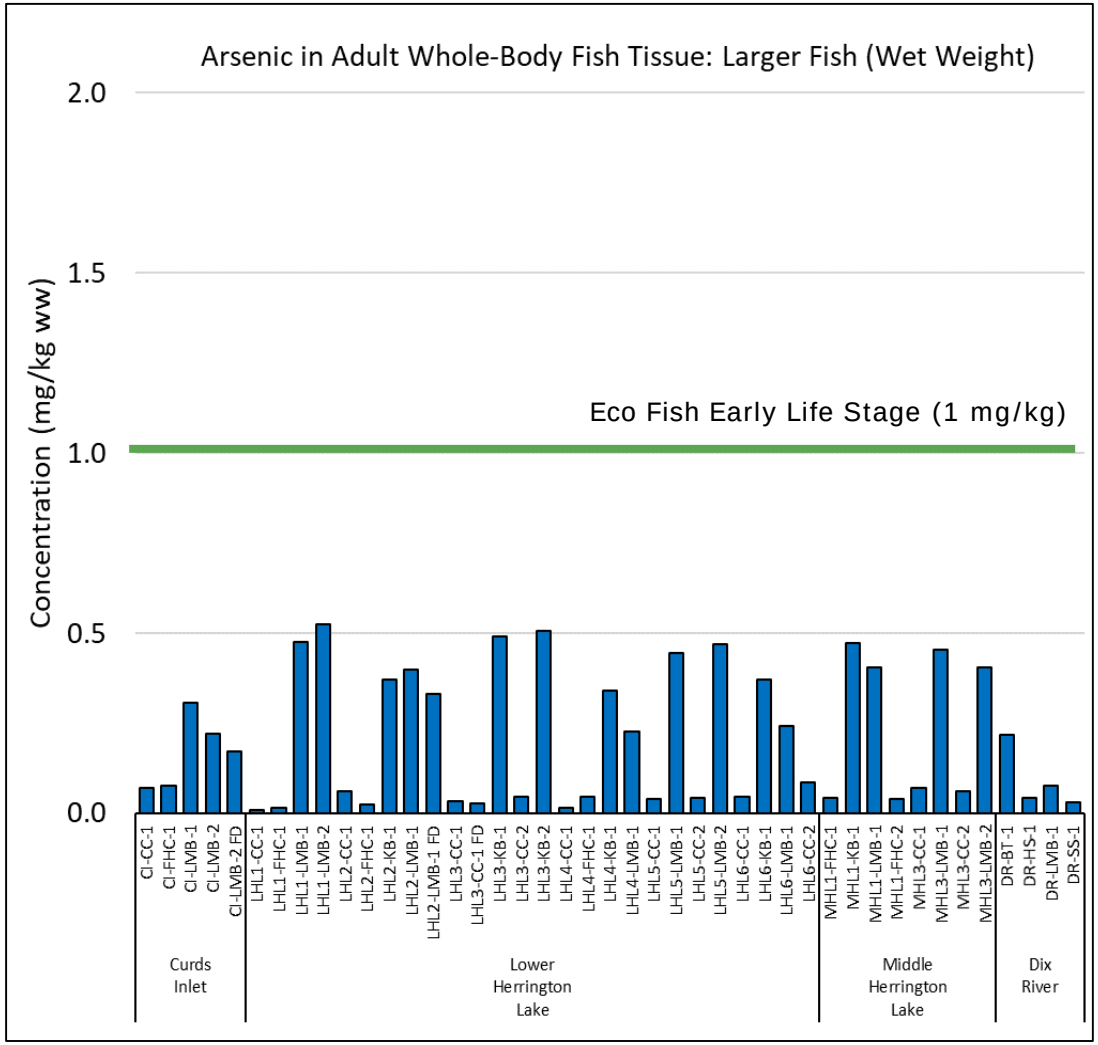
Curds Inlet (CI), Dix River (DR), Dry Weight (DW), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Wet Weight (WW)

Observation

LHL6 is approximately 2.5 miles upgradient from Curds Inlet.

RAMBOLL	**SELENIUM IN VEGETATION AND INVERTEBRATES (PHASE I)**	FIGURE
	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-3M
DRAFTED BY: PAL	DATE: 02/01/2019	



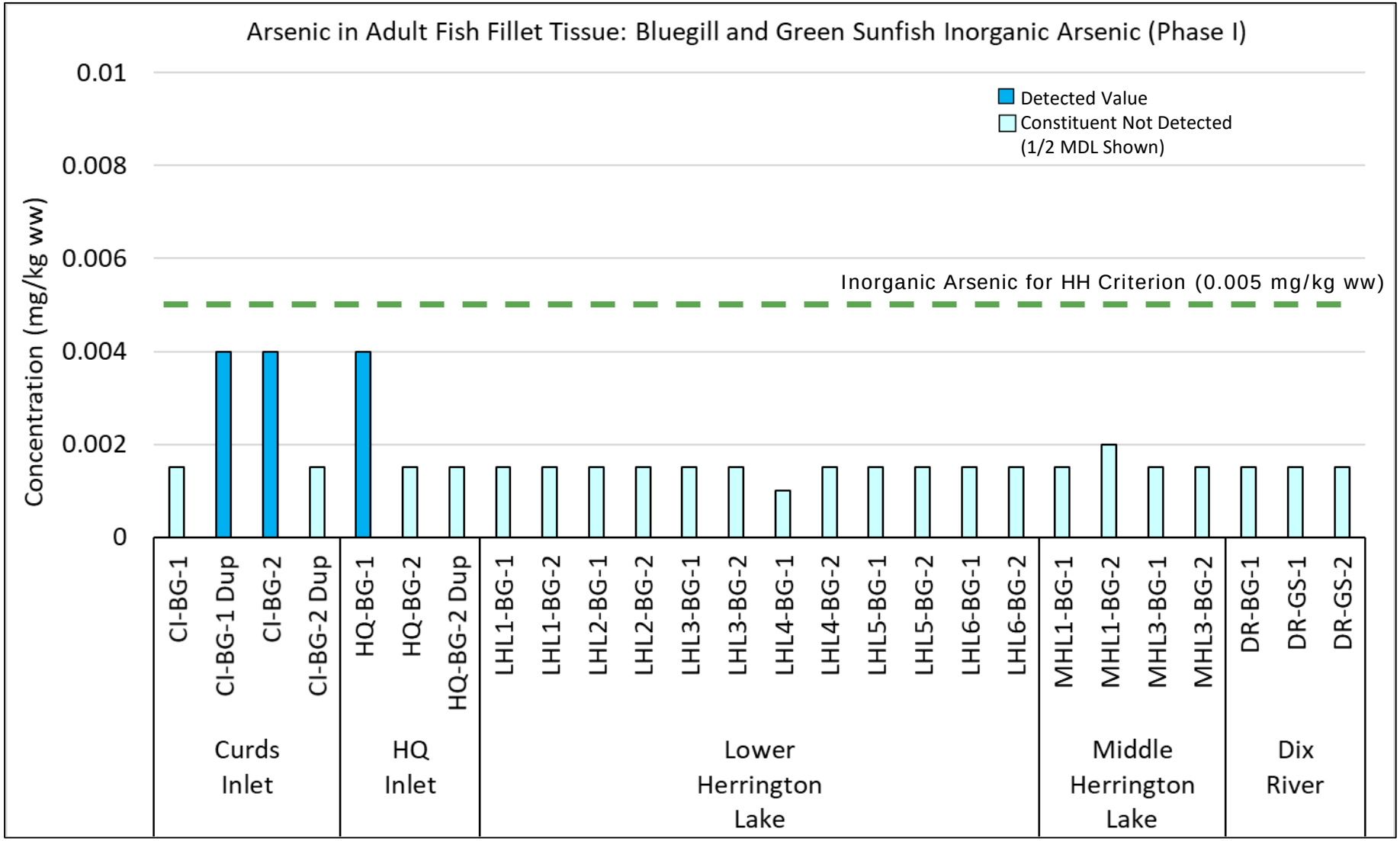


Bluegill (BG), Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Ecological (Eco), Field Duplicated (FD), Flathead Catfish (FHC), Green Sunfish (GS), HQ Inlet (HQ), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Northern Hogsucker (HS), Phase I (P1), Phase II (P2), Spotted Sucker (SS)

Observations

Fish tissue screening levels for adult and early life stage from scientific literature, including Jarvinen and Ankley (1999).
The ecological adult fish screening value of 5 mg/kg is not shown on the figure because the concentrations are below this screening value.

RAMBOLL	**ARSENIC IN ADULT WHOLE-BODY FISH TISSUE (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-4A

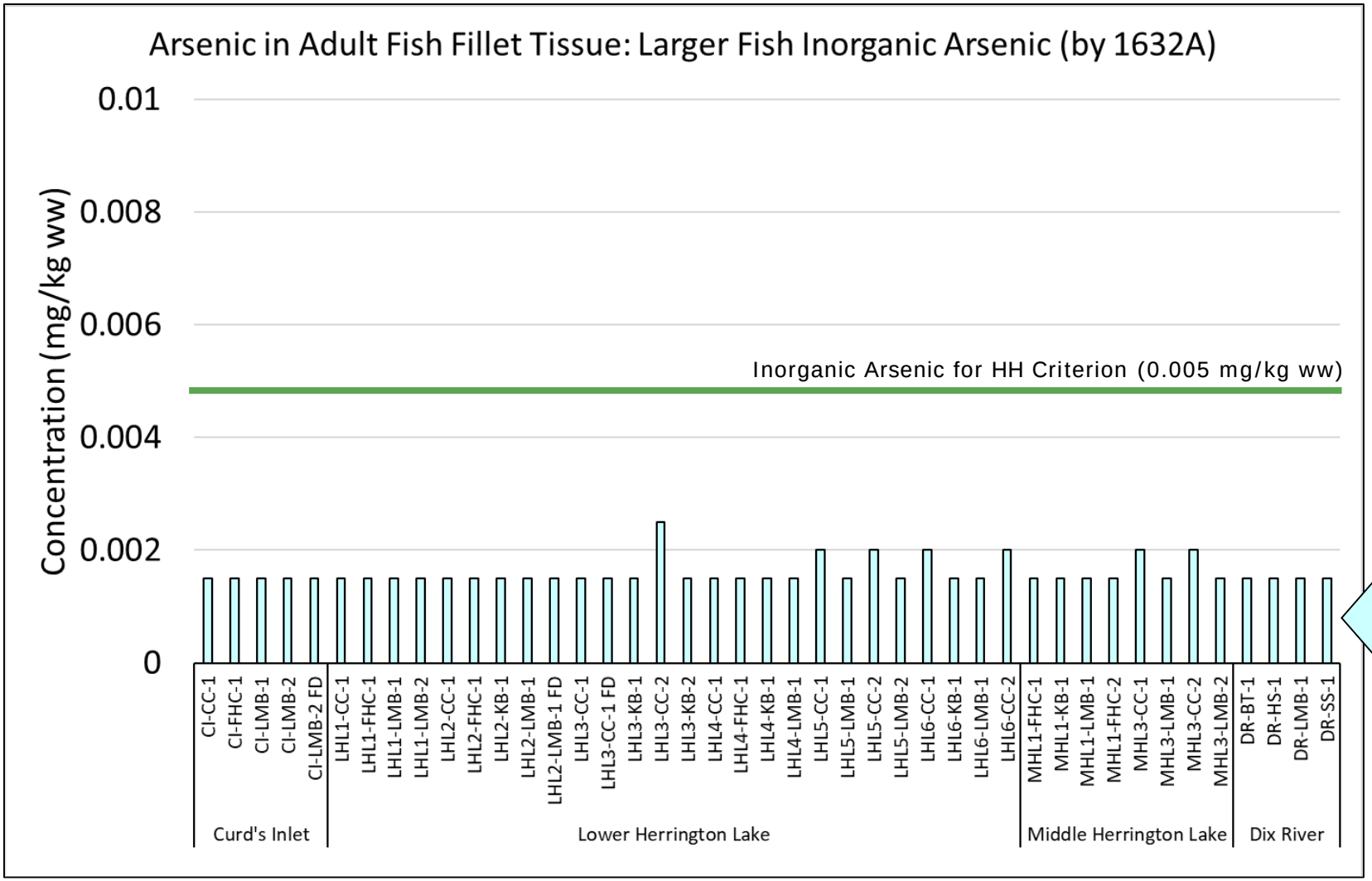


Bluegill (BG), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Green Sunfish (GS), Human Health (HH), HQ Inlet (HQ), Lower Herrington Lake (LHL), Method Detection Limit (MDL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Phase I (P1), Phase II (P2), wet weight (ww)

Observation

Kentucky Ecological Chronic Criterion human health risk-based concentration for inorganic arsenic is 0.005 mg/kg ww based on 10^{-6} risk level assuming 50 meals per year.

RAMBOLL	**ARSENIC IN ADULT FISH FILLET TISSUE: BLUEGILL AND GREEN SUNFISH INORGANIC ARSENIC (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-4B



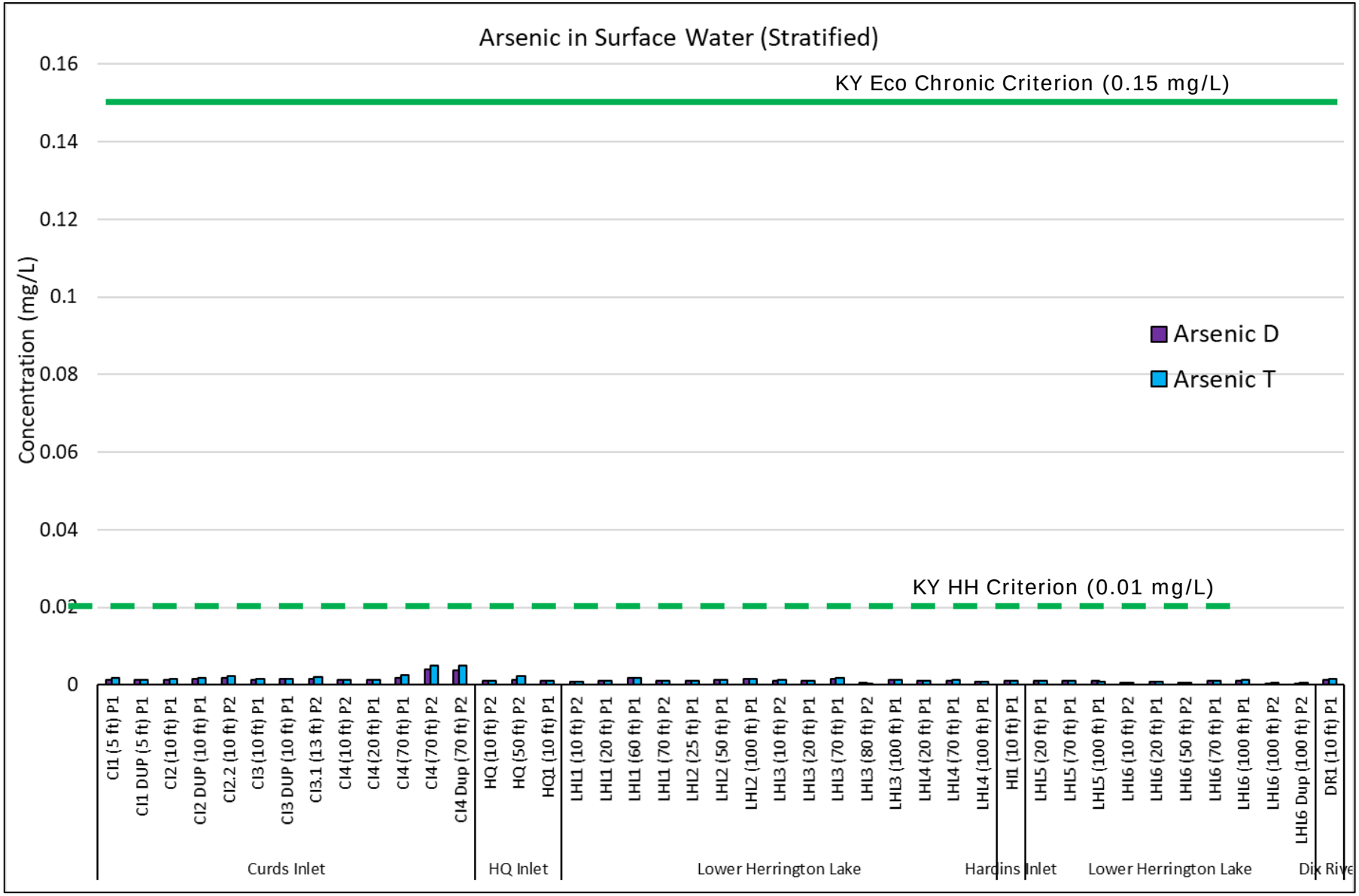
All bars shown reflect ½ method detection limits because inorganic arsenic was not detected in bass, catfish, or trout fillet tissues.

Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Field Duplicate (FD), Flathead Catfish (FHC), Human Health (HH), HQ Inlet (HQ), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Northern Hogsucker (HS), Phase I (P1), Phase II (P2), Spotted Sucker (SS), wet weight (ww),

Observation

Human health risk-based concentration for inorganic arsenic is 0.005 mg/kg ww based on 10^{-6} risk level assuming 50 meals per year.

RAMBOLL	**ARSENIC IN ADULT FISH FILLET TISSUE: LARGER FISH INORGANIC ARSENIC (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-4C

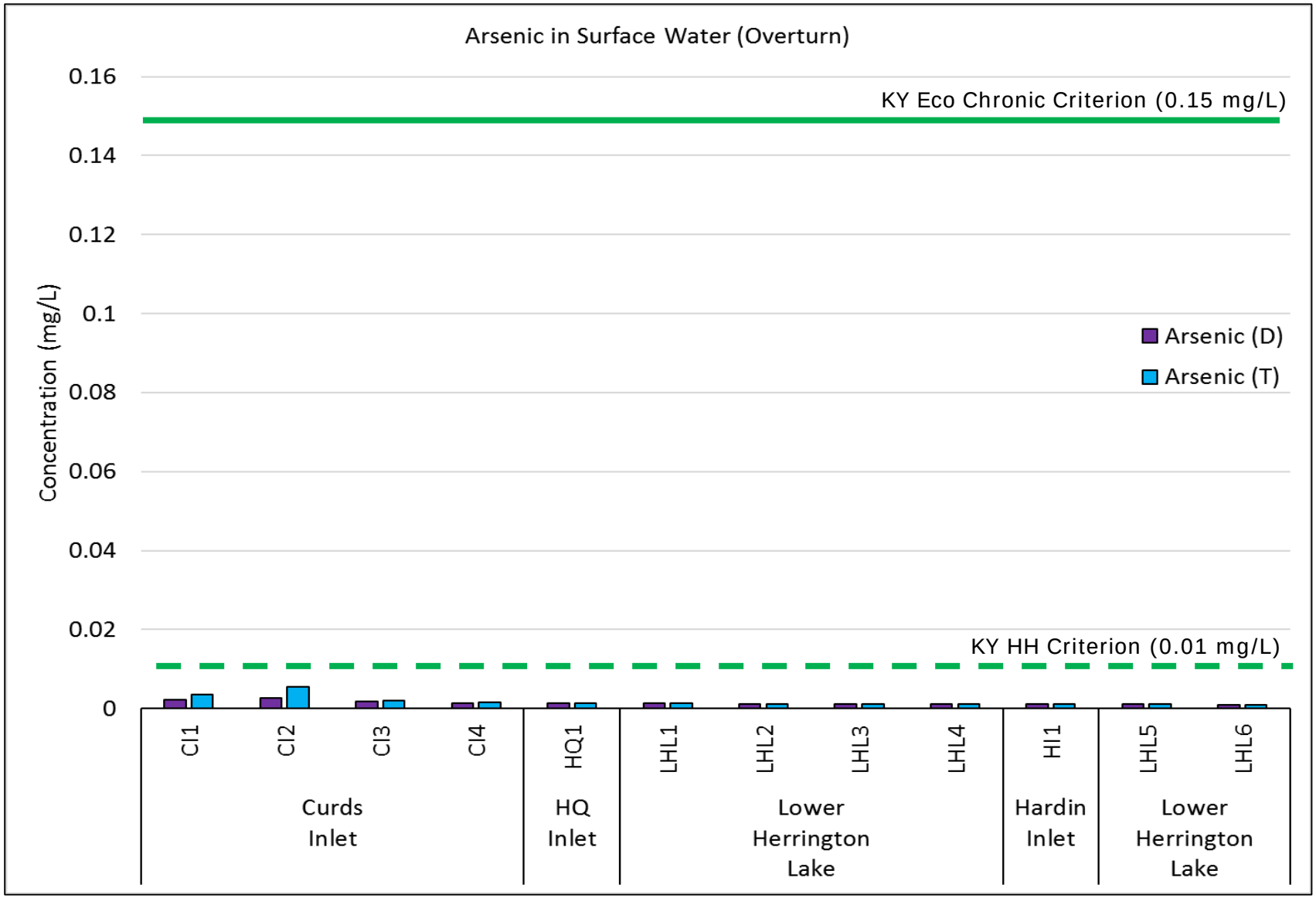


Curds Inlet (CI), Dissolved (D), Dix River (DR), feet (ft), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Water Quality Criterion (KY Eco Chronic Criterion), Kentucky Human Health Criterion (KY HH Criterion), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), Total Unfiltered (T)

Observation

Numbers above sample IDs in stratification chart indicate sample depth in feet.

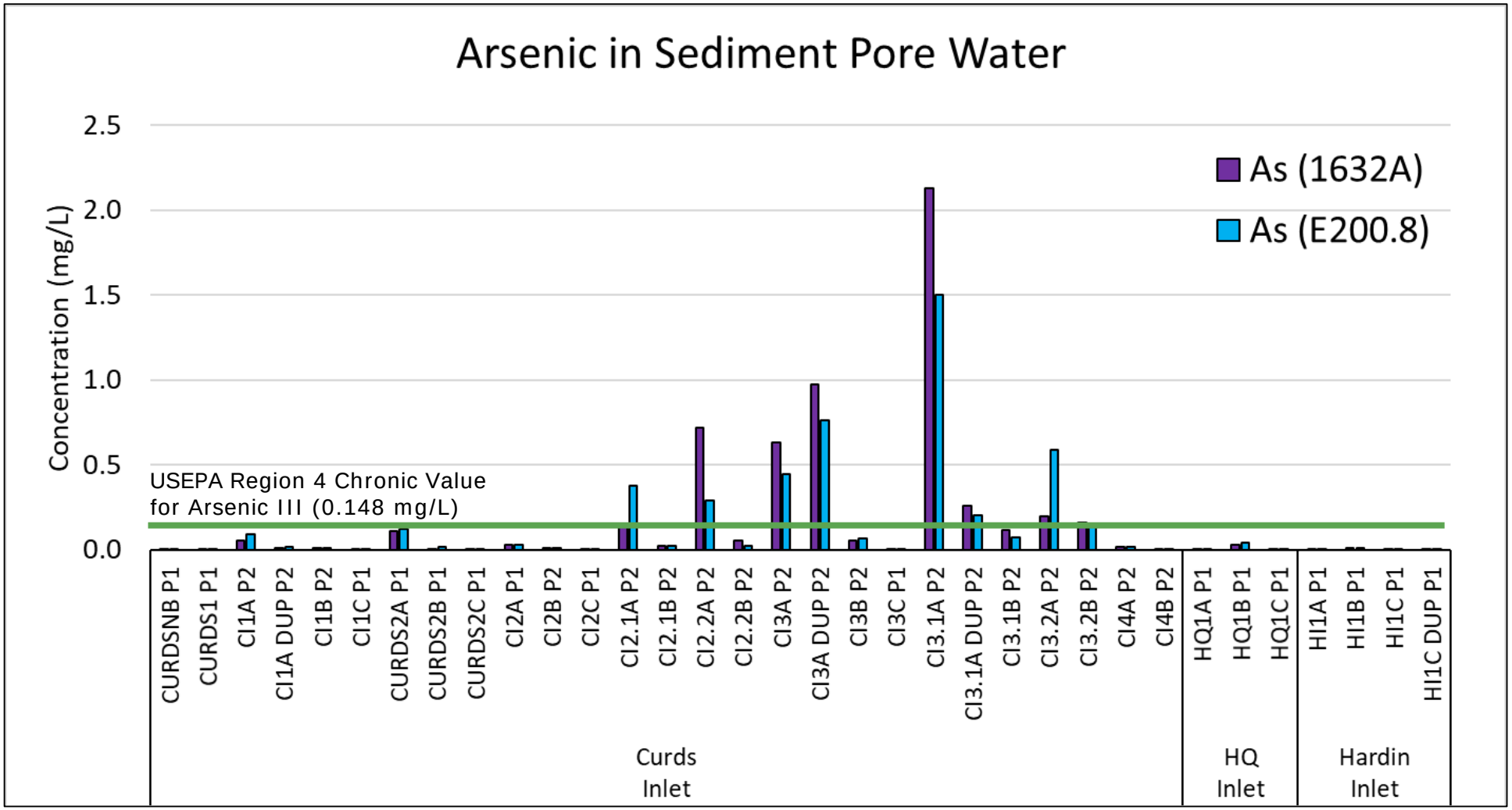
RAMBOLL	**ARSENIC IN STRATIFIED SURFACE WATER (PHASE I AND PHASE II)**	FIGURE
	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-4D
DRAFTED BY: PAL	DATE: 02/01/2019	



Curds Inlet (CI), Dissolved (D), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Water Criterion (KY Eco Chronic Criterion), Kentucky Human Health Water Quality Criterion (KY HH Criterion), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Total Unfiltered (T)

Note
Numbers above sample IDs in stratification chart indicate sample depth in feet.

RAMBOLL	**ARSENIC IN OVERTURN SURFACE WATER (PHASE II)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-4E



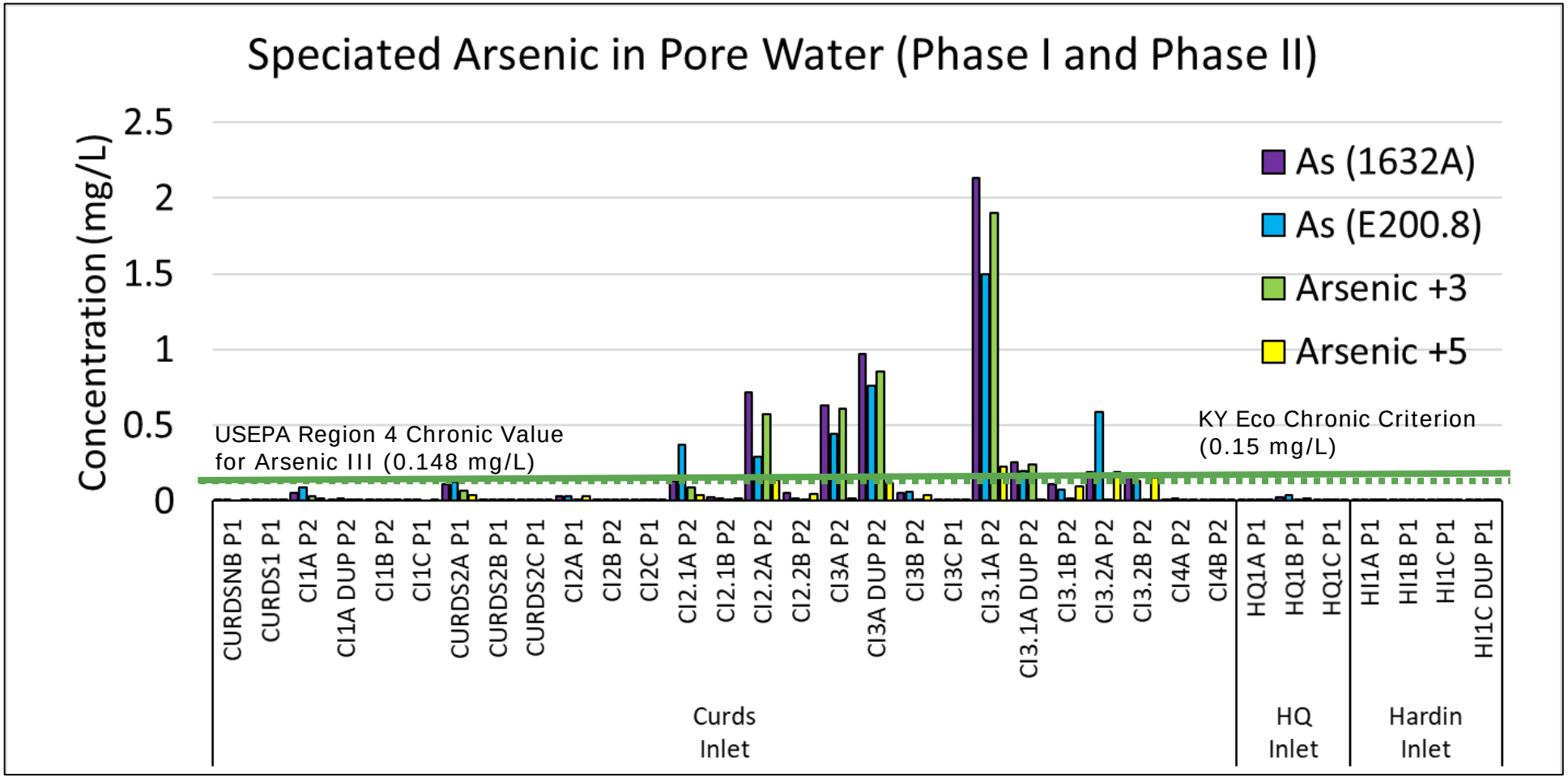
Arsenic (As), Curds Inlet (CI), Dissolved (D), Duplicate (Dup), Environmental Protection Agency (EPA), EPA Method 1632A (1632A), EPA Method 200.8 (E200.8), Hardin Inlet (HI), HQ Inlet (HQ), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Observations

Speciated Arsenic

- The two EPA analytical methods 200.8 and 1632A (for speciation) produce similar results.
- Results for As are lower than Kentucky criterion for ecological receptors.
- Human health criteria is inappropriate for pore water.

RAMBOLL	**ARSENIC IN SEDIMENT PORE WATER (PHASE I AND PHASE II)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-4F



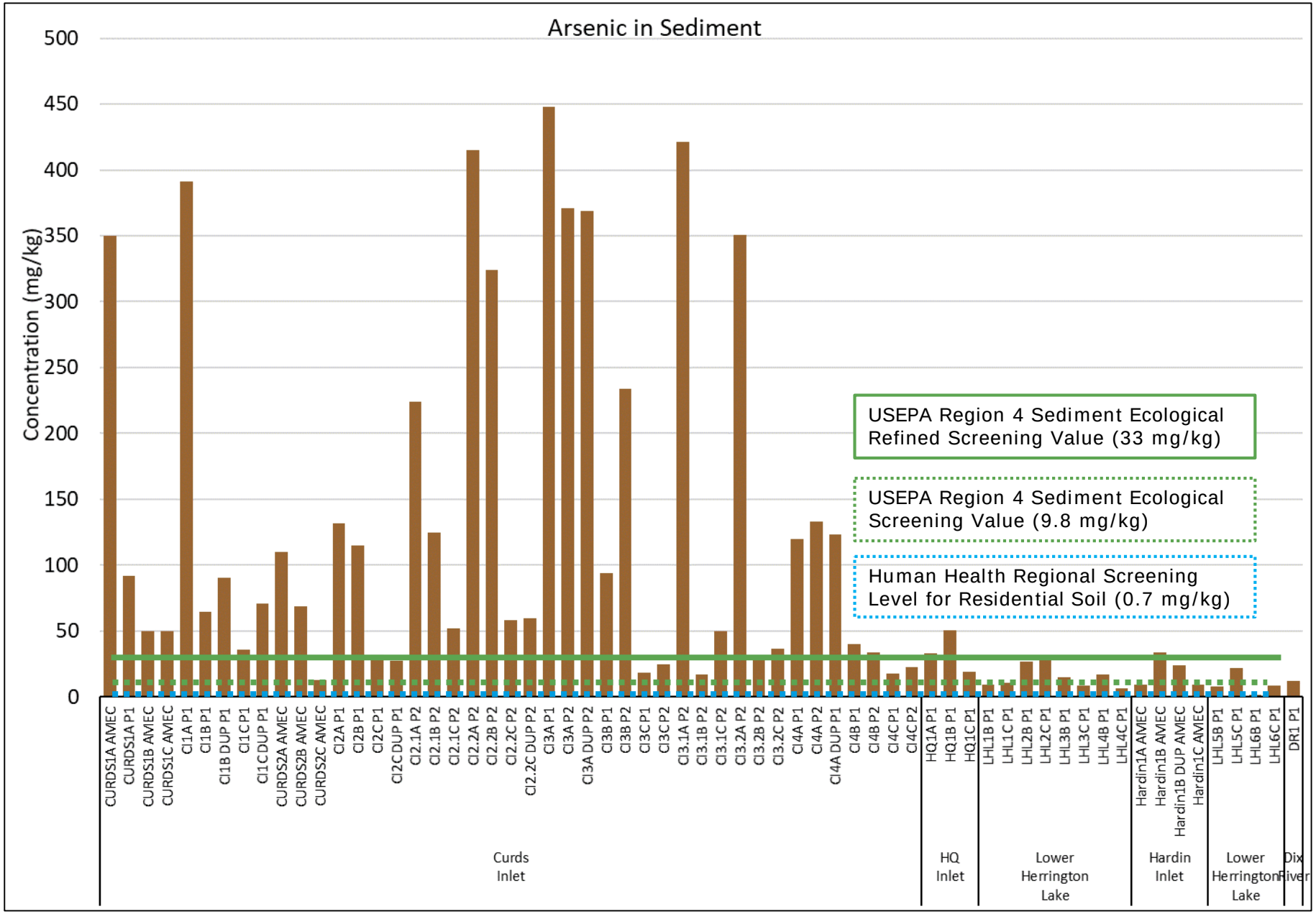
Arsenic (As), Curds Inlet (CI), Dissolved (D), Duplicate (Du), Environmental Protection Agency (EPA), EPA Method 1632A (1632A), EPA Method 200.8 (E200.8), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Water Quality Criterion (Kentucky Eco Chronic Criterion), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Observations

Speciated arsenic

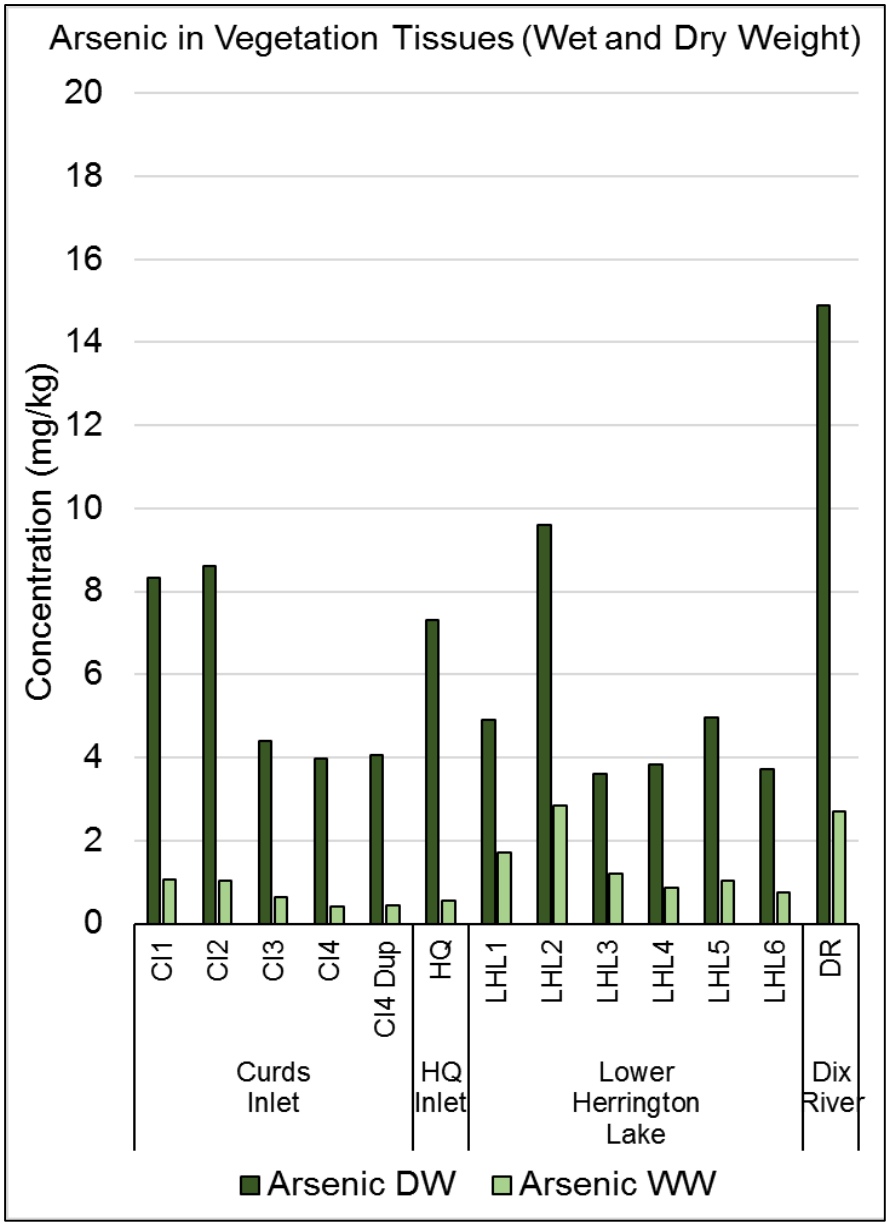
- The two EPA analytical methods 200.8 and 1632A (for speciation) produce similar results.
- Results for As are lower than Kentucky criterion for ecological receptors.
- Human health drinking water criteria is not applicable to pore water.

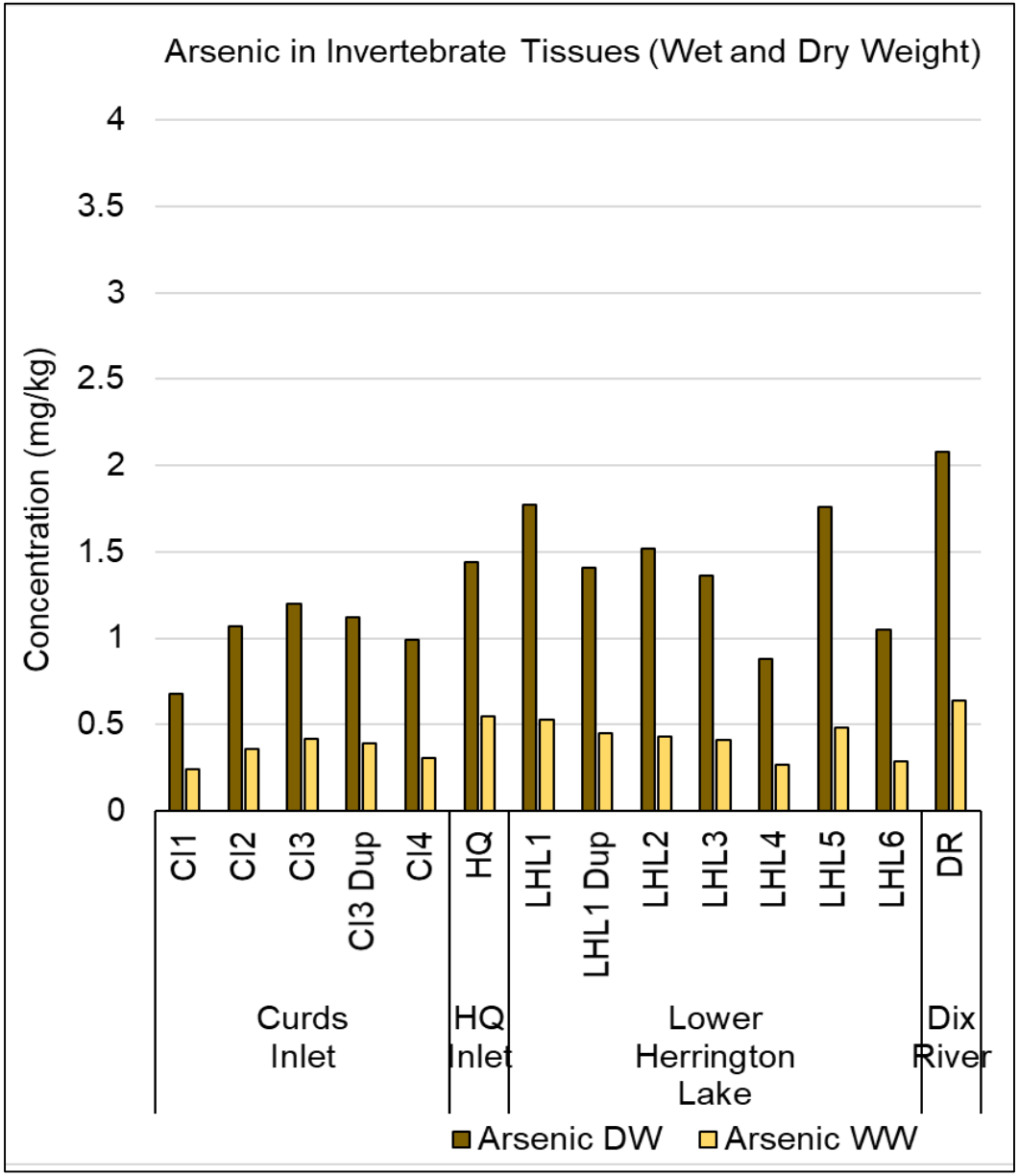
RAMBOLL	**SPECIATED ARSENIC IN SEDIMENT PORE WATER (PHASE I and II)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-4G



Curds Inlet (CI), Data from AMEC (AMEC), Dix River (DR), Duplicate (DUP), Hardin Inlet (Hardin), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

RAMBOLL	**ARSENIC IN SEDIMENT (AMEC FEBRUARY 2017, PHASE I AND PHASE II)**		FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-4H

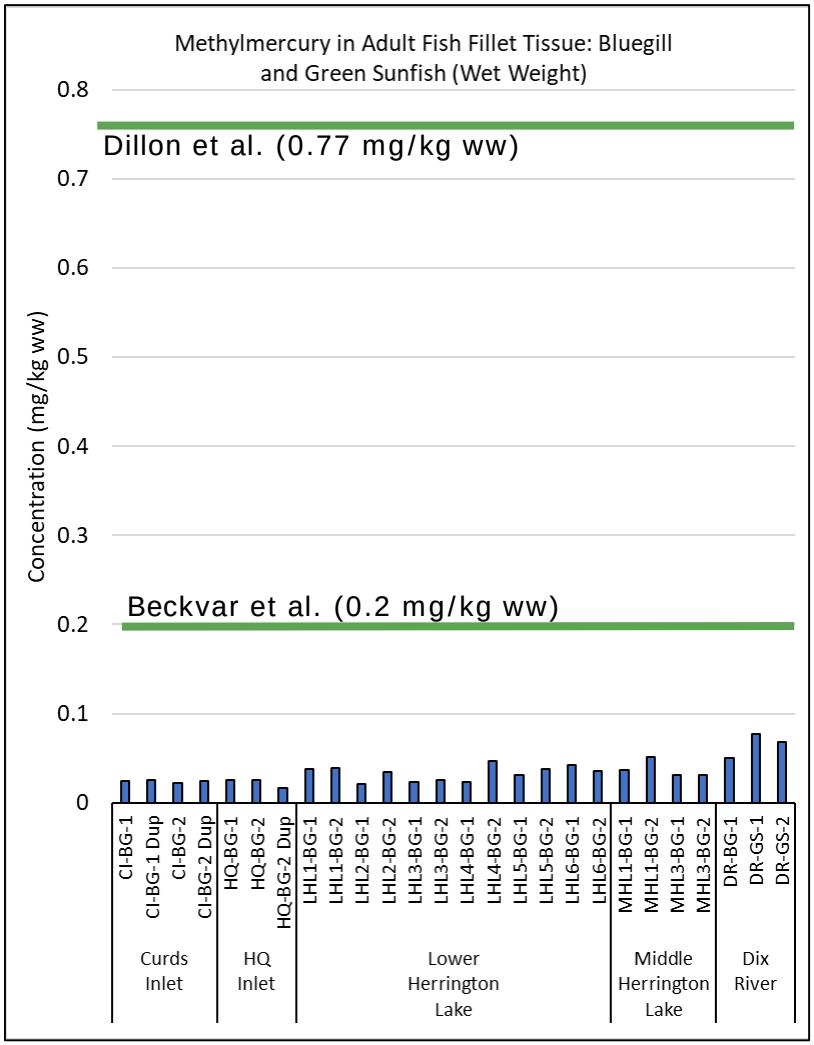


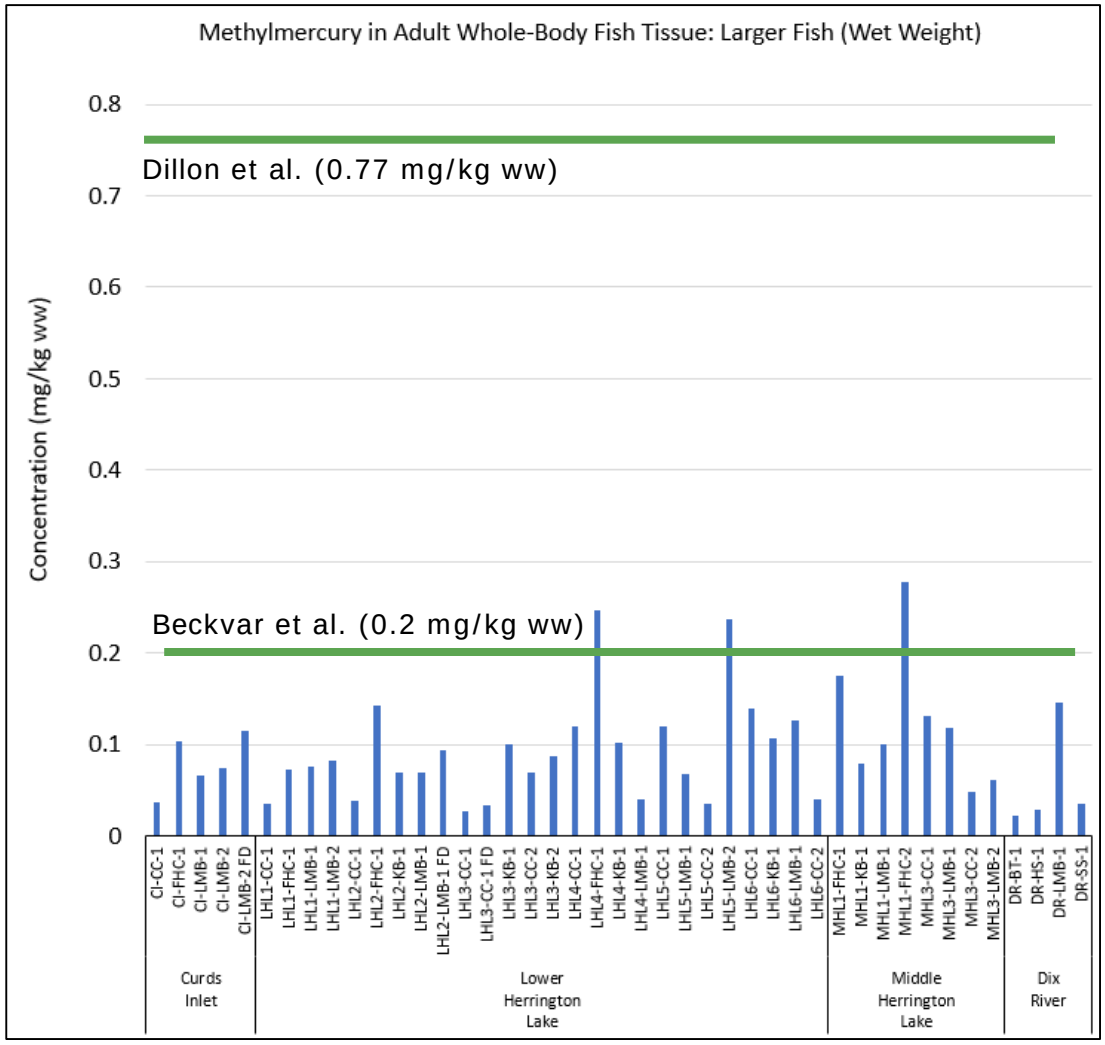


Curds Inlet (CI), Dix River (DR), Dry Weight (DW), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Wet Weight (WW)

Observation
No pattern of high concentration in Curds Inlet

RAMBOLL	**ARSENIC IN VEGETATION AND INVERTEBRATES (PHASE I)**	FIGURE
	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-41
DRAFTED BY: PAL	DATE: 02/01/2019	





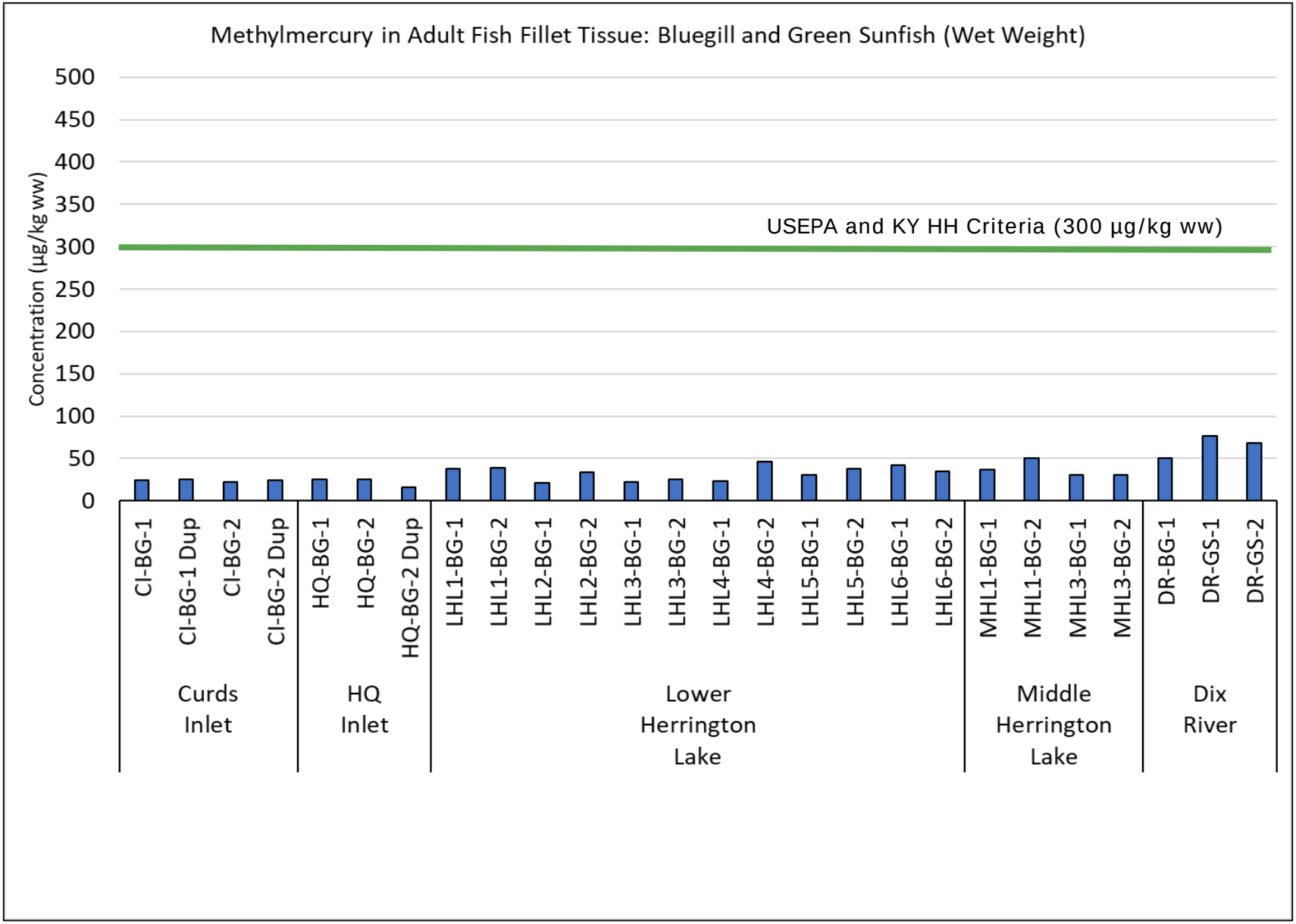
Bluegill (BG), Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Green Sunfish (GS), Flathead Catfish (FHC), Field Duplicate (FD), Kentucky Bass (KB), Largemouth Bass (LMB), HQ Inlet (HQ), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Northern Hogsucker (HS), Spotted Sucker (SS), wet weight (WW)

Observations

Wet weight fillet and whole-body tissue residues.

Ecological screening values include Dillon et al. 2010 (0.77 mg/kg ww) and Beckvar et al. 2005 (0.2 mg/kg).

RAMBOLL	**METHYLMERCURY IN ADULT WHOLE-BODY FISH-TISSUE (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-5A

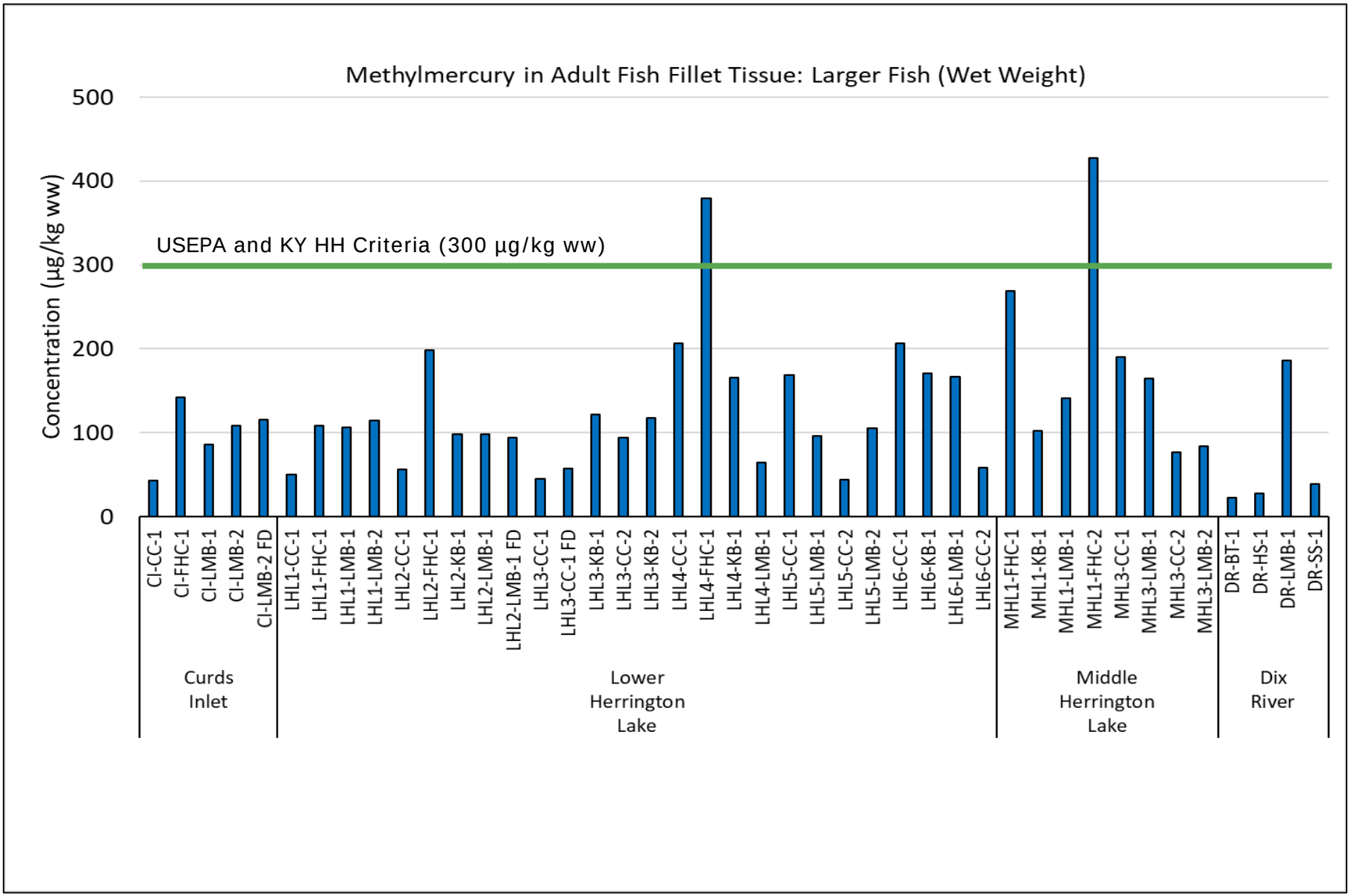


Bluegill (BG), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Green Sunfish (GS), HQ Inlet (HQ), Human Health (HH), Kentucky (KY), Lower Herrington Lake (LHL), micrograms per kilogram (µg/kg), Middle Herrington Lake (MHL), United States Environmental Protection Agency (USEPA), wet weight (ww)

Observation

United States Environmental Protection Agency and Kentucky Human Health criteria of 0.3 mg/kg (300 µg/kg).

RAMBOLL	**METHYLMERCURY IN ADULT FISH FILLET TISSUE: BLUEGILL AND GREEN SUNFISH (WET WEIGHT) (PHASE I)**	FIGURE	
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-5B

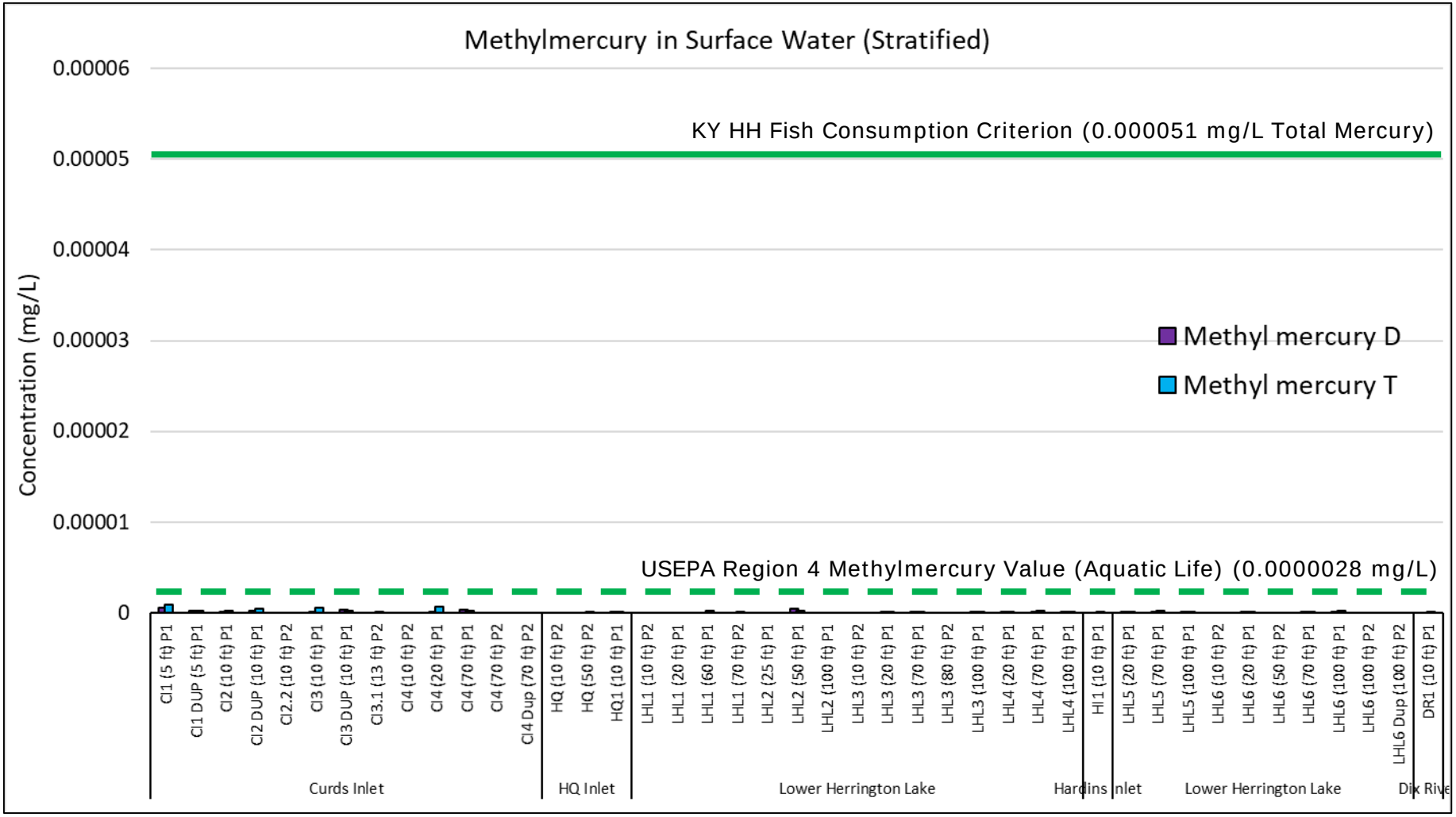


Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Flathead Catfish (FHC), Kentucky (KY), Kentucky Bass (KB), Human Health (HH), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), micrograms per kilogram (µg/kg), Northern Hogsucker (HS), United States Environmental Protection Agency (USEPA), wet weight (ww)

Observation

United States Environmental Protection Agency and Kentucky Human Health criteria of 0.3 mg/kg (300 µg/kg) was exceeded by two fish.

RAMBOLL	**METHYLMERCURY IN ADULT FISH FILLET TISSUE: LARGER FISH (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-5C



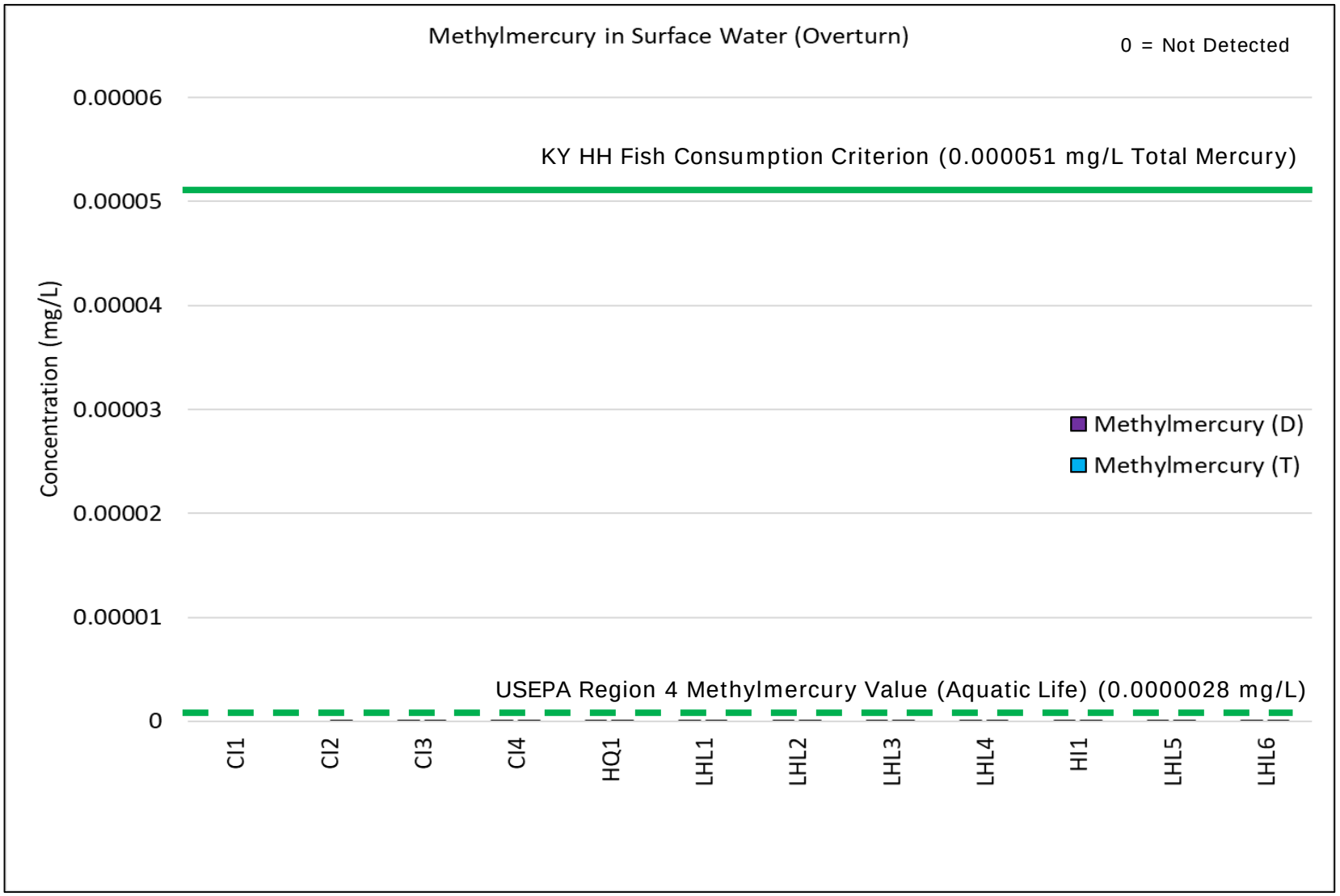
Curds Inlet (CI), Dissolved (D), Dix River (DR), feet (ft), Hardin Inlet (HI), HQ Inlet (HQ), Human Health (HH), Kentucky (KY), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

Observations

Numbers above sample IDs in stratification chart indicate sample depth in feet.
Detections of total and dissolved methylmercury are below criteria.
The following criteria are not shown because they are at higher values than the graph allows:

- Kentucky Ecological Water Quality Criterion (0.00077 mg/L total mercury)
- USEPA Region 4 Ecological Chronic Value (0.00077 mg/L methylmercury)
- Kentucky Human Health drinking water criterion (0.002 mg/L total mercury)

RAMBOLL	**METHYLMERCURY IN STRATIFIED SURFACE WATER (PHASE I AND PHASE II)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-5D



Curds Inlet (CI), Dissolved (D), Hardin Inlet (HI), HQ Inlet (HQ), Human Health (HH), Kentucky (KY), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

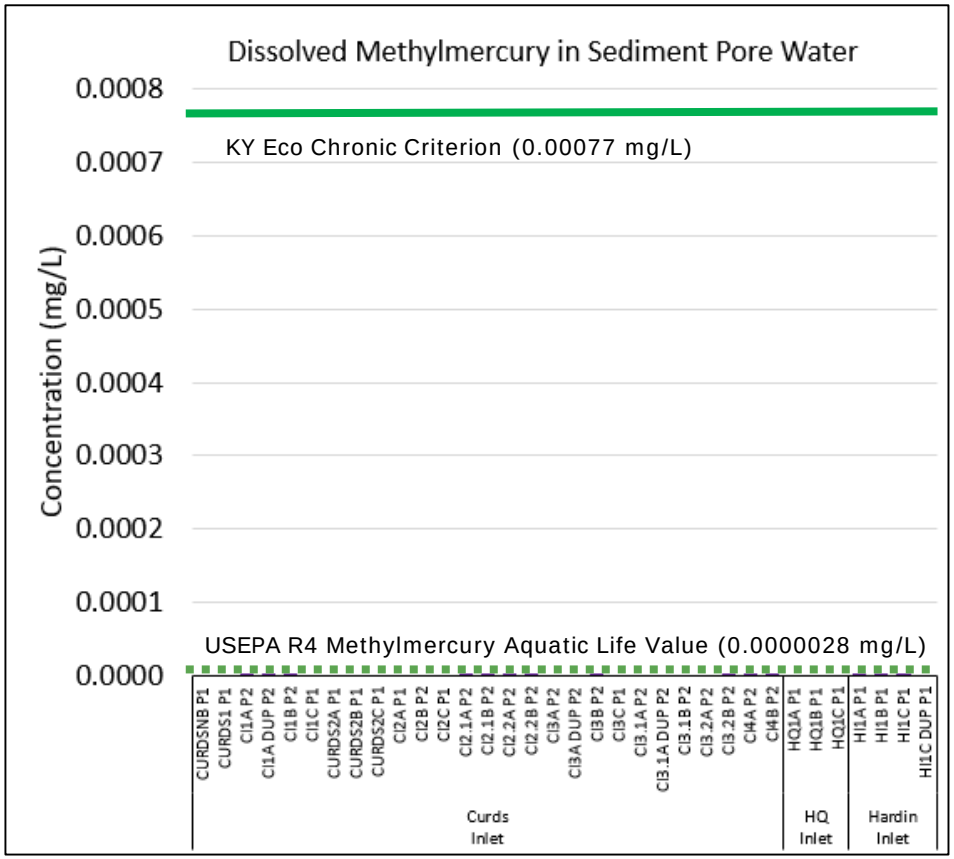
Observations

Numbers above sample IDs in stratification chart indicate sample depth in feet.
Detections of total and dissolved methylmercury are below criteria.
The following criteria are not shown because they are at higher values than the graph allows:

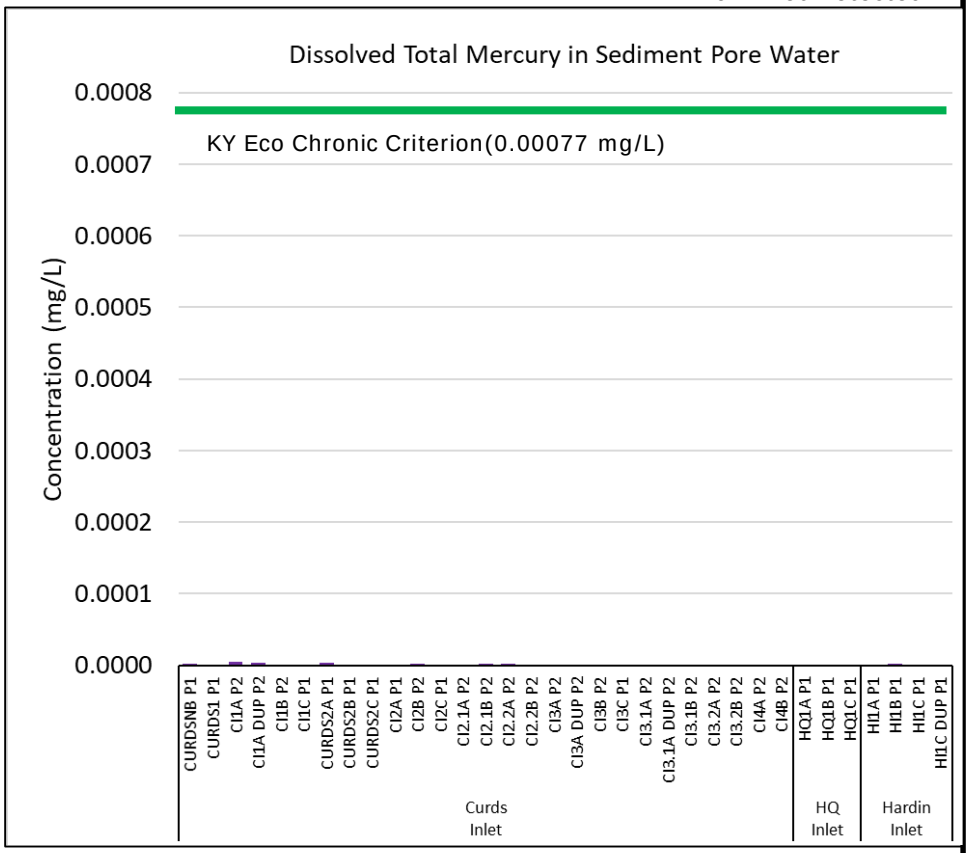
- Kentucky Ecological Water Quality Criterion (0.00077 mg/L total mercury)
- USEPA Region 4 Ecological Chronic Value (0.00077 mg/L methylmercury)
- Kentucky Human Health drinking water criterion (0.002 mg/L total mercury)

RAMBOLL		**METHYLMERCURY IN OVERTURN SURFACE WATER (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-5E

0 = Not Detected



0 = Not Detected



Curds Inlet (CI), Dissolved (D), Duplicate (Dup), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Water Quality Criterion (KY Eco Chronic Criterion), milligrams per liter (mg/L), Phase I (P1), Phase 2 (P2), United States Environmental Protection Agency (USEPA)

Observations

The USEPA Region 4 methylmercury wildlife value and human health water quality criterion are not shown because it is not appropriate for pore water.

RAMBOLL

DRAFTED BY: PAL

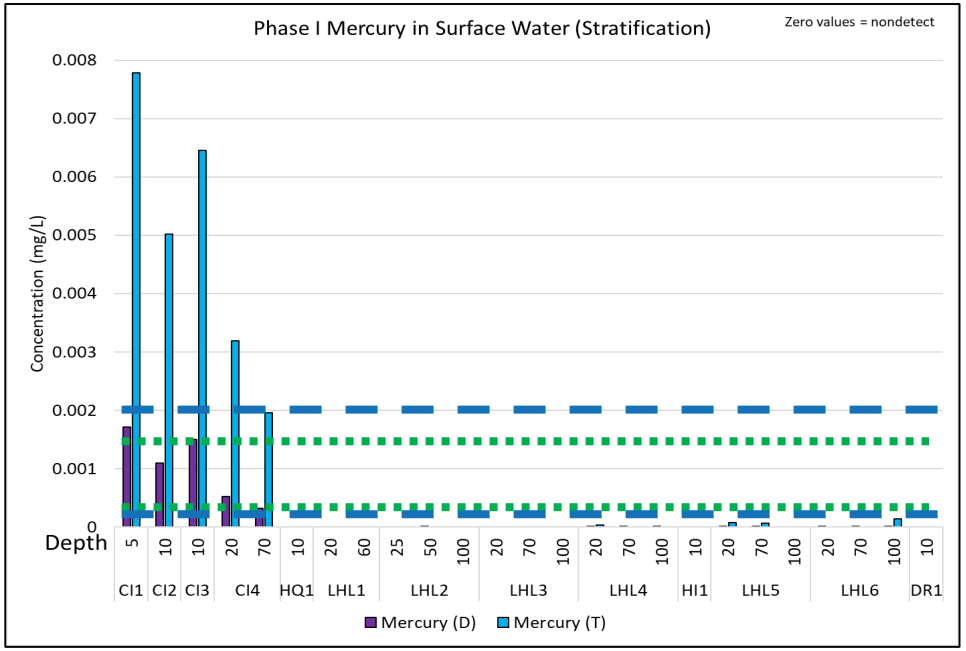
DATE: 02/01/2019

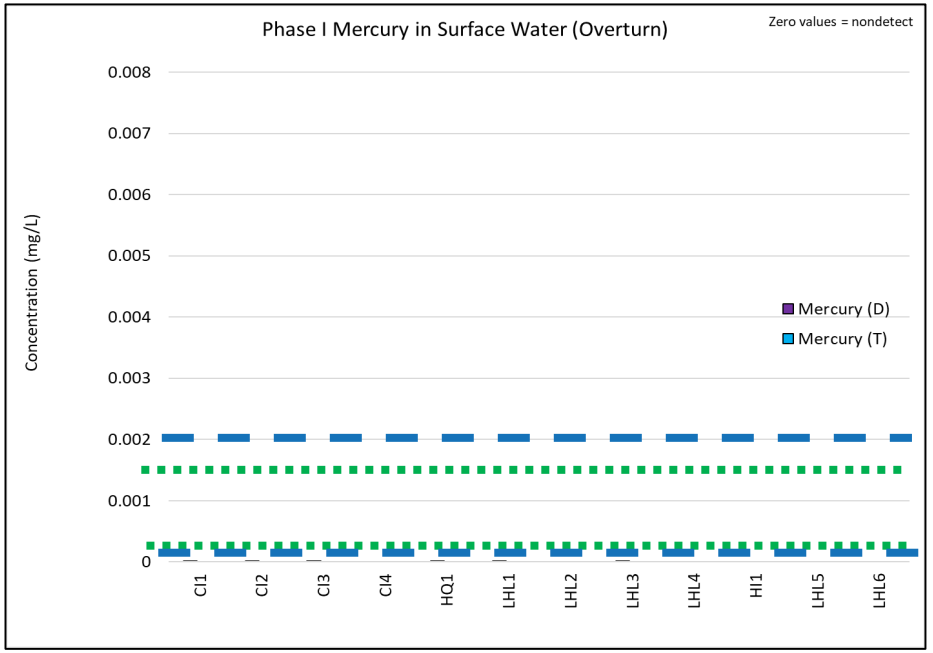
DISSOLVED TOTAL MERCURY AND DISSOLVED METHYLMERCURY IN PORE WATER (PHASE I AND PHASE II)

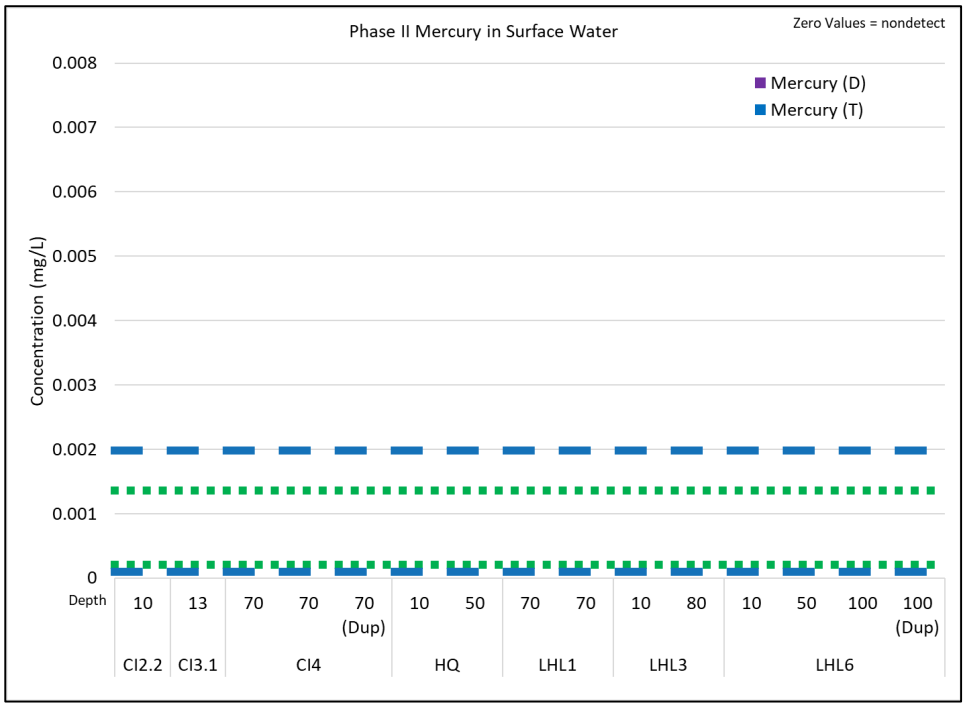
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-5F







- Kentucky (KY) Human Health Drinking Water Quality Criterion (0.002 mg/L)
- KY Ecological (Eco) Acute Water Quality Criterion (0.0014 mg/L)
- KY Eco Chronic Water Quality Criterion (0.00077 mg/L)
- KY Human Health Fish Consumption (0.000051 mg/L)
- USEPA R4 Wildlife Based Value (0.0000013 mg/L)

Curds Inlet (CI), Dissolved (D), Dix River (DR), Duplicate (Dup), Hardin Inlet (HI), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

Observations

Numbers above sample IDs indicate sample depth in feet.
USEPA Region 4 chronic value for wildlife is based on fish eating wildlife.
Phase I includes stratified and overturn data. Phase II includes only stratified data.
Elevated mercury seen during stratified sampling was not seen during lake overturn sampling in Phase I sampling. Elevated mercury was not seen during Phase II stratified lake sampling, indicating a transient condition in Curds Inlet.

Human Health Observations

Kentucky Human Health (HH) Water Quality Criterion for mercury is for fish consumption (see data for mercury in fish)
Kentucky HH Water Quality Criterion apply at point of surface water withdrawal for domestic drinking water use.

The subsequent figure shows the same information but at an expanded scale so the very low concentrations are more easily visualized.

RAMBOLL

DRAFTED BY: PAL

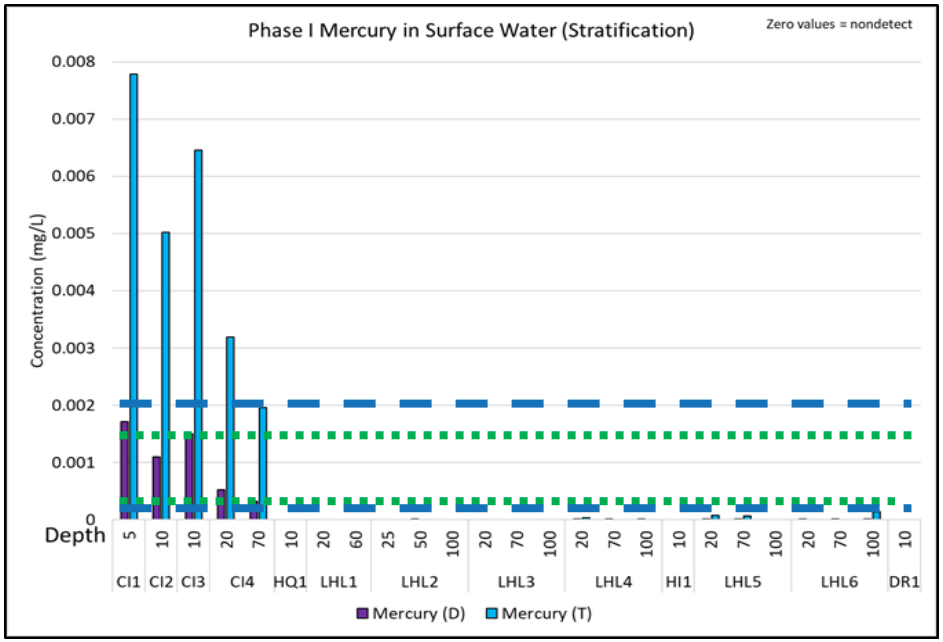
DATE: 02/01/2019

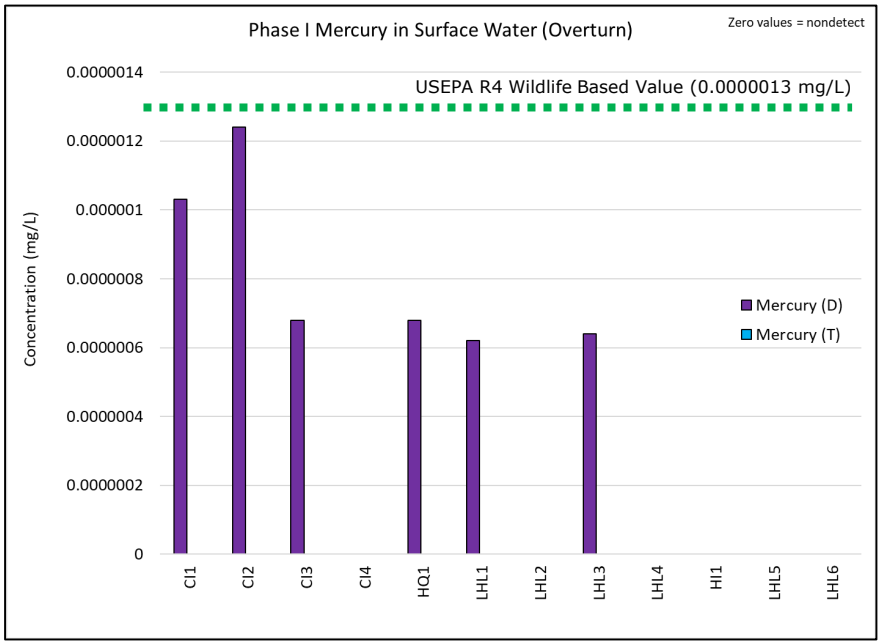
TOTAL MERCURY IN STRATIFIED AND OVERTURN SURFACE WATER (PHASE I AND PHASE II)

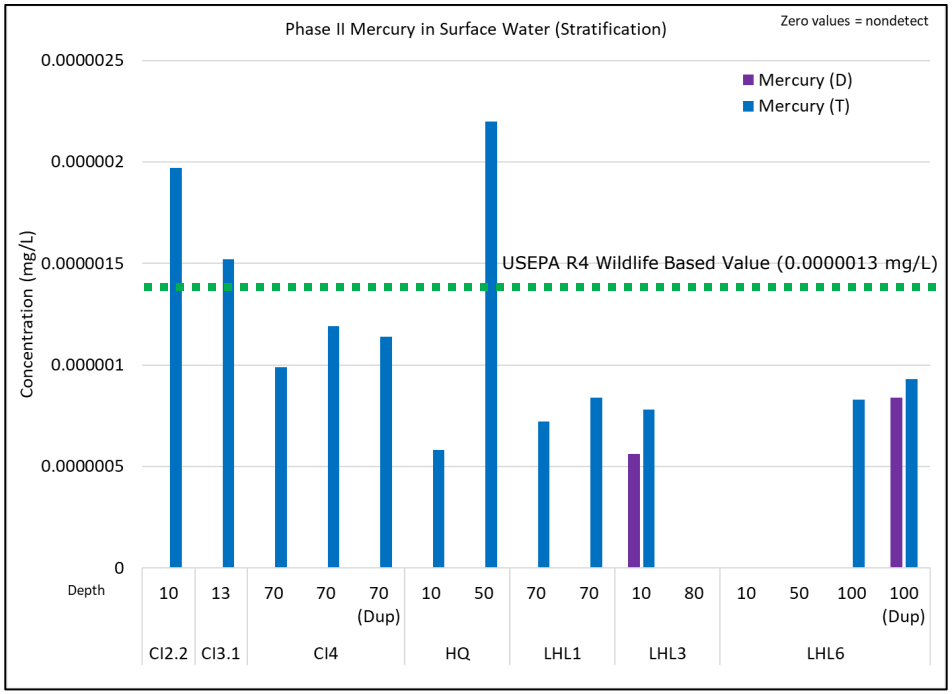
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-5G







- Kentucky (KY) Human Health Drinking Water Quality Criterion (0.002 mg/L)
- KY Ecological (Eco) Acute Water Quality Criterion (0.0014 mg/L)
- KY Eco Chronic Water Quality Criterion (0.00077 mg/L)
- KY Human Health Fish Consumption (0.000051 mg/L)
- USEPA R4 Wildlife Based Value (0.0000013 mg/L)

Curds Inlet (CI), Dissolved (D), Dix River (DR), Duplicate (Dup), Hardin Inlet (HI), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

Observations

Numbers above sample IDs indicate sample depth in feet.
USEPA Region 4 chronic value for wildlife is based on fish eating wildlife.
Phase I includes stratified and overturn data. Phase II includes only stratified data.
Elevated mercury seen during stratified sampling was not seen during lake overturn sampling in Phase I sampling. Elevated mercury was not seen during Phase II stratified lake sampling, indicating a transient condition in Curds Inlet.

Human Health Observations

Kentucky Human Health (HH) Water Quality Criterion for mercury is for fish consumption (see data for mercury in fish)
Kentucky HH Water Quality Criterion apply at point of surface water withdrawal for domestic drinking water use.

The previous figure shows the same information, but this figure shows an expanded scale so the very low concentrations are more easily visualized.

RAMBOLL

DRAFTED BY: PAL

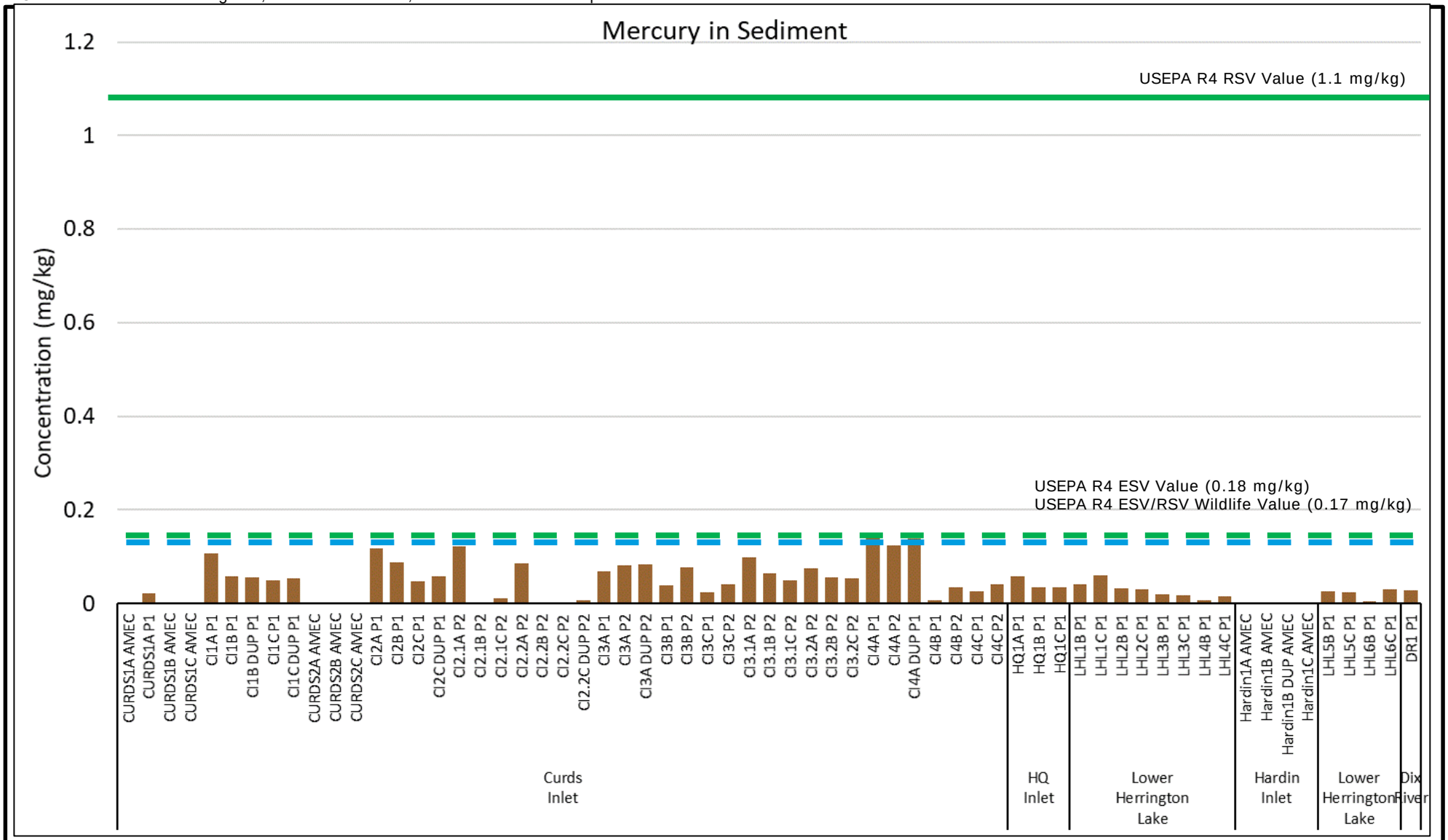
DATE: 02/01/2019

TOTAL MERCURY IN STRATIFIED AND OVERTURN SURFACE WATER (PHASE I AND PHASE II) EXPANDED SCALE

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-5H

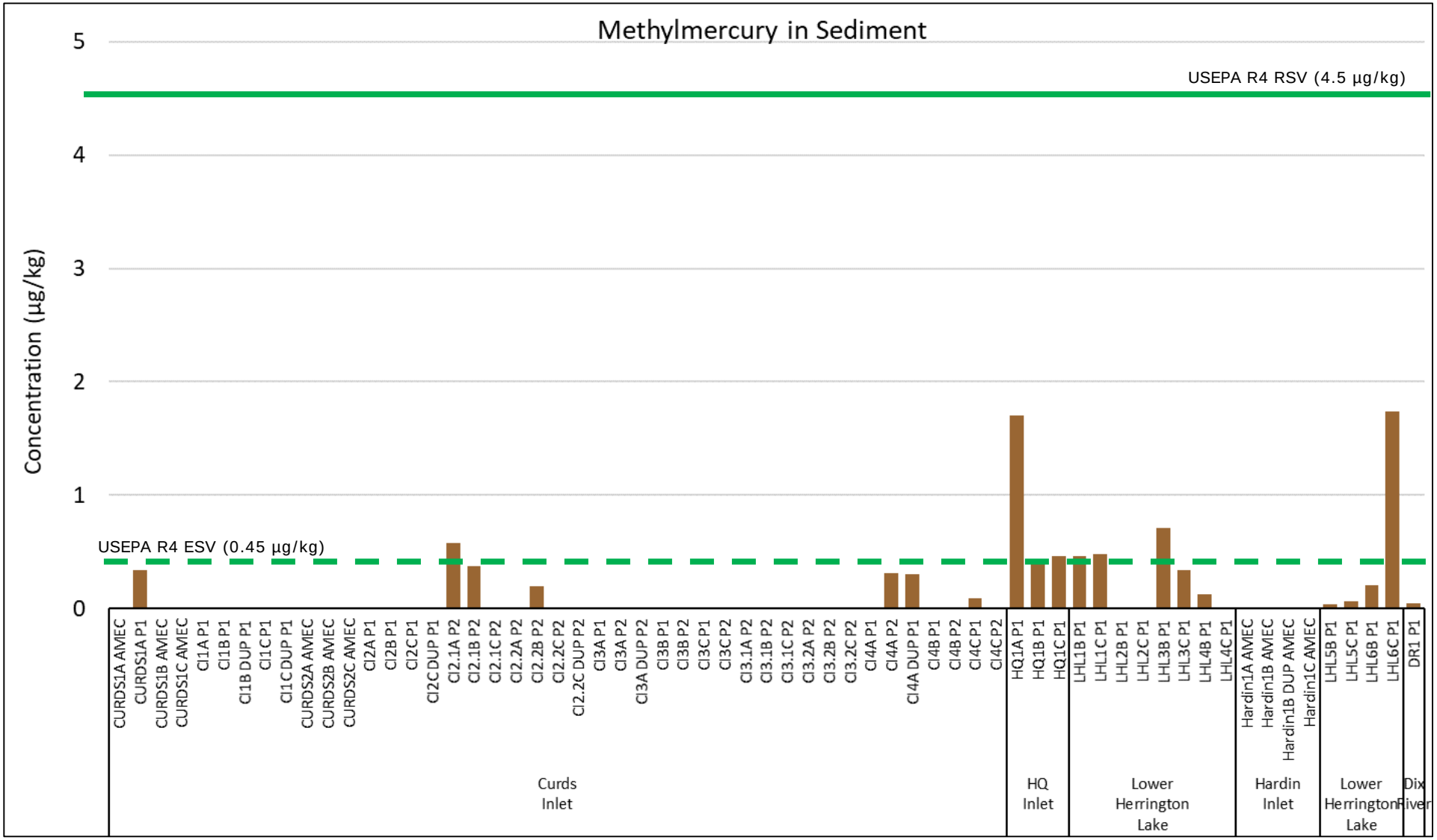


Curds Inlet (CI), Data from AMEC (AMEC), Dix River (DR), Duplicate (Dup), Ecological Screening Value (ESV), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Refinement Screening Value (RSV), Region 4 (R4), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Observation

USEPA Human Health Regional Screening Levels for residential soil include values for mercury (inorganic) of 23 mg/kg and methylmercury of 8 mg/kg.

RAMBOLL	**TOTAL MERCURY IN SEDIMENT (AMEC FEBRUARY 2017, PHASE I, AND PHASE II)**		FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-5I

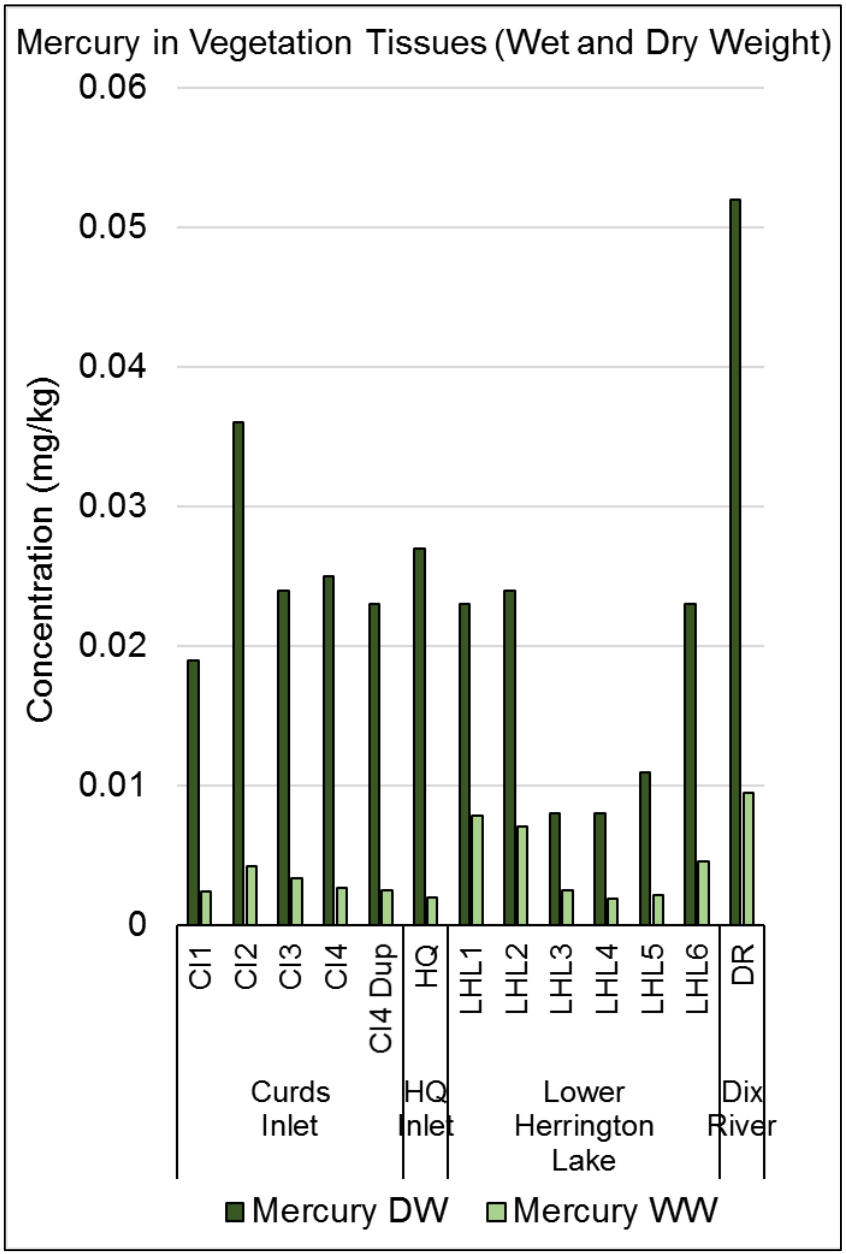


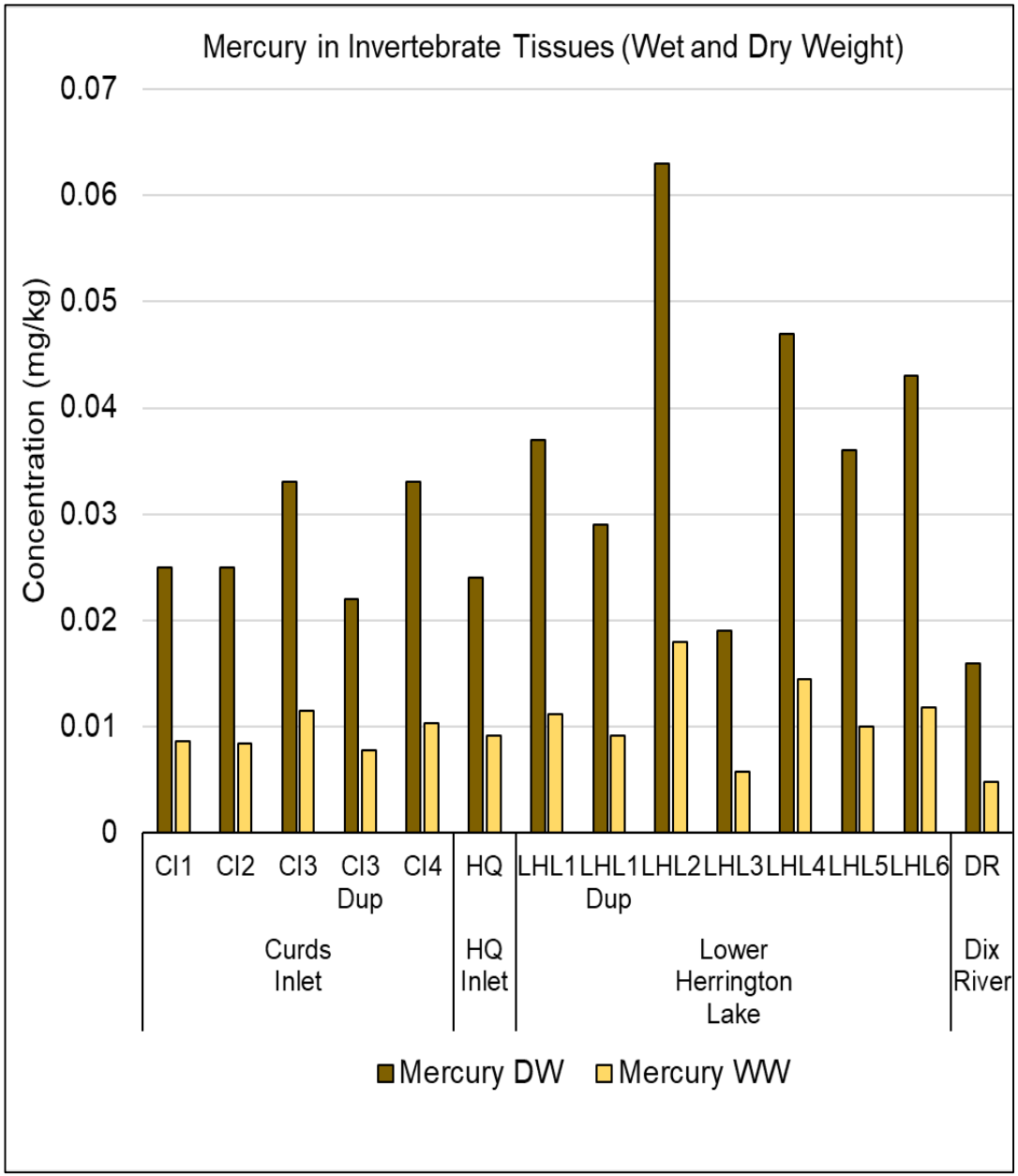
Curds Inlet (CI), Data from AMEC (AMEC), Dix River (DR), Duplicate (Dup), Ecological Screening Value (ESV), HQ Inlet (HQ), Lower Herrington Lake (LHL), micrograms per kilogram (µg/kg), Refinement Screening Value (RSV), Region 4 (R4), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Observation

USEPA Human Health Regional Screening Levels for residential soil include values for mercury (inorganic) of 23 mg/kg and methylmercury of 8 mg/kg.

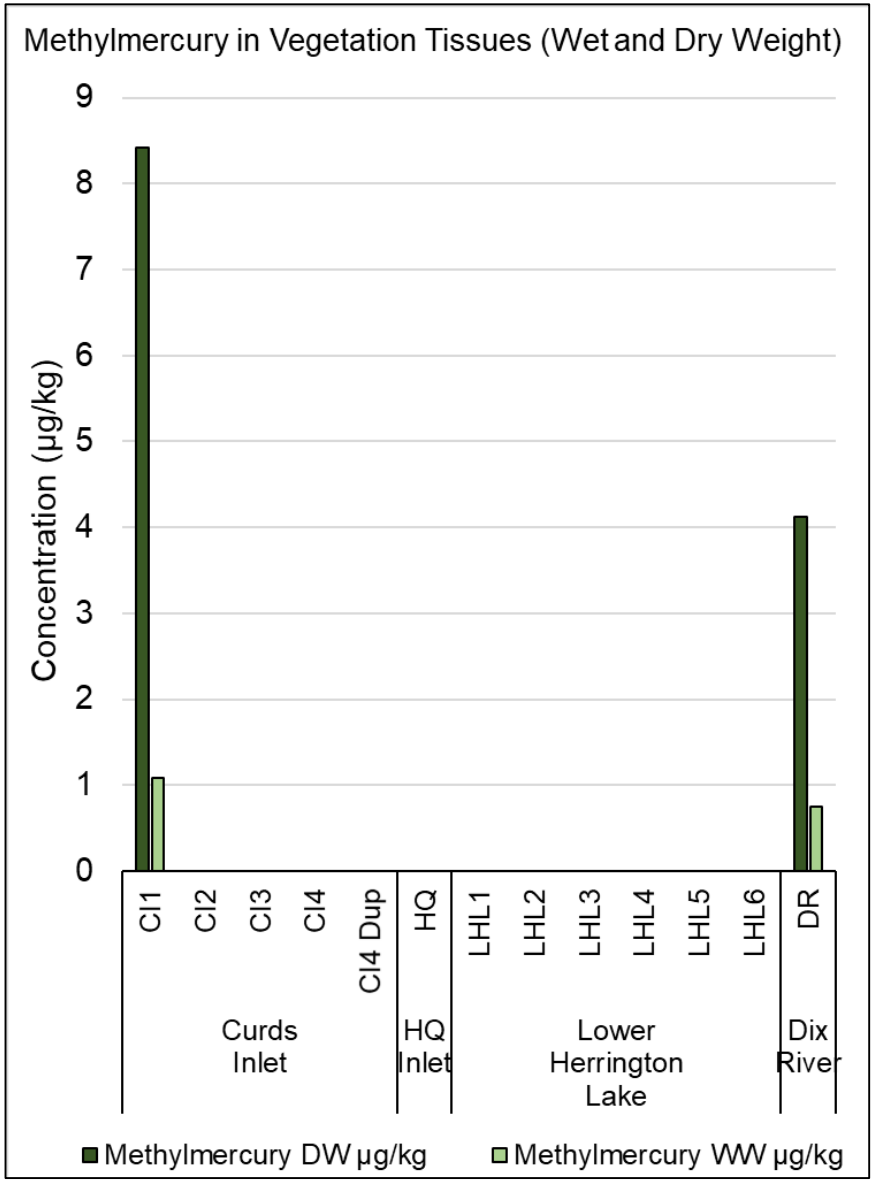
RAMBOLL	**METHYLMERCURY IN SEDIMENT (AMEC FEBRUARY 2017, PHASE I, AND PHASE II)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-5J
DRAFTED BY: PAL	DATE: 02/01/2019	

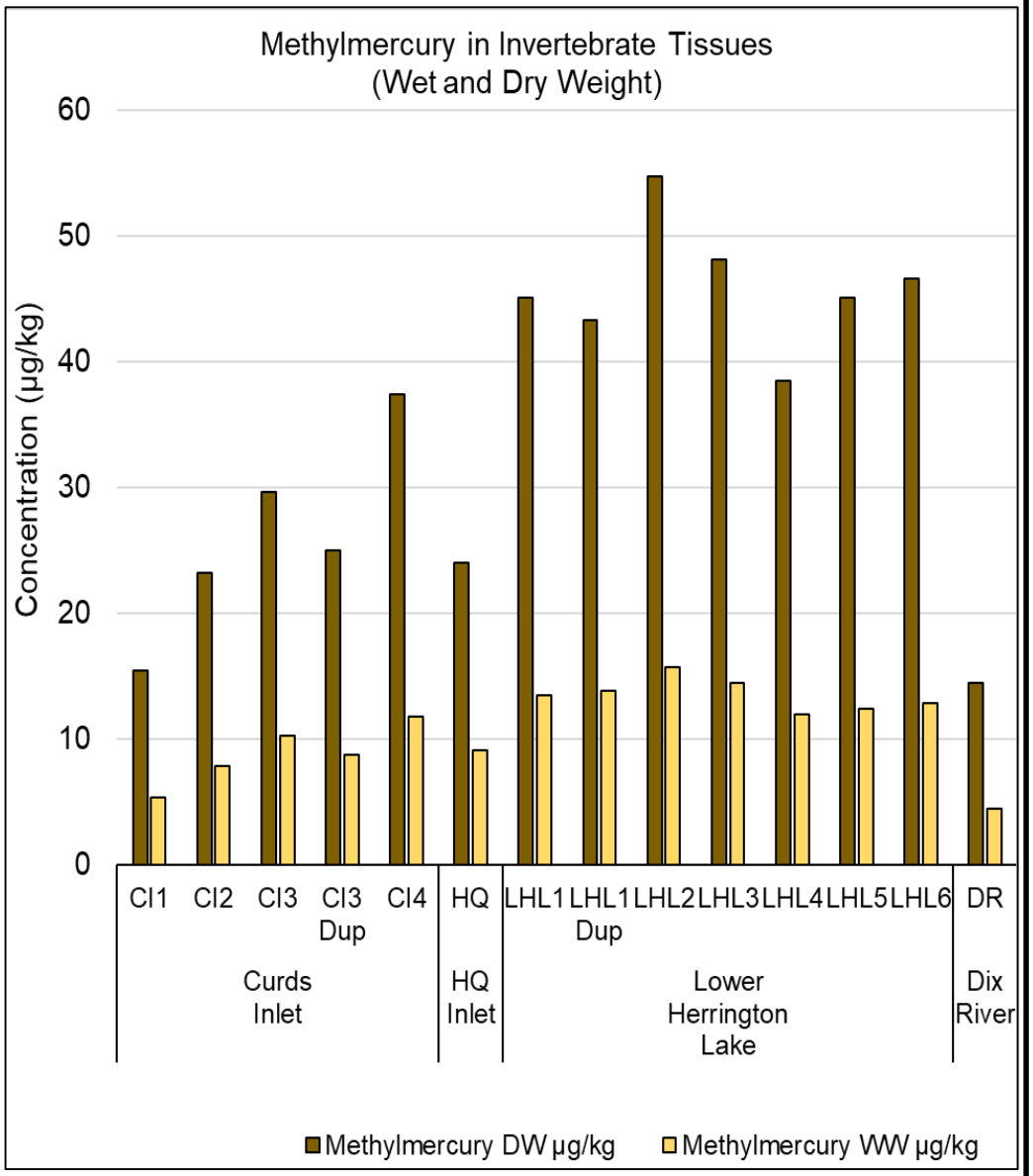




Curds Inlet (CI), Dix River (DR), Dry Weight (DW), Duplicate (Dup), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Wet Weight (WW)

RAMBOLL		**TOTAL MERCURY IN VEGETATION AND INVERTEBRATES (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-5K

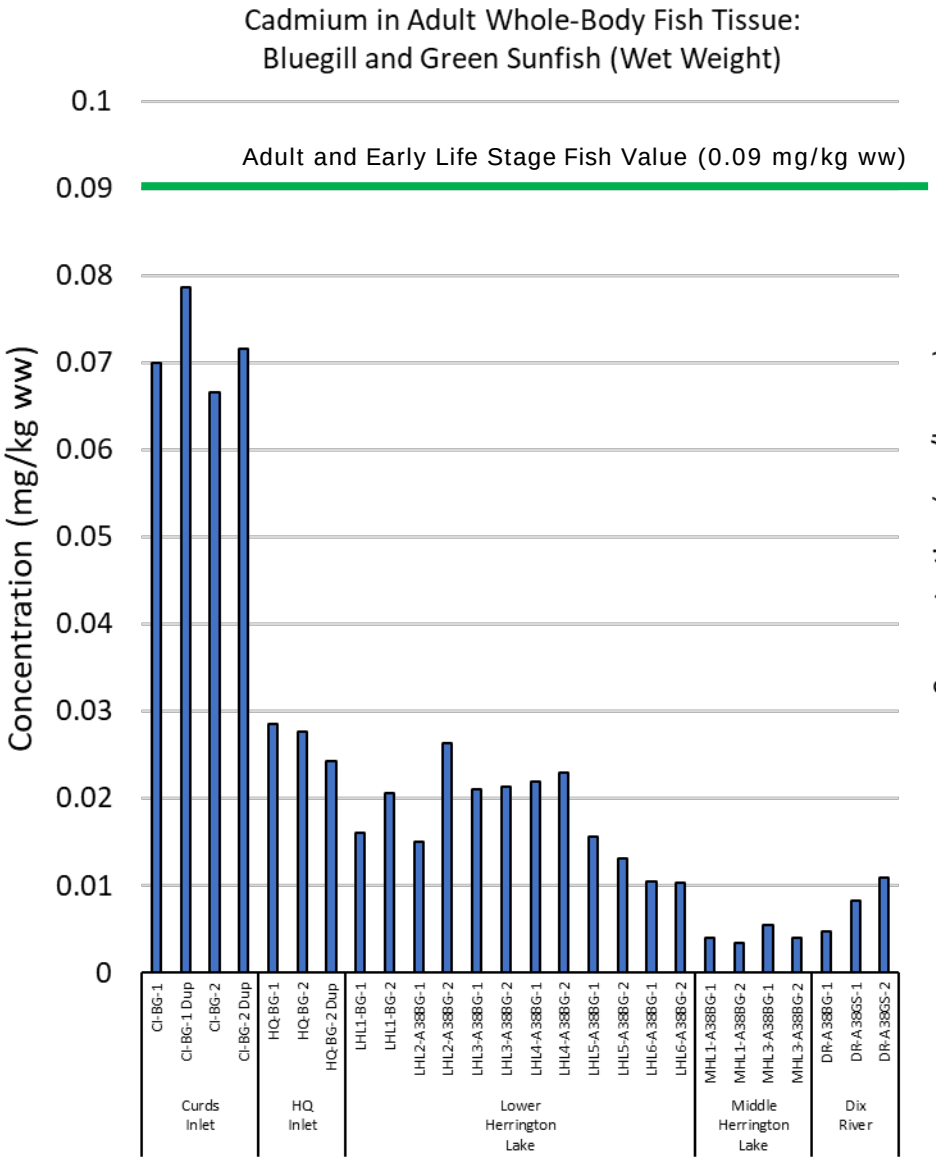


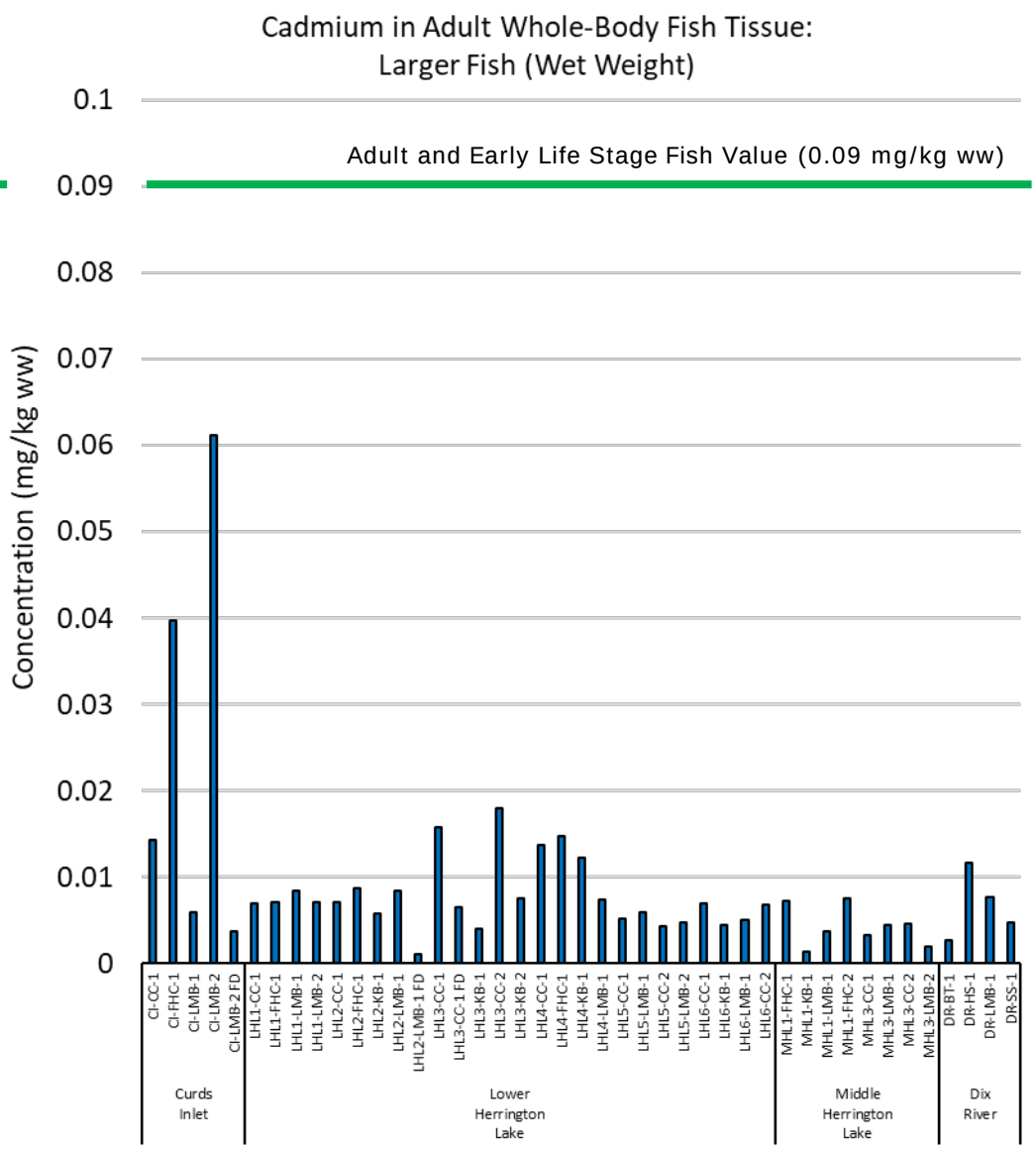


Curds Inlet (CI), Dix River (DR), Dry Weight (DW), Duplicate (Dup), HQ Inlet (HQ), Lower Herrington Lake (LHL), micrograms per kilogram (µg/kg), Wet Weight (WW)

Observation
Blank values indicate the constituent was not detected.

RAMBOLL	**METHYLMERCURY IN VEGETATION AND INVERTEBRATES (PHASE I)**	FIGURE
	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-5L
DRAFTED BY: PAL	DATE: 02/01/2019	



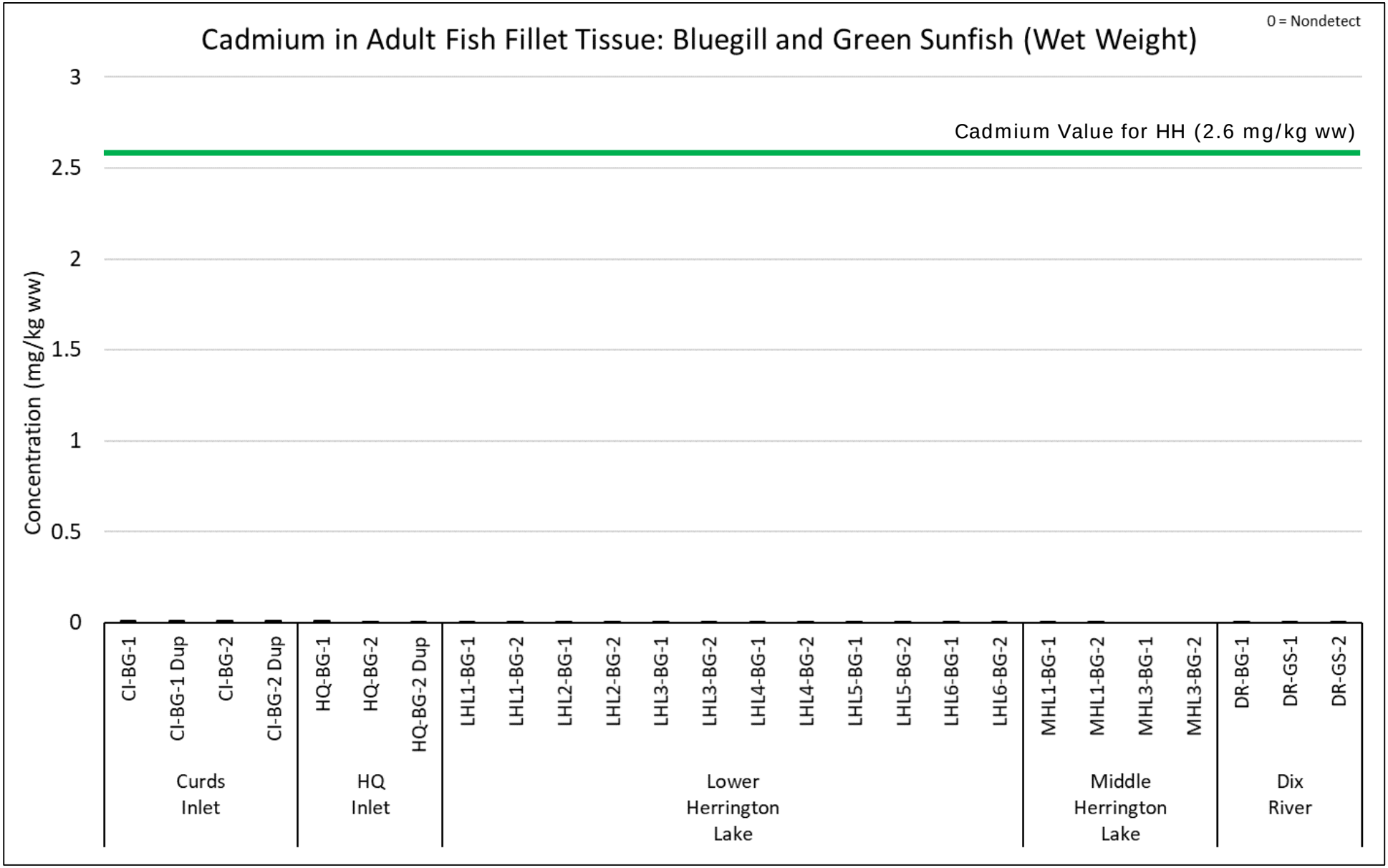


Bluegill (BG), Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Field Duplicate (FD), Flathead Catfish (FHC), Green Sunfish (GS), HQ Inlet (HQ), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Northern Hogsucker (HS), Spotted Sucker (SS), wet weight (ww)

Observation

Ecological fish tissue screening levels for adult and early life stage are from scientific literature, including Jarvinen and Ankley (1999).

RAMBOLL	**CADMIUM IN ADULT WHOLE-BODY FISH TISSUE (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-6A

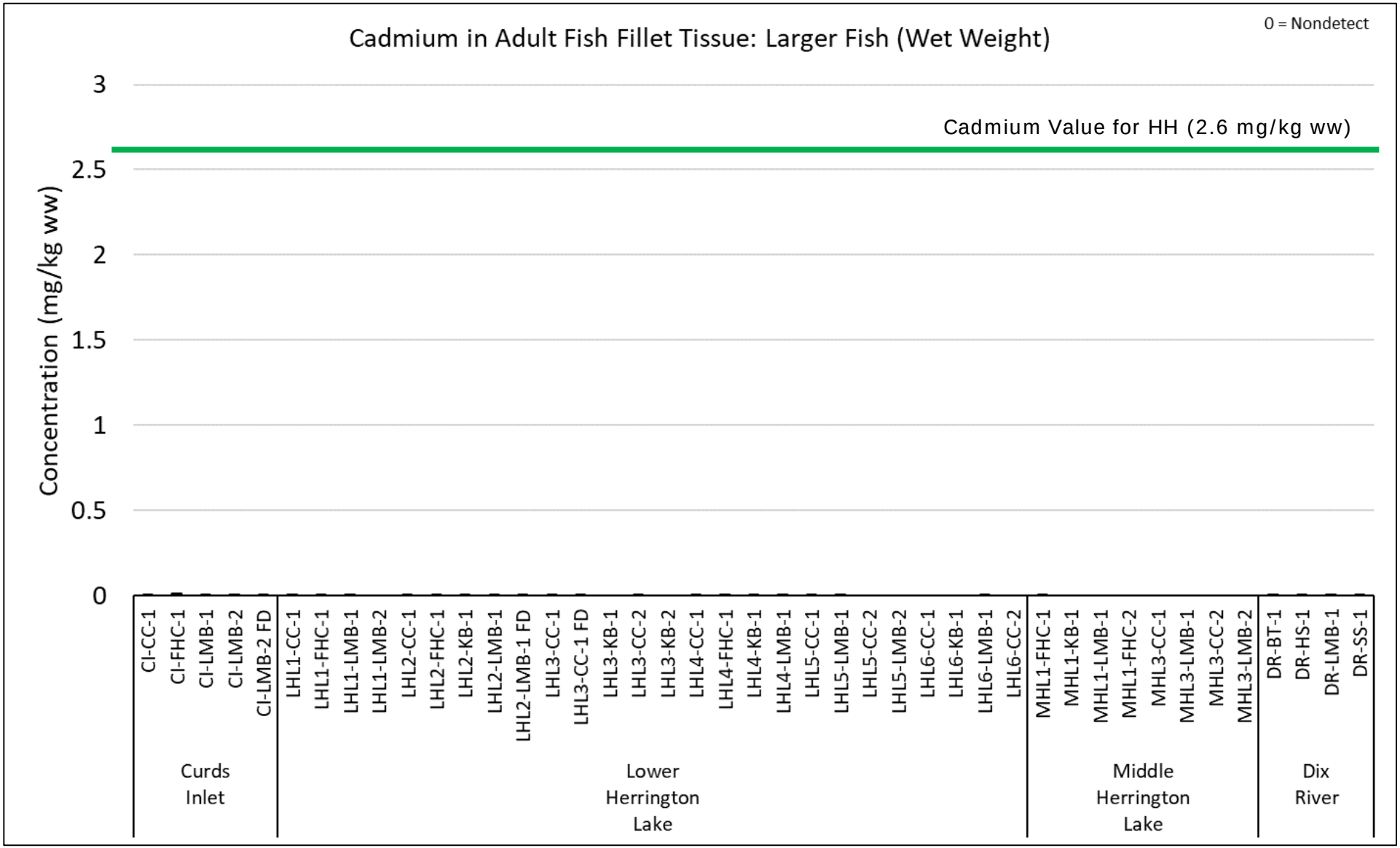


Bluegill (BG), Curds Inlet (CI), Dix River (DR), Green Sunfish (GS), HQ Inlet (HQ), Human Health (HH), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), wet weight (ww)

Observation

Human health risk based concentration (2.6 mg/kg ww) is derived assuming 50 meals per year by an adult.

RAMBOLL	**CADMIUM IN ADULT FISH TISSUE BLUEGILL AND GREEN SUNFISH (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-6B

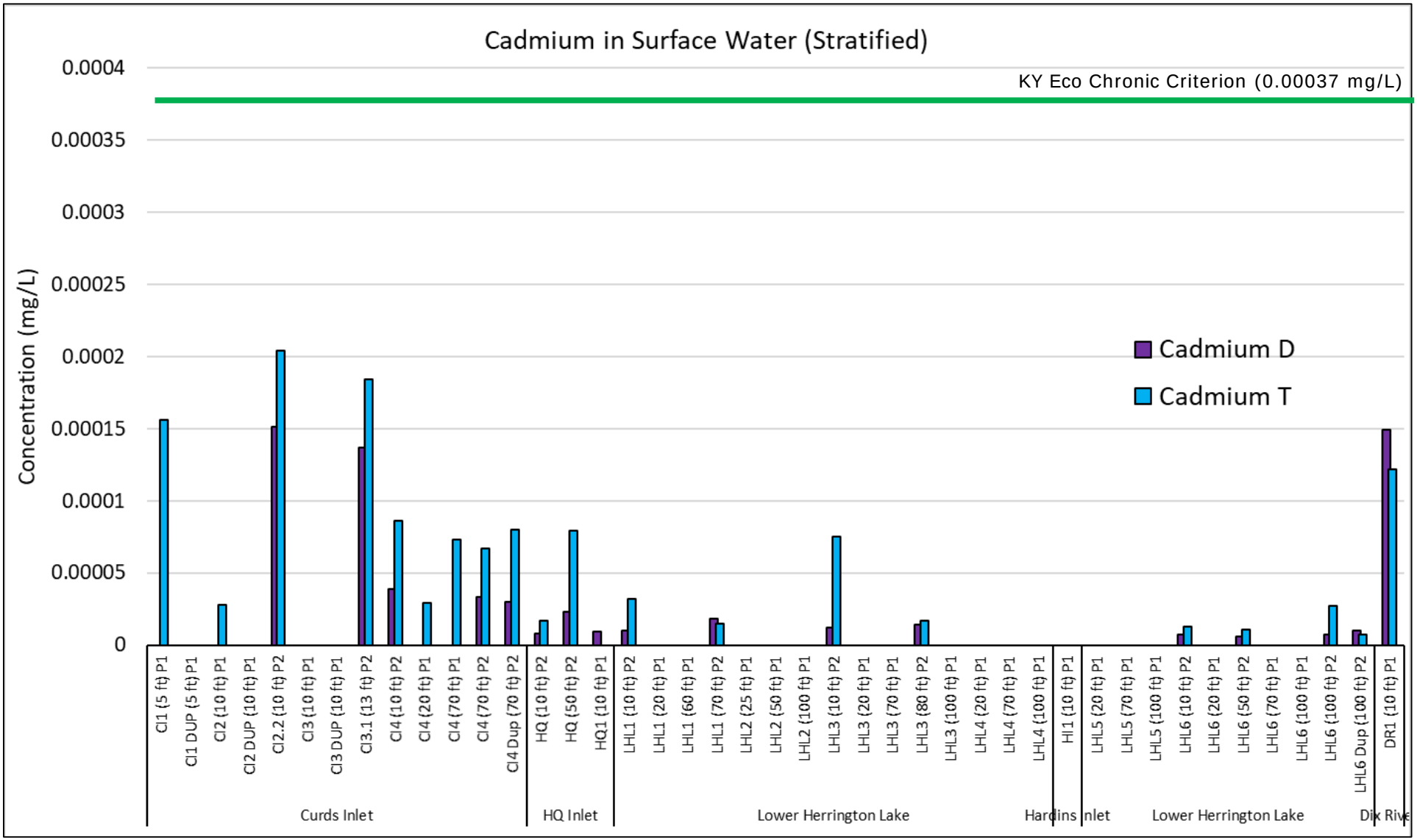


Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Field Duplicate (FD), Flathead Catfish (FHC), HQ Inlet (HQ), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Northern Hogsucker (HS), wet weight (ww)

Observation

Human health risk based concentration (2.6 mg/kg ww) is derived assuming 50 meals per year by an adult.

RAMBOLL	**CADMIUM IN ADULT FISH FILLET TISSUE: LARGER FISH (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-6C

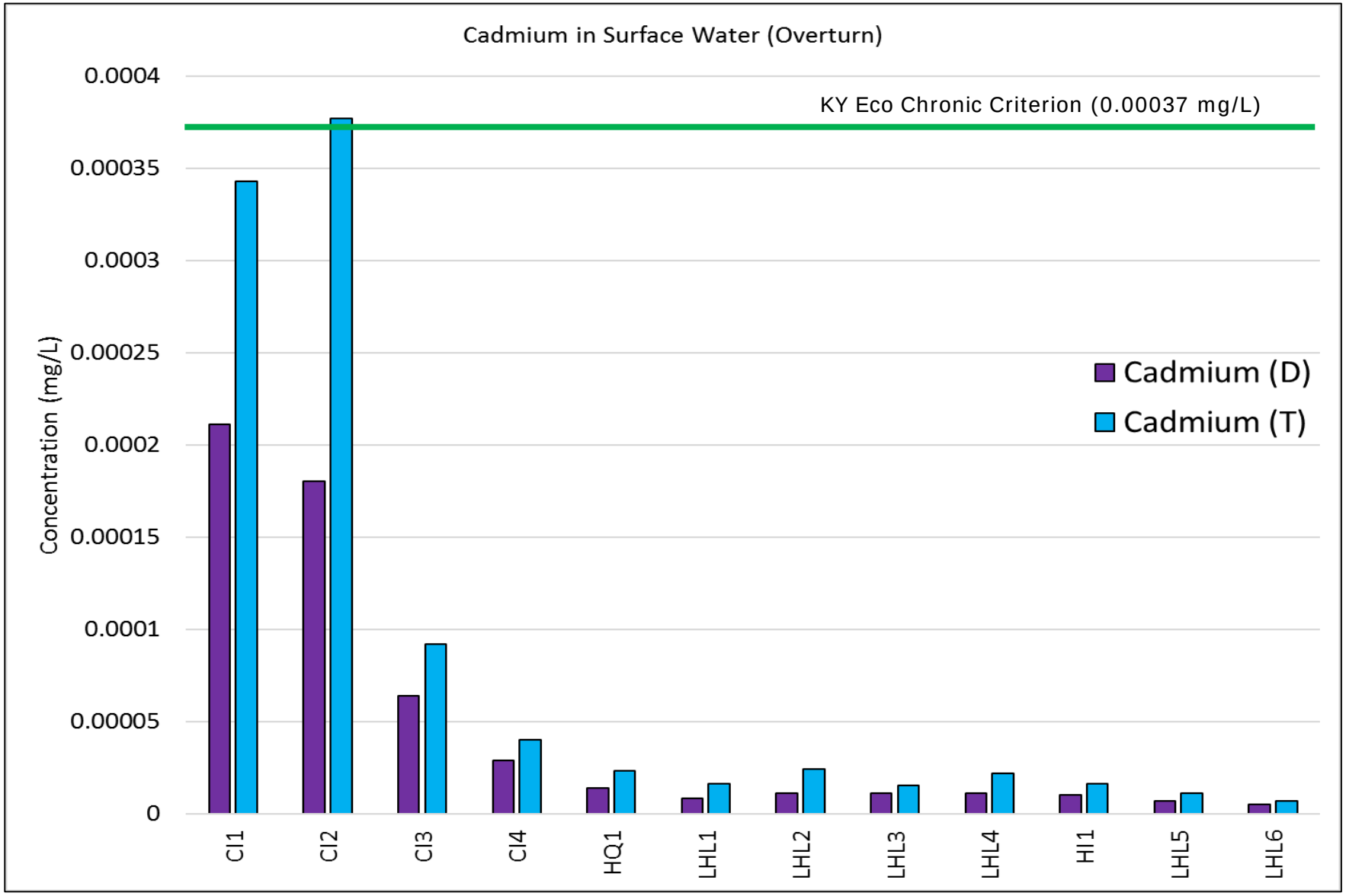


Curds Inlet (CI), Dissolved (D), Dix River (DR), Duplicate (Dup), feet (ft), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Water Quality Criterion (KY Eco Chronic Criterion), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

Observations

Numbers above sample IDs in stratification chart indicate sample depth in feet (ft).
Human Health Kentucky Water Quality Criterion and USEPA Maximum Contaminant Level is 0.005 mg/L.
The Kentucky Ecological Criterion for Cadmium is calculated based on surface water hardness.

RAMBOLL	**CADMIUM IN STRATIFIED SURFACE WATER (PHASE I AND PHASE II)**	FIGURE
	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-6D
DRAFTED BY: PAL	DATE: 02/01/2019	

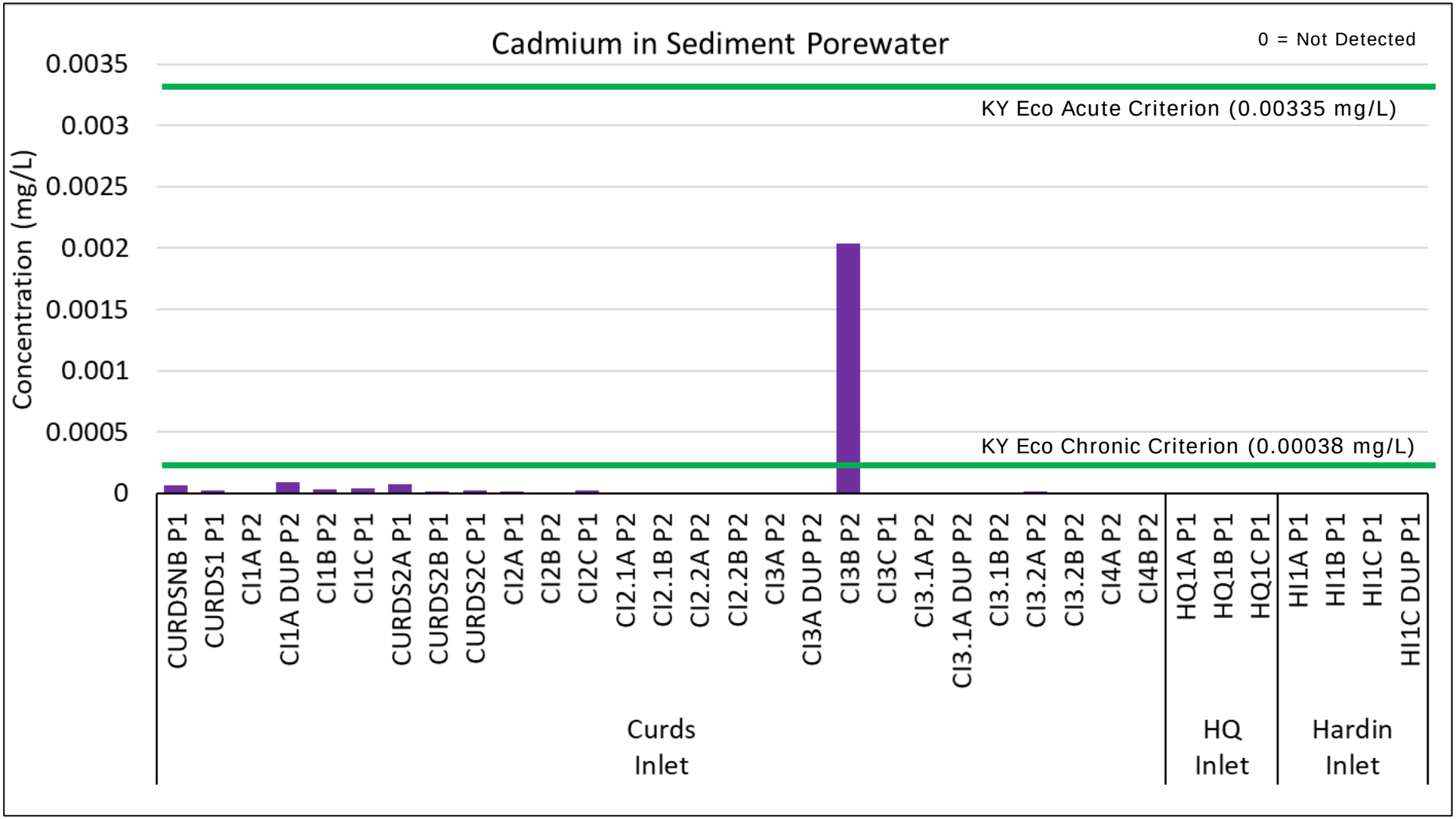


Curds Inlet (CI), Dissolved (D), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Water Quality Criterion (KY Eco Chronic Criterion), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Total Unfiltered (T)

Observations

Numbers above sample IDs in stratification chart indicate sample depth in feet.
Human Health Kentucky Water Quality Criterion and USEPA Maximum Contaminant Level is 0.005 mg/L.
The Kentucky Eco Criterion for Cadmium is calculated based on surface water hardness.

RAMBOLL		**CADMIUM IN OVERTURN SURFACE WATER (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-6E

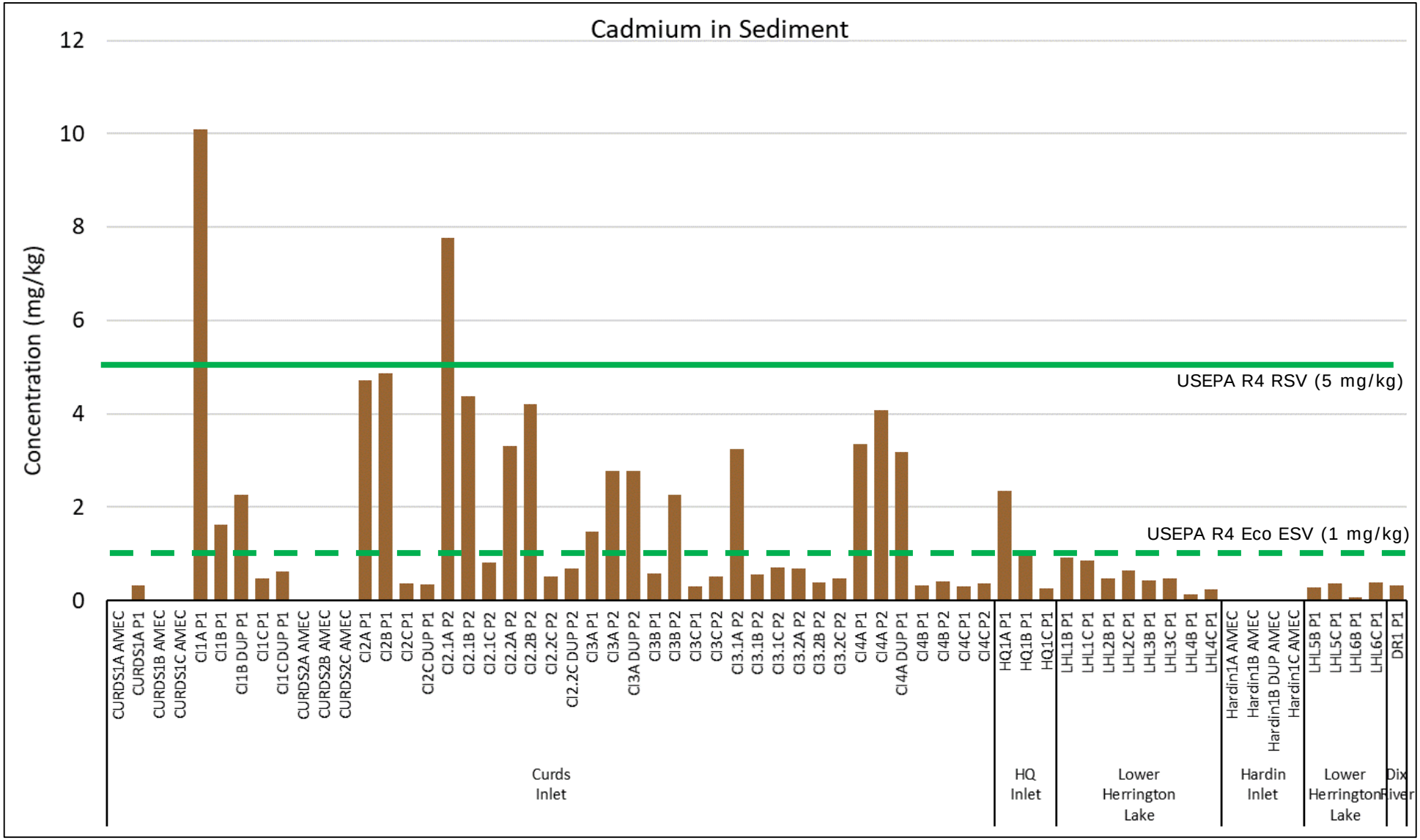


Curds Inlet (CI), Duplicate (Dup), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Water Quality Criterion (KY Eco Criterion), milligrams per liter (mg/L), Phase I (P1), Phase II (P2)

Observations

The Kentucky Eco Criterion for Cadmium is calculated based on surface water hardness.

RAMBOLL	**CADMIUM IN SEDIMENT POREWATER (PHASE I AND PHASE II)**	FIGURE
	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-6F
DRAFTED BY: PAL	DATE: 02/01/2019	

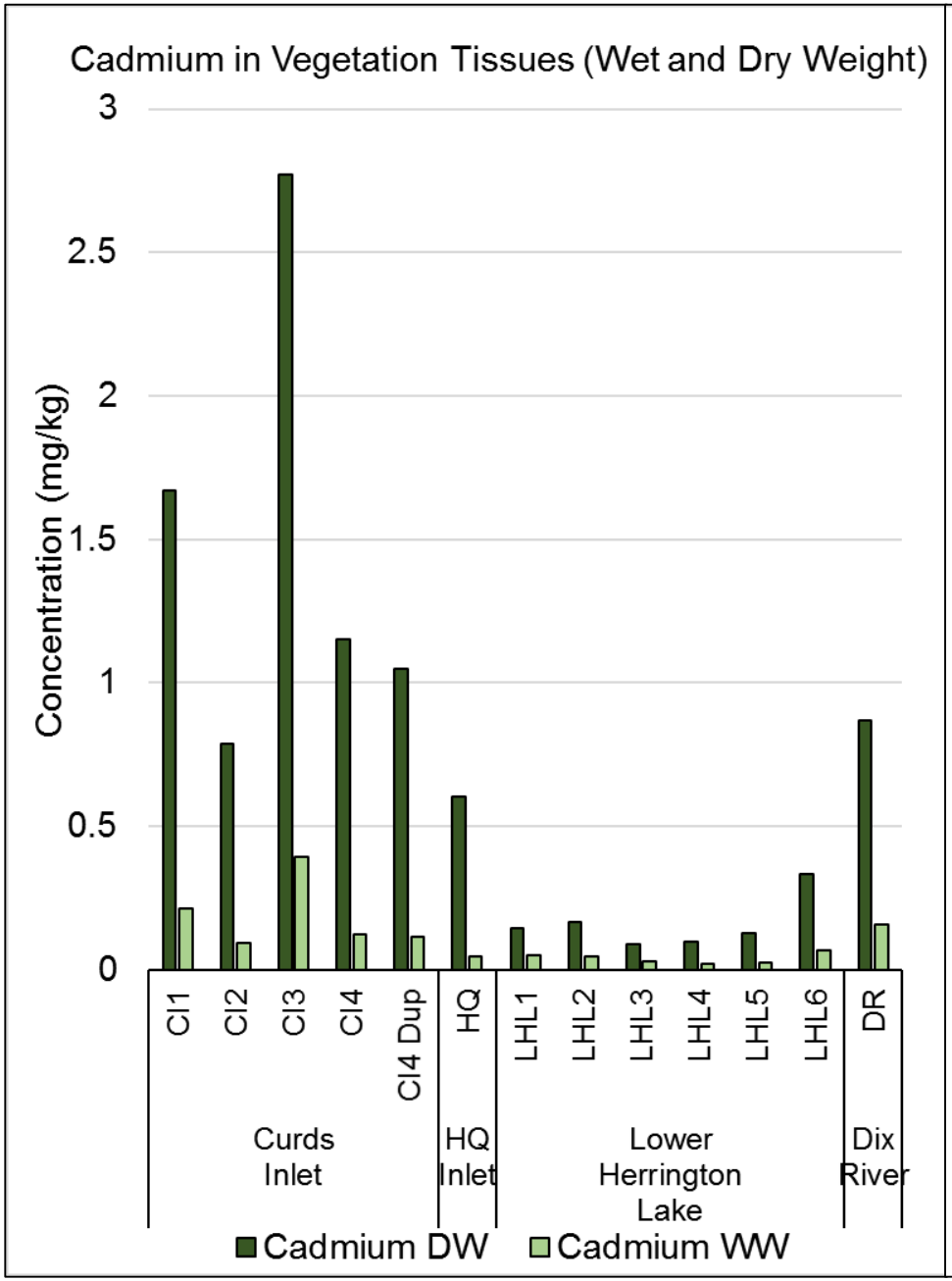


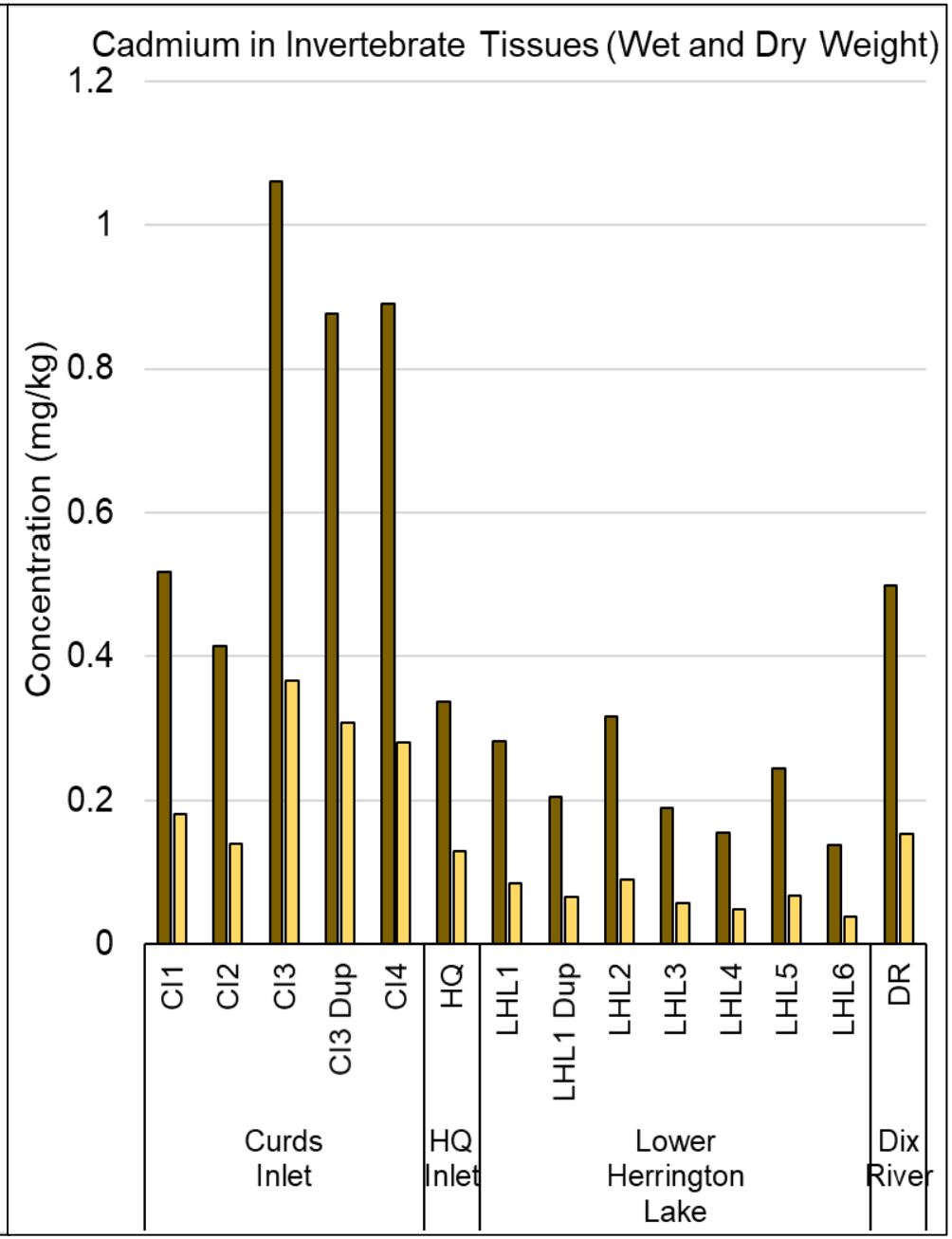
Curds Inlet (CI), Data from AMEC (AMEC), Dix River (DR), Duplicate (Dup), Hardin Inlet (HI), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Phase I (P1), Phase II (P2), Refined Screening Value (RSV), Region 4 (R4), Sediment Ecological Screening Value (ESV), United States Environmental Protection Agency (USEPA)

Observations

USEPA human health regional screening level of 71 mg/kg is based on residential soil.
Cadmium is not elevated at CI3 like selenium and arsenic in sediment.

RAMBOLL	**CADMIUM IN SEDIMENT (PHASE I AND PHASE II)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-6G





Curds Inlet (CI), Dix River (DR), Dry Weight (DW), HQ Inlet (HQ), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Wet Weight (WW)

RAMBOLL

DRAFTED BY: PAL

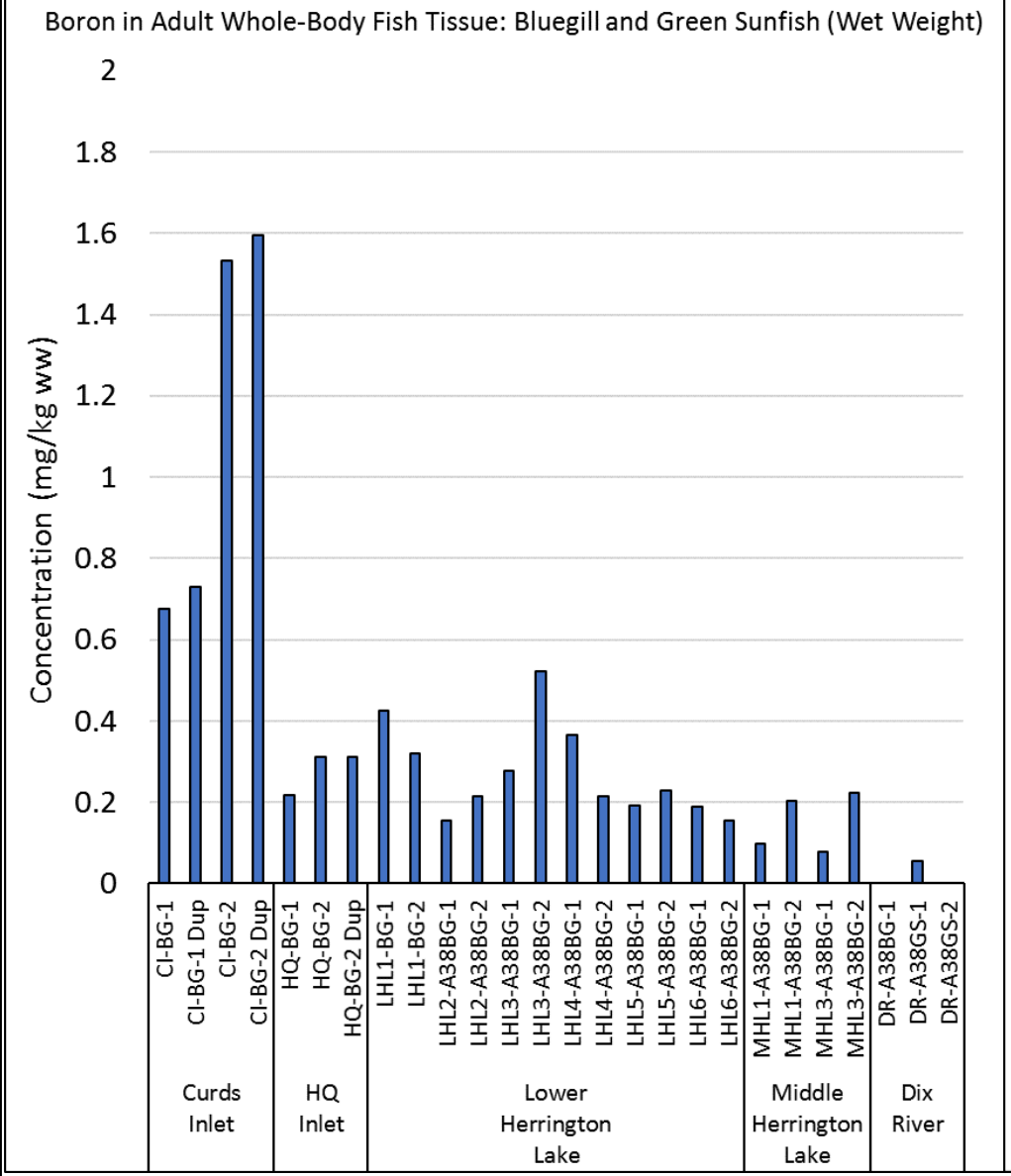
DATE: 02/01/2019

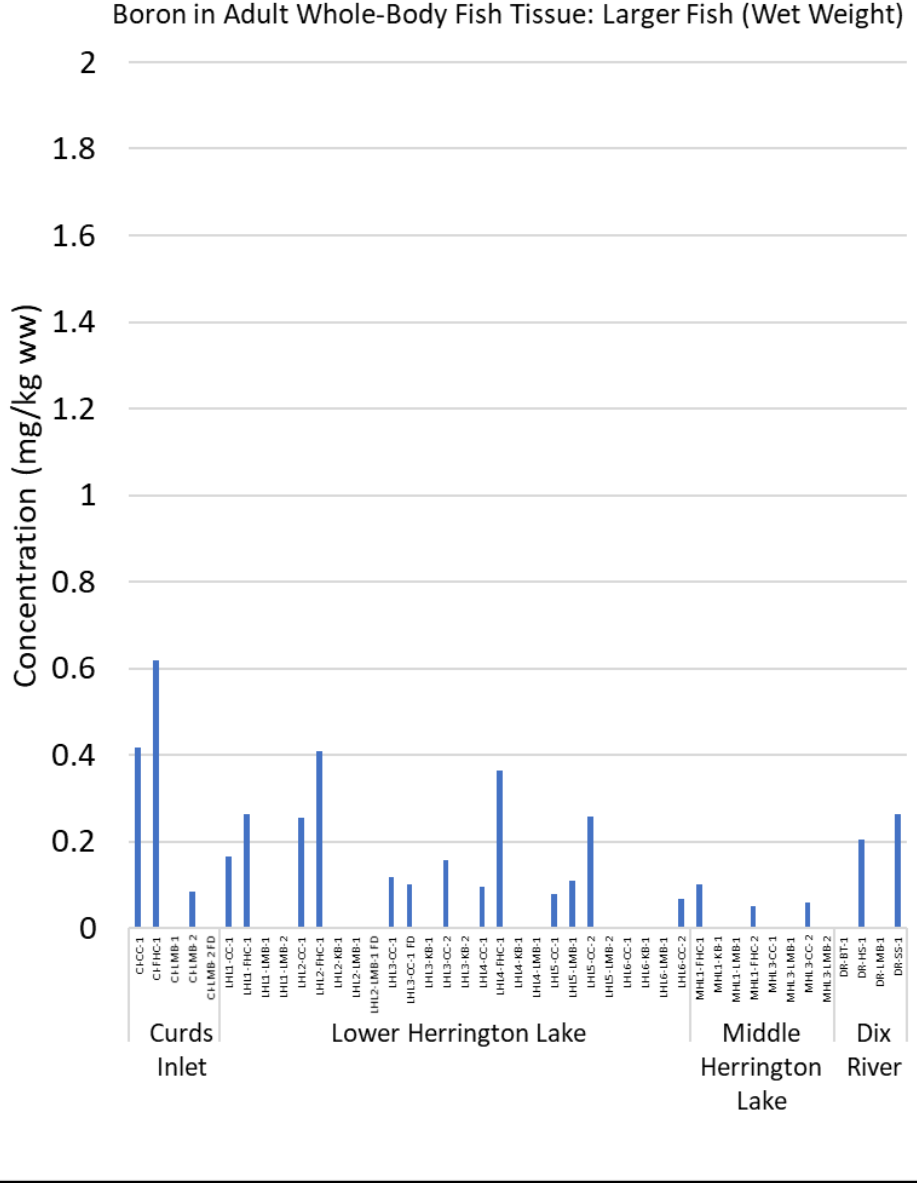
CADMIUM IN VEGETATION AND INVERTEBRATES (PHASE I)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-6H





Bluegill (BG), Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Field Duplicate (FD), Flathead Catfish (FHC), Green Sunfish (GS), HQ Inlet (HQ), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), Northern Hogsucker (HS), Spotted Sucker (SS), wet weight (ww)

Observation
Boron ecological risk-based screening levels for fish tissue were not found.

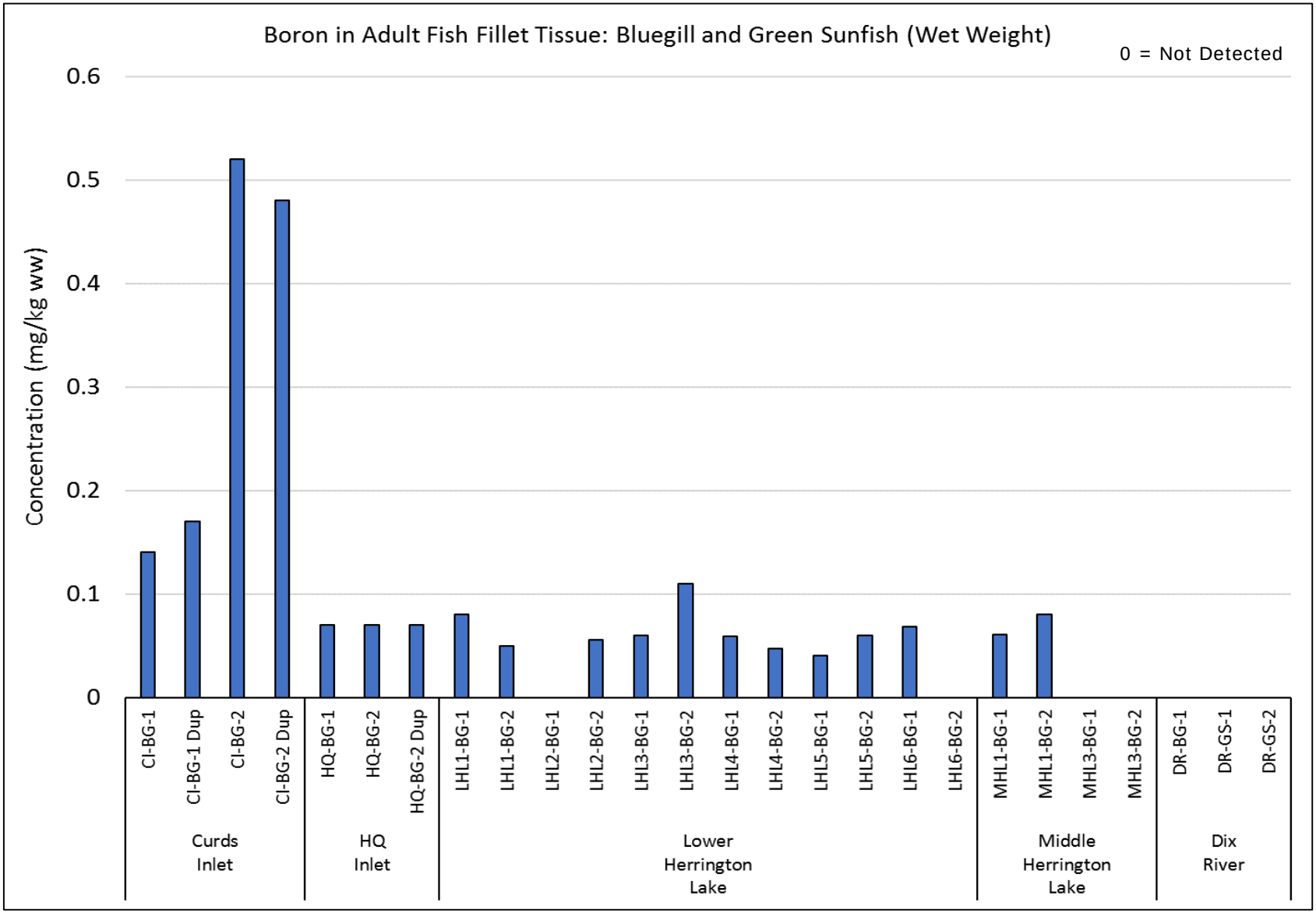
RAMBOLL

DRAFTED BY: PAL | DATE: 02/01/2019

BORON IN ADULT WHOLE-BODY FISH TISSUE (WET WEIGHT) (PHASE I)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
2-7A

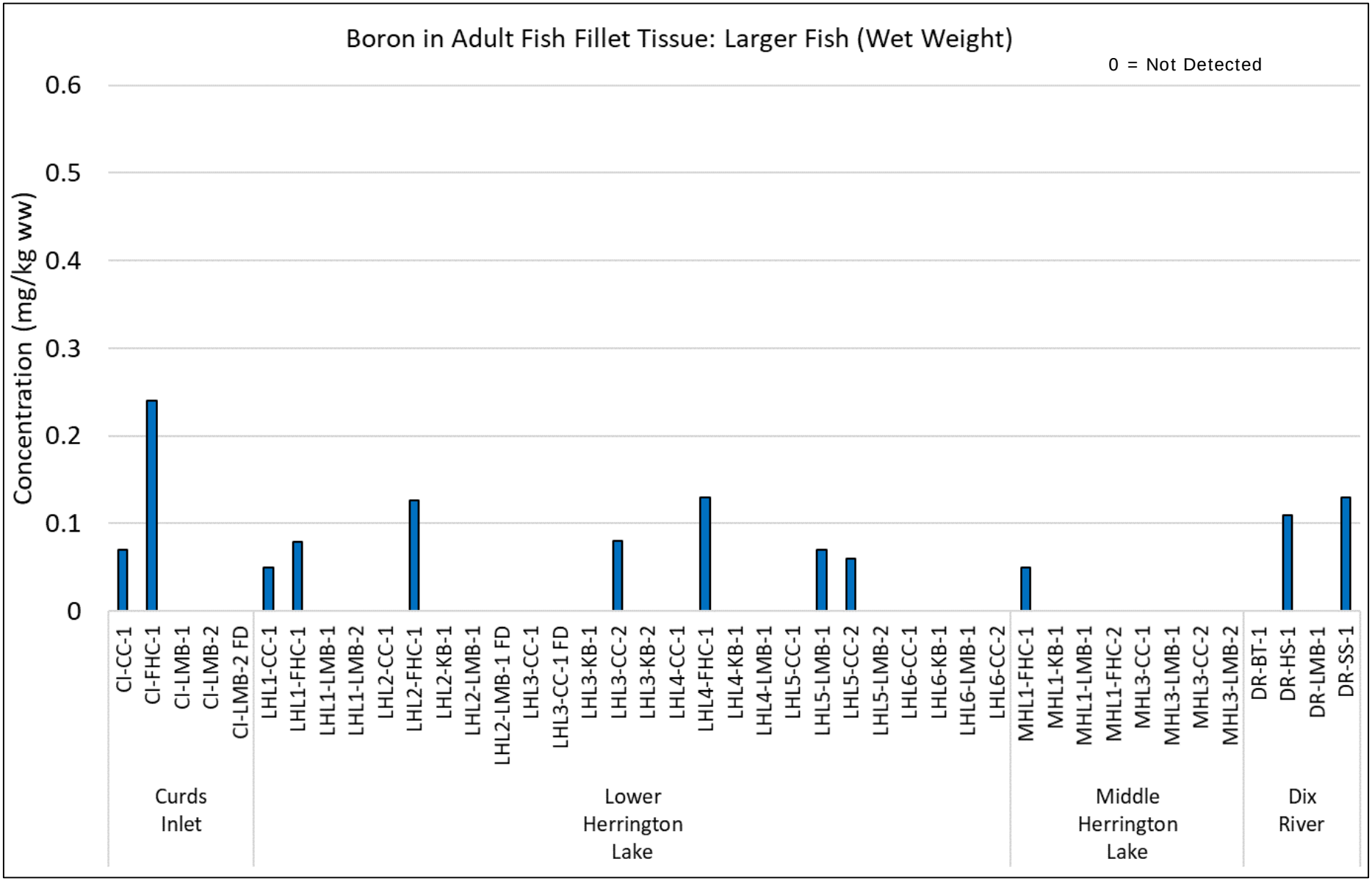


Bluegill (BG), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Green Sunfish (GS), HQ Inlet (HQ), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), wet weight (ww)

Observation

The human health risk based concentration (516 mg/kg) derived assuming 50 meals per year for an adult is off the graphic scale.

RAMBOLL		**BORON IN ADULT FISH FILLET TISSUE: BLUEGILL AND GREEN SUNFISH (WET WEIGHT) (PHASE I)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-7B
DRAFTED BY: PAL	DATE: 02/01/2019		

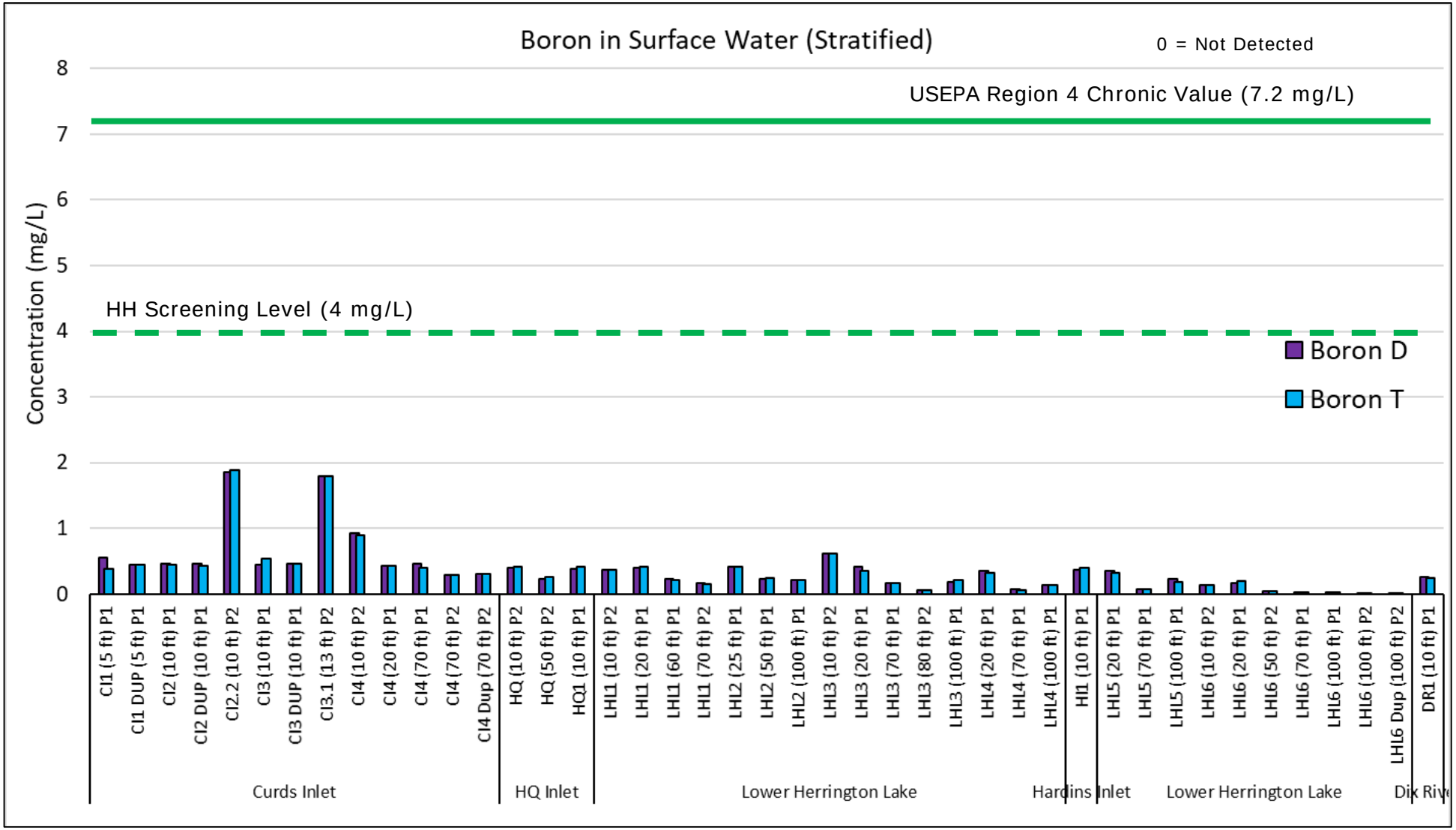


Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Field Duplicate (FD), Flathead Catfish (FHC), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Northern Hogsucker (HS), Spotted Sucker (SS), wet weight (ww)

Observation

The human health risk based concentration (516 mg/kg) derived assuming 50 meals per year for an adult is off the graphic scale.

RAMBOLL	**BORON IN ADULT FISH FILLET TISSUE: LARGER FISH (WET WEIGHT) (PHASE I)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-7C
DRAFTED BY: PAL	DATE: 02/01/2019	



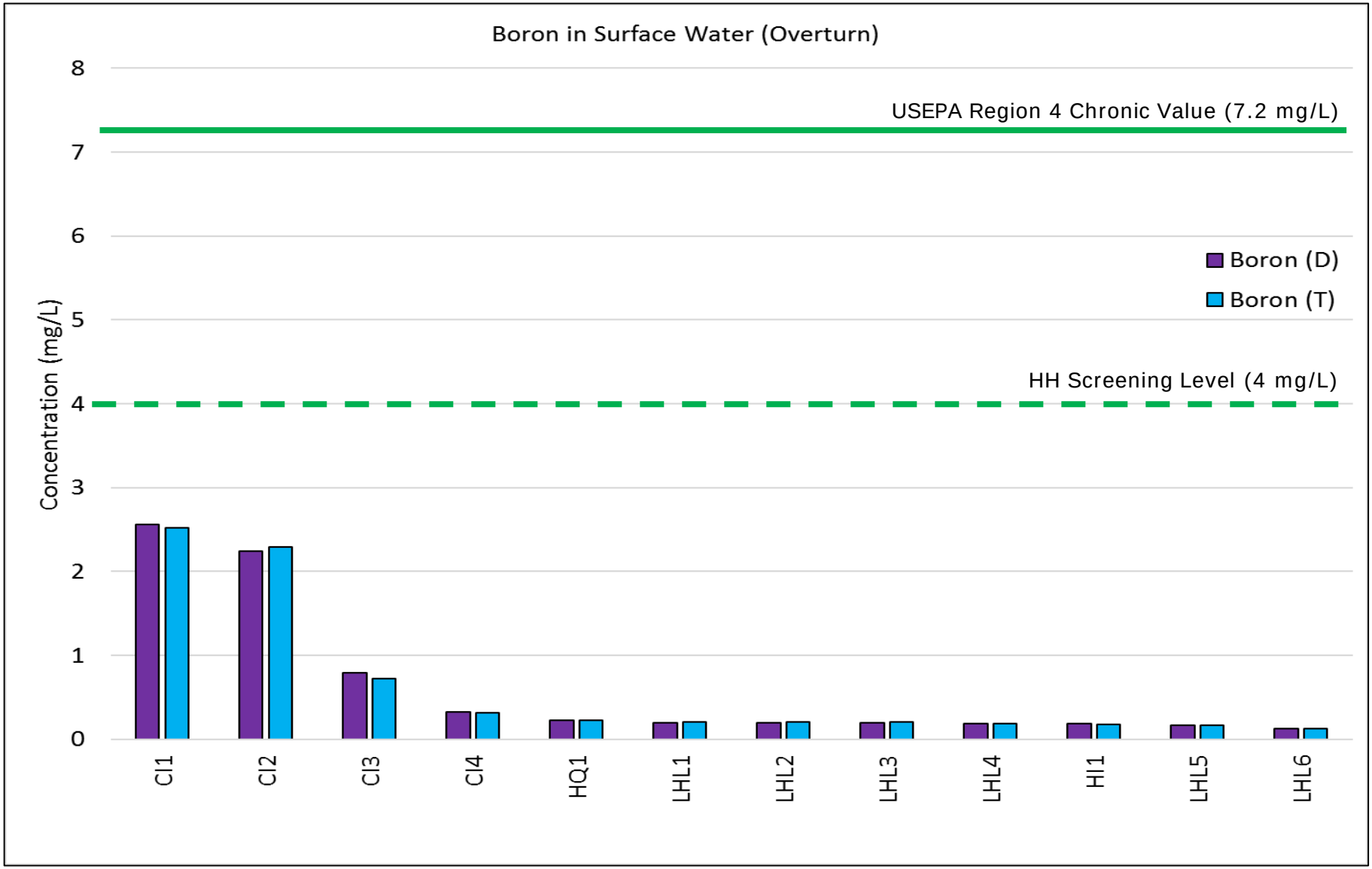
Curds Inlet (CI), Dissolved (D), Dix River (DR), Duplicate (Dup), feet (ft), Hardin Inlet (HI), HQ Inlet (HQ), Human Health (HH), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

Observations

Numbers above sample IDs in stratification chart indicate sample depth in feet.

USEPA human health screening level based on drinking water.

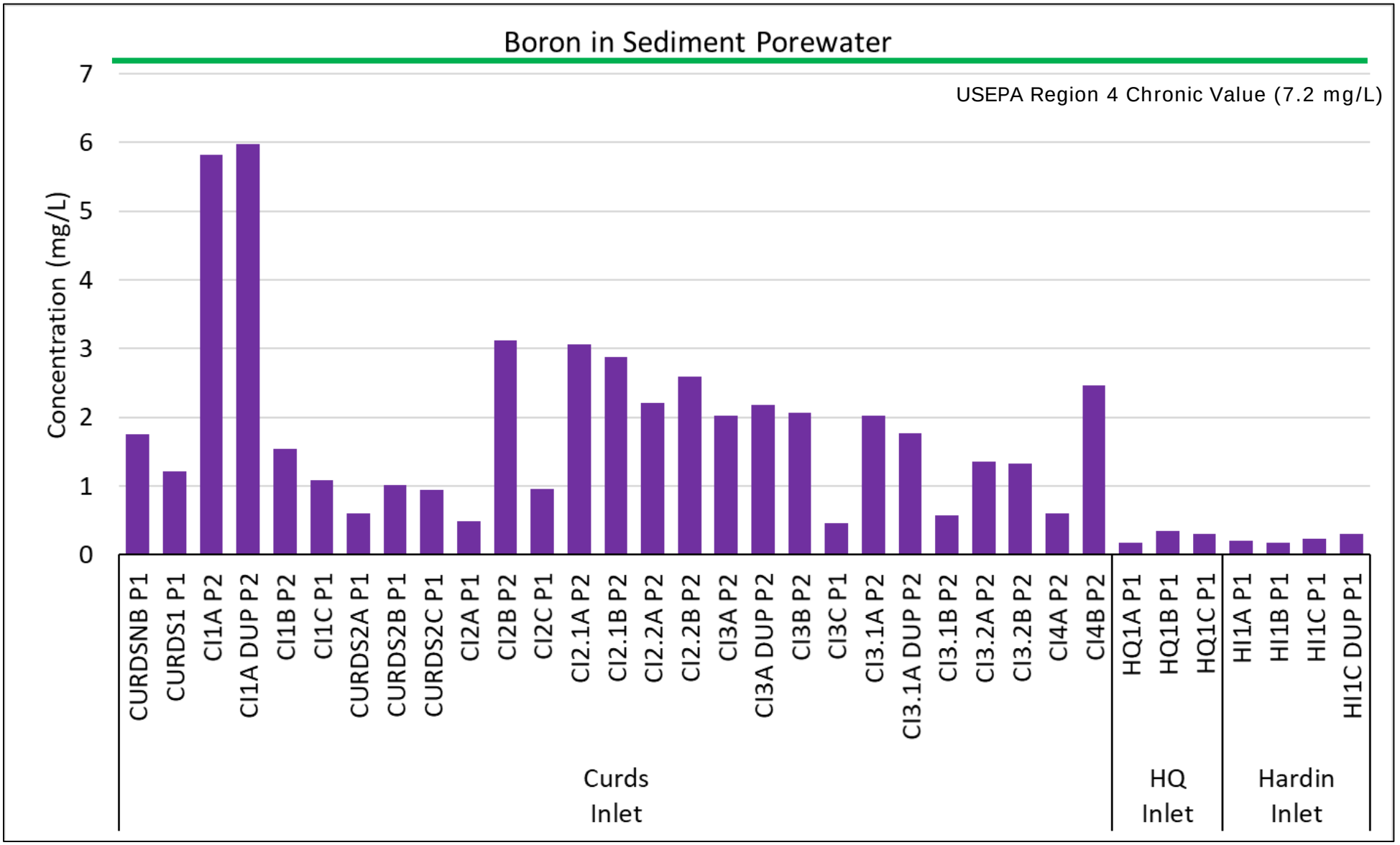
RAMBOLL	**BORON IN STRATIFIED SURFACE WATER (PHASE I AND PHASE II)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-7D
DRAFTED BY: PAL	DATE: 02/01/2019	



Curds Inlet (CI), Dissolved (D), Hardin Inlet (HI), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Region 4 (R4), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

Observations
Numbers above sample IDs in stratification chart indicate sample depth in feet.
USEPA human health screening level is based on drinking water.

RAMBOLL		**BORON IN OVERTURN SURFACE WATER (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-7E

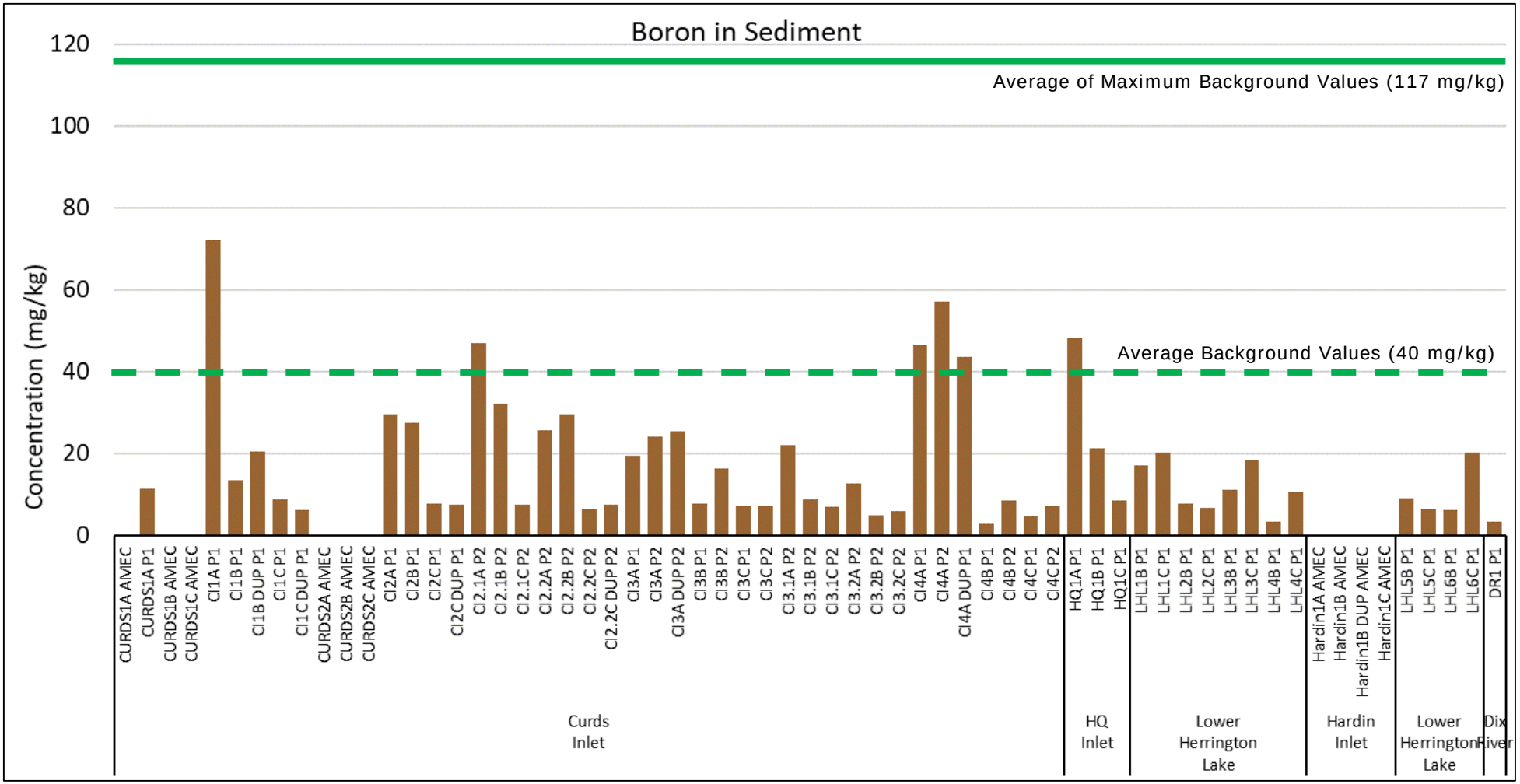


Curds Inlet (CI), Hardin Inlet (HI), HQ Inlet (HQ), Total Unfiltered (T), milligrams per liter (mg/L). Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Observation

USEPA Region 4 Chronic Sediment Ecological Screening Value is 7.2 mg/L.

RAMBOLL		**BORON IN SEDIMENT POREWATER (PHASE i)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-7F



Curds Inlet (CI), Data from AMEC (AMEC), Dix River (DR), Duplicate (DUP), Hardin Inlet (HI), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

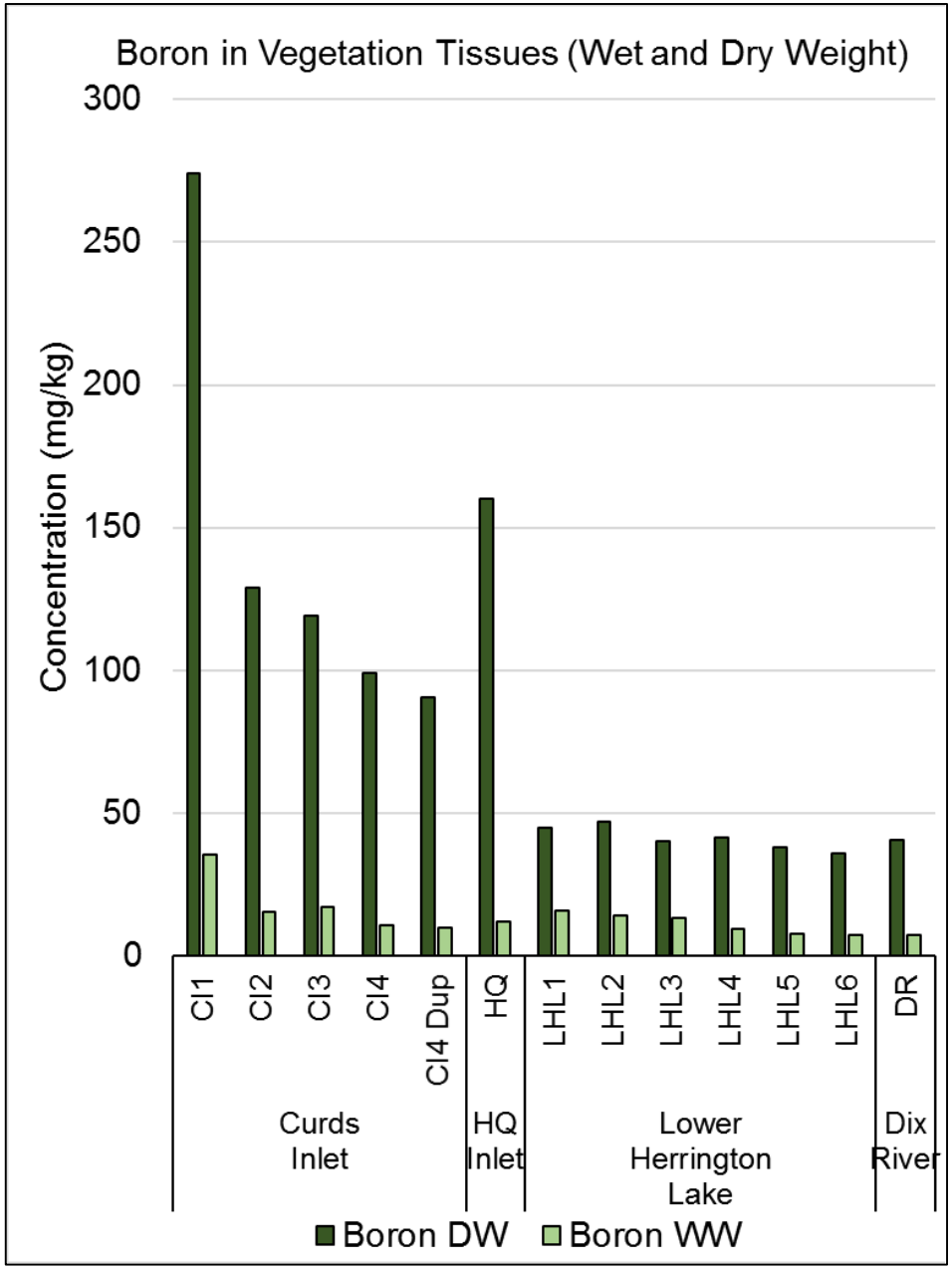
Observations

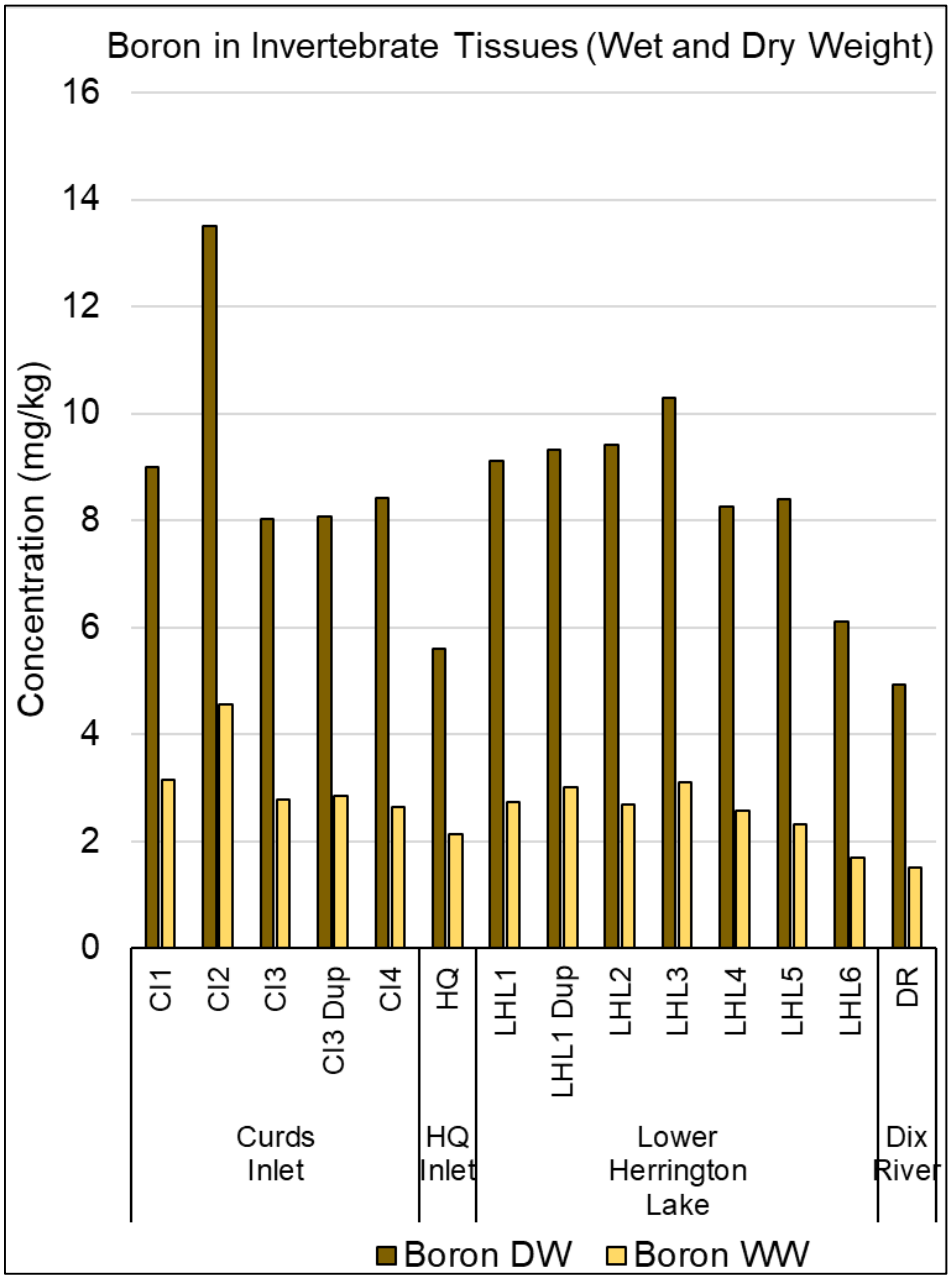
USEPA human health regional screening level for residential soil of 16,000 mg/kg is not shown because the value is much higher than scale allows.

Mason and Dragun (1996) provide typical background ranges for boron in sediment for a basis of context.

- Information is not available for Kentucky.
- Background for Georgia, Washington, Illinois, Kansas, Nebraska, Michigan, Utah, and New Mexico shows that naturally occurring background ranges are 10 mg/kg to 700 mg/kg (average of approximately 40 mg/kg).

RAMBOLL		**BORON IN SEDIMENT (PHASE I AND PHASE II)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-7G
DRAFTED BY: PAL	DATE: 02/01/2019		





Curds Inlet (CI), Dix River (DR), Dry Weight (DW), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Wet Weight (WW)

RAMBOLL

DRAFTED BY: PAL

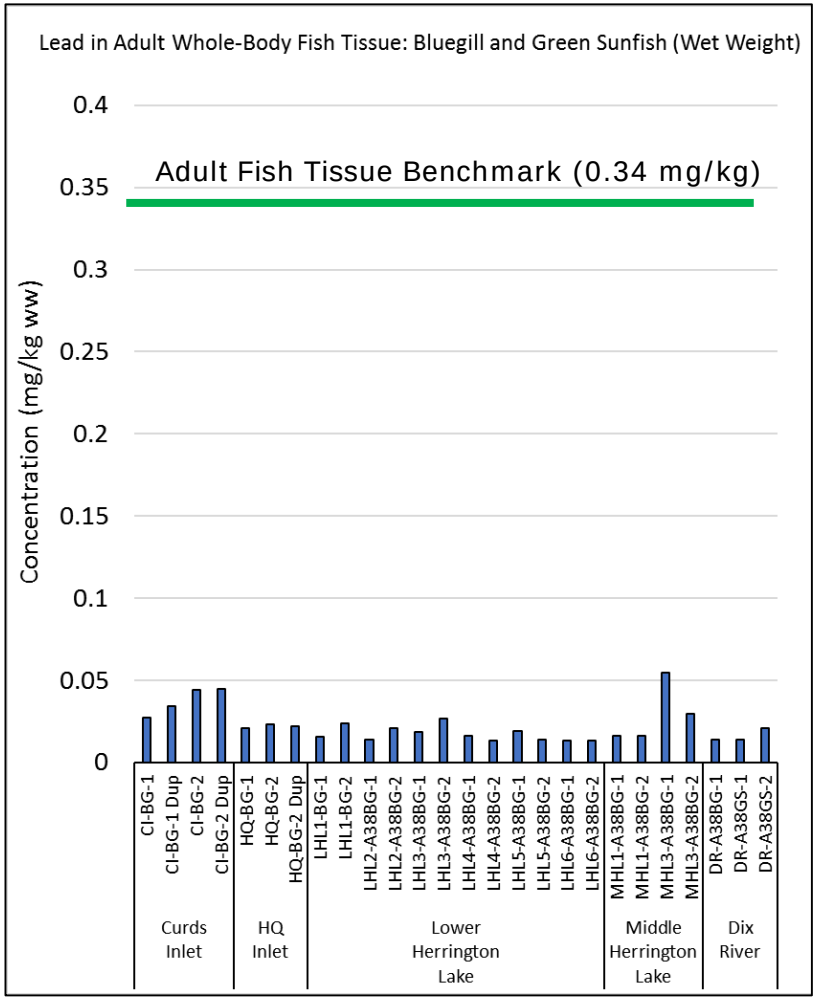
DATE: 02/01/2019

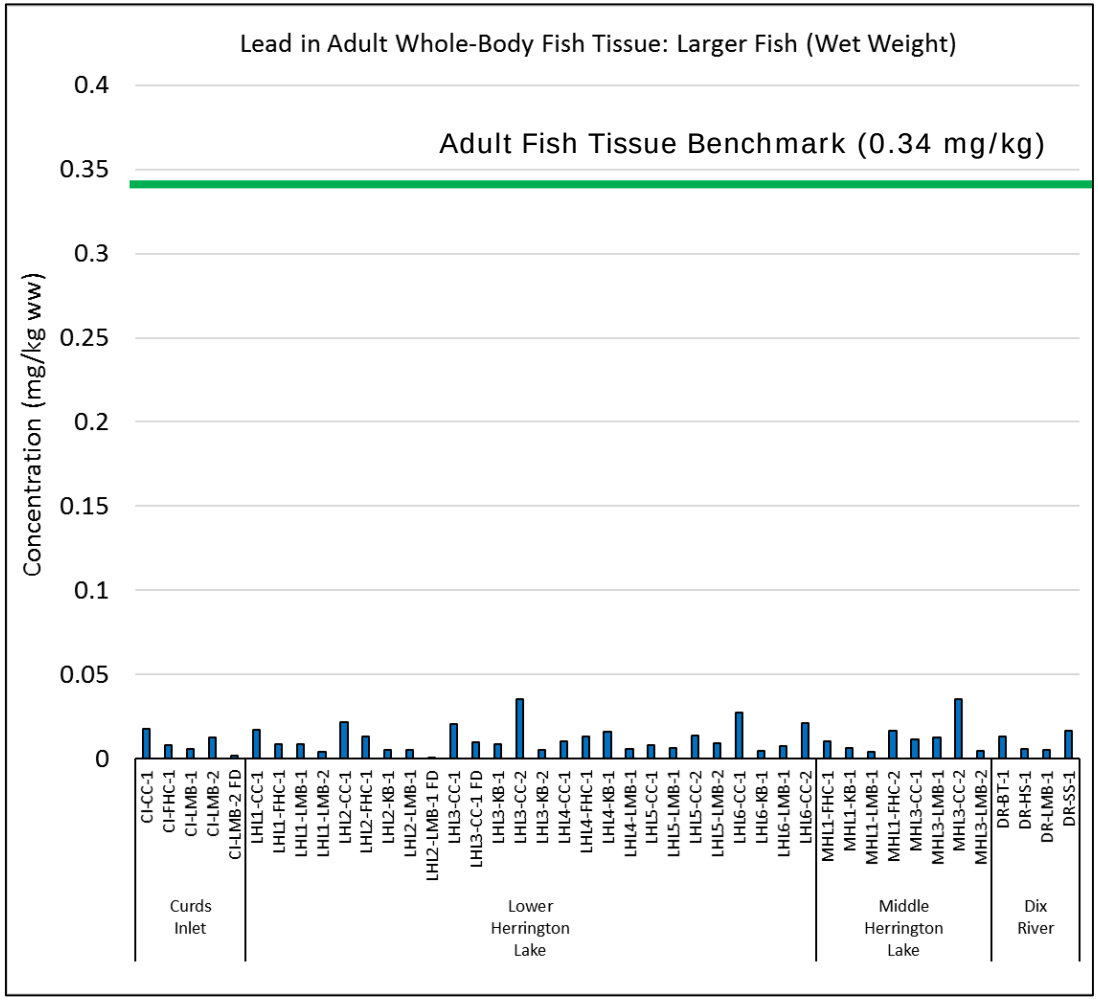
BORON IN VEGETATION AND INVERTEBRATES (PHASE I)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-7H



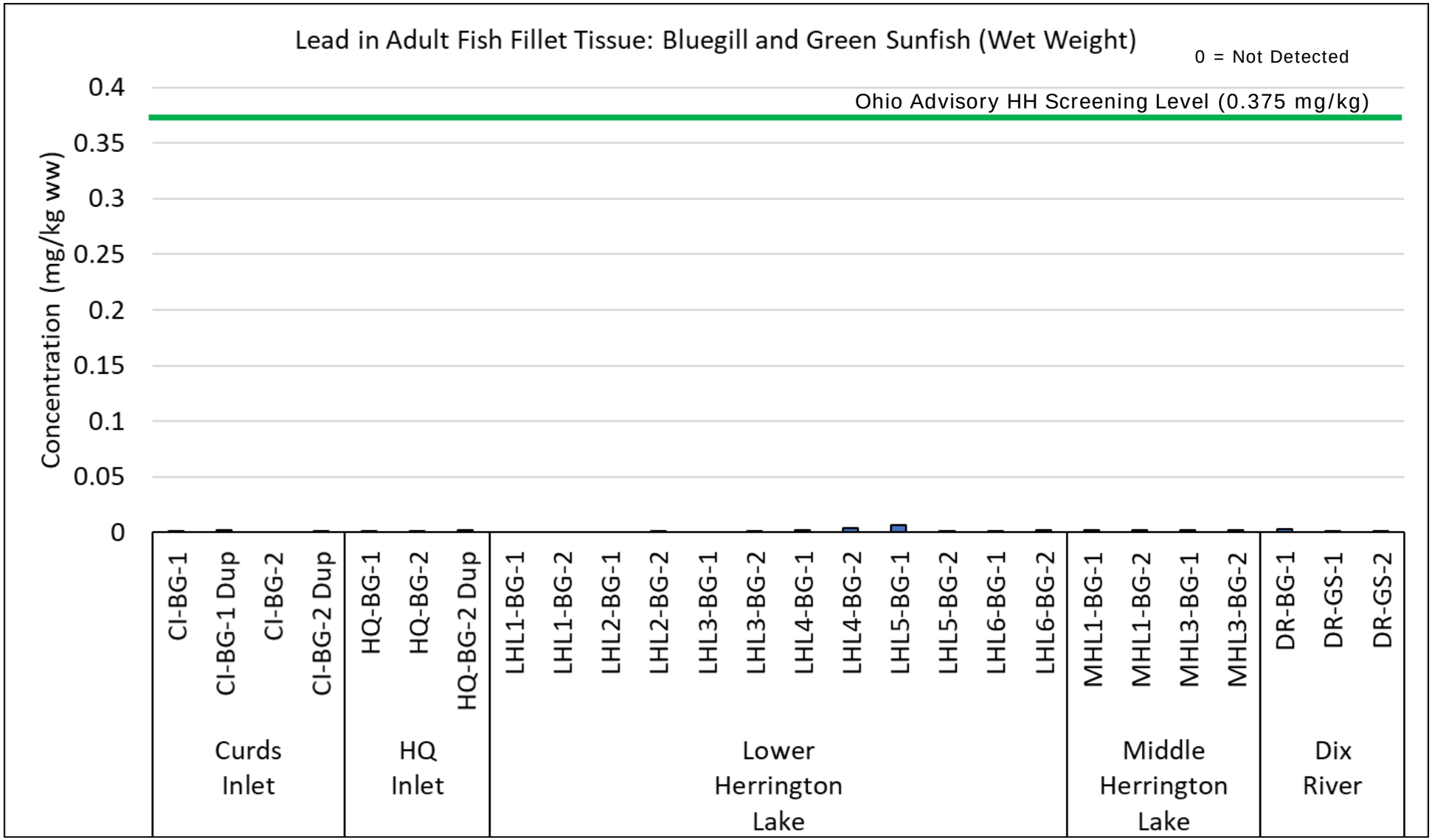


Bluegill (BG), Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Field Duplicate (FD), Flathead Catfish (FHC), Green Sunfish (GS), HQ Inlet (HQ), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Northern Hogsucker (HS), Spotted Sucker (SS), wet weight (ww)

Observation

Early life stage whole-body fish tissue residue benchmark of 2.6 mg/kg is not shown because it is much higher than the scale allows.

RAMBOLL	**LEAD IN ADULT WHOLE-BODY FISH TISSUE (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-8A

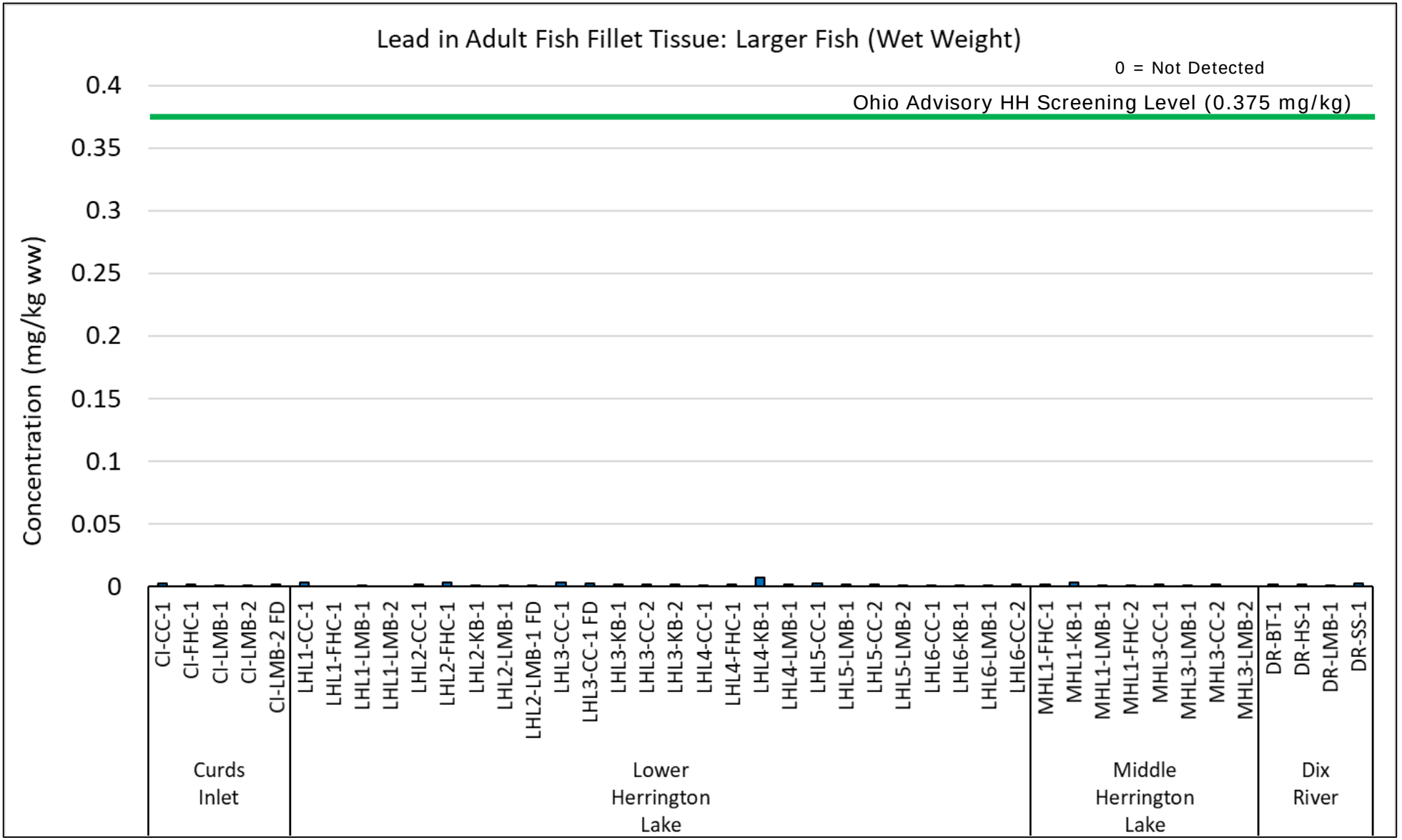


Bluegill (BG), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Green Sunfish (GS), HQ Inlet (HQ), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), wet weight (ww)

Observation

Ohio advisory human health screening level of 0.375 mg/kg in fish tissue is based on one meal per week.

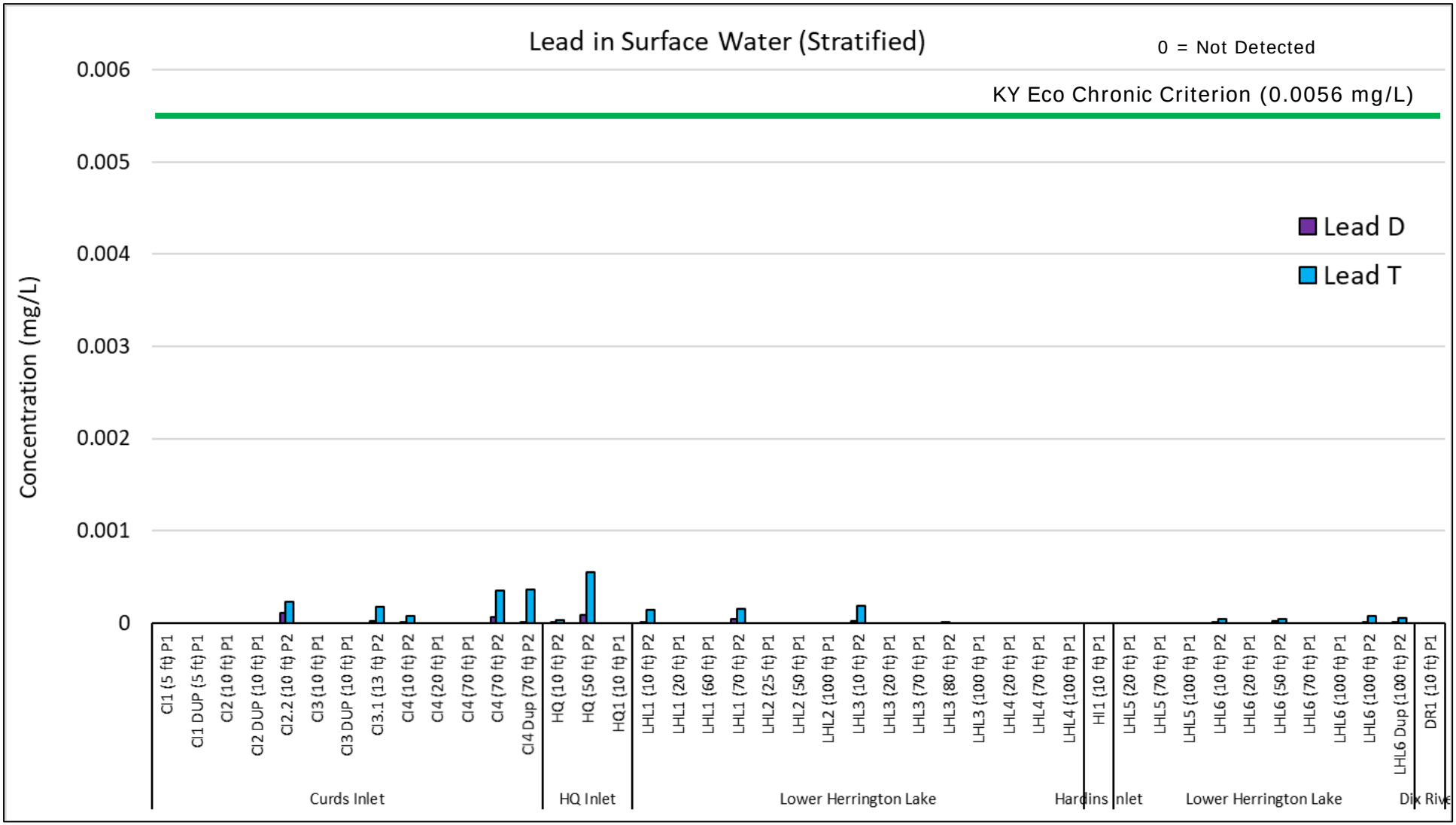
RAMBOLL		**LEAD IN ADULT FISH FILLET TISSUE: BLUEGILL AND GREEN SUNFISH (WET WEIGHT) (PHASE I)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-8B
DRAFTED BY: PAL	DATE: 02/01/2019		



Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Field Duplicate (FD), Flathead Catfish (FHC), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Northern Hogsucker (HS), wet weight (ww)

Observation
Ohio advisory human health screening level of 0.375 mg/kg in fish tissue is based on one meal per week.

RAMBOLL		**LEAD IN ADULT FISH FILLET TISSUE: LARGER FISH (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-8C



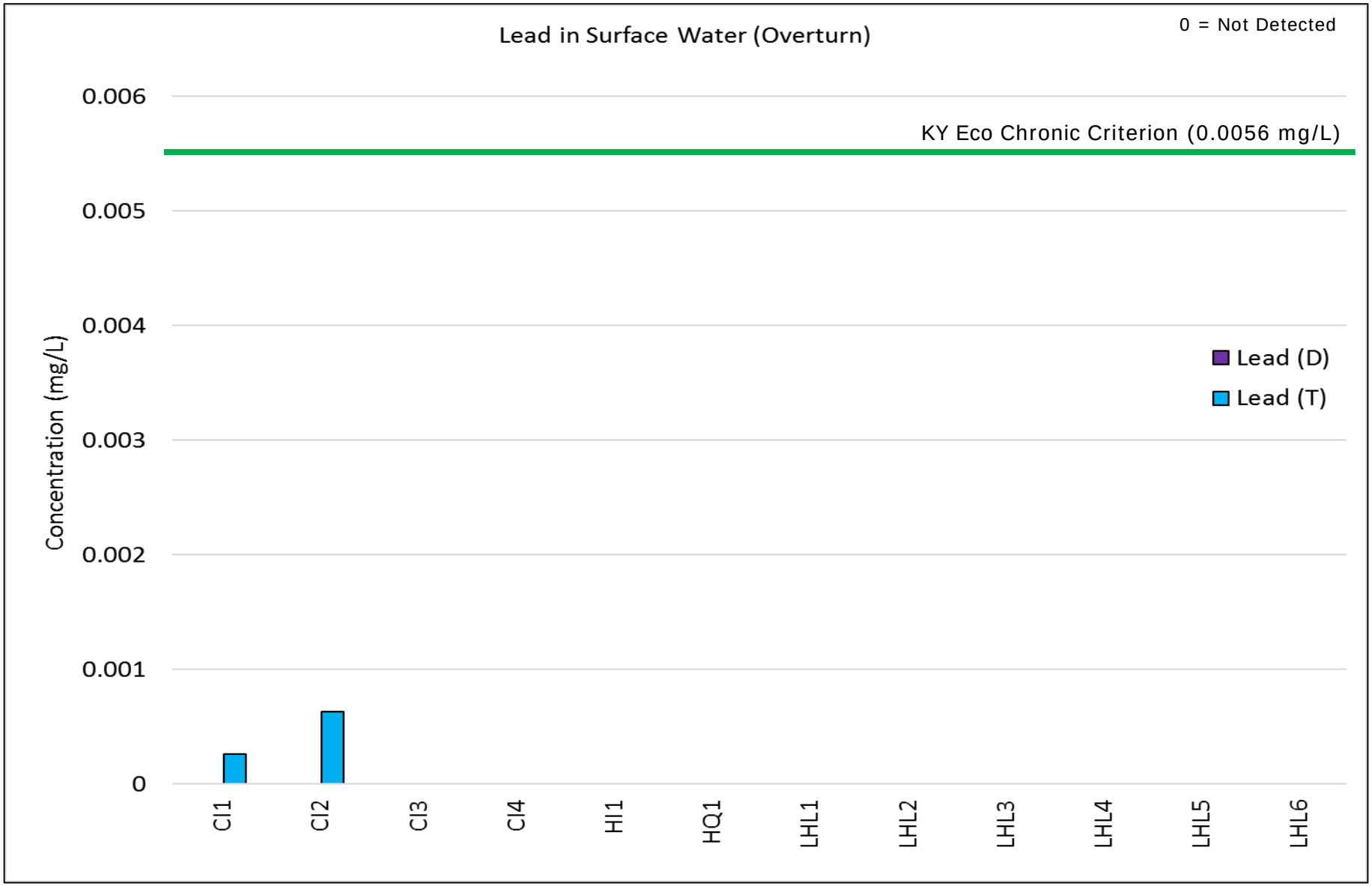
Curds Inlet (CI), Dissolved (D), Dix River (DR), Duplicate (DUP), feet (ft), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Criterion (KY Eco Chronic Criterion), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Phase (P1), Phase 2 (P2), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

Observations

Kentucky Ecological Criterion of 0.144 mg/L and the USEPA human health maximum contaminant level of 0.015 mg/L are not shown because they are higher than the scale allows.

The Kentucky Eco Criterion for Lead is calculated based on surface water hardness.

RAMBOLL	**LEAD IN STRATIFIED SURFACE WATER (PHASE I AND PHASE II)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-8D
DRAFTED BY: PAL	DATE: 02/01/2019	



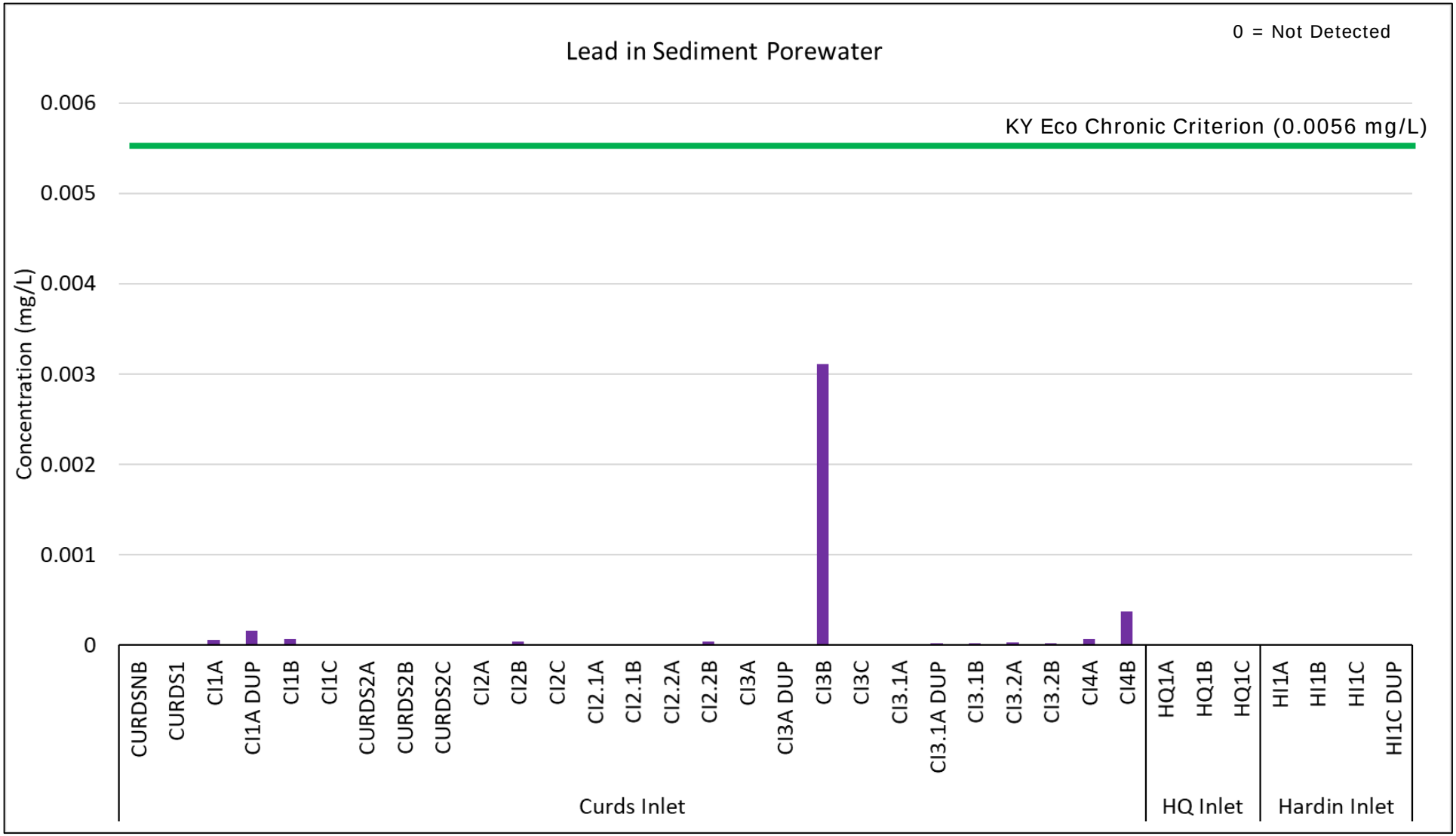
Curds Inlet (CI), Dissolved (D), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Criterion (KY Eco Chronic Criterion), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Total Unfiltered (T)

Observations

Kentucky Ecological Criterion of 0.144 mg/L and the USEPA human health maximum contaminant level of 0.015 mg/L are not shown because they are higher than the scale allows.

The Kentucky Eco Criterion for Lead is calculated based on surface water hardness.

RAMBOLL	**LEAD IN OVERTURN SURFACE WATER (PHASE I)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-8E
DRAFTED BY: PAL	DATE: 02/01/2019	



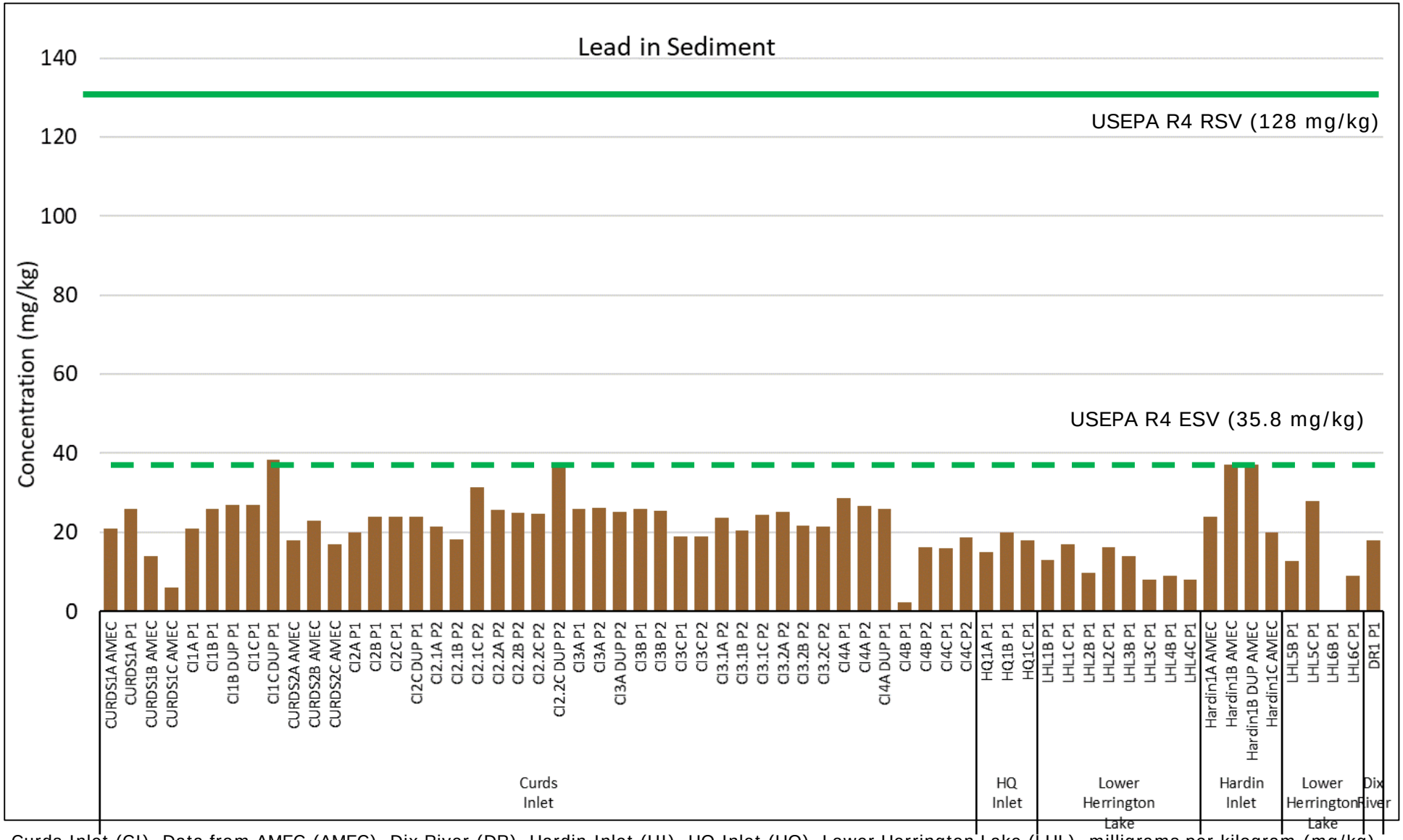
Curds Inlet (CI), Duplicate (DUP), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Criterion (KY Eco Chronic Criterion), milligrams per liter (mg/L), United States Environmental Protection Agency (USEPA)

Observations

Kentucky Ecological Criterion of 0.144 mg/L and the USEPA human health maximum contaminant level of 0.015 mg/L are not shown because they are higher than the scale allows.

The Kentucky Eco Criterion for Lead is calculated based on surface water hardness.

RAMBOLL	**LEAD IN SEDIMENT POREWATER (PHASE I AND II)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-8F
DRAFTED BY: PAL	DATE: 02/01/2019	

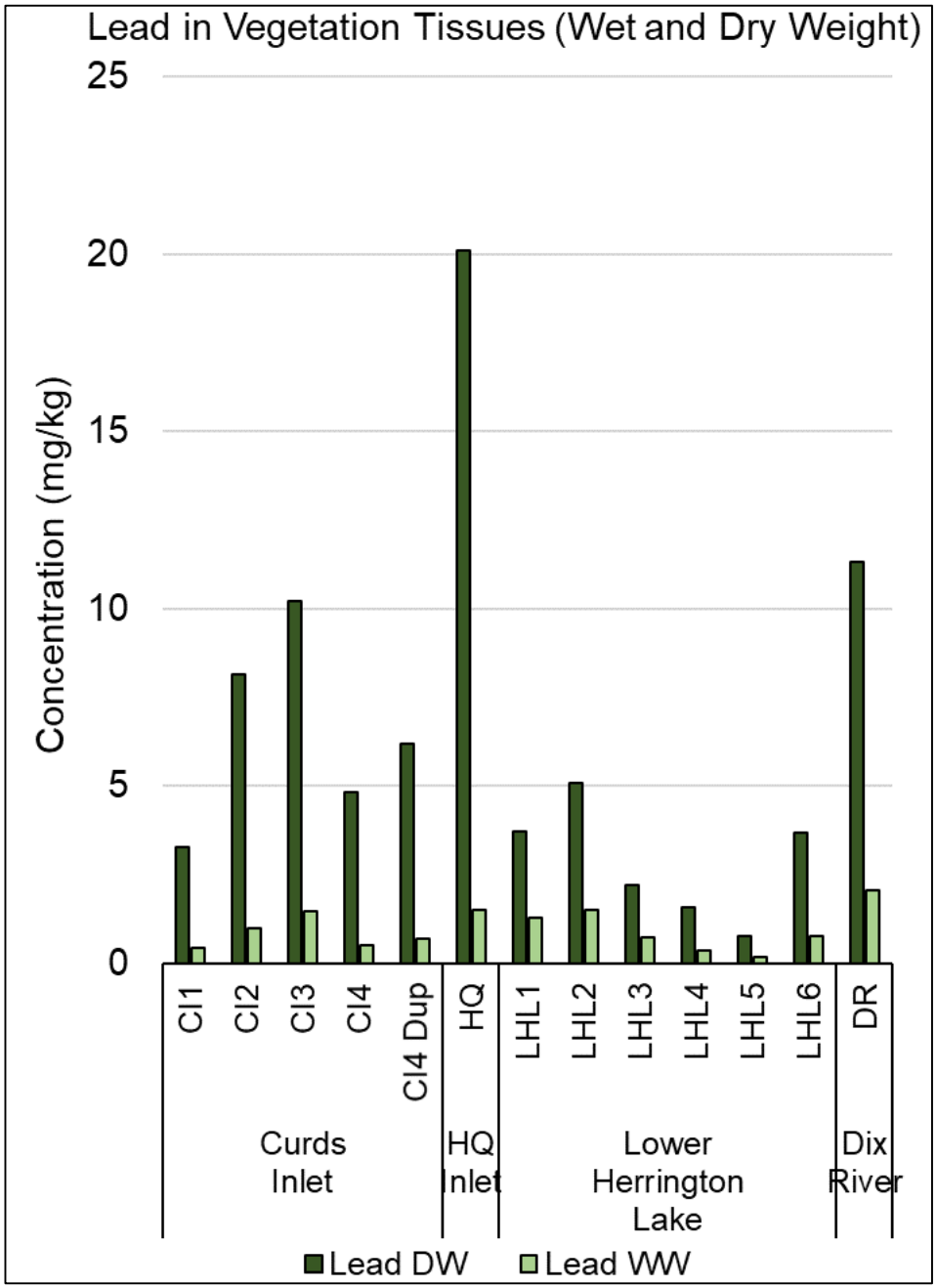


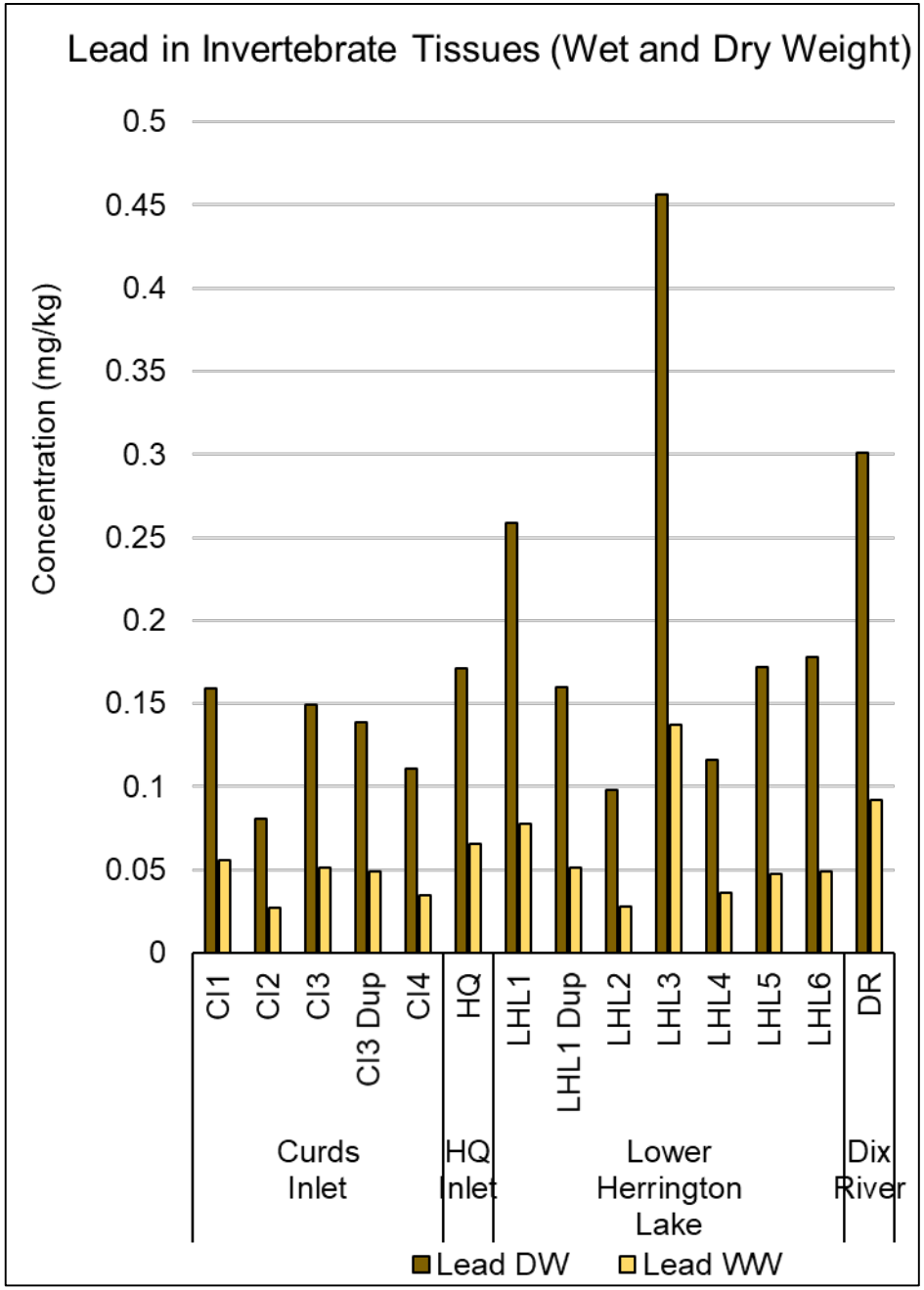
Curds Inlet (CI), Data from AMEC (AMEC), Dix River (DR), Hardin Inlet (HI), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Region 4 Sediment Ecological Screening Value (R4 ESV), Region 4 Sediment Refined Screening Value (R4 RSV), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Observation

The human health lead screening value of 400 mg/kg for residential soil is not shown because the screening value is higher than the scale allows.

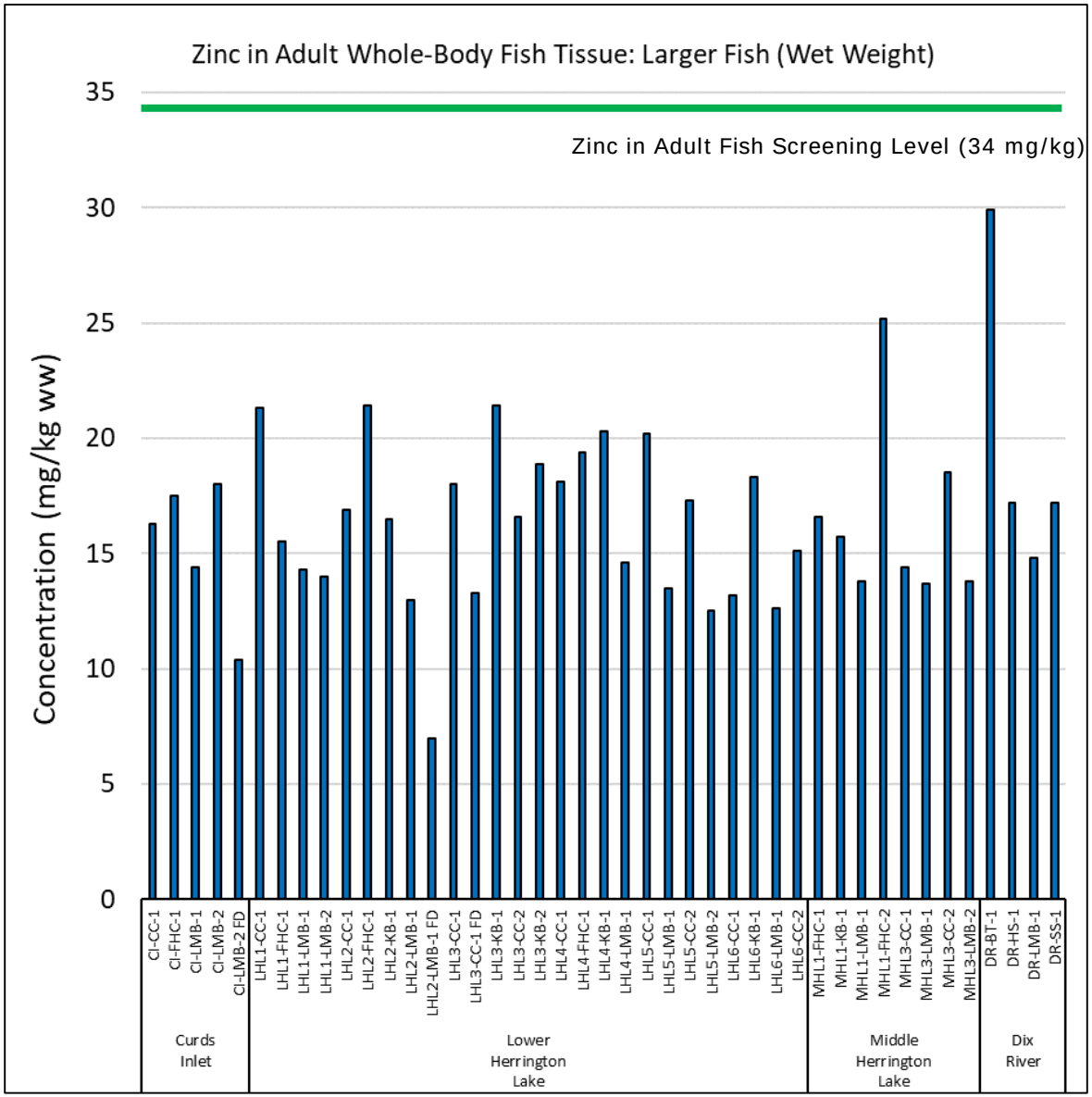
RAMBOLL	**LEAD IN SEDIMENT (AMEC FEBRUARY 2017, PHASE I AND PHASE II)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-8G
DRAFTED BY: PAL	DATE: 02/01/2019	

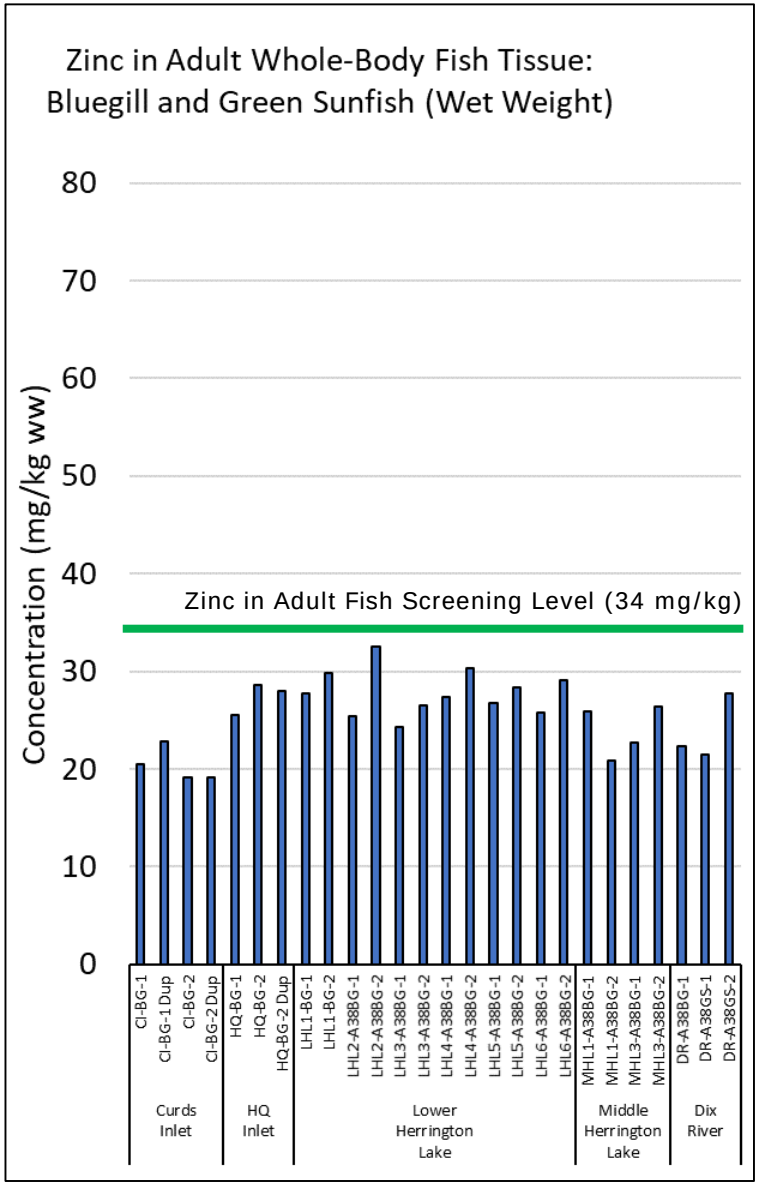




Curds Inlet (CI), Dix River (DR), Dry Weight (DW), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg) Wet Weight (WW),

RAMBOLL		**LEAD IN VEGETATION AND INVERTEBRATES (PHASE I)** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 2-8H
DRAFTED BY: PAL	DATE: 02/01/2019		





Bluegill (BG), Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Field Duplicate (FD), Flathead Catfish (FHC), Green Sunfish (GS), HQ Inlet (HQ), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram (mg/kg), Northern Hogsucker (HS), wet weight (ww)

Observation

The fish tissue screening level is from scientific literature, including Jarvinen and Ankley (1999).

RAMBOLL

DRAFTED BY: PAL

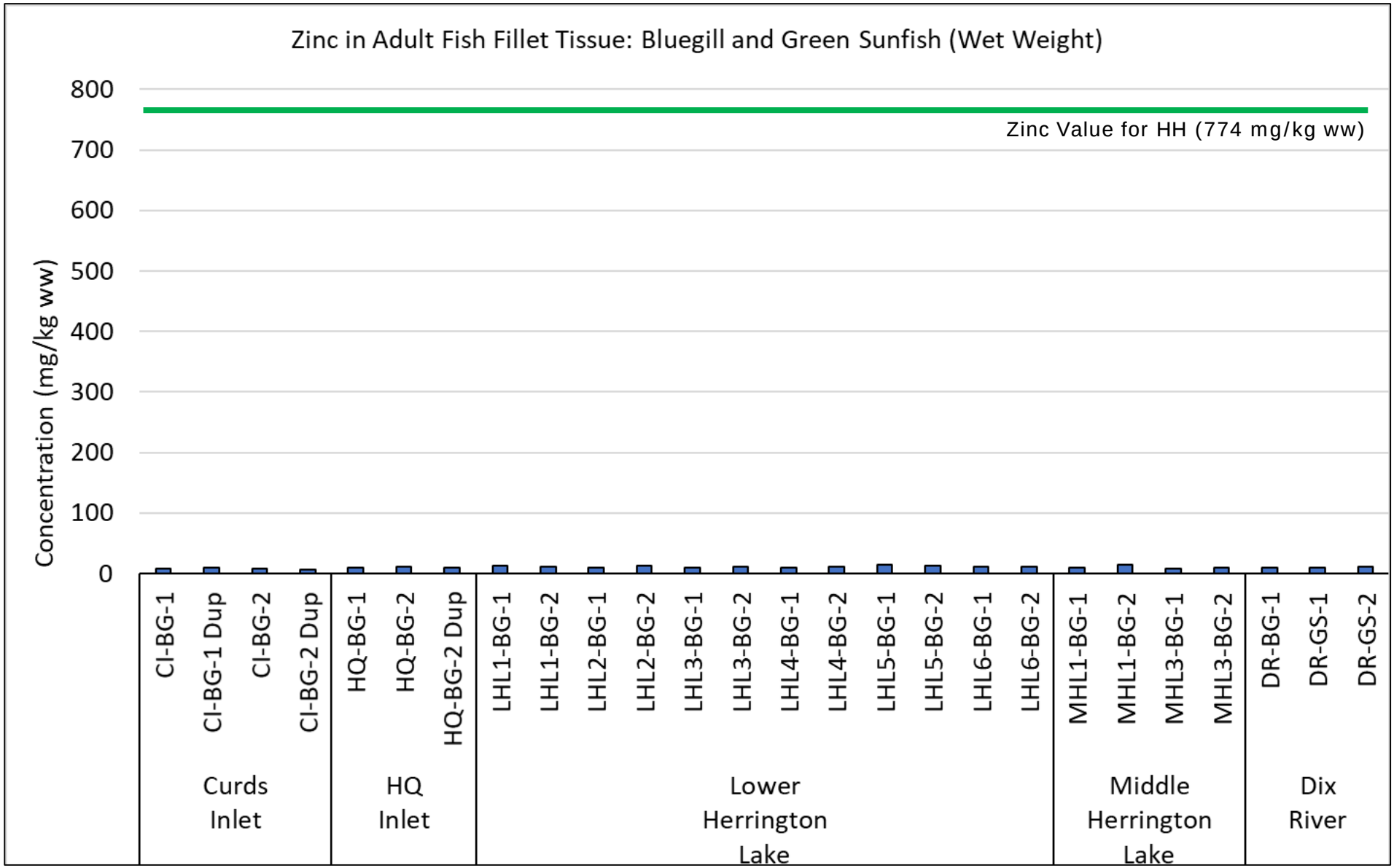
DATE: 02/01/2019

ZINC IN ADULT WHOLE-BODY FISH-TISSUE (WET WEIGHT) (PHASE I)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-9A

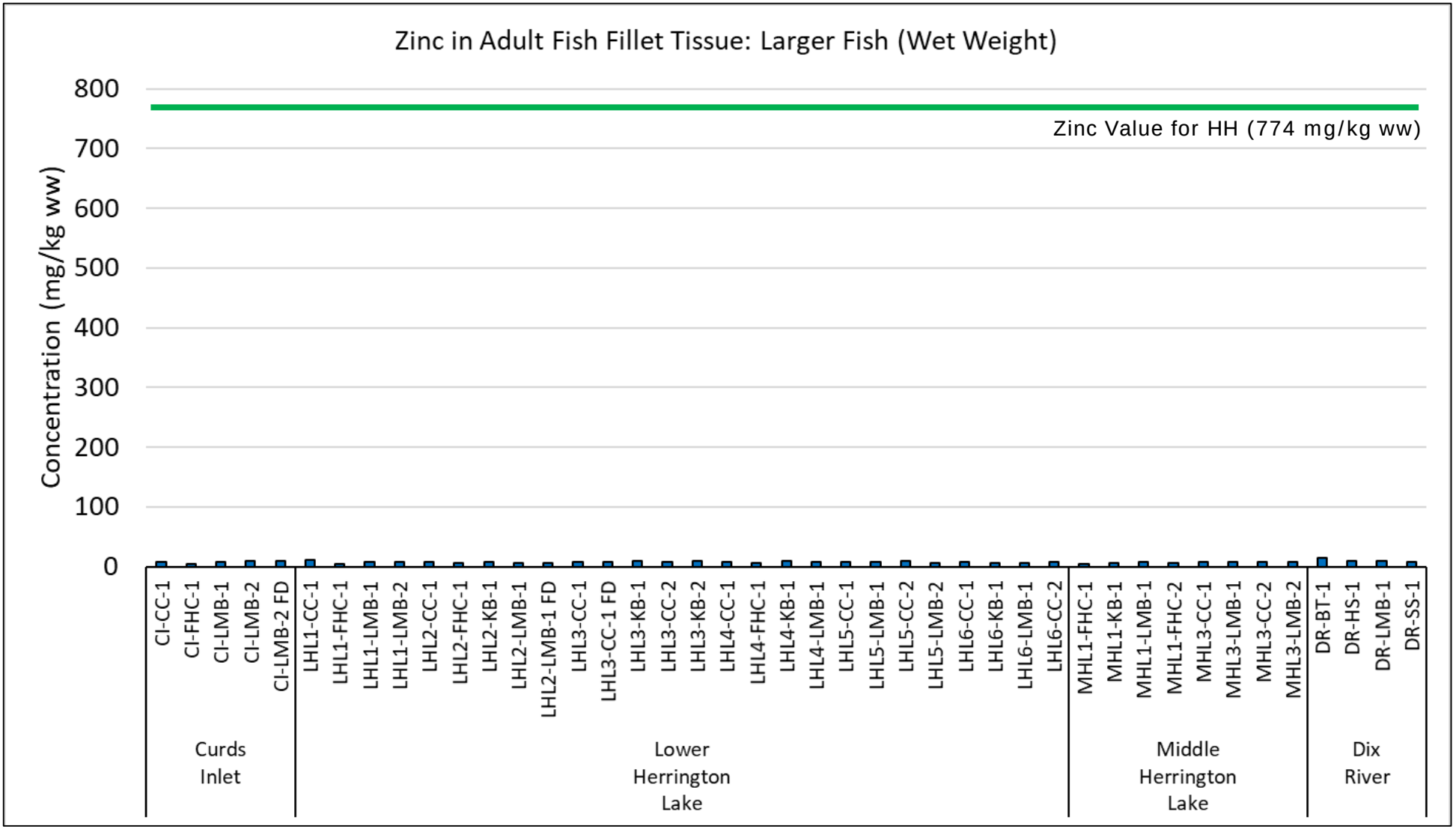


Bluegill (BG), Curds Inlet (CI), Dix River (DR), Duplicate (Dup), Green Sunfish (GS), Human Health (HH), HQ Inlet (HQ), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligram per kilogram (mg/kg), wet weight (ww)

Observation

Human health risk based concentration derived assuming 50 meals per year for an adult.

RAMBOLL		**ZINC IN ADULT FISH FILLET TISSUE: BLUEGILL AND GREEN SUNFISH (WET WEIGHT) (PHASE I)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-9B

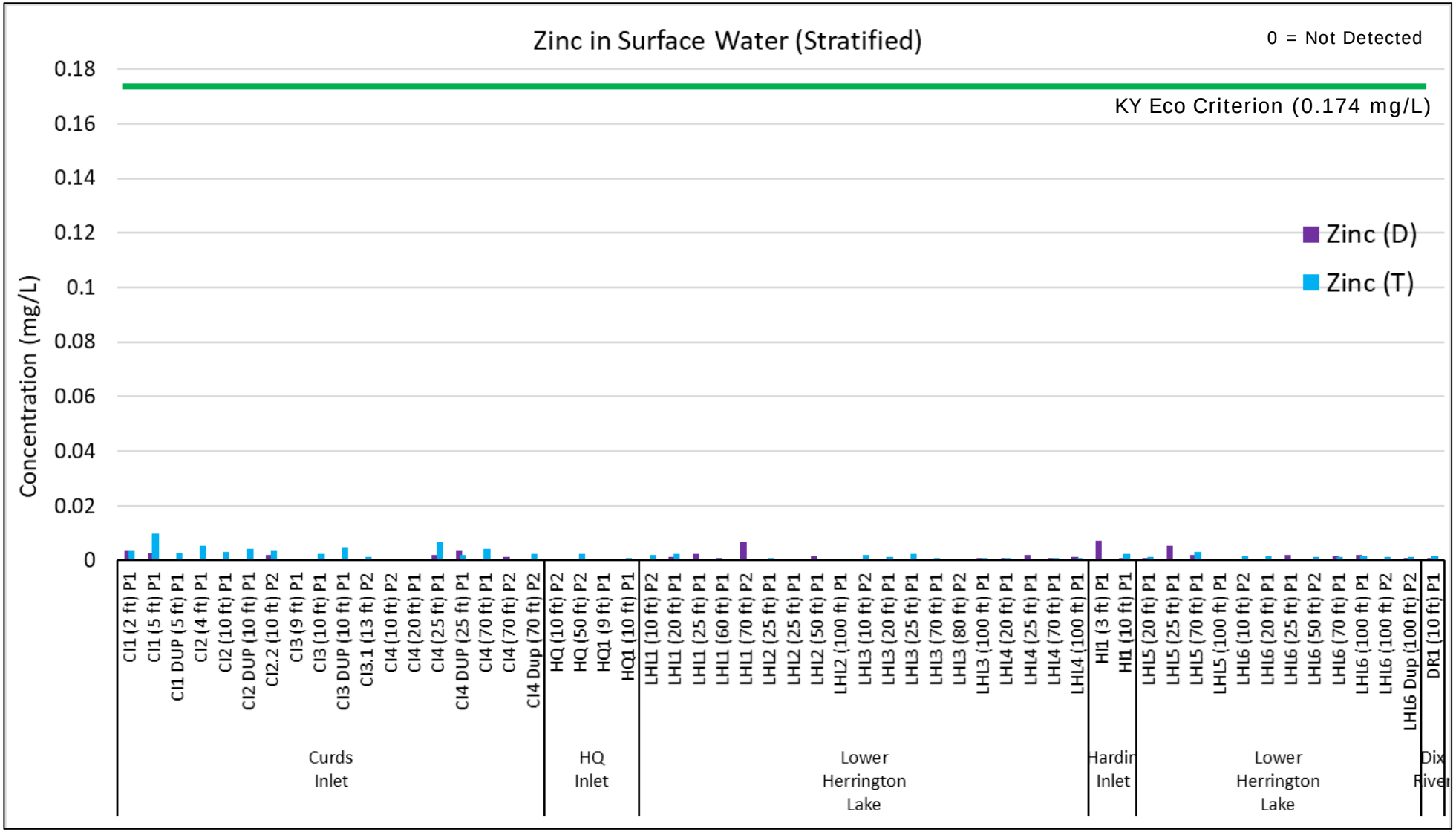


Brown Trout (BT), Channel Catfish (CC), Curds Inlet (CI), Dix River (DR), Field Duplicate (FD), Flathead Catfish (FHC), Kentucky Bass (KB), Largemouth Bass (LMB), Lower Herrington Lake (LHL), Middle Herrington Lake (MHL), milligrams per kilogram, Northern Hogsucker (HS), Spotted Sucker (SS), wet weight (ww)

Observation

Human health risk based concentration derived assuming 50 meals per year for an adult.

RAMBOLL		**ZINC IN ADULT FISH FILLET TISSUE: LARGER FISH (WET WEIGHT) (PHASE I**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-9C



Curds Inlet (CI), Dissolved (D), Dix River (DR), Duplicate (DUP), feet (ft), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Criterion (KY Eco Criterion), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), Total Unfiltered (T)

Observations

Kentucky Human Health Criterion of 26 mg/L for consumption of fish and Kentucky Human Health Criterion of 7.4 mg/L for drinking water are not shown because they higher than the scale allows.

The Kentucky Ecological Criterion for Zinc is calculated based on surface water hardness.

RAMBOLL

DRAFTED BY: PAL

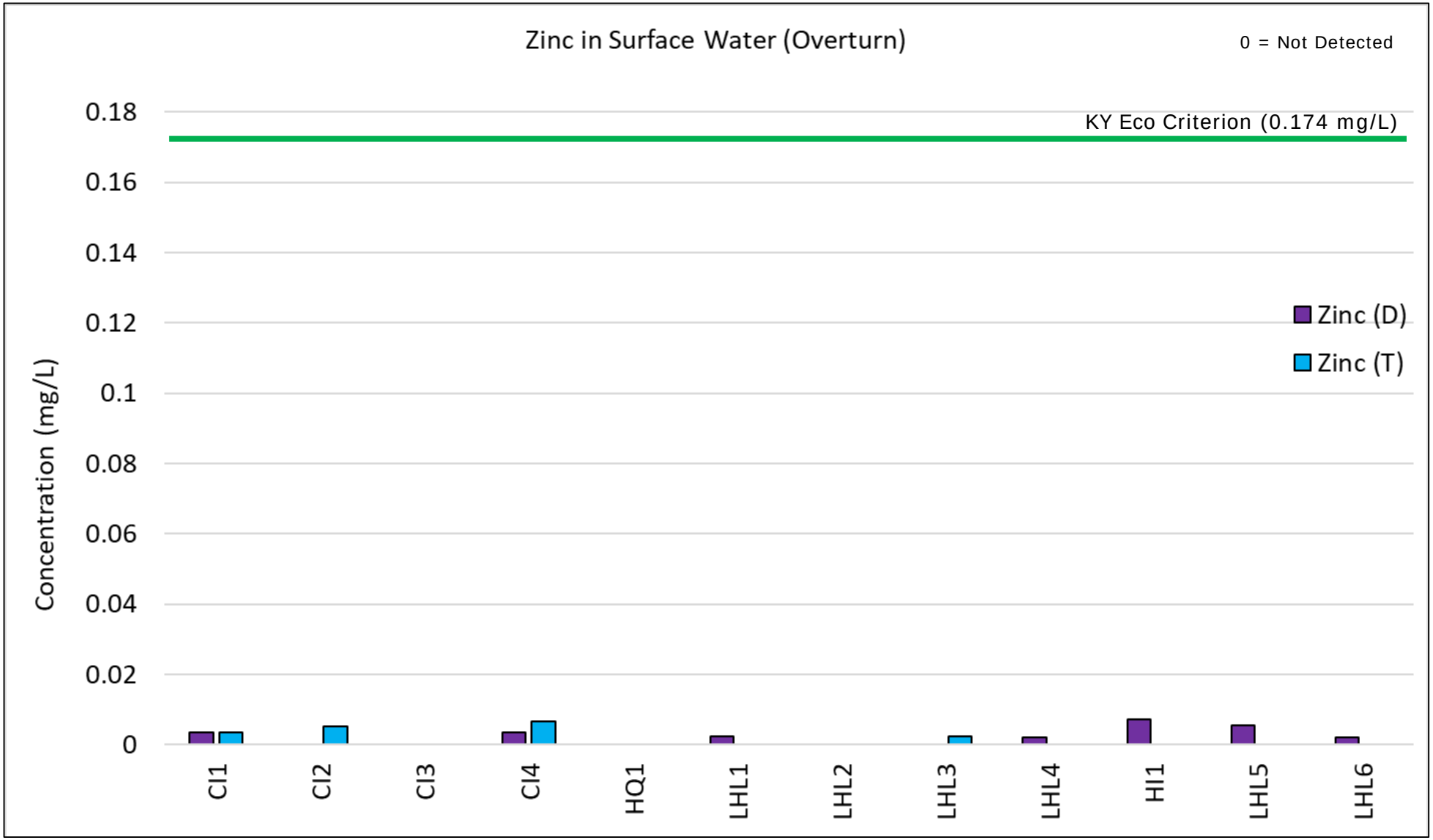
DATE: 02/01/2019

ZINC IN STRATIFIED SURFACE WATER (PHASE I AND PHASE II)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-9D



Curds Inlet (CI), Dissolved (D), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Criterion (KY Eco Criterion), Lower Herrington Lake (LHL), milligrams per liter (mg/L), Total Unfiltered (T)

Observations

Kentucky Human Health Criterion of 26 mg/L for consumption of fish and Kentucky Human Health Criterion of 7.4 mg/L for drinking water are not shown because they higher than the scale allows.

The Kentucky Ecological Criterion for Zinc is calculated based on surface water hardness.

RAMBOLL

DRAFTED BY: PAL

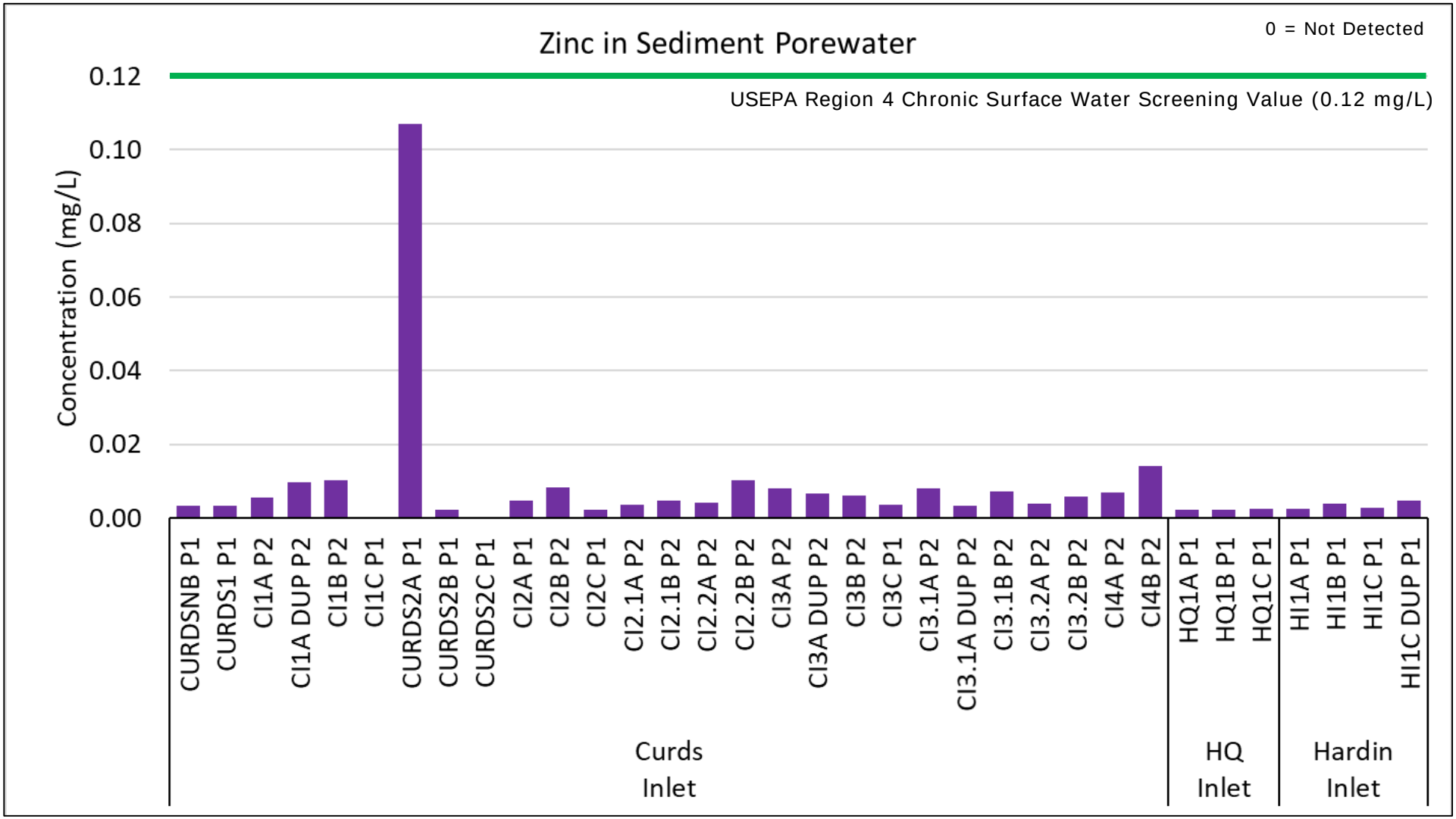
DATE: 02/01/2019

ZINC IN OVERTURN SURFACE WATER (PHASE I)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-9E

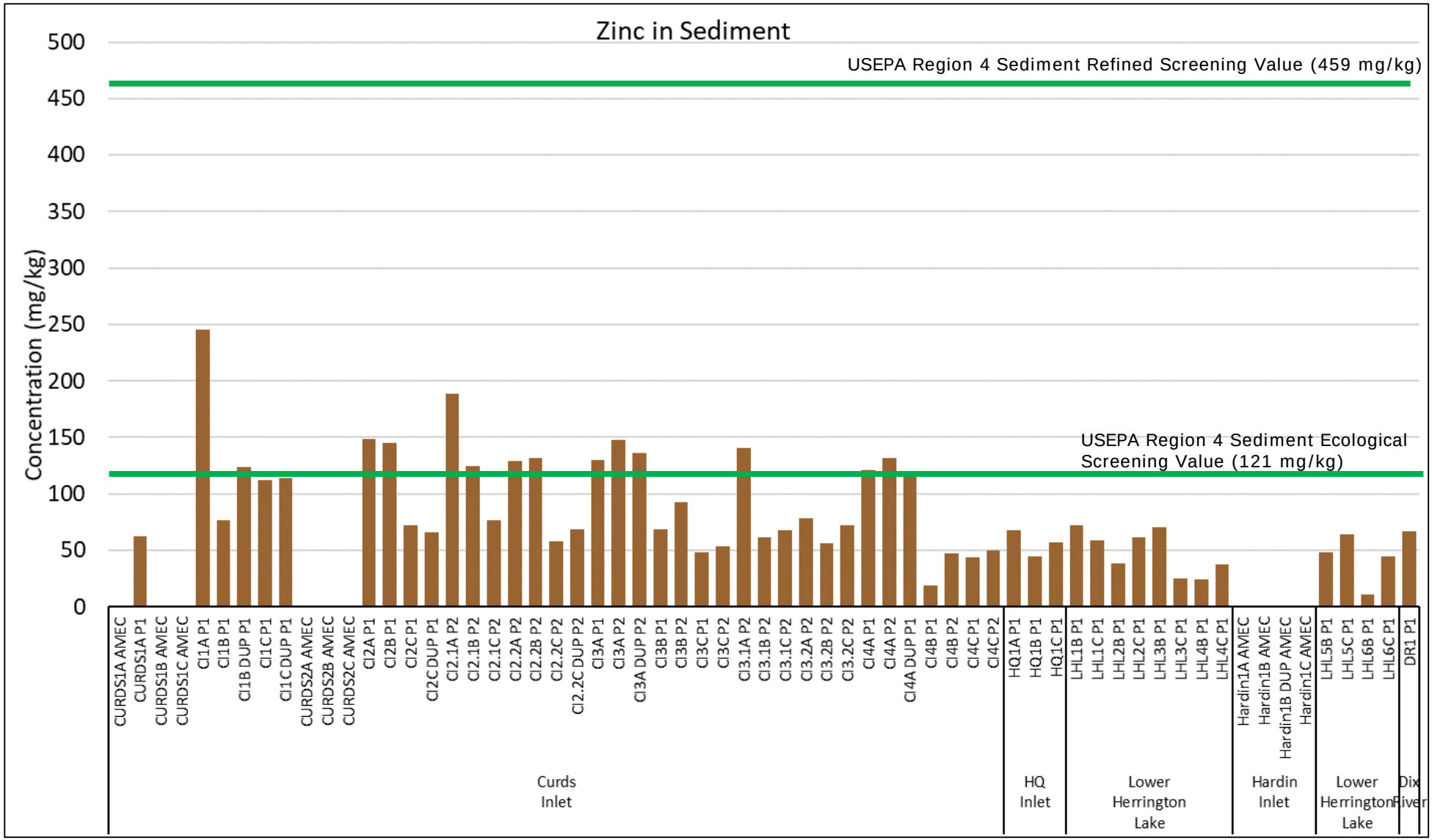


Curds Inlet (CI), Duplicate (DUP), Hardin Inlet (HI), HQ Inlet (HQ), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Observation

USEPA Region 4 Chronic Surface Water Screening Value is 0.12 mg/L.

RAMBOLL		**ZINC IN SEDIMENT POREWATER (PHASE I AND PHASE II)**	FIGURE
DRAFTED BY: PAL	DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-9F

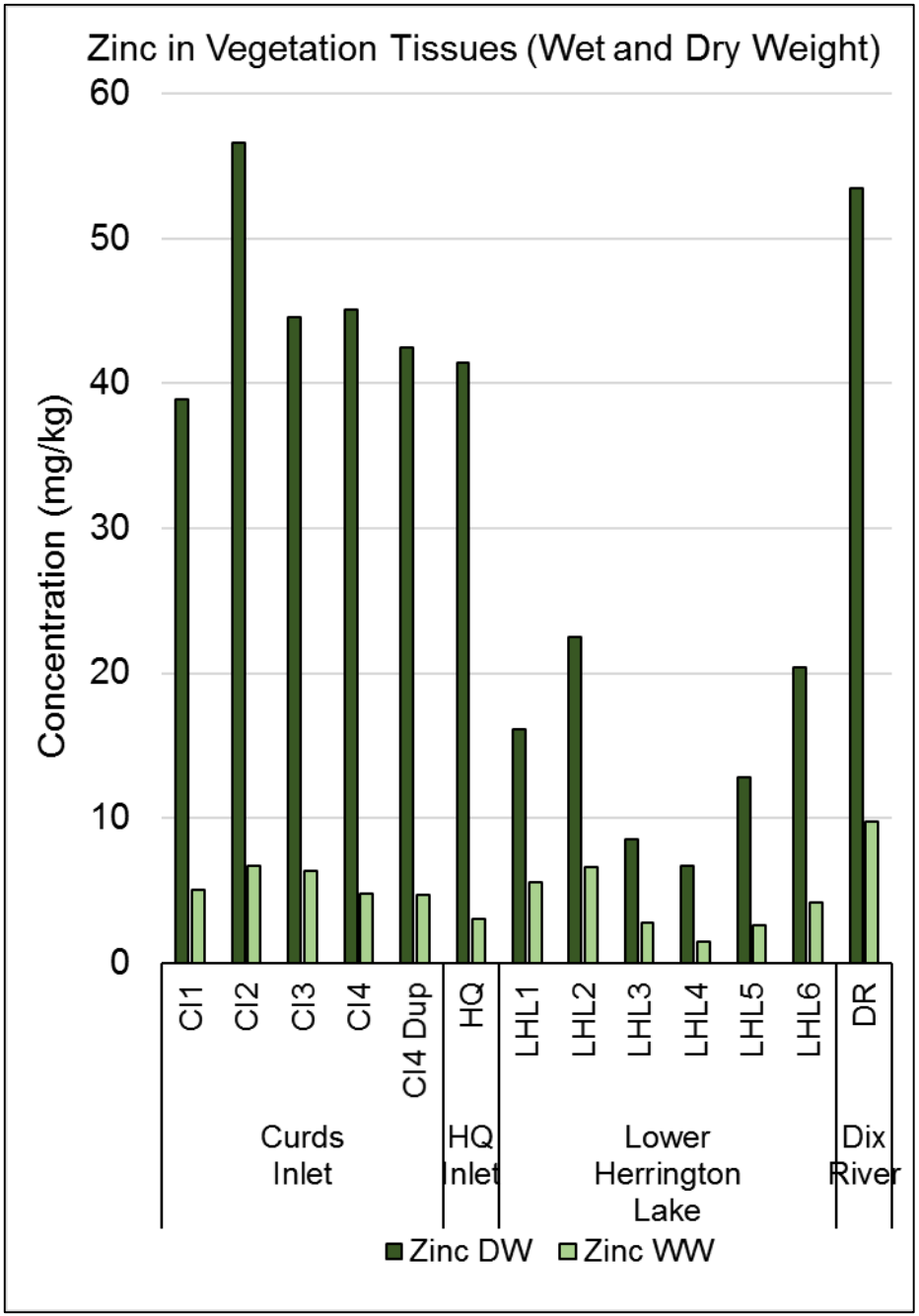


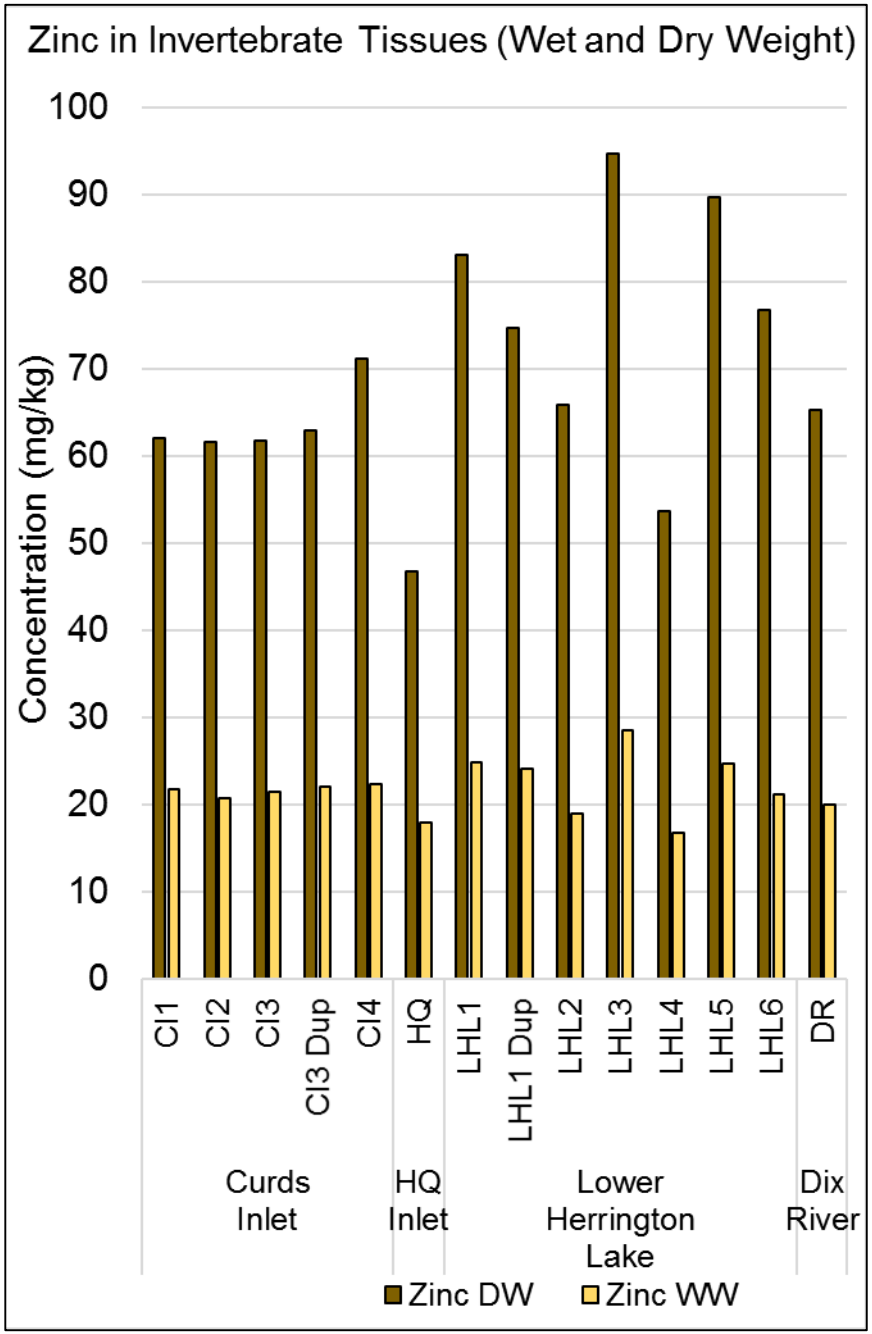
Curds Inlet (CI), Data from AMEC (AMEC), Dix River (DR), Duplicate (DUP), Hardin Inlet (Hardin), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Observations

USEPA Region 4 Sediment Ecological Screening Value 121 mg/kg.
USEPA Region 4 Sediment Refined Screening Value 459 mg/kg.
Human Health screening value for zinc based on residential soil of 23,000 mg/kg is not shown becuase it is higher than the scale allows.

RAMBOLL	**ZINC IN SEDIMENT (AMEC FEBRUARY 2017, PHASE I, AND PHASE II)**	FIGURE
DRAFTED BY: PAL / DATE: 02/01/2019	Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	2-9G





Curds Inlet (CI), Dix River (DR), Dry Weight (DW), HQ Inlet (HQ), Lower Herrington Lake (LHL), milligrams per kilogram (mg/kg), Wet Weight (WW)

RAMBOLL

DRAFTED BY: PAL

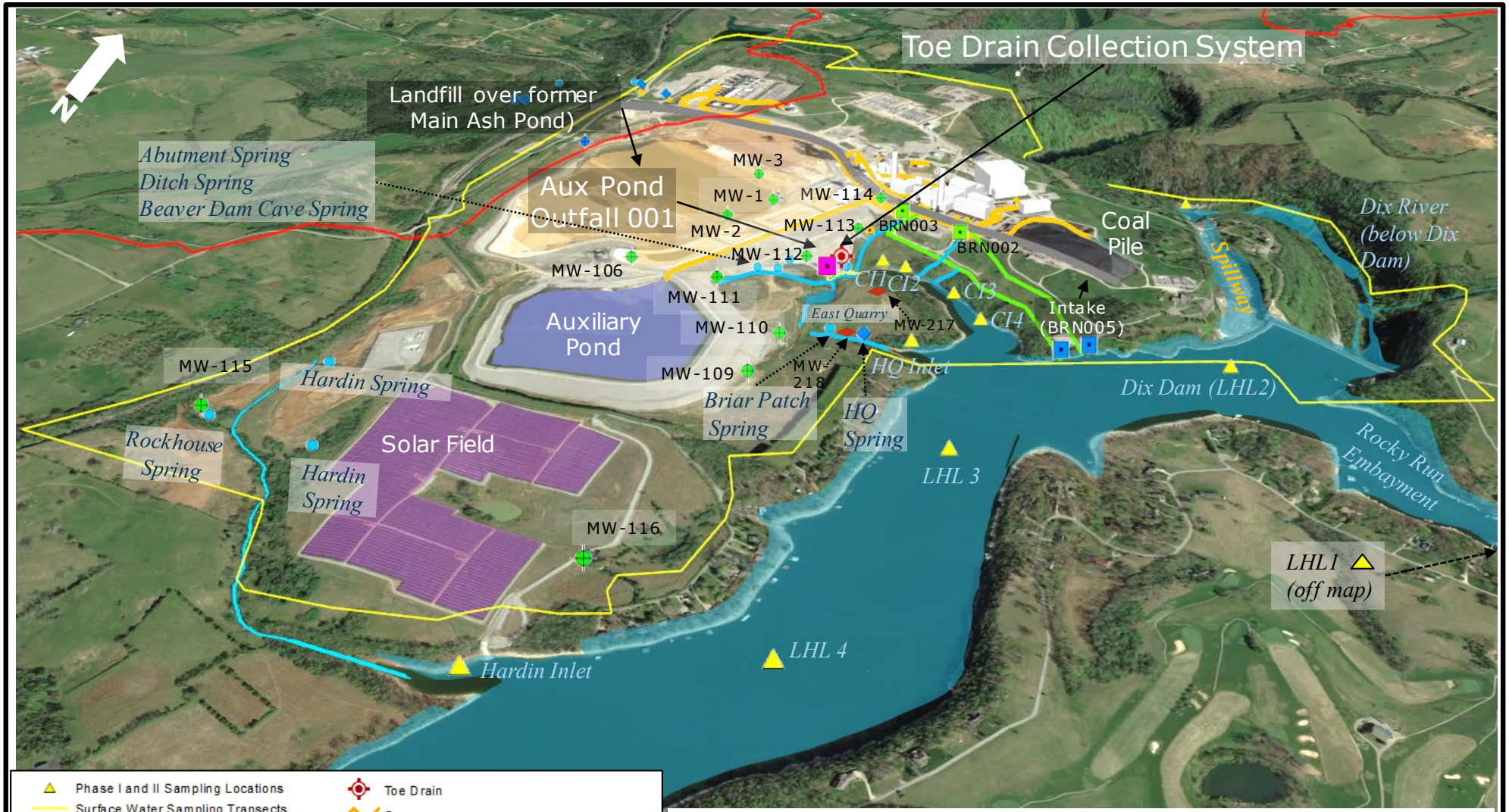
DATE: 02/01/2019

ZINC IN VEGETATION AND INVERTEBRATES (PHASE I)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

2-9H



Notes:
E.W. Brown Site Layout Overview, including Herrington Lake near the Plant. The following are identified on this graphic:

- The Auxiliary Pond and Outfall 001.
- Units 1 and 2 were retired in February 2019, so non-contact cooling water is no longer discharged via KPDES Outfall BRN002. BRN003 remains active.
- Phase I and Phase II Sampling areas within Curds Inlet, HQ Inlet, Hardin Inlet, and the Lower Herrington Lake (LHL) locations closet to Curds Inlet.
- Groundwater monitoring wells nearest Herrington Lake.
- Toe Drain Collection System pumps flow from groundwater to Auxiliary Pond

RAMBOLL

Figure Created by: AJS

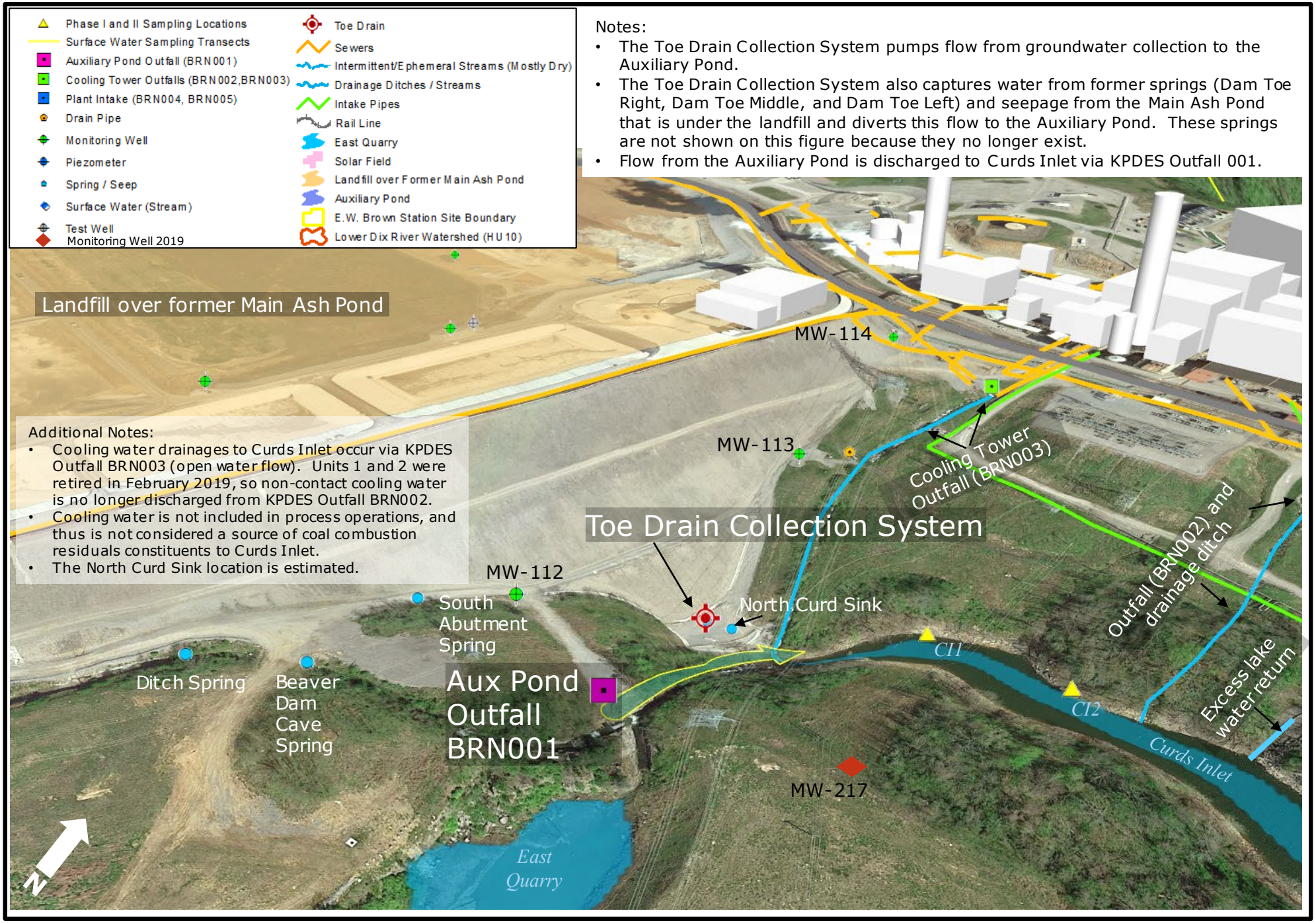
DATE: 03/01/2019

CONCEPTUAL SITE MODEL FOR SOURCE IDENTIFICATION: SITE OVERVIEW

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-1A



RAMBOLL

Figure Created by: AJS

DATE: 03/01/2019

CONCEPTUAL SITE MODEL FOR SOURCE IDENTIFICATION: TOE DRAIN AND OUTFALL VIEW

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-1B

HERRINGTON LAKE

CURDS INLET

HARDIN INLET

AUXILIARY POND

HQ SPRING

BRIAR PATCH SPRING

SOUTH ABUTMENT SEEP

DITCH SPRING

BEAVER DAM CAVE SPRING

TOE DRAIN COLLECTION SYSTEM

DAM TOE LEFT

DAM TOE MIDDLE

DAM TOE RIGHT

SEDIMENT POND 1

LEACHATE POND

SEDIMENT POND 2

CLOSED ASH POND AND LANDFILL UNDER CONSTRUCTION

MW-217 MW-218 MW-114 MW-113 MW-112 MW-111 MW-110 MW-109 MW-116 MW-106

PZ-11-01 PZ-11-02

AB-11-01 AB-11-02

B-104 B-108

A 0+00 5+00 10+00 15+00 20+00 25+00 30+00 35+00 40+00 45+00 50+00 55+00 57+00 A'

B 0+00 5+00 10+00 15+00 20+00 25+00 30+00 B'

0 500
SCALE IN FEET

LEGEND:

- MONITORING WELL
- SOIL BORING
- TRACER DYE TEST INJECTION POINT
- PIEZOMETER
- SEEP LOCATION
- GROUNDWATER BASIN DIVIDE

SOURCE:

AERIAL IMAGERY: Google Earth. IMAGE DATE 04/12/2017.

GROUNDWATER BASIN DIVIDE FROM 2013 AMEC GROUNDWATER ASSESSMENT REPORT.

CROSS-SECTION KEY MAP

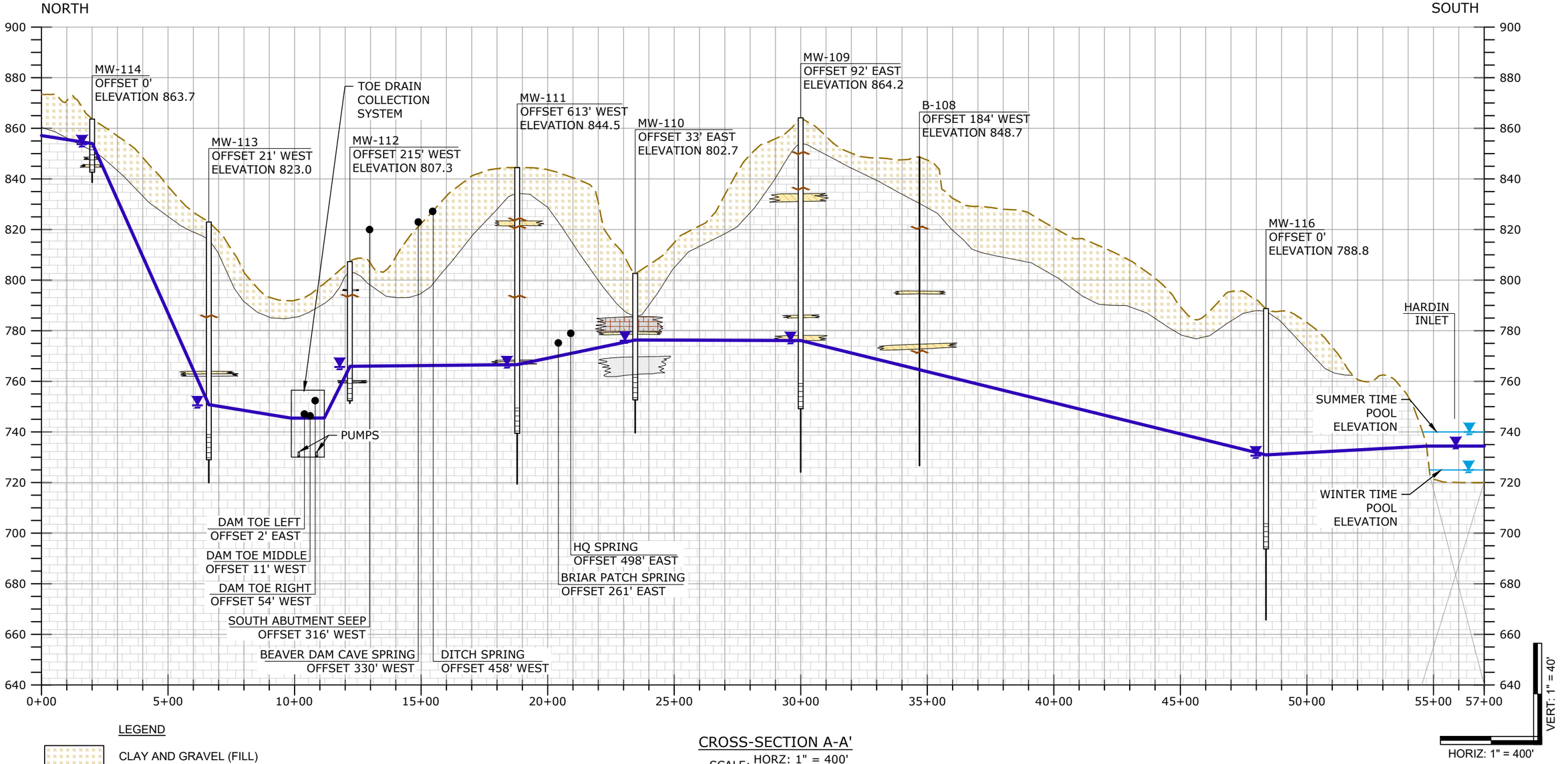
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

RAMBOLL

FIGURE 3-1C

DRAFTED BY: MSB | DATE: 06/10/2019 | PROJECT: 1690006320

MBLEI 6/10/19 F:\1690006320_HW HERRINGTON LAKE_WIP < SECT >



LEGEND

- CLAY AND GRAVEL (FILL)
- BEDROCK (LIMESTONE)
- CLAY
- WEATHERED BEDROCK (LIMESTONE)
- SAND
- COAL ASH
- VOID
- DISCONTINUITY
- UNKNOWN LITHOLOGY

- GROUNDWATER ELEVATION
- MONITORING WELL
- MONITORING WELL SCREEN
- EXTENT OF INITIAL BOREHOLE
- FRACTURE

CROSS-SECTION A-A'

SCALE: HORZ: 1" = 400'
VERT: 1" = 40'

NOTE:

1. WATER LEVEL AND LAKE LEVEL FROM JUNE 19, 2018 SAMPLING EVENT.
2. ELEVATIONS SHOWN ARE BASED ON WELL SPECIFIC SURVEYS FROM WELL TO WELL.

GEOLOGIC CROSS-SECTION A-A'

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

RAMBOLL

FIGURE
3-1D

DRAFTED BY: MSB | DATE: 05/16/2019 | PROJECT:

MBLEI 5/16/19 F:\1690006320_HW HERRINGTON LAKE_WIP < SECT >

HERRINGTON LAKE

CURDS INLET

HARDIN INLET

HQ SPRING

BRIAR PATCH SPRING

MW-217

MW-218

TOE DRAIN COLLECTION SYSTEM

DAM TOE LEFT

DAM TOE MIDDLE

DAM TOE RIGHT

A

A'

B

B'

0+00

5+00

10+00

15+00

20+00

25+00

30+00

35+00

40+00

45+00

50+00

55+00

57+00

MW-114

MW-113

MW-112

MW-110

MW-109

MW-116

SEGMENT 1

SEGMENT 2

SEGMENT 3

SEGMENT 4

SEGMENT 5

SEGMENT 6

SEGMENT 7

B-108

BEAVER DAM CAVE SPRING

SOUTH ABUTMENT SEEP

DITCH SPRING

PZ-11-01

PZ-11-02

MW-111

AB-11-02

AB-11-01

AUXILIARY POND

MW-106

SEDIMENT POND 1

LEACHATE POND

SEDIMENT POND 2

CLOSED ASH POND AND LANDFILL UNDER CONSTRUCTION

B-104

0 500

SCALE IN FEET

LEGEND:

- MONITORING WELL
- SOIL BORING
- TRACER DYE TEST INJECTION POINT
- PIEZOMETER
- SEEP LOCATION

SOURCE:

AERIAL IMAGERY: Google Earth. IMAGE DATE 04/12/2017.

LOCATION OF SEGMENTS FOR GROUNDWATER DISCHARGE

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

RAMBOLL

FIGURE 3-1E

DRAFTED BY: MSB | DATE: 06/10/2019 | PROJECT: 1690006320

MBLEI 6/10/19 F:\1690006320_HW HERRINGTON LAKE_WIP < SECT >

0 300 600 Feet

(836.92) WATER LEVEL IN PARENTHESIS WHERE OMITTED FROM PIEZOMETRIC SURFACE INTERPRETATION

HERRINGTON LAKE WATER LEVEL BASED ON USGS GAGE @ 11:00 ON 06/19/18

20' CONTOUR
PIEZOMETRIC SURFACE CONTOUR
(DASHED WHERE INFERRED)

0.5' CONTOUR
PIEZOMETRIC SURFACE CONTOUR
(DASHED WHERE INFERRED)

MW-105 MONITORING WELL LOCATION

PZ-103 PIEZOMETER LOCATION

SOURCE:

FROM 2019 AECOM SECOND ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT, 2018. JANUARY 31, 2019.

PIEZOMETRIC SURFACE FOR JUNE 19, 2018

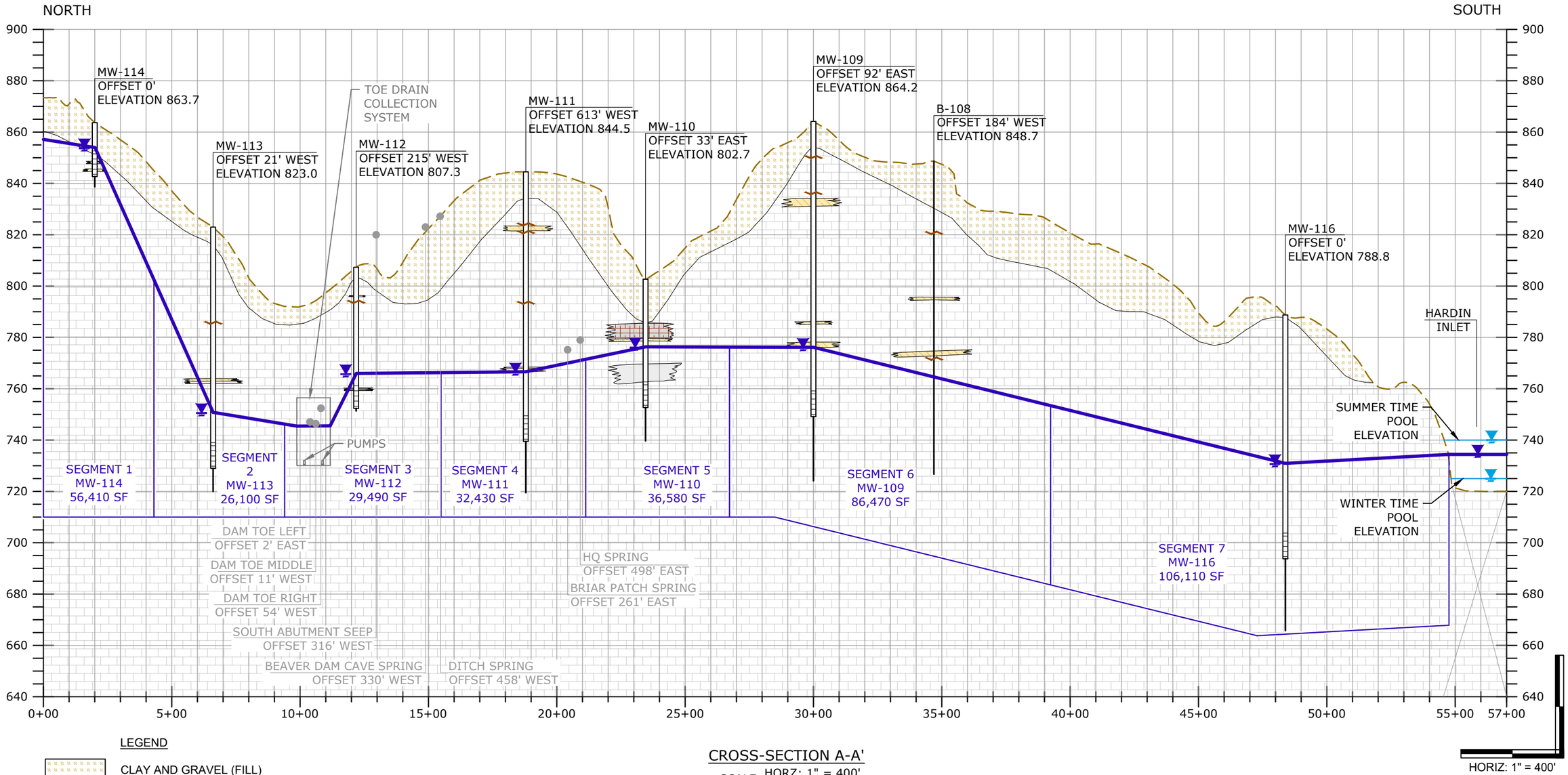
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

RAMBOLL

FIGURE
3-1F

DRAFTED BY: MSB | DATE: 04/30/2019 | PROJECT:

MBLEI 4/30/19 F:\169000632O_HW HERRINGTON LAKE_WIP < GW MONITORING >



LEGEND

- CLAY AND GRAVEL (FILL)
- BEDROCK (LIMESTONE)
- CLAY
- WEATHERED BEDROCK (LIMESTONE)
- SAND
- COAL ASH
- VOID
- DISCONTINUITY
- UNKNOWN LITHOLOGY

- GROUNDWATER ELEVATION
- MONITORING WELL
- MONITORING WELL SCREEN
- EXTENT OF INITIAL BOREHOLE
- FRACTURE

CROSS-SECTION A-A'

SCALE: HORZ: 1" = 400'
VERT: 1" = 40'

NOTE:

1. WATER LEVEL AND LAKE LEVEL FROM JUNE 19, 2018 SAMPLING EVENT.
2. ELEVATIONS SHOWN ARE BASED ON WELL SPECIFIC SURVEYS FROM WELL TO WELL.

GEOLOGICAL CROSS-SECTION A-A' AND SEGMENTS FOR GROUNDWATER DISCHARGE

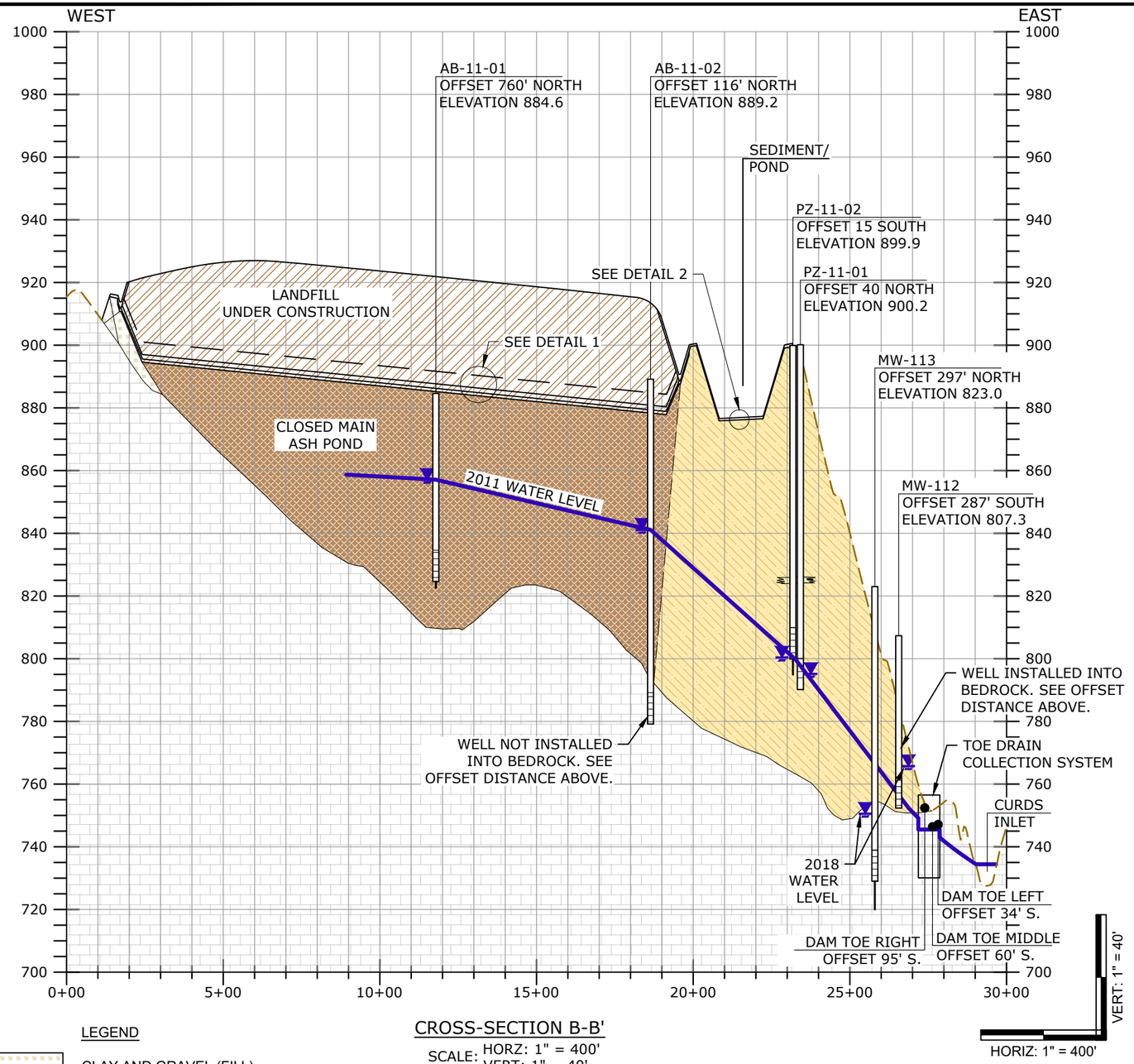
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

RAMBOLL

FIGURE
3-1G

DRAFTED BY: MSB | DATE: 05/16/2019 | PROJECT:

MBLEI 5/16/19 F:\169000320_HW HERRINGTON LAKE_WIP < SECT >

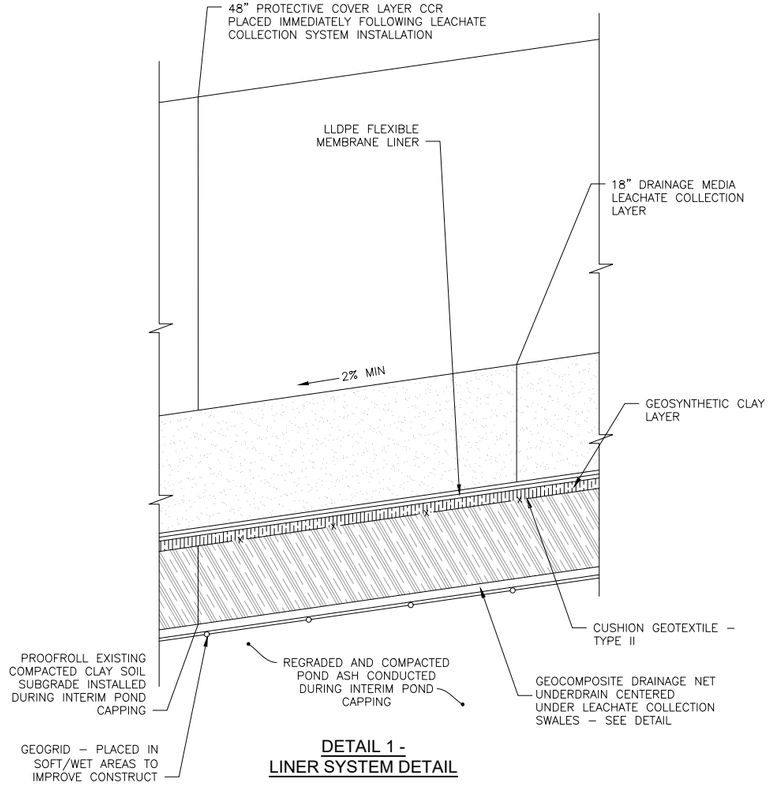


CROSS-SECTION B-B'

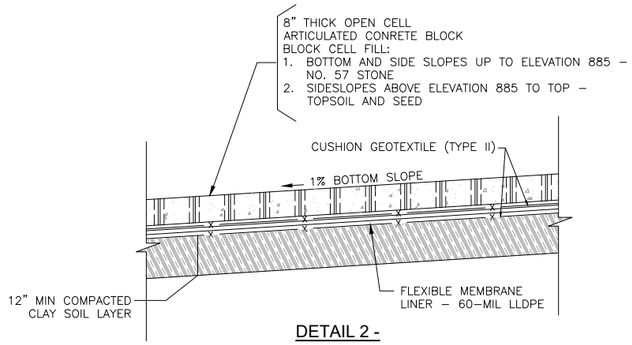
SCALE: HORZ: 1" = 400'
VERT: 1" = 40'

LEGEND

- CLAY AND GRAVEL (FILL)
- BEDROCK (LIMESTONE)
- CLAY FILL
- WEATHERED BEDROCK (LIMESTONE)
- SAND
- CLOSED MAIN ASH POND
- VOID
- DISCONTINUITY
- UNKNOWN LITHOLOGY
- GROUNDWATER ELEVATION
- MONITORING WELL
- MONITORING WELL SCREEN
- EXTENT OF INITIAL BOREHOLE



DETAIL 1 -
LINER SYSTEM DETAIL



DETAIL 2 -
STORMWATER POND LINER DETAIL

SOURCE:

1. WATER LEVEL FROM 2013 AMEC GROUNDWATER ASSESSMENT REPORT.
2. DETAILS: ATTACHMENT 20 OF AMECS SPECIAL WASTE PERMIT APPLICATION DESIGN PLANS.

GEOLOGIC CROSS-SECTION B-B'

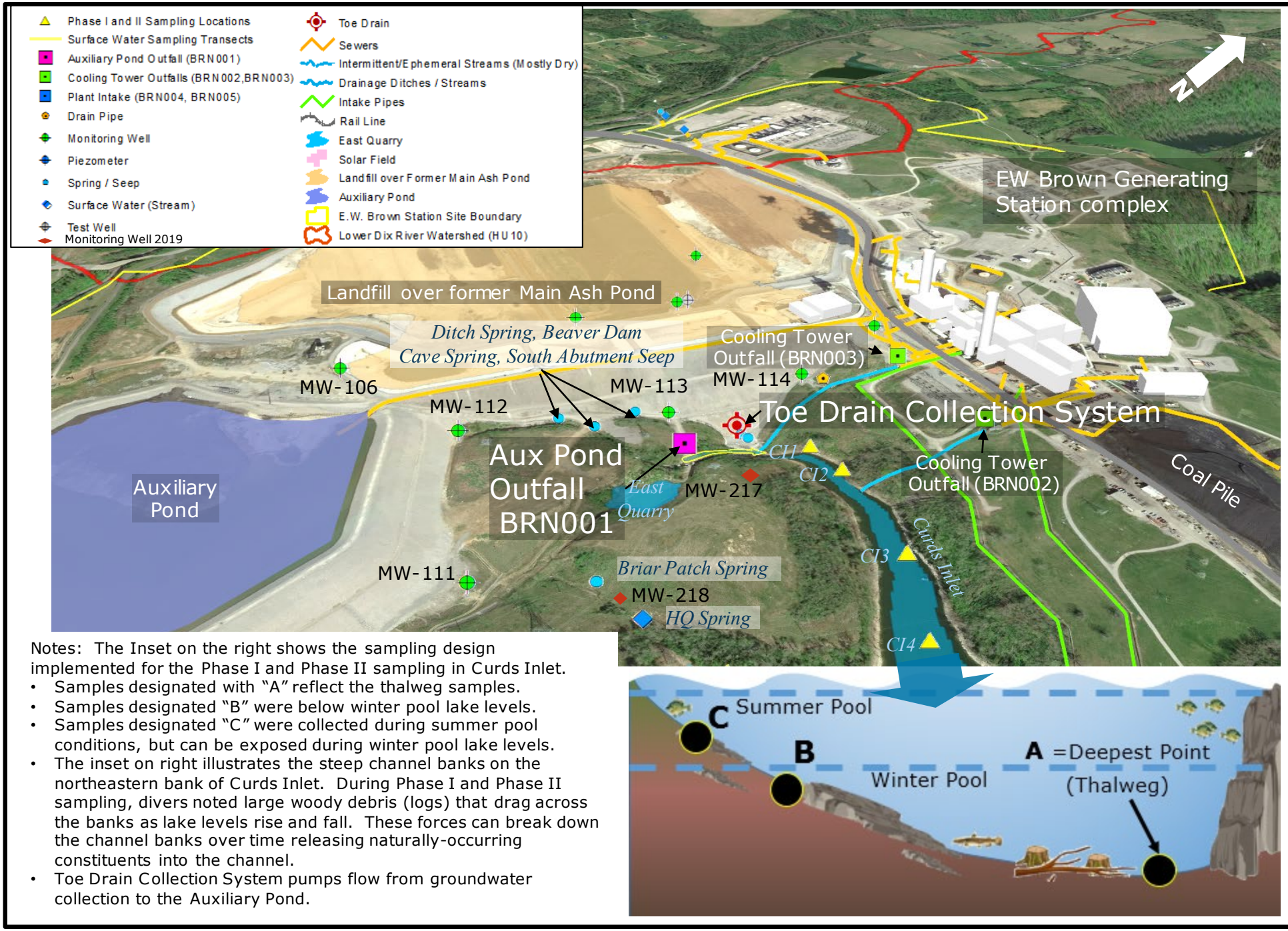
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

RAMBOLL

FIGURE
3-1H

DRAFTED BY: MSB | DATE: 05/24/2019 | PROJECT:

MBLEI 5/24/19 F:\1690006320_HW HERRINGTON LAKE_WIP < SECT >



Notes: The Inset on the right shows the sampling design implemented for the Phase I and Phase II sampling in Curds Inlet.

- Samples designated with "A" reflect the thalweg samples.
- Samples designated "B" were below winter pool lake levels.
- Samples designated "C" were collected during summer pool conditions, but can be exposed during winter pool lake levels.
- The inset on right illustrates the steep channel banks on the northeastern bank of Curds Inlet. During Phase I and Phase II sampling, divers noted large woody debris (logs) that drag across the banks as lake levels rise and fall. These forces can break down the channel banks over time releasing naturally-occurring constituents into the channel.
- Toe Drain Collection System pumps flow from groundwater collection to the Auxiliary Pond.

RAMBOLL

Figure Created by: AJS

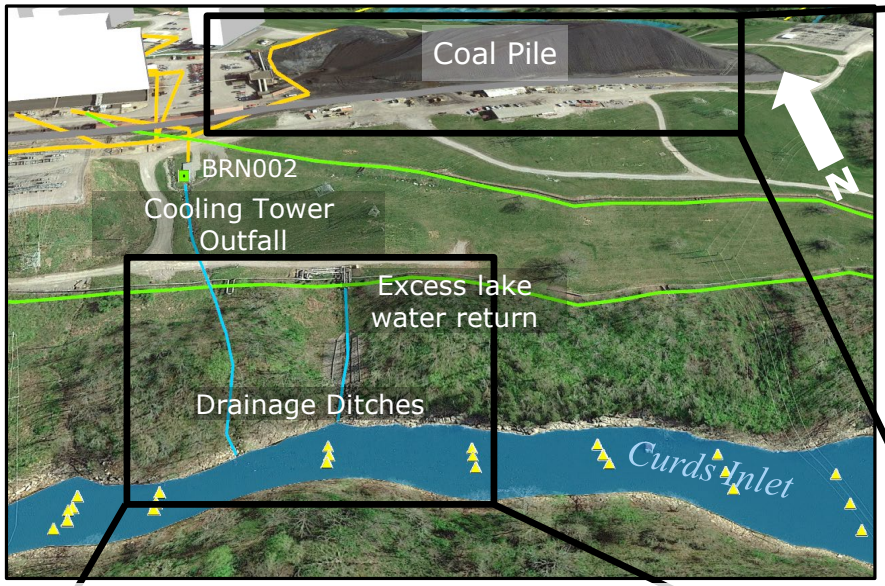
DATE: 03/01/2019

CONCEPTUAL SITE MODEL FOR SOURCE IDENTIFICATION: CURDS INLET VIEW WITH CROSS-SECTION EXAMPLE

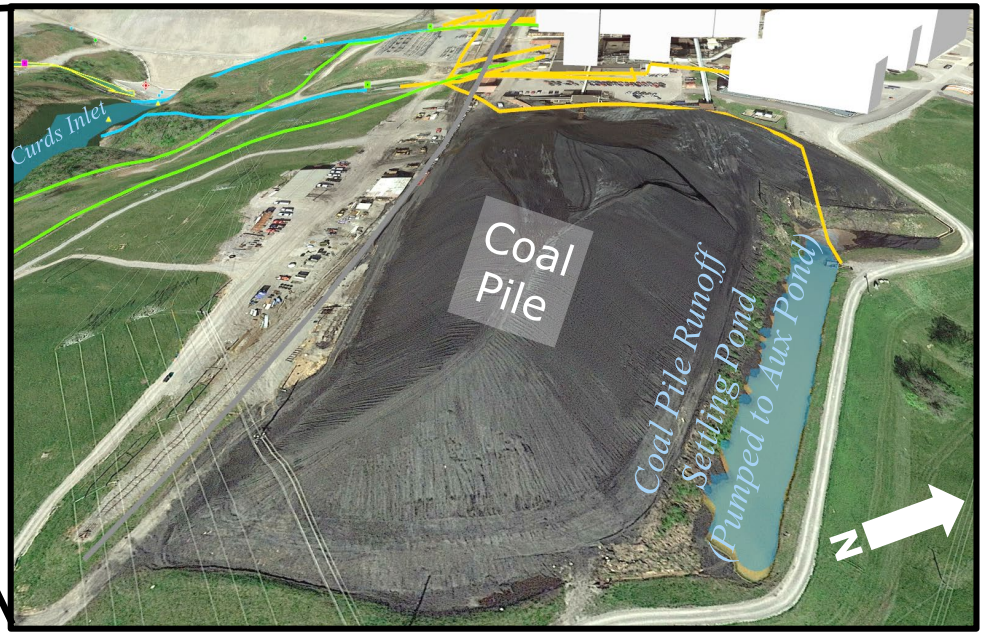
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

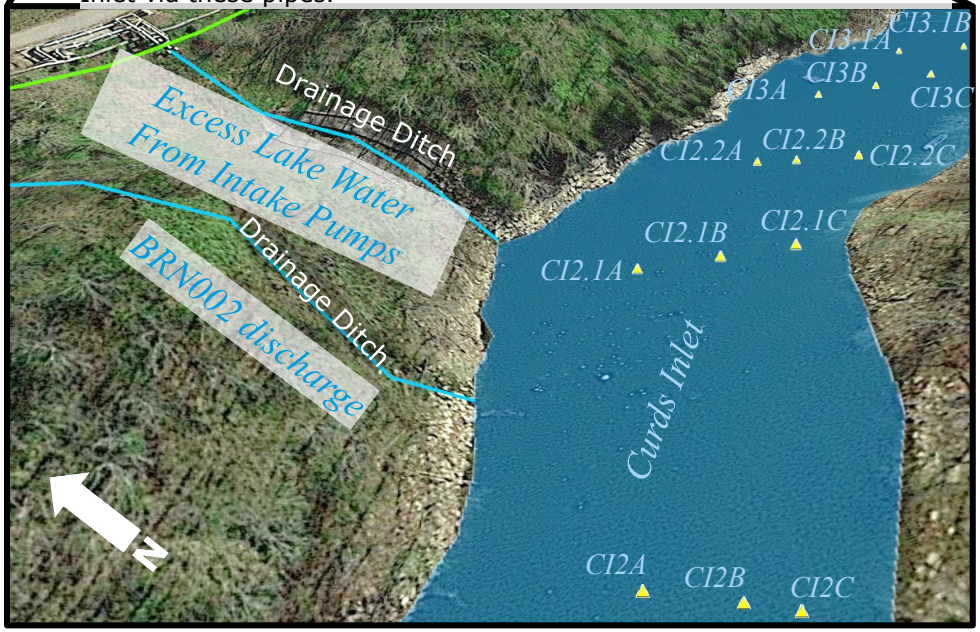
3-1I

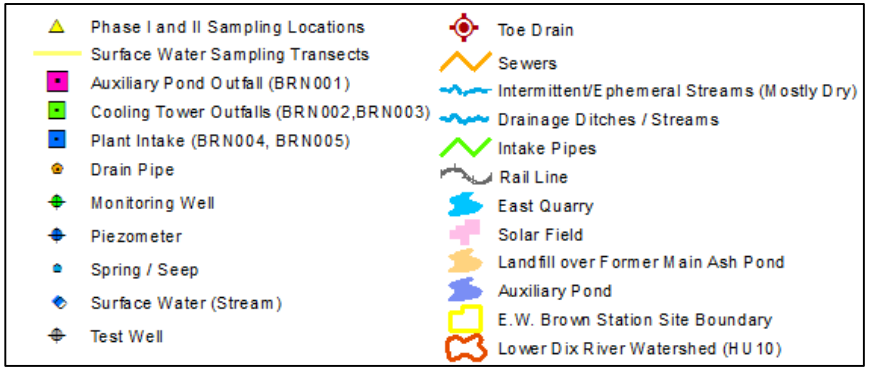


Notes: Cooling tower Units 1 and 2 were retired in February 2019, so non-contact cooling water is no longer discharged from KPDES Outfall BRN002. The pipe parallel to BRN002 returns excess lake water from intake pumps. Water from the coal pile does not discharge to Curds Inlet via these pipes.



Notes:
Drainage from the coal pile is collected in the coal pile runoff and settling pond and is pumped to the Auxiliary Pond. Water from the Auxiliary Pond is ultimately discharged to Curds Inlet via KPDES Outfall 001.





Notes:
Drainage from the coal pile is pumped to the Auxiliary Pond.

RAMBOLL

Figure Created by: AJS

DATE: 03/01/2019

CONCEPTUAL SITE MODEL FOR SOURCE IDENTIFICATION: CURDS INLET AND COAL PILE DRAINAGE VIEW

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-1J

Notes:

Springs and Outfalls:

- Briar Patch Spring and HQ Spring flow to HQ Inlet. The flow from these two springs has decreased since the installation of the Toe Drain Collection System.
- Ditch Spring and Beaver Dam Cave formerly flowed to Curds Inlet but have mostly been dry since the installation of the Toe Drain Collection System.
- Groundwater flowing under the Landfill is captured by the Toe Drain Collection System and channeled to the Auxiliary Pond, which ultimately flows to Curds Inlet via KDPES Outfall 001.
- Flow from former springs Dam Toe Right, Dam Toe Middle, and Dam Toe Left is also captured in the Toe Drain and channeled to the Auxiliary Pond.
- Units 1 and 2 were retired in February 2019, so non-contact cooling water is no longer discharged via KPDEQ Outfall BRN002
- The average Se and As concentrations in the Dam Toe Springs prior to Toe Dam placement was 0.022 mg/L and 0.7 mg/L, respectively (Tables 3-2 and 3-4). Se and As concentrations in the Dam Toe Springs exceeded the KY surface water quality standards of 0.005 mg/L and 0.15 mg/L, respectively.

- Phase I and II Sampling Locations
- Surface Water Sampling Transects
- Auxiliary Pond Outfall (BRN001)
- Cooling Tower Outfalls (BRN002,BRN003)
- Plant Intake (BRN004, BRN005)
- Drain Pipe
- Monitoring Well
- Piezometer
- Spring / Seep
- Surface Water (Stream)
- Test Well
- Monitoring Well 2019
- Toe Drain
- Sewers
- Intermittent/Ephemeral Streams (Mostly Dry)
- Drainage Ditches / Streams
- Intake Pipes
- Rail Line
- East Quarry
- Solar Field
- Landfill over Former Main Ash Pond
- Auxiliary Pond
- E.W. Brown Station Site Boundary
- Lower Dix River Watershed (HU10)

Groundwater Results for 2016 to 2018

- Table 3-6 provides reports groundwater monitoring data for the years of 2016 to 2018 for Se and As at groundwater monitoring wells adjacent to Curds Inlet and HQ Inlet.
- Se was not detected in the wells closest to Curds Inlet (MW-009, -110, -112, -113, and 114). Detection limits were 0.003 mg/L, which is below the KY surface water criterion of 0.005 mg/L.
- Se was detected once at MW-111 (0.02 mg/L) in 2016; Se was not detected in the next 10 sampling events from 2016 to 2018.
- Se was detected at MW-106 at concentrations ranging from 0.007 mg/L to 0.021 mg/L from 2016 to 2018. MW-106, located adjacent to the landfill. MW-111 is downgradient from MW-106.
- As was not detected in monitoring wells MW-009, -110, and -114. As was detected in wells MW-106, -109, -112, and -113 at concentrations ranging from 0.0053 mg/L to 0.047 mg/L, with these concentrations below the KY As surface water criterion of 0.15 mg/L.

RAMBOLL

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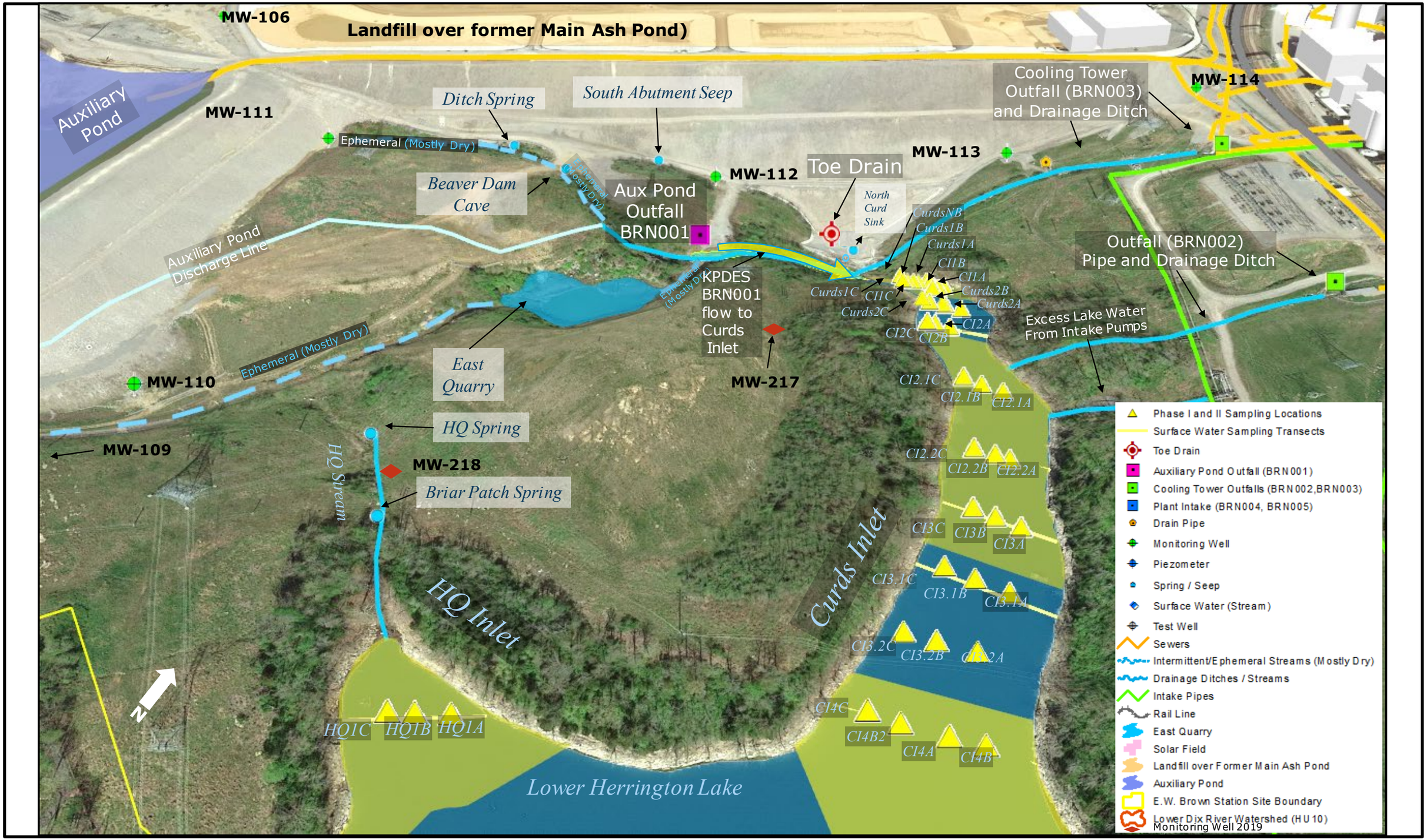
DATE: 03/01/2019

CONCEPTUAL SITE MODEL FOR SOURCE IDENTIFICATION: CURDS INLET, HQ INLET, SPRINGS, AND GROUNDWATER MONITORING WELLS

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-1K



RAMBOLL

Figure Created by: AJS

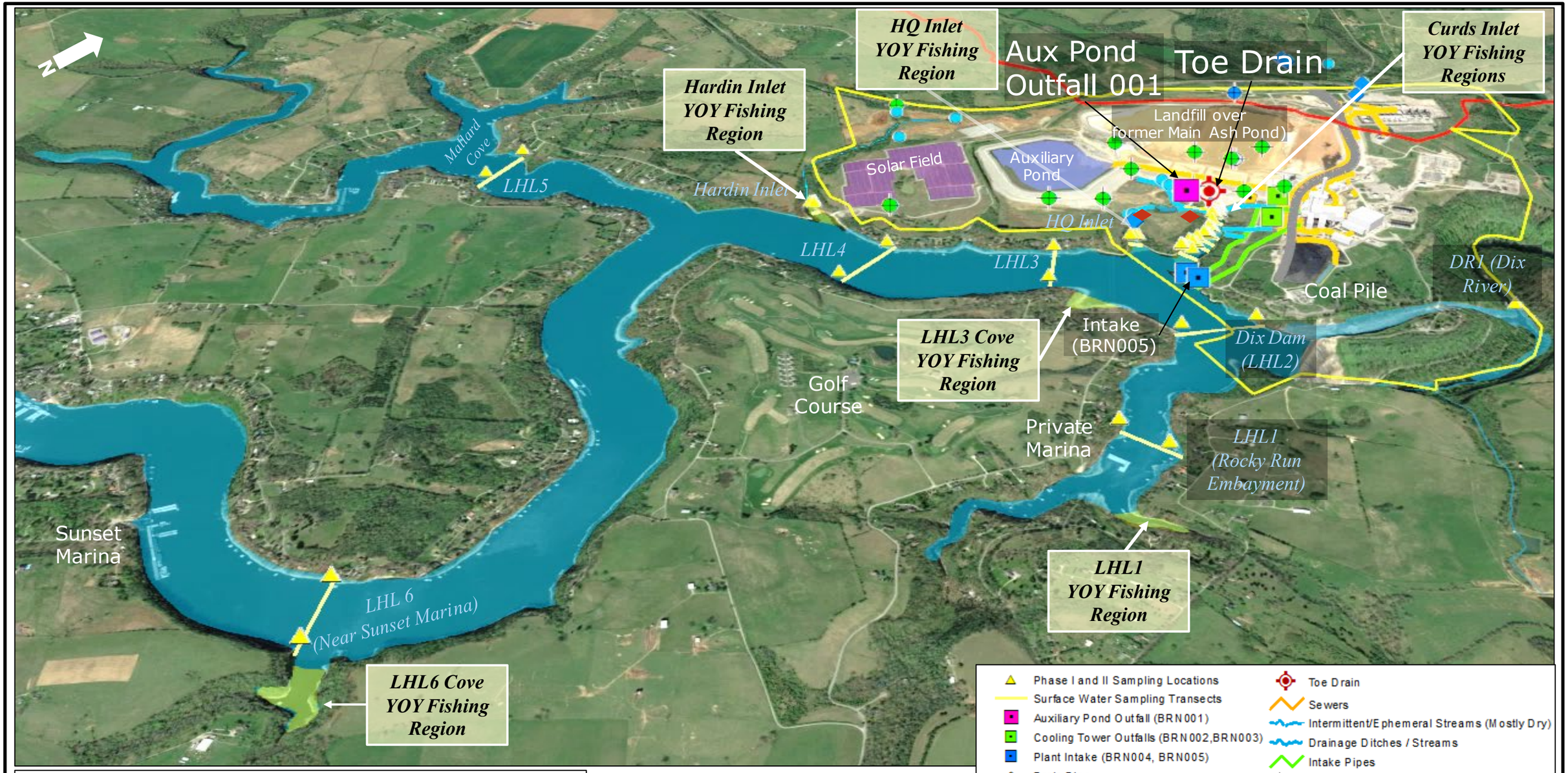
DATE: 03/01/2019

CONCEPTUAL SITE MODEL FOR SOURCE IDENTIFICATION: CURDS AND HQ INLETS WITH SPRINGS AND GROUNDWATER MONITORING WELLS

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-1L



Notes:
Locations LHL5 and LHL6 are Lower Herrington Lake (LHL) samples located approximately 1.8 and 3 miles upstream from The Plant, respectively, and are considered reference areas for the evaluation of concentrations upgradient and away from the influence of Curds inlet KPDES Outfall 001.

RAMBOLL

Figure Created by: AJS

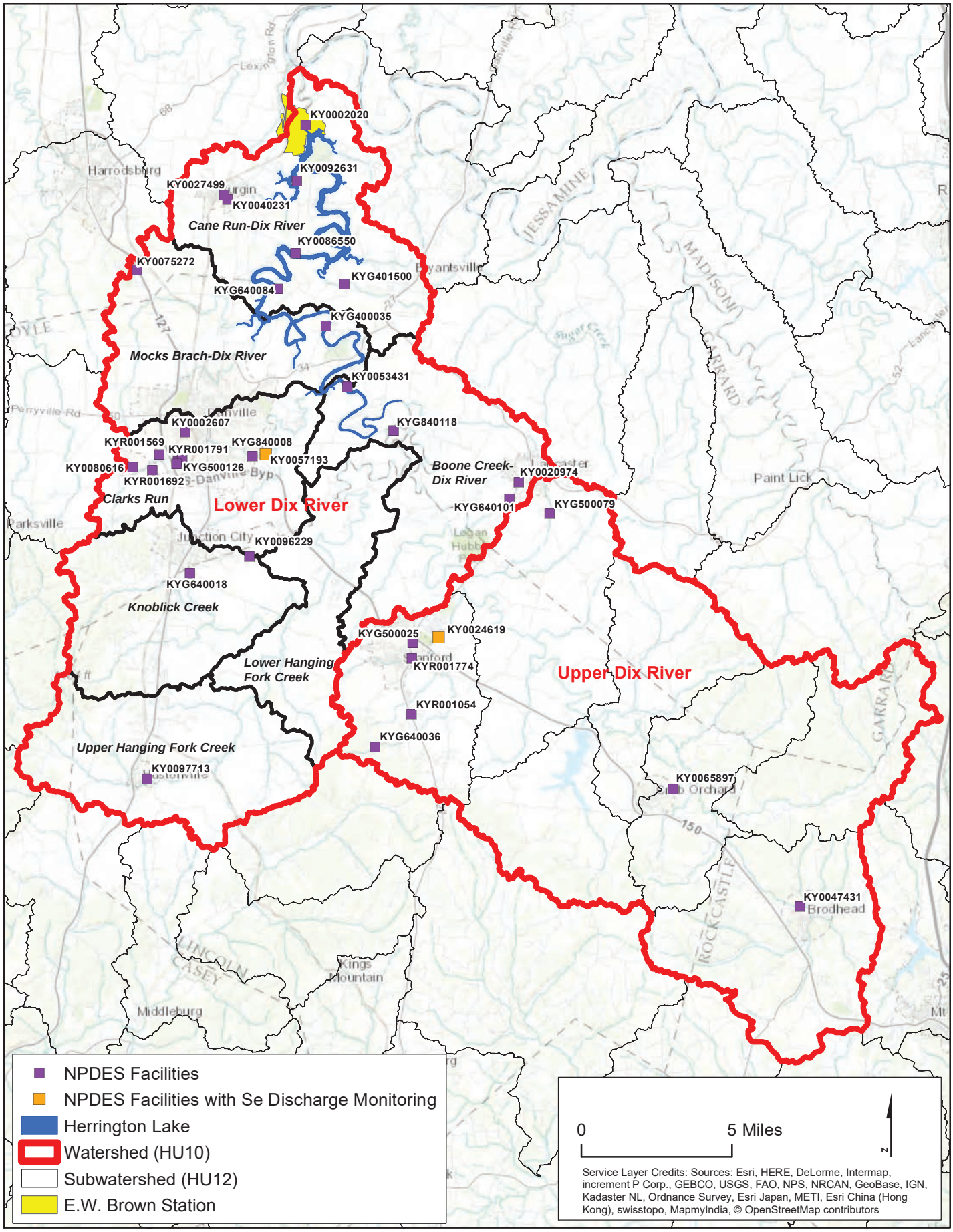
DATE: 03/01/2019

CONCEPTUAL SITE MODEL FOR SOURCE IDENTIFICATION: LOWER HERRINGTON LAKE INCLUDING LHL5 AND LHL6 STUDY REFERENCE AREAS

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-1M



RAMBOLL

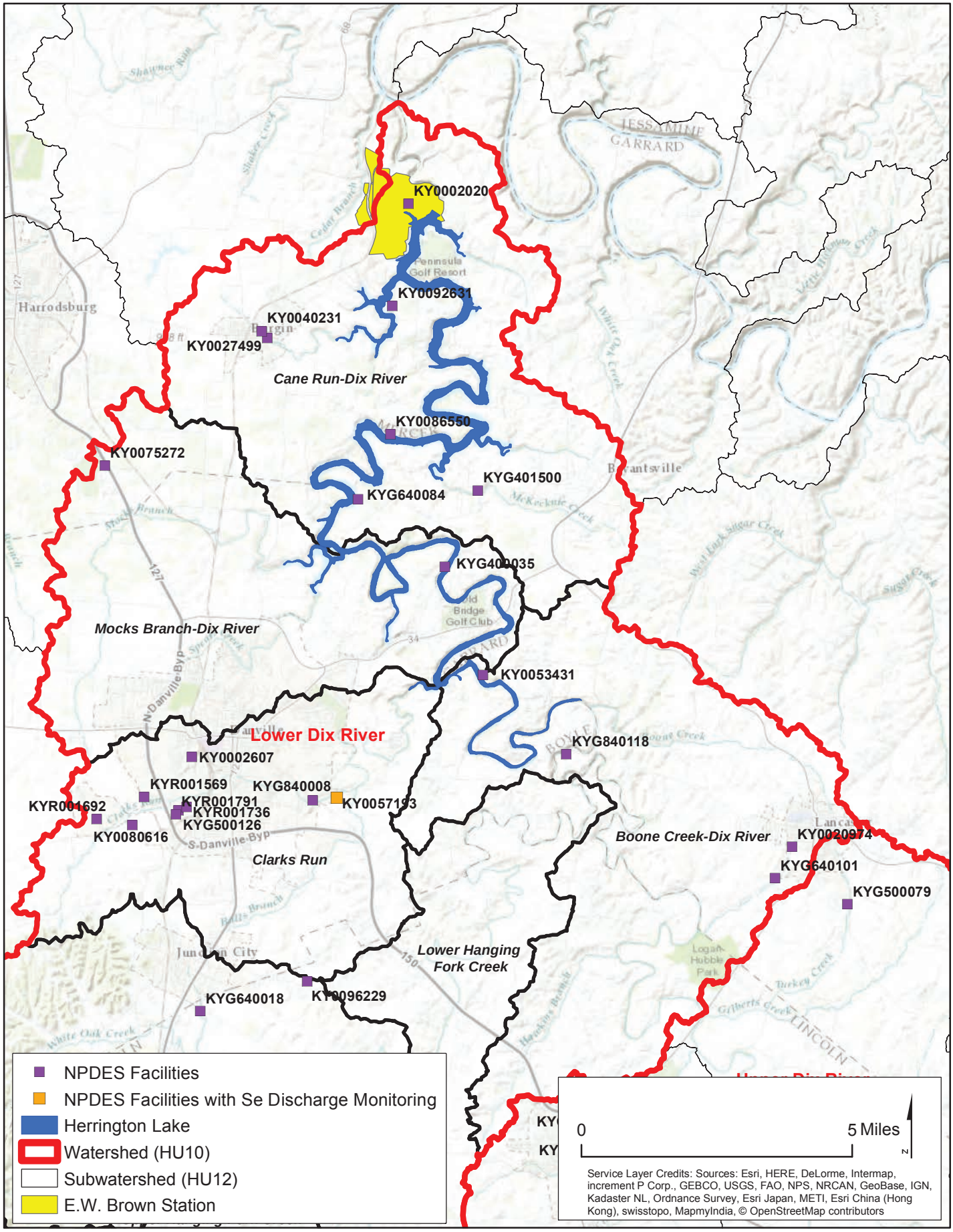
Map Design: AJS, Date: March 22, 2017

Permitted Dischargers within Upper and Lower Dix River Watersheds

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 3-2A

Project Code:



RAMBOLL

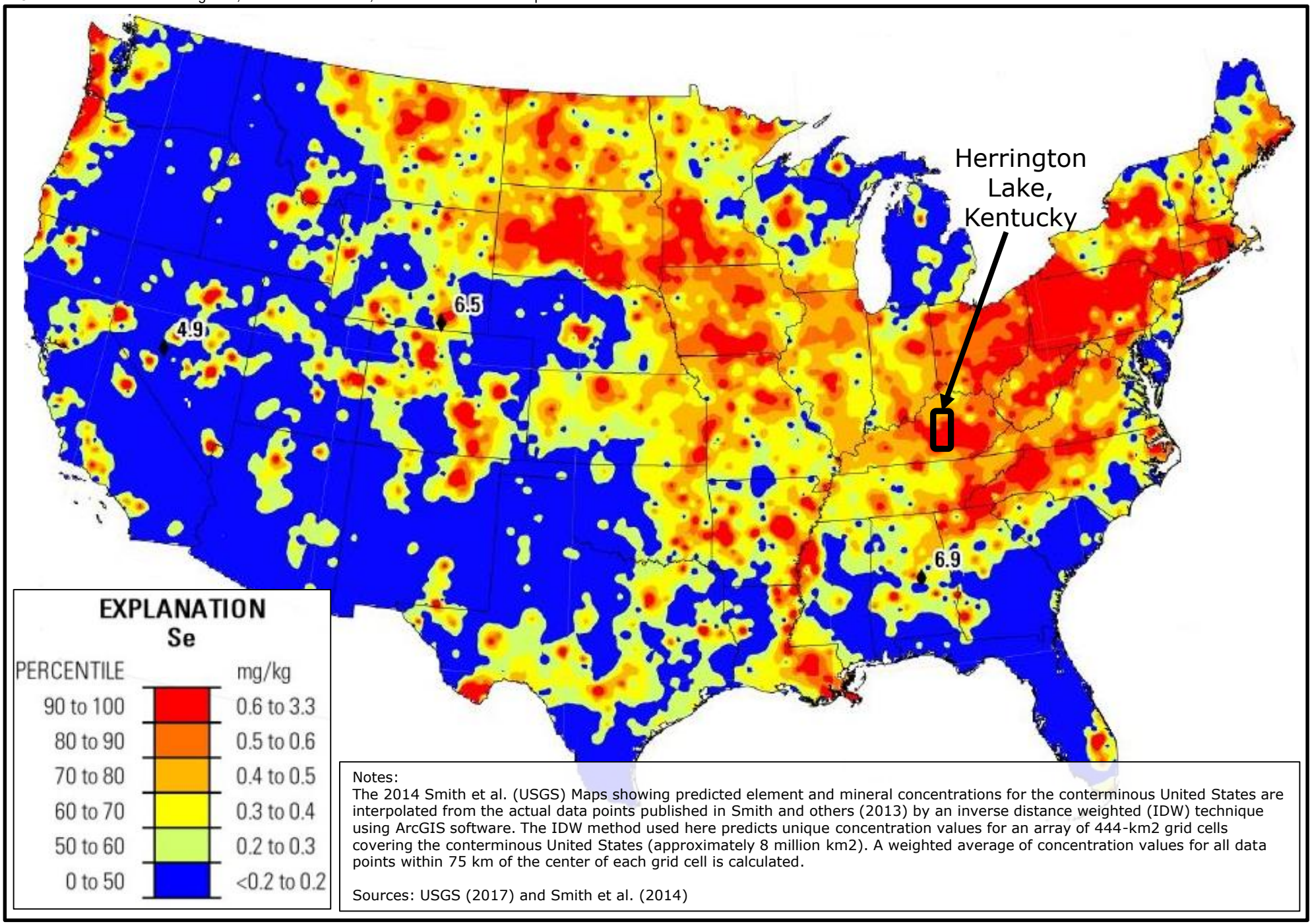
Map Design: AJS, Date: March 22, 2017

Permitted Dischargers within the Lower Dix River Watersheds

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 3-2B

Project Code:



Notes:
The 2014 Smith et al. (USGS) Maps showing predicted element and mineral concentrations for the conterminous United States are interpolated from the actual data points published in Smith and others (2013) by an inverse distance weighted (IDW) technique using ArcGIS software. The IDW method used here predicts unique concentration values for an array of 444-km2 grid cells covering the conterminous United States (approximately 8 million km2). A weighted average of concentration values for all data points within 75 km of the center of each grid cell is calculated.

Sources: USGS (2017) and Smith et al. (2014)

RAMBOLL

Figure Created by: AJS

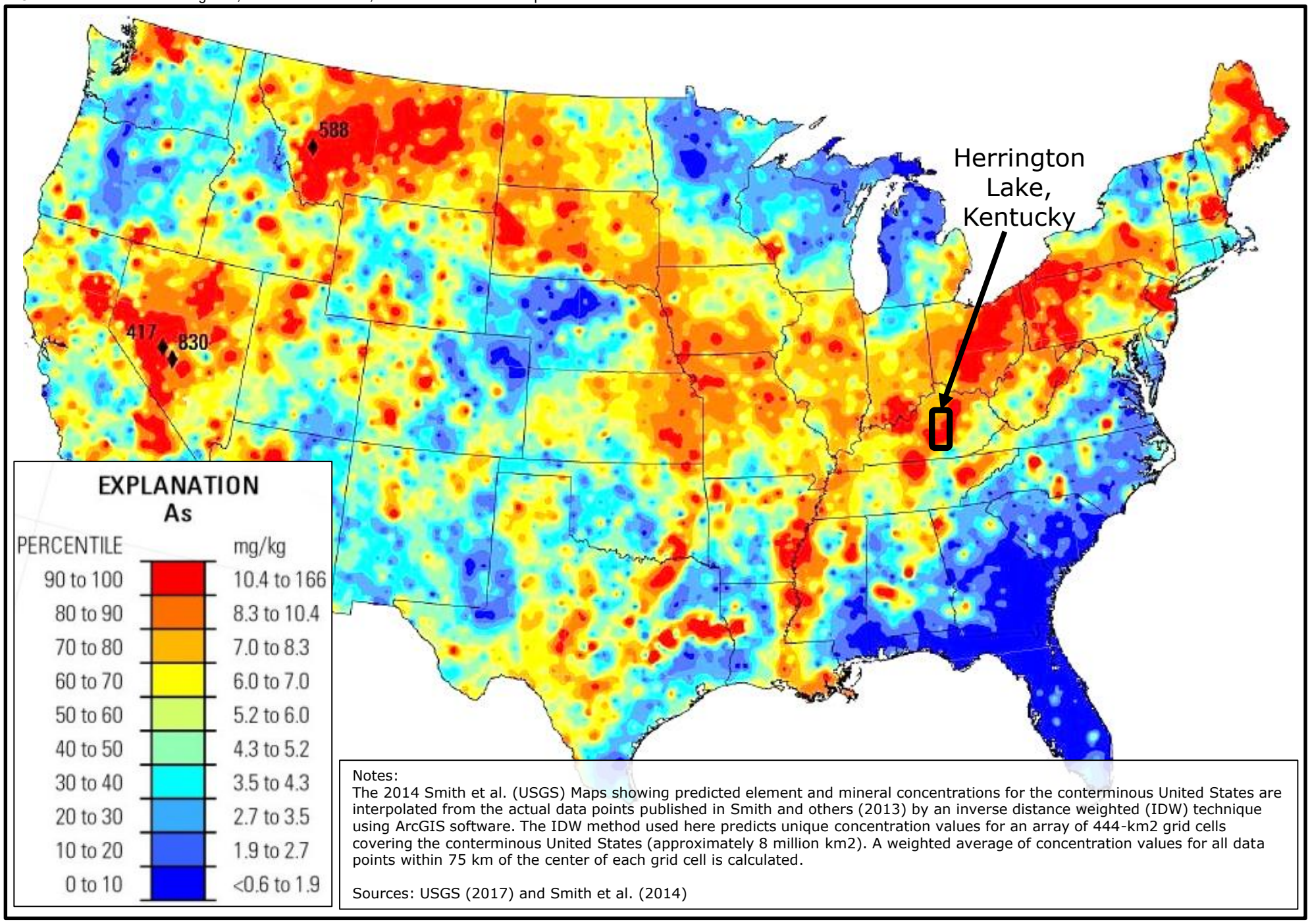
DATE: 03/01/2019

BACKGROUND SELENIUM CONCENTRATIONS IN SOIL IN 0-5 CM (1-2 INCHES) AS REPORTED IN USGS (SMITH ET AL. 2014) WITH HIGHLIGHTED REGION SURROUNDING HERRINGTON LAKE, KENTUCKY

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-3A



Notes:
The 2014 Smith et al. (USGS) Maps showing predicted element and mineral concentrations for the conterminous United States are interpolated from the actual data points published in Smith and others (2013) by an inverse distance weighted (IDW) technique using ArcGIS software. The IDW method used here predicts unique concentration values for an array of 444-km2 grid cells covering the conterminous United States (approximately 8 million km2). A weighted average of concentration values for all data points within 75 km of the center of each grid cell is calculated.

Sources: USGS (2017) and Smith et al. (2014)

RAMBOLL

Figure Created by: AJS

DATE: 03/01/2019

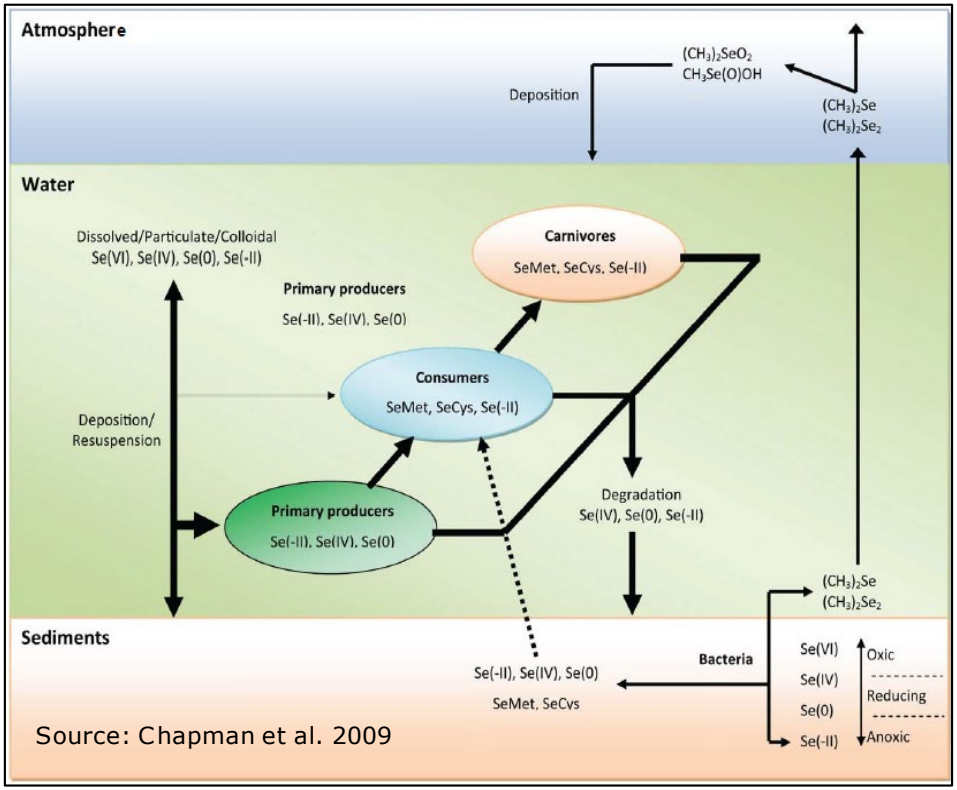
BACKGROUND ARSENIC CONCENTRATIONS IN SOIL IN 0-5 CM (1-2 INCHES) AS REPORTED IN USGS (SMITH ET AL. 2014) WITH HIGHLIGHTED REGION SURROUNDING HERRINGTON LAKE, KENTUCKY

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-3B

A. Selenium Geochemical Cycle



Source: Chapman et al. 2009

Within reducing sediments:
- Selenium is present as Se(0), Se(-II), and Se(IV)
- Arsenic is present as As(V)

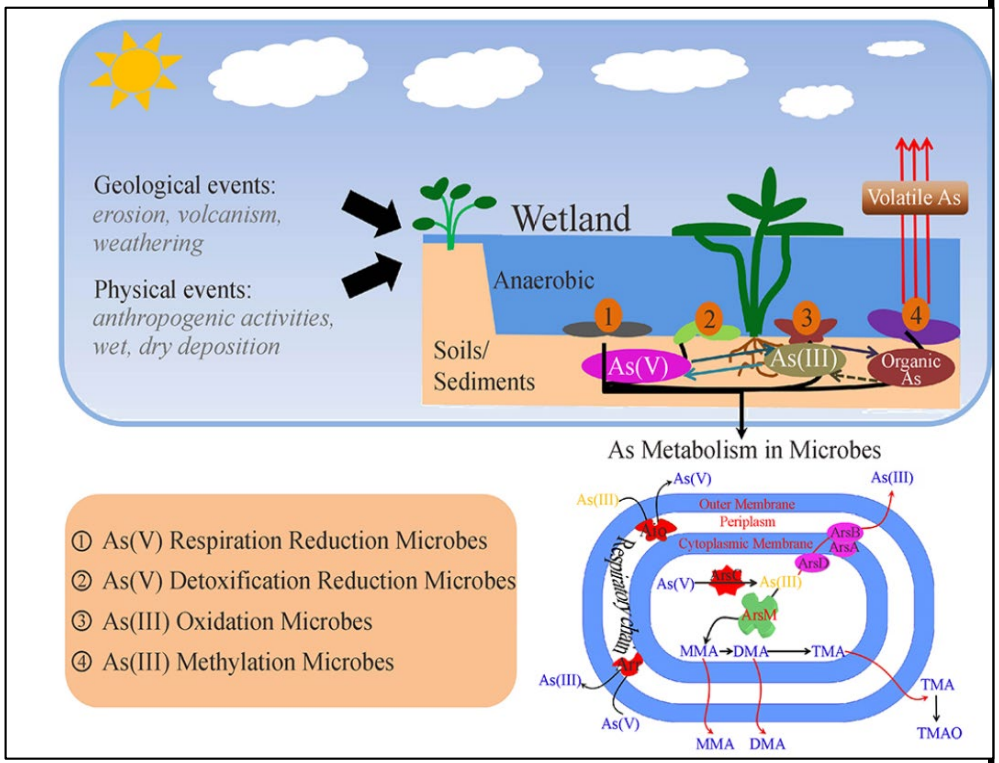
Within oxidizing sediments:
- Selenium is present as Se(VI)
- Arsenic is present as As(III)

Microbially-mediated transformation of selenium to reduced forms facilitates selenium uptake and subsequent incorporation into higher trophic levels (Reidel et al. 1996). Se(IV), and to a lesser degree Se(VI), can be taken up directly by phytoplankton, bacteria, and microalgae to form organic selenium compounds (e.g. selenomethionine, selenocysteine). Selenium mobility is limited in reducing conditions.

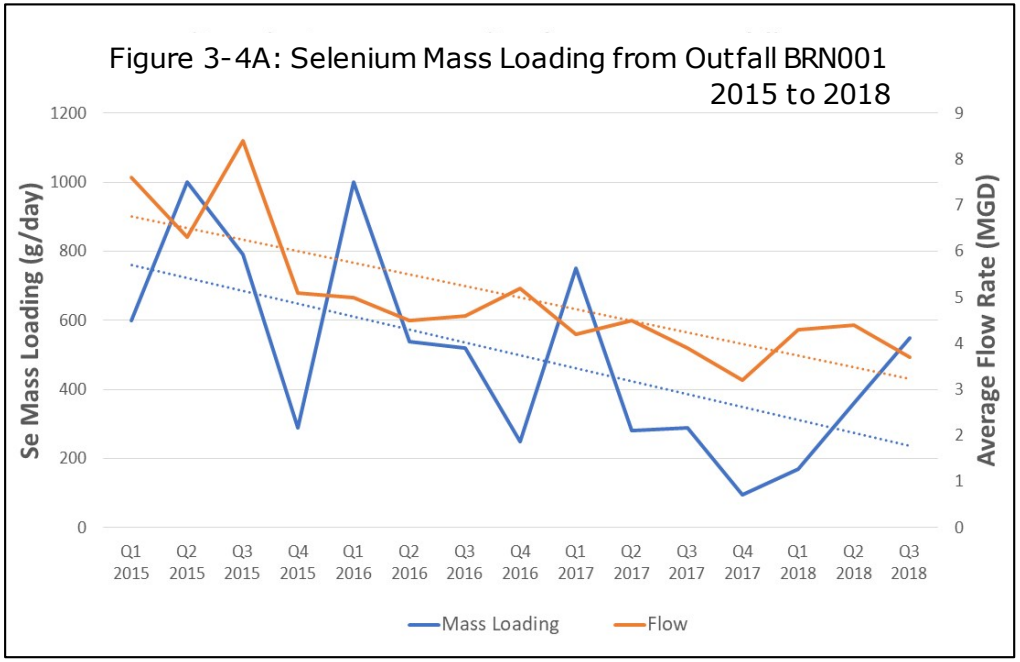
Arsenic derived from coal ash exists mainly as As(V); however, in natural waters it is mostly found in inorganic form as oxyanions of As(III) and As(V) (Smedley and Kinniburgh, 2002). The two main forms of organic arsenic are dimethylarsenic acid (DMAA) and monomethylarsonic acid (MMAA). In both DMAA and MMAA, arsenic is present as As(V). As(V) tends to sorb more strongly to mineral phases compared to the reduced As(III) form because As(III) (Raven et al., 1998; Schwartz et. al., 2016).

Contrary to selenium, arsenic solubility increases under reducing conditions. Mobilization of arsenic in sediments to overlying water can occur in reducing conditions (Cummings et al., 1999). In addition to chemical redox reactions in which equilibrium between sediment and overlying water is achieved slowly, biological activity can also result in arsenic availability for the food web.

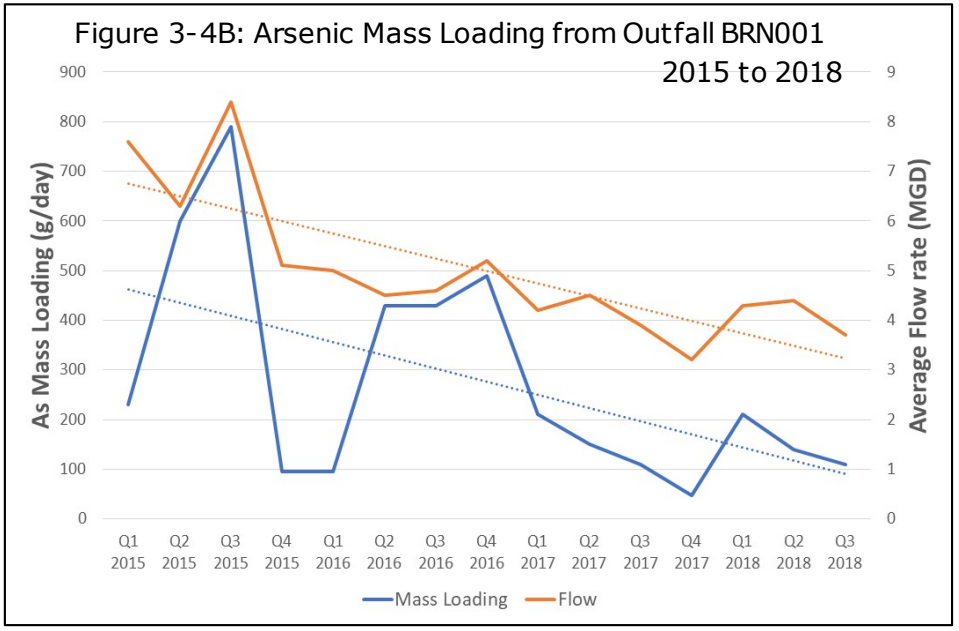
B. Arsenic Geochemical Cycle



RAMBOLL		**PRELIMINARY MODELS OF THE SELENIUM AND ARSENIC GEOCHEMICAL CYCLES IN AQUATIC SYSTEMS** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 3-3C
DRAFTED BY: TDG	DATE: 11/6/2018		



- Figure 3-4A and 3-4B show variability over time but generally decreasing selenium and arsenic mass loadings over time from KPDES Outfall BRN001 with the 2015 to 2018 data evaluated.



Notes:

KPDES = Kentucky Pollution Discharge Elimination System
g/day = Grams per day
MGD = Million Gallons per Day
Q = Quarter

RAMBOLL

DRAFTED BY: TDG

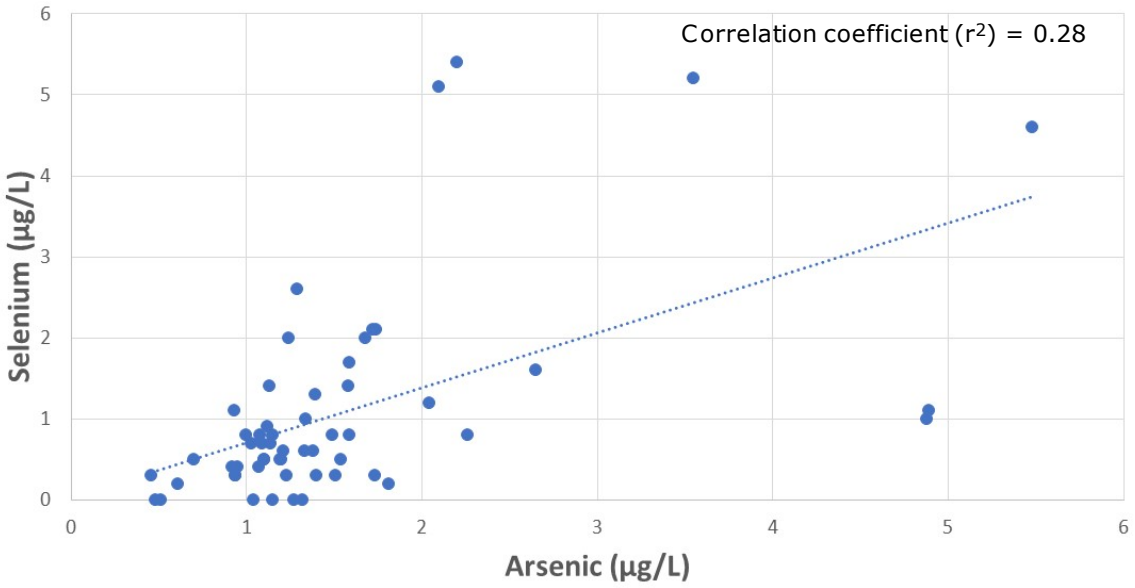
DATE: 11/6/2018

TREND IN SELENIUM AND ARSENIC MASS LOADING FROM AUXILIARY POND OUTFALL KPDES BRN001
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-4A,B

Figure 3-5A: Total Selenium vs Total Arsenic in Surface Water



- Figure 3-5A (left). The correlation coefficient (r^2 = 0.28) indicates a significant but weak correlation between arsenic and selenium in Herrington Lake surface water samples

Figure 3-5B: Total Selenium and Total Arsenic vs Total Boron in Surface Water

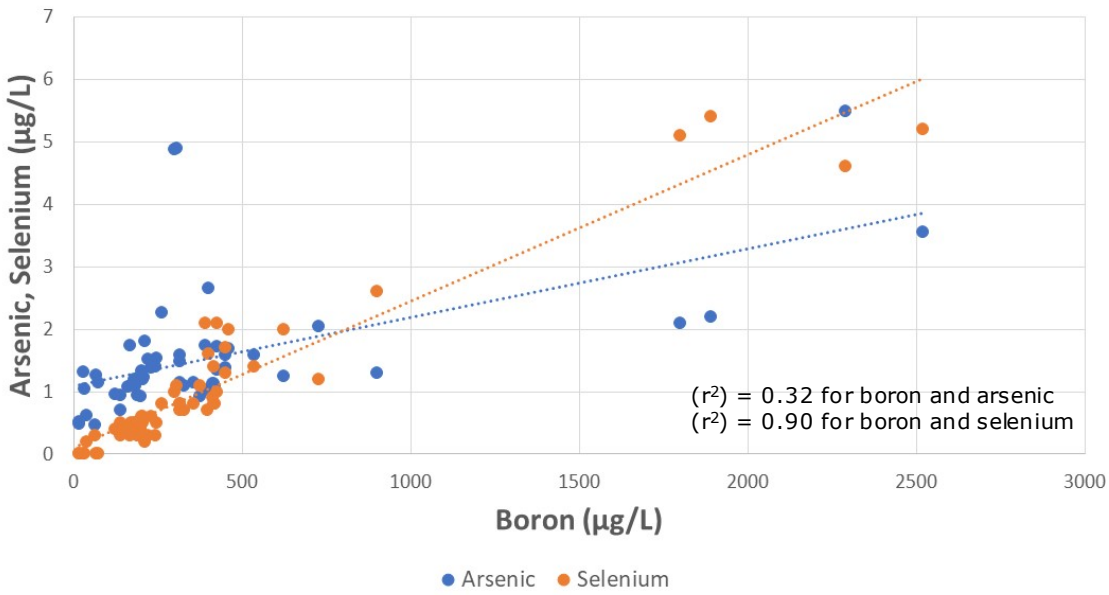


Figure 3-5B (right) indicates

- Strong correlation between total boron and total selenium in surface water (R^2 = 0.90)
- Weaker correlation observed for total boron and total arsenic (R^2 = 0.32)

Notes:
µg/L = Micrograms per Liter

RAMBOLL

DRAFTED BY: TDG

DATE: 11/6/2018

TOTAL SELENIUM, TOTAL ARSENIC, AND TOTAL BORON IN SURFACE WATER

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-5A,B

Figure 3-6A: Selenium vs Boron in Pore Water

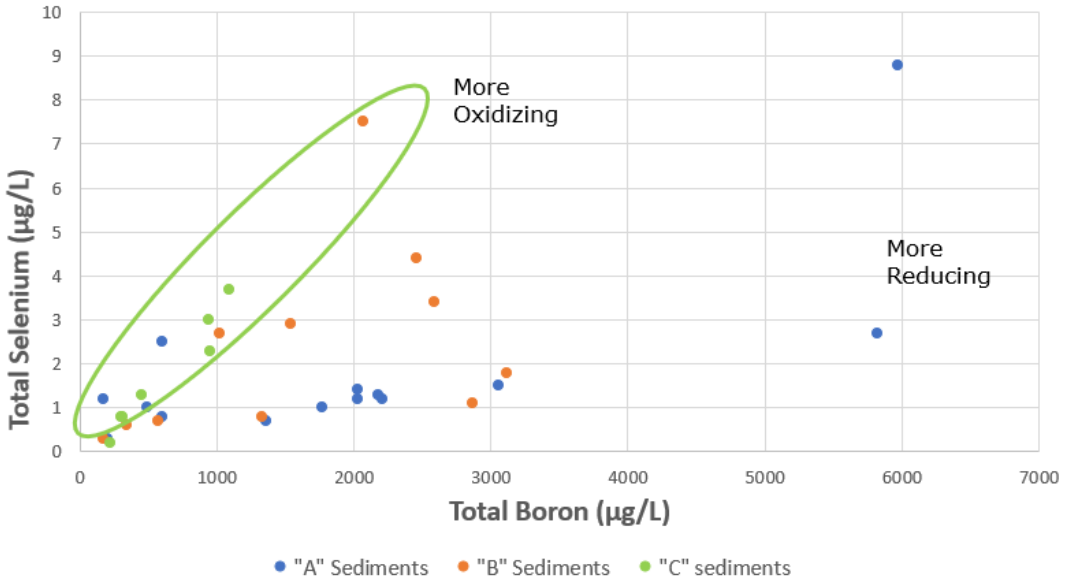
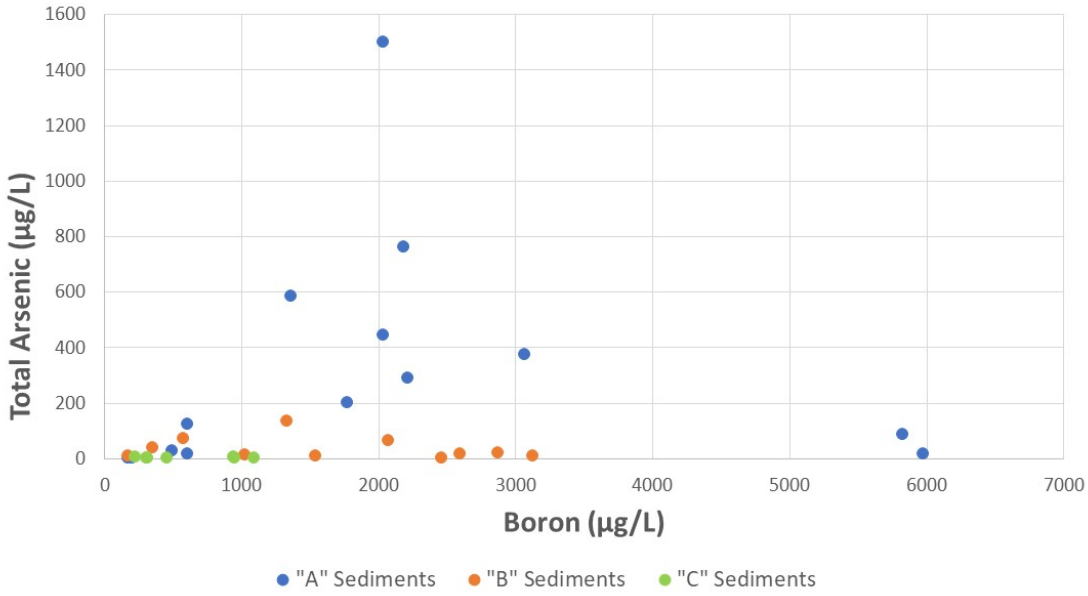


Figure 3-5B showed a strong relationship between selenium and boron in surface water. This figure (Figure 3-7A) confirms higher selenium concentrations detected in more oxidizing "B" and "C" sediments. Under more oxidizing conditions, there is a clear relationship between selenium and boron as indicated for the "C" sediment locations. However, because selenium tends to drop out of solution under reducing conditions, there is no apparent relationship between selenium and boron at "A" and "B" locations

Similarly, Figure 3-5B showed a weak relationship between arsenic and boron in surface water. This figure (3-7B) evaluates the arsenic and boron relationship from pore water with consideration of the A, B, and C sediment locations.

Similar to that seen in surface water, there is a weak relationship between arsenic and boron in pore water. However, this figure does confirm that the highest arsenic concentrations are observed in the "A" sediments (thalweg, reducing sediments)

Figure 3-6B: Arsenic vs Boron in Pore Water



Notes:
Analyzed using Method 200.8.
µg/L = Micrograms per Liter

RAMBOLL

DRAFTED BY: TDG

DATE: 11/6/2018

TOTAL SELENIUM AND TOTAL ARSENIC VS. TOTAL BORON IN PORE WATER

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-6A,B

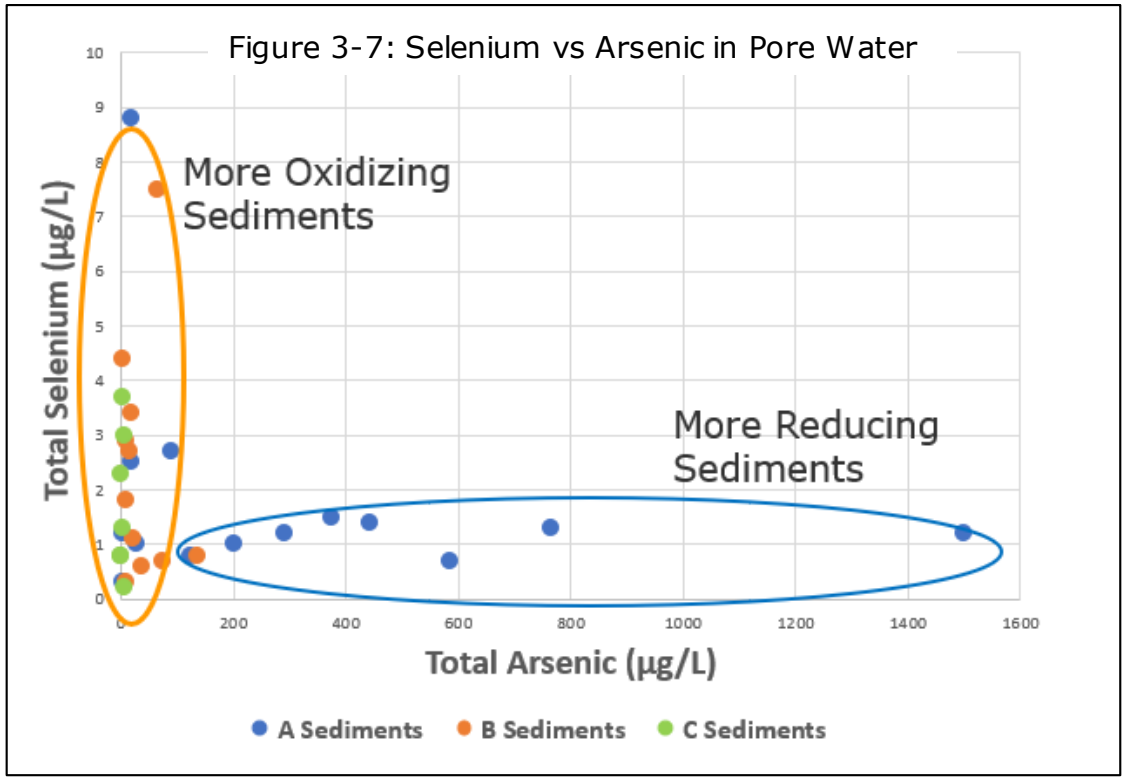
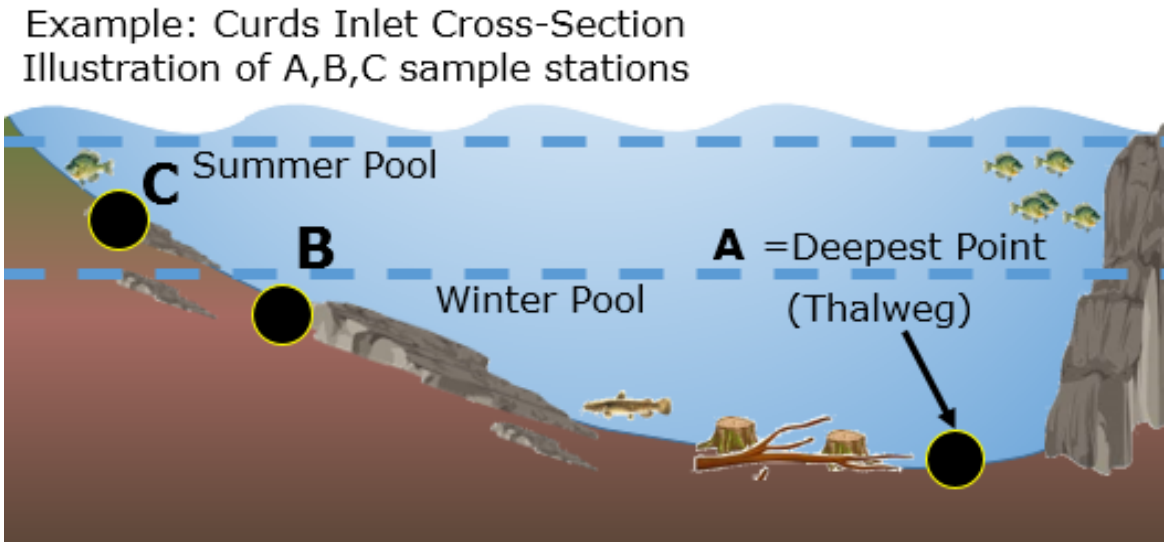


Figure 3-6 (left) illustrates:

- The highest pore water arsenic concentrations are clearly associated with the deeper, thalweg (A) sediments. The highest selenium concentrations are associated with the more oxidized (B) and (C) sediments.

Figure (below) presents an illustration of the A, B, and C sampling used for Phase I and Phase II sampling:
A: Thalweg channel
B: Below winter pool
C: Above winter pool, below summer pool



Notes:
Measured using Method 200.8.
µg/L = Micrograms per Liter

RAMBOLL

DRAFTED BY: TDG

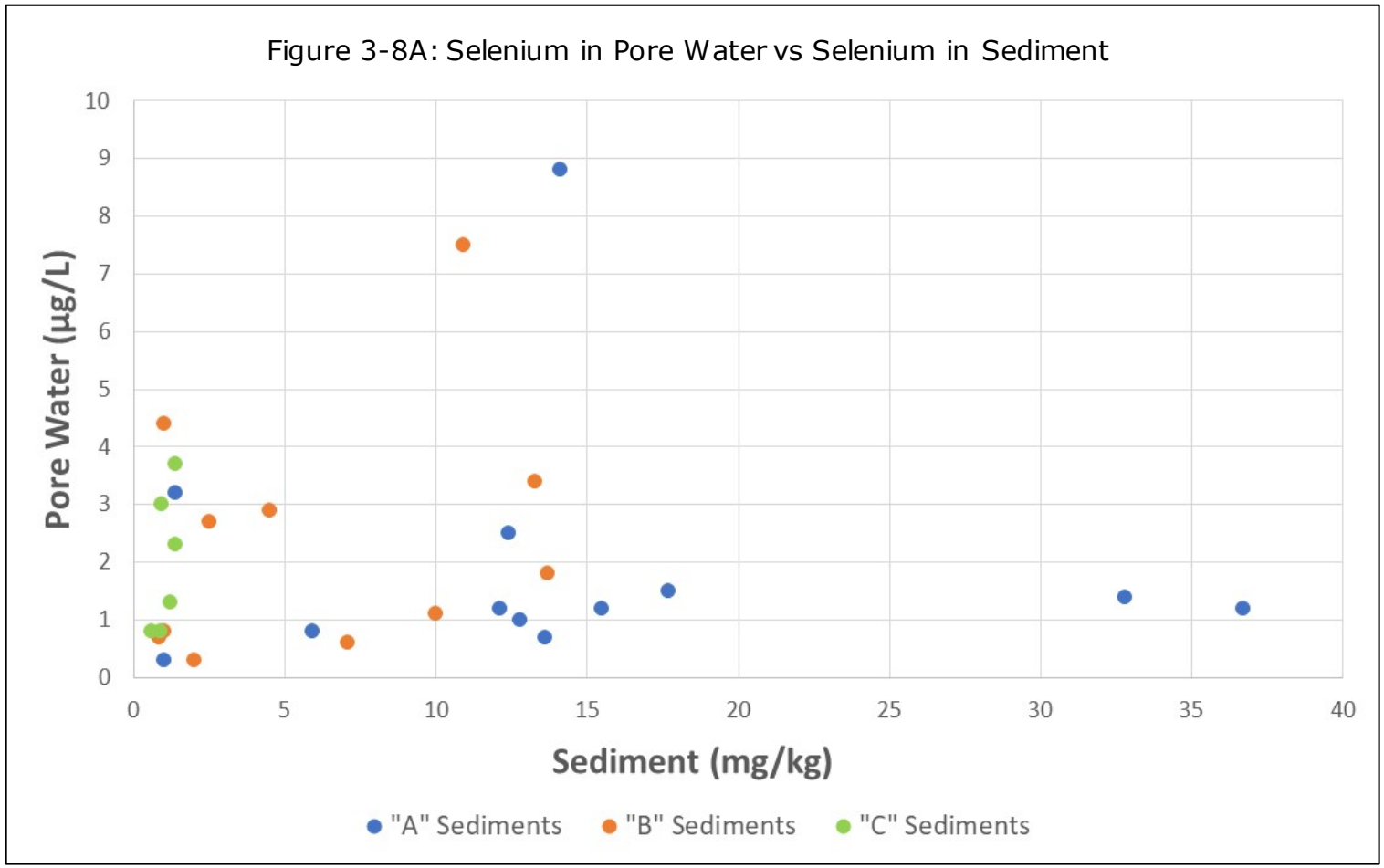
DATE: 11/6/2018

TOTAL SELENIUM VS. TOTAL ARSENIC IN PORE WATER

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

3-7

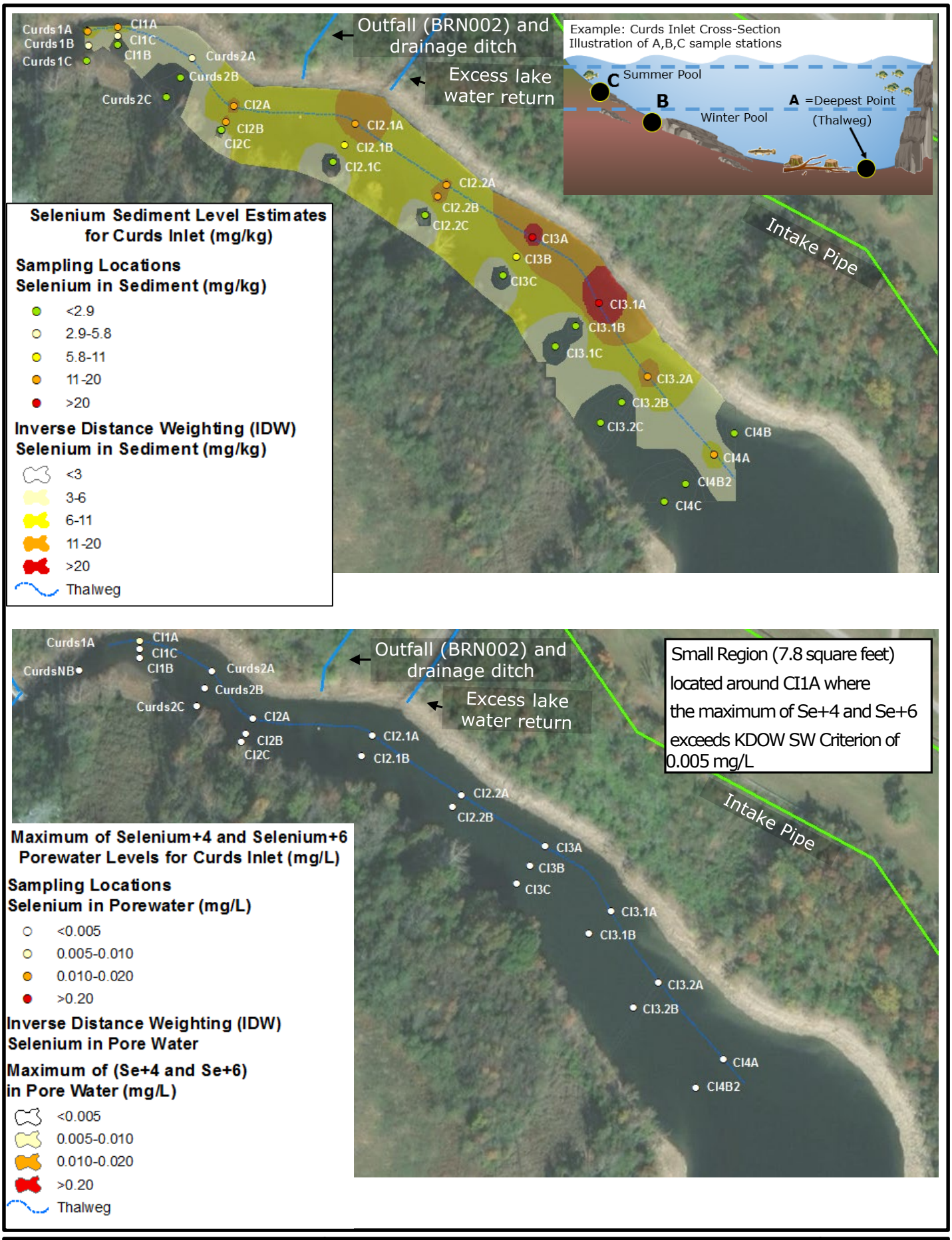


Notes:
Measured using Method 200.8.
µg/L = Micrograms per liter
Mg/kg = Milligrams per kilogram

Figure 3-8A illustrates:

- No apparent relationship between selenium pore water and sediment concentrations
- More reducing "A" sediments have lower pore water selenium, which is consistent with the geochemical model shown in Figure 3-3 where Se(IV) and Se(0) are less soluble than Se(VI) in reducing conditions.
- This graphic indicates that selenium in pore water cannot be reliably predicted from selenium in sediment. This also indicates that sediment is a sink for selenium in Herrington Lake and sediments are not a source of selenium for the water column. The concentrations results for selenium in sediment and pore water are illustrated on maps of Curds Inlet on Figure 3-8B.

RAMBOLL		**TOTAL SELENIUM IN PORE WATER VS. SEDIMENT** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 3-8A
DRAFTED BY: TDG	DATE: 11/6/2018		



RAMBOLL

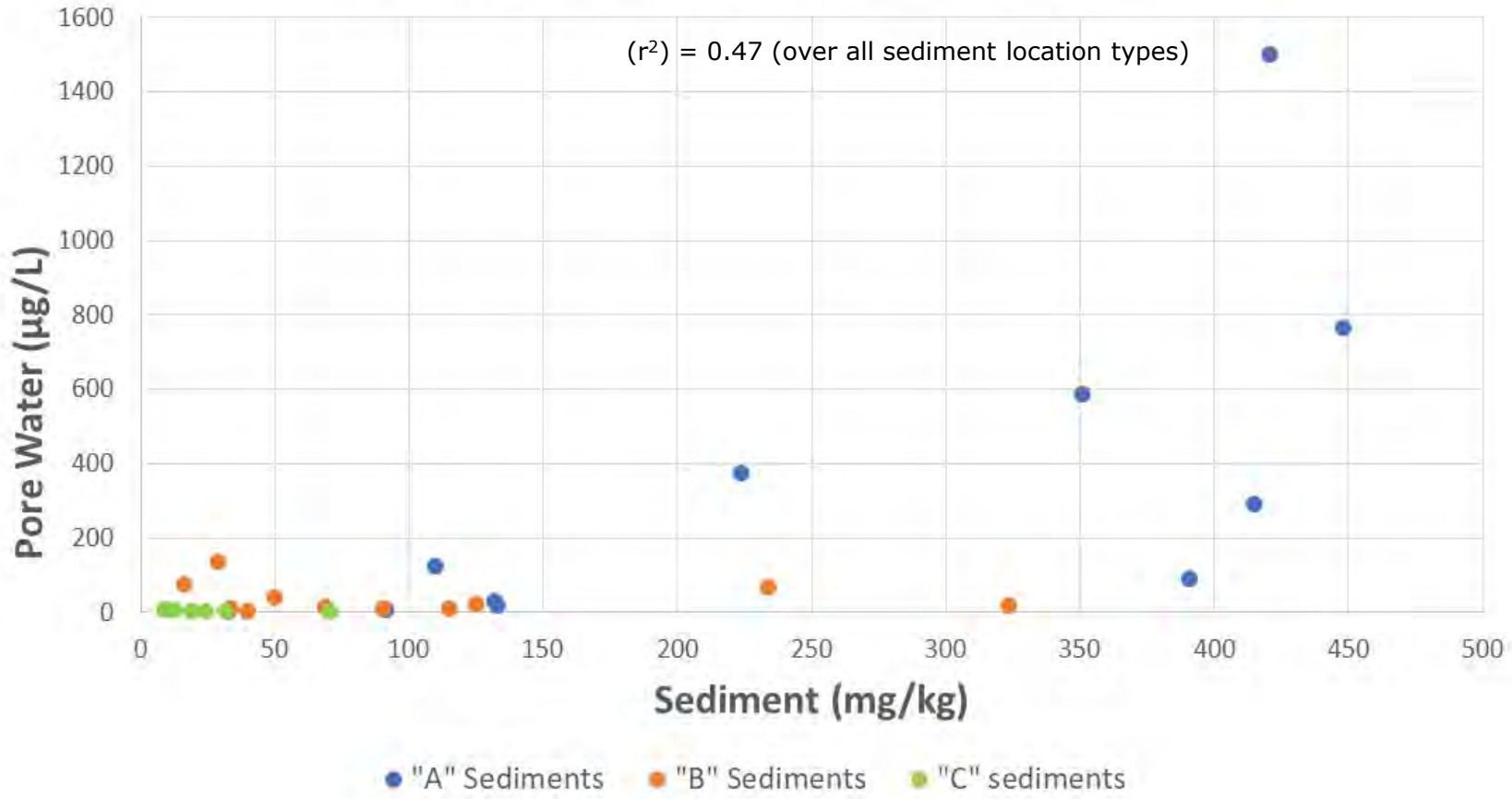
DRAFTED BY: AJS | DATE: 1/29/2018

ESTIMATED CURDS INLET SEDIMENT AND PORE WATER SELENIUM DISTRIBUTION IN CURDS INLET USING IDW INTERPOLATION METHOD AND GIS

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
3-8B

Figure 3-9A: Total Arsenic in Pore Water vs Sediment

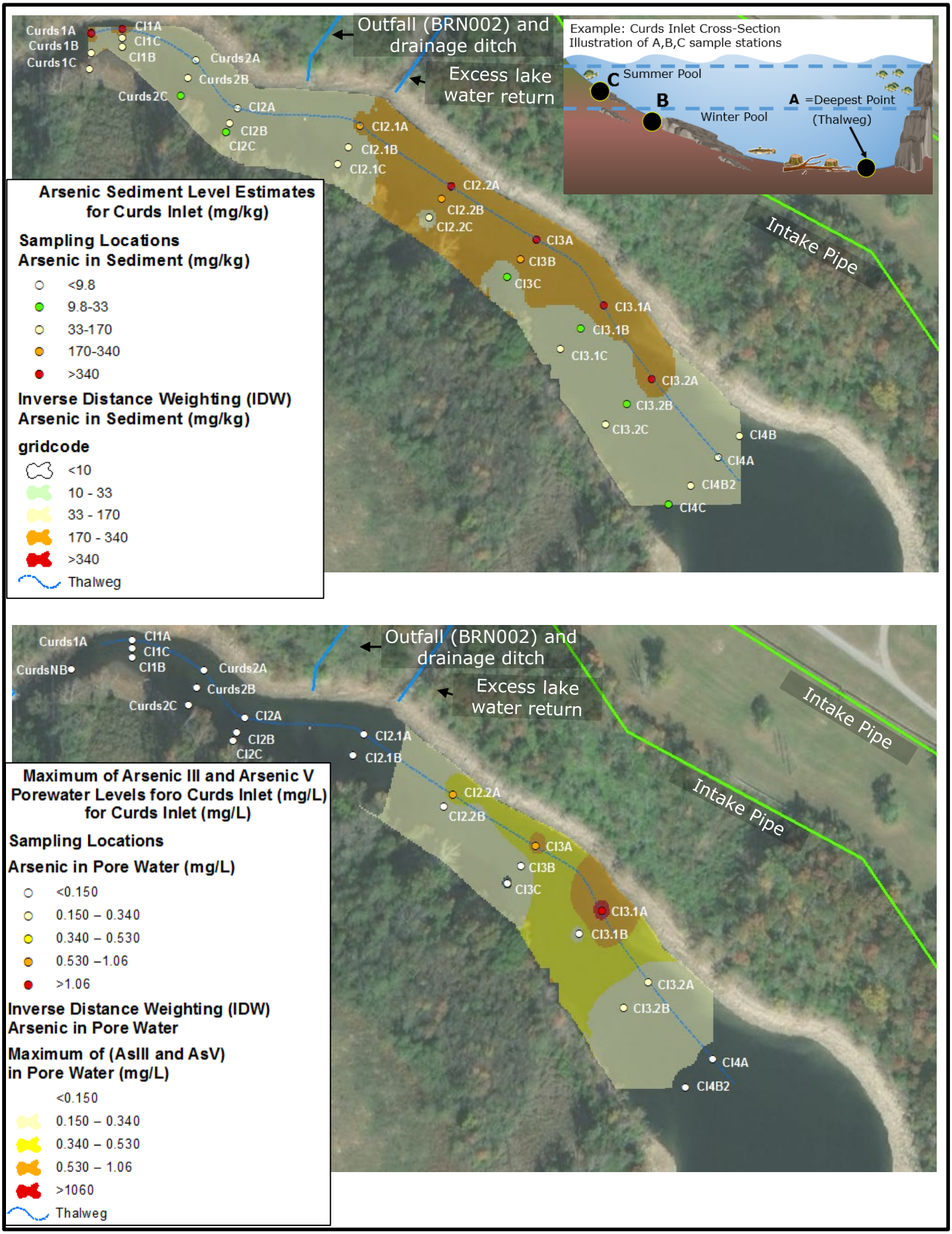


Notes:
Measured using Method 200.8.
µg/L = Micrograms per liter
Mg/kg = Milligrams per kilogram

Figure 3-9A (right) demonstrates that:

- Highest pore water arsenic concentrations associated with more reducing "A" sediments.
- No apparent relationship between sediment and pore water arsenic in more oxidizing "B" and "C" sediments.
- Under reducing conditions, As(III) is more soluble than As(V) resulting in higher pore water arsenic concentrations.

RAMBOLL		**TOTAL ARSENIC IN PORE WATER VS. SEDIMENT** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 3-9A
DRAFTED BY: TDG	DATE: 11/6/2018		



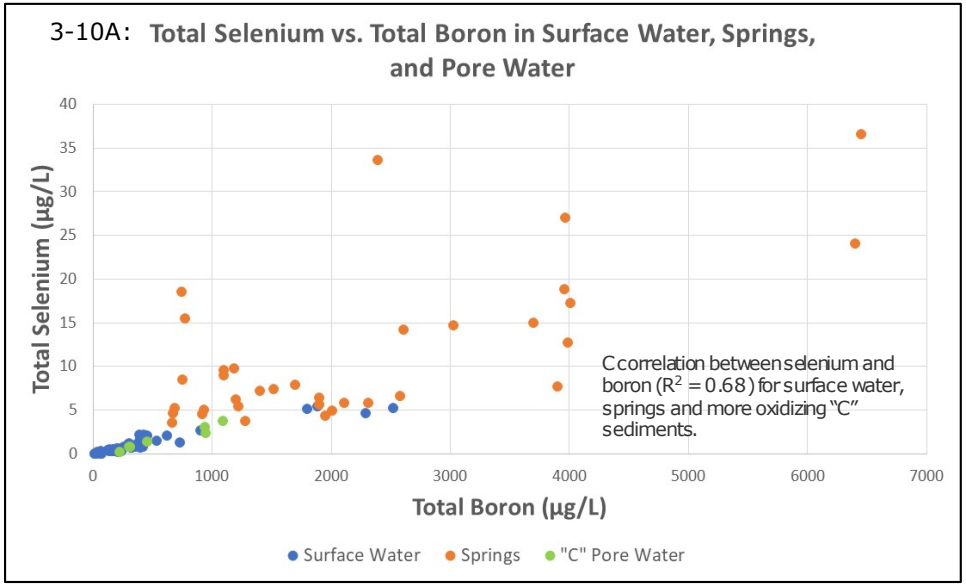
RAMBOLL

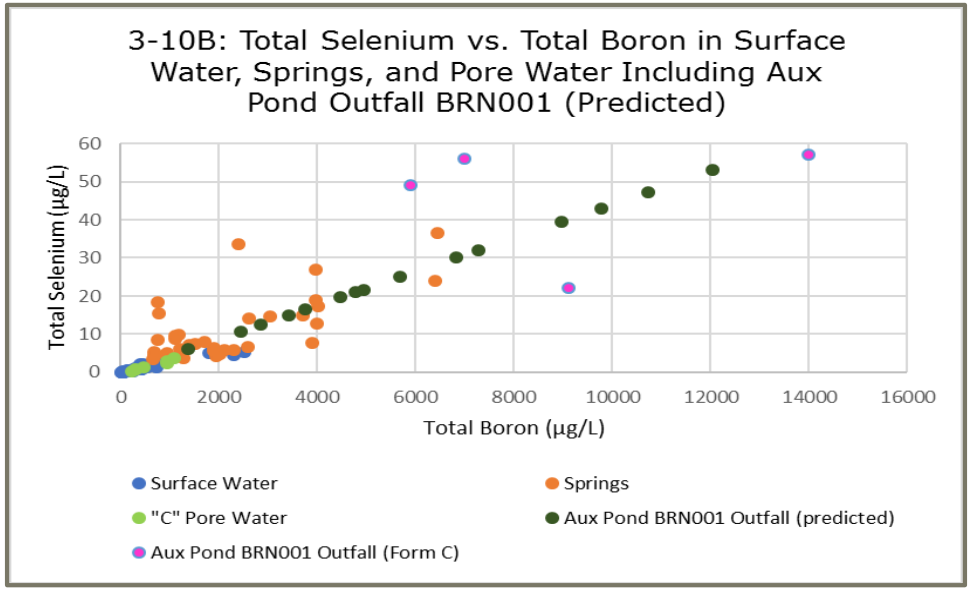
DRAFTED BY: AJS | DATE: 1/29/2018

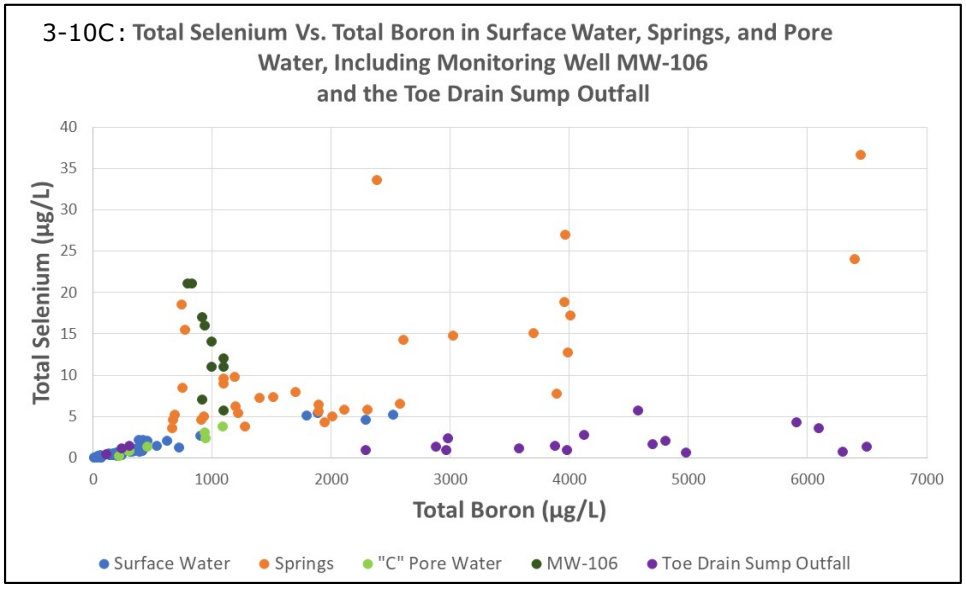
CURDS INLET ARSENIC LEVELS IN SEDIMENT AND PORE WATER: RESULTS AND INVERSE DISTANCE WEIGHTING INTERPOLATION

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
3-9B







Notes:
These figures demonstrate the relationship between selenium (Se) and boron (Bo) in various media, with units of microgram per liter (µg/L).

- 3-10A shows that Se is consistently higher in the springs than in surface water or pore water from Herrington Lake.
- 3-10B illustrates measured Se and predicted boron concentrations for Outfall BRN001. Outfall BRN001 Se concentration results exceed those from surface water, pore water, and springs.
- 3-10B includes Selenium and Boron data for 2014 (three results and 2019 (one result) as follows:

Year	Boron (µg/L)	Selenium (µg/L)
2014	5900	49
2014	7000	56
2014	14000	57
2019	9100	22

- 3-10C presents the same data as Figure 3-6A, with addition of groundwater well MW-106 and the Toe Drain Sump. Se concentrations in MW-106 are within the range of concentrations seen in the springs. The Toe Drain sump has similar boron concentrations as the springs but the springs have higher selenium concentrations than the Toe Drain Sump.
- 3-10D presents the same data as Figure 3-6B with the addition of the Landfill Leachate data, showing leachate Se-Bo relationships are similar to those seen in other media, but the landfill leachate concentrations demonstrate the highest concentrations observed. Landfill leachate is not directly discharged to Herrington Lake.

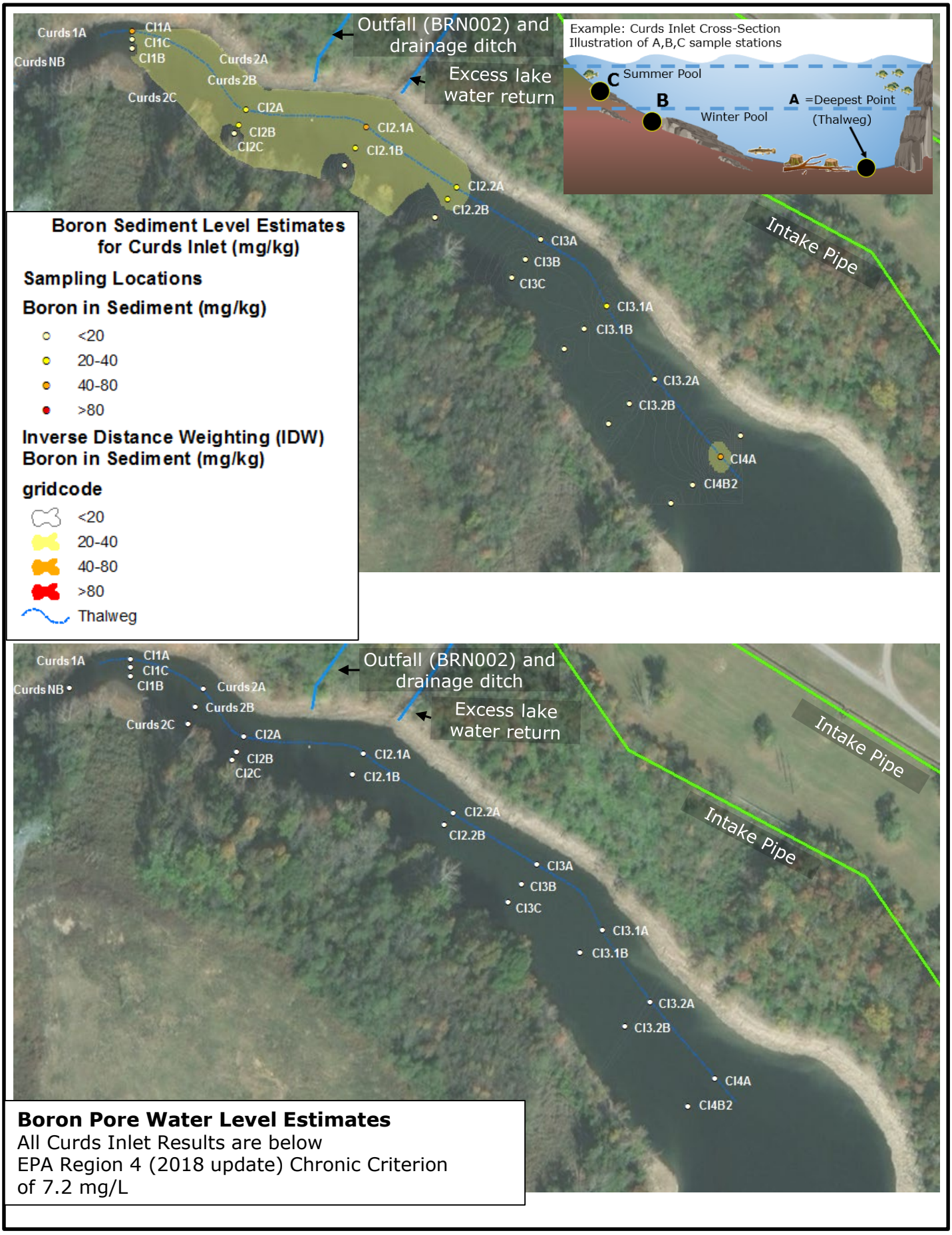
RAMBOLL

DRAFTED BY: TDG

DATE: 11/6/2018

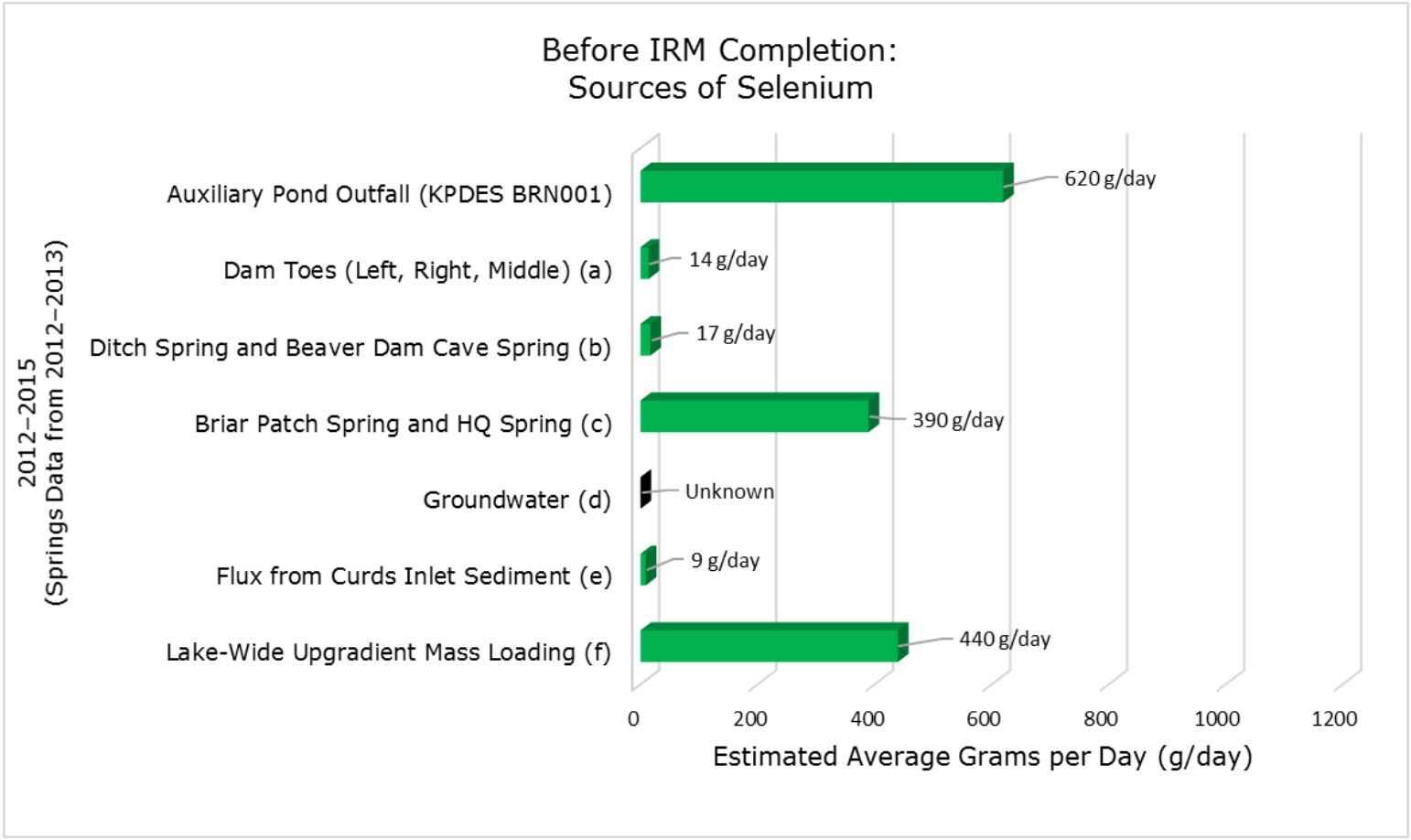
SELENIUM VS. BORON IN SURFACE WATER, SPRINGS, PORE WATER, MONITORING WELLS, AND AUXILIARY POND OUTFALL BRN001
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
3-10A, B, C



Boron Pore Water Level Estimates
All Curds Inlet Results are below
EPA Region 4 (2018 update) Chronic Criterion
of 7.2 mg/L

RAMBOLL	**CURDS INLET BORON LEVELS IN SEDIMENT AND PORE WATER: RESULTS AND INVERSE DISTANCE WEIGHTING INTERPOLATION METHOD AND GIS** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 3-10D
DRAFTED BY: AJS	DATE: 1/29/2018	



The Auxiliary Pond Outfall KPDES BRN001 is the primary outfall to Curds Inlet. The selenium mass loading ranged from 250-1000 g/day, with a weighted average of 620 g/day.

a. Dam Toe Springs (Left, Right, and Middle) flowed into Curds Inlet prior to completion of the Toe Drain collection system. The selenium loading ranged from 2.4–37 g/day, with a weighted average of 14 g/day.
b. Mass loading from Ditch Spring and Beaver Dam Cave Spring prior to IRMs ranged from 1.2–26 g/day, with a weighted average of 17 g/day.
c. Mass loading from Briar Patch Spring and HQ Spring prior to IRMs ranged from 84–530 g/day, with a weighted average of 390 g/day.
d. Weighted average mass loading estimates for groundwater to Curds Inlet are not available for the period before completion of the IRMs. The monitoring wells surrounding the landfill were installed in 2016 (i.e. pre-IRM GW data are unknown).
e. The mass loading estimates shown on this graphic are based on estimates using data from Phase I and Phase II investigations (2017 and 2018, after completion of the IRM). However, IRMs did not likely affect sediment flux, so the same estimates are shown on both figures. The selenium flux was estimated from 9–18 g/day, with a weighted average of 9 g/day.
f. The lake-wide upgradient mass loading shown on this graphic are based on estimates from Phase I and Phase II investigation data (2017 and 2018, after completion of the IRMs). The IRMs did not affect lake-wide upgradient conditions, therefore the same estimates are shown on both the pre-and post IRM figures. The selenium mass load estimates range 340–540 g/day, with a weighted average of 440 g/day.

RAMBOLL

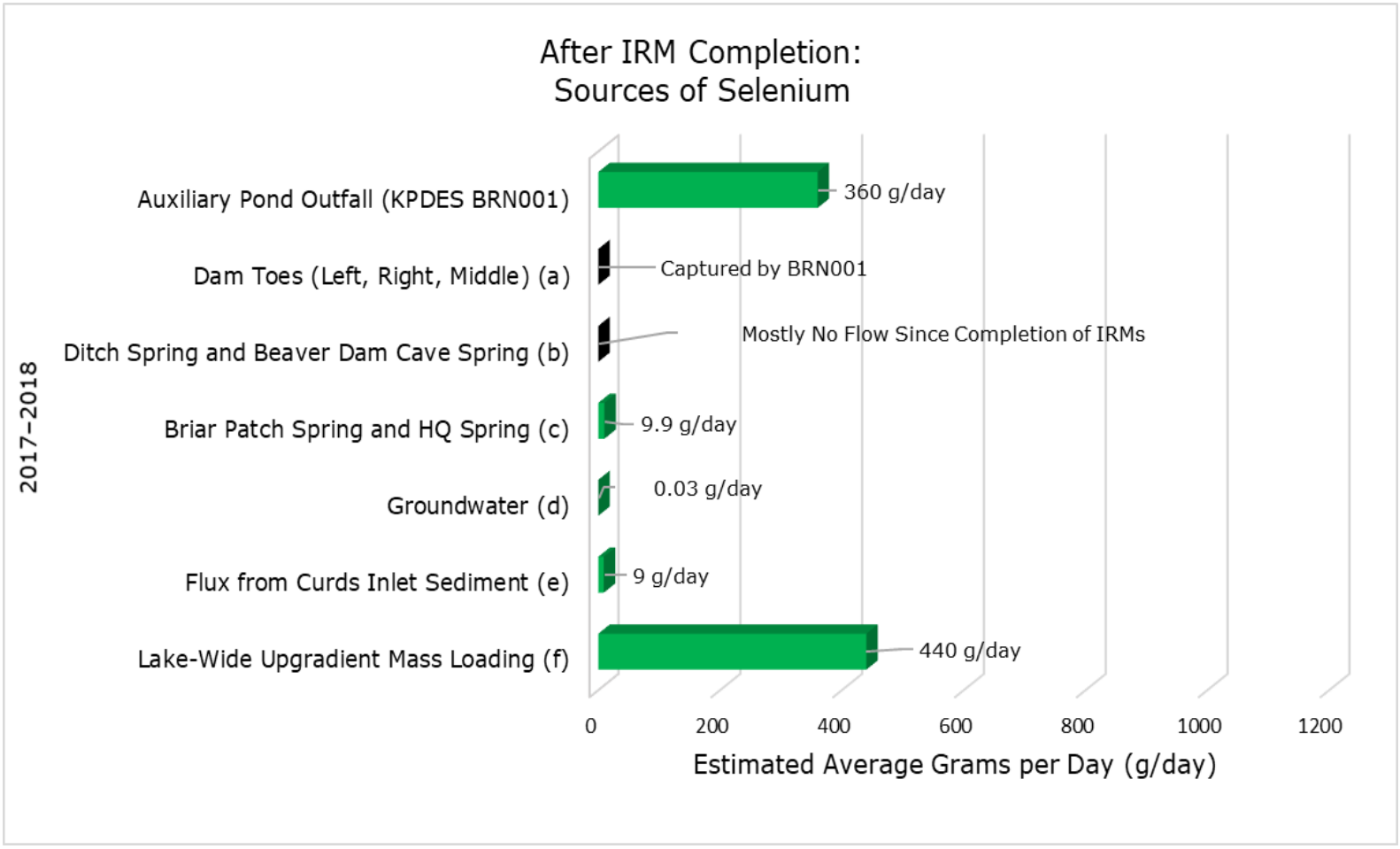
DRAFTED BY: TDG | DATE: 11/6/2018

Acronyms:
Aux – Auxiliary Pond
g – grams
IRM – Interim Remedial Measures
KPDES – Kentucky Pollution Discharge Elimination System
TDCS – Toe Drain Collection System

SOURCE IDENTIFICATION SUMMARY FOR SELENIUM INTO LOWER HERRINGTON LAKE: PRIOR TO COMPLETION OF THE INTERIM REMEDIAL MEASURES (IRMs)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
3-11A



The Auxiliary Pond Outfall KPDES BRN001 is the primary outfall to Curds Inlet. The selenium mass loading ranged from 95–750 g/day, with a weighted average of 360 g/day.

a. Dam Toe Springs (Left, Right, and Middle) are now captured by the Toe Drain collection system; therefore, there is no longer direct flow from these springs to Curds Inlet.
b. There is minimal or no flow from Ditch Spring and Beaver Dam Cave Spring after completion of the IRMs.
c. Mass loading from Briar Patch Spring and HQ Spring post-IRMs yielded selenium estimates that ranged from 1.6–63.4 g/day, with a weighted average of 9.9 g/day.
d. Mass loading of selenium from groundwater wells closest to the lake range from 0.03-0.03 g/day, with a weighted average of 0.03 g/day (values are the same because selenium was not detected during 2017 or 2018, therefore the estimates reflect ½ the detection limit).
e. The mass loading estimates shown on this graphic are based on estimates using data from Phase I and Phase II investigations (2017 and 2018, after completion of the IRM). The selenium flux was estimated from 9–18 g/day, with a weighted average of 9 g/day.
f. The lake-wide upgradient mass loading shown on this graphic are based on estimates from Phase I and Phase II investigation data (2017 and 2018, after completion of the IRMs). The IRMs did not affect lake-wide upgradient conditions, therefore the same estimates are shown on both the pre-and post IRM figures. The selenium mass load estimates range 340–540 g/day, with a weighted average of 440 g/day.

RAMBOLL

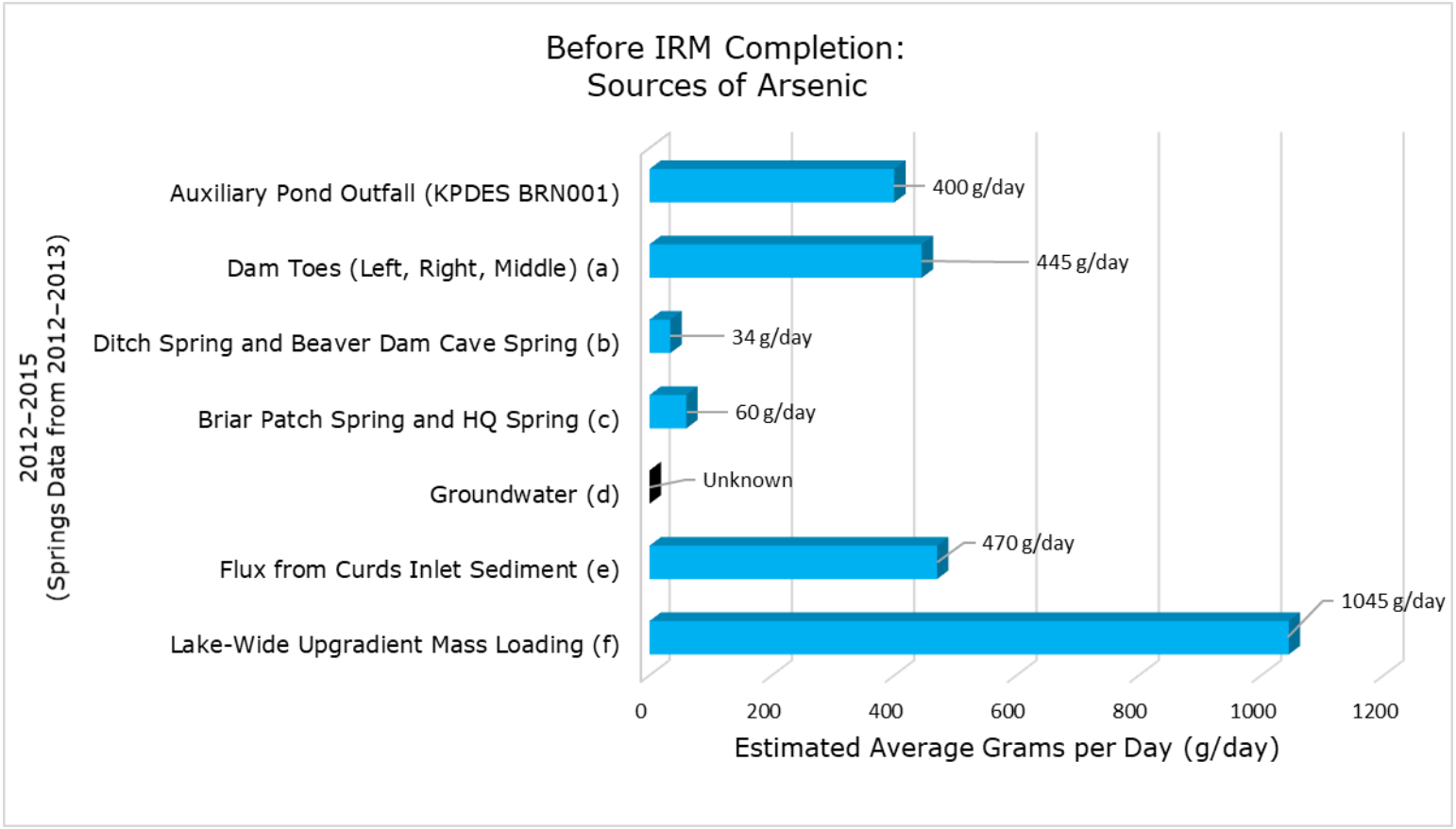
DRAFTED BY: TDG | DATE: 11/6/2018

Acronyms:
Aux – Auxiliary Pond
g – grams
IRM – Interim Remedial Measures
KPDES – Kentucky Pollution Discharge Elimination System
TDCS – Toe Drain Collection System

SOURCE IDENTIFICATION SUMMARY FOR SELENIUM INTO LOWER HERRINGTON LAKE: AFTER COMPLETION OF THE INTERIM REMEDIAL MEASURES (IRMs)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
3-11B



The Auxiliary Pond Outfall KPDES BRN001 is the primary outfall to Curds Inlet. The arsenic mass loading ranged from 95–790 g/day, with a weighted average of 400 g/day.

a. Dam Toe Springs (Left, Right, and Middle) flowed into Curds Inlet prior to completion of the Toe Drain collection system. The arsenic mass loading ranged from 78-1200 g/day, with an weighted average of 445 g/day.
b. Mass loading from Ditch Spring and Beaver Dam Cave Spring prior to IRMs ranged from 2.9–70 g/day, with a weighted average of 34 g/day.
c. Mass loading from Briar Patch Spring and HQ Spring prior to IRMs ranged from 38–290 g/day, with a weighted average of 60 g/day.
d. Weighted average mass loading estimates for groundwater to Curds Inlet are not available for the period before completion of the IRMs. The monitoring wells surrounding the landfill were installed in 2016 (i.e. pre-IRM GW data are unknown).
e. The mass loading estimates shown on this graphic are based on estimates using Phase I and Phase II investigation data (2017 and 2018, after completion of the IRM). However, IRMs did not likely affect sediment flux; therefore, the same estimates are shown on both figures. The arsenic flux was estimated from 180–760 g/day, with a weighted average of 470 g/day.
f. The udient mass loading shown on this graphic are based on estimates from Phase I and Phase II investigation data (2017 and 2018, after completion of the IRMs). IRMs did not affect lake-wide upgradient conditions, so the same estimates are shown on both figures. The arsenic mass load estimates range from 790–1,300 g/day, with weighted average of 1,045 g/day.

RAMBOLL

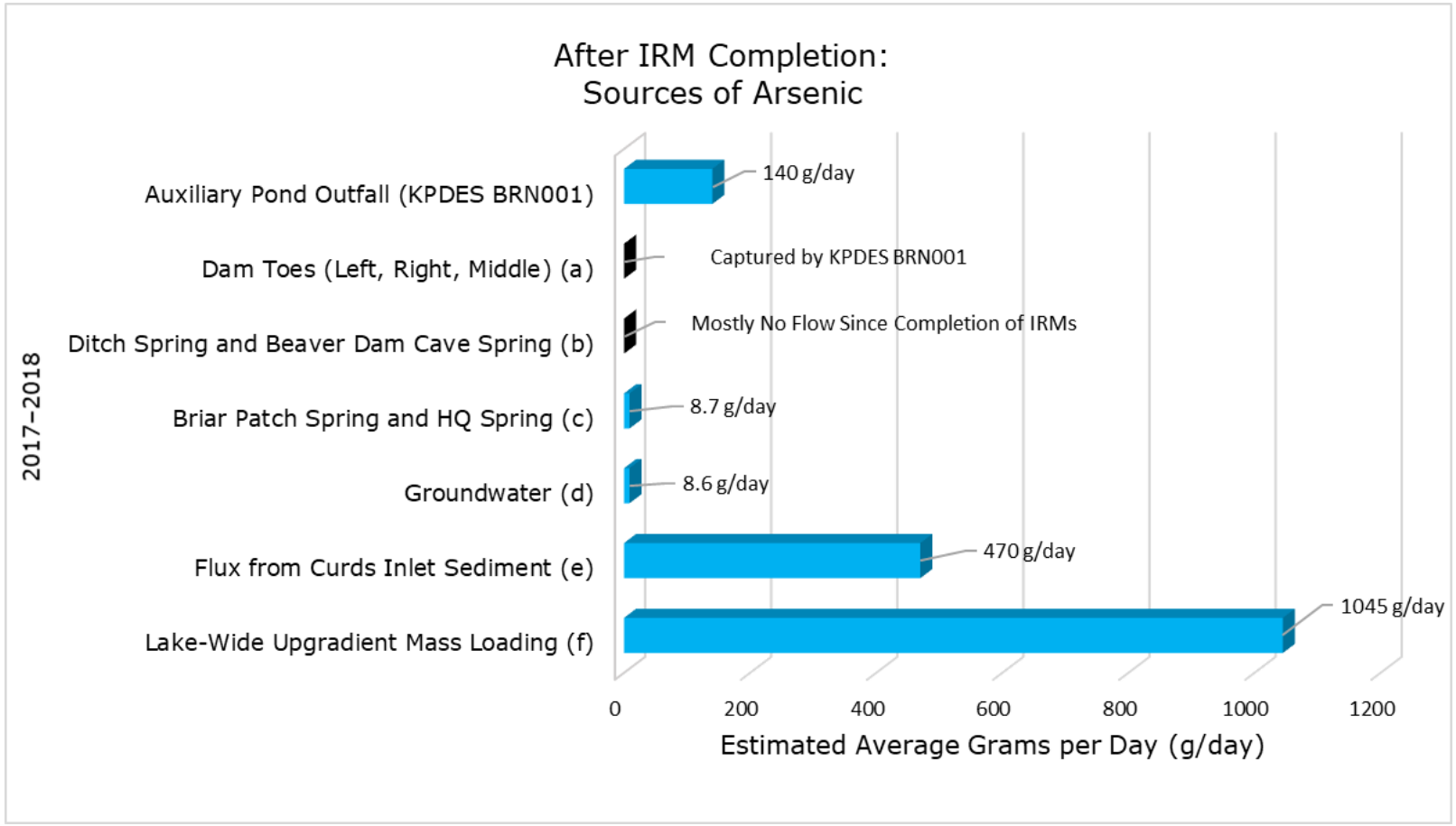
DRAFTED BY: TDG | DATE: 11/6/2018

Acronyms:
Aux – Auxiliary Pond
g – grams
IRM – Interim Remedial Measures
KPDES – Kentucky Pollution Discharge Elimination System
TDCS – Toe Drain Collection System

SOURCE IDENTIFICATION SUMMARY FOR ARSENIC INTO LOWER HERRINGTON LAKE: PRIOR TO COMPLETION OF THE INTERIM REMEDIAL MEASURES (IRMs)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
3-11C



The Auxiliary Pond Outfall KPDES BRN001 is the primary outfall to Curds Inlet. The arsenic mass loading ranged from 48-210 g/day, with a weighted average of 140 g/day.

a. Dam Toe Springs (Left, Right, and Middle) are now captured by the Toe Drain collection system; therefore, there is no longer direct flow from these springs to Curds Inlet.
b. There is minimal or no flow from Ditch Spring and Beaver Dam Cave Spring after completion of the IRMs.
c. Mass loading from Briar Patch Spring and HQ Spring post-IRMs yielded arsenic estimates that ranged from 1.2-36 g/day, with a weighted average of 4.1 g/day.
d. Mass loading of arsenic from groundwater wells closest to the lake range from 3.2-19.1 g/day, with a weighted average of 8.6 g/day.
e. The mass loading estimates shown on this graphic are based on estimates using Phase I and Phase II investigation data (2017 and 2018, after completion of the IRM). The arsenic flux was estimated from 180-760 g/day, with a weighted average of 470 g/day.
f. The lake-wide upgradient mass loading shown on this graphic are based on estimates from Phase I and Phase II investigation data (2017 and 2018, after completion of the IRMs). The arsenic mass load estimates range from 790-1,300 g/day, with weighted average of 1,045 g/day.

RAMBOLL

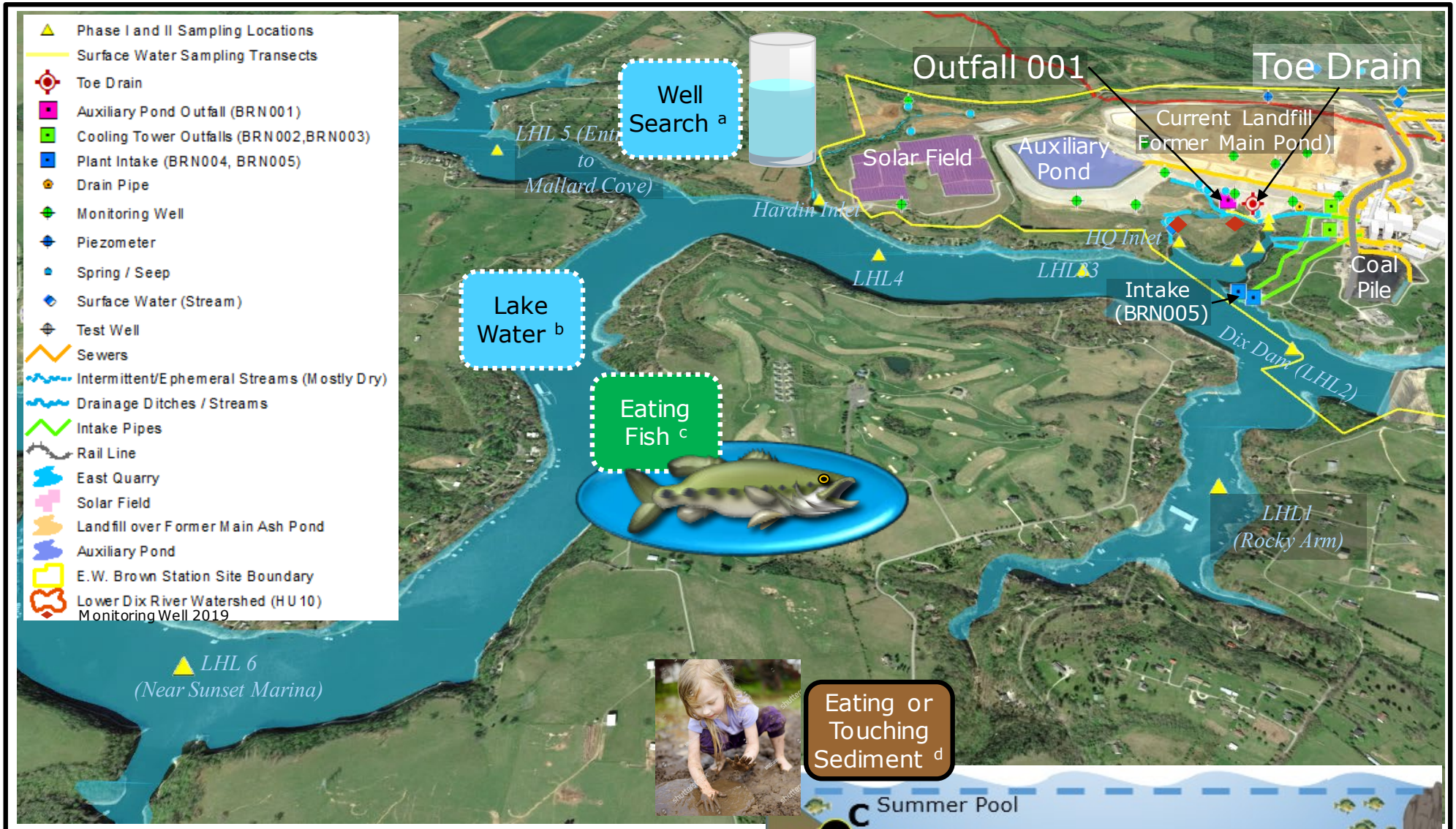
DRAFTED BY: TDG | DATE: 11/6/2018

Acronyms:
Aux – Auxiliary Pond
g – grams
IRM – Interim Remedial Measures
KPDES – Kentucky Pollution Discharge Elimination System
TDCS – Toe Drain Collection System

SOURCE IDENTIFICATION SUMMARY FOR ARSENIC INTO LOWER HERRINGTON LAKE: AFTER COMPLETION OF THE INTERIM REMEDIAL MEASURES (IRMs)

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
3-11D



a-A 2018 search did not identify any residential wells within 2 miles.
b -Comparison of lake water concentration data with USEPA and Cabinet criteria for drinking water did not identify any contaminants of potential concern (CoPCs).
c- No CoPCs were identified in fish fillets based on comparison with screening levels based on consumption of 50 meals per year.
d – Arsenic was identified as a CoPC for sediments and is further evaluated . in the human health risk assessment for sediment areas under water depths of 24 feet or less.

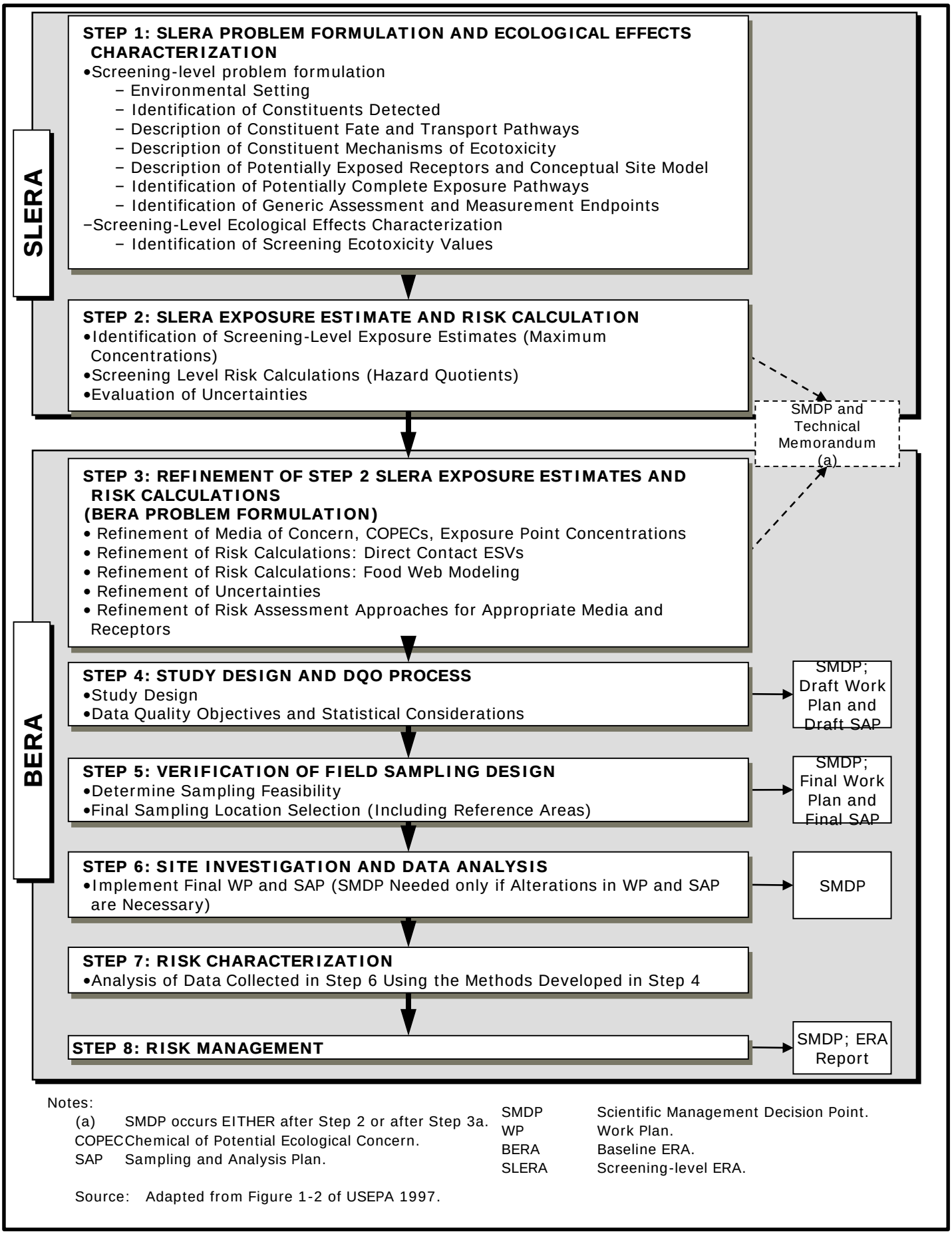
RAMBOLL

DRAFTED BY: PAL | DATE: 02/21/2019

CONCEPTUAL SITE MODEL FOR HUMAN HEALTH RISK ASSESSMENT PERFORMED FOR HERRINGTON LAKE

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
4-1



Notes:

(a) SMDP occurs EITHER after Step 2 or after Step 3a.

COPEC Chemical of Potential Ecological Concern.

SAP Sampling and Analysis Plan.

SMDP	Scientific Management Decision Point.
WP	Work Plan.
BERA	Baseline ERA.
SLERA	Screening-level ERA.

Source: Adapted from Figure 1-2 of USEPA 1997.

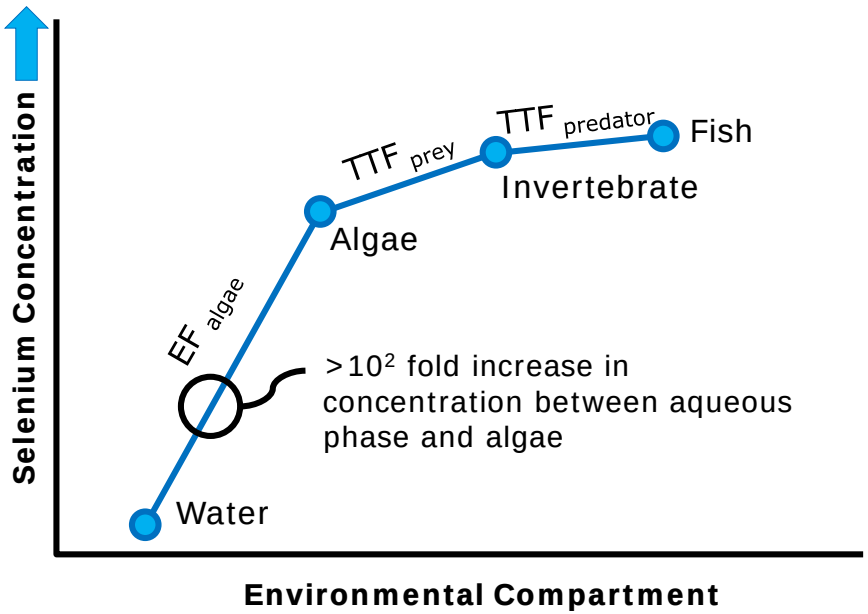
RAMBOLL

DRAFTED BY: PAL | DATE: 3/3/2019

USEPA'S 8-STEP PROCESS

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

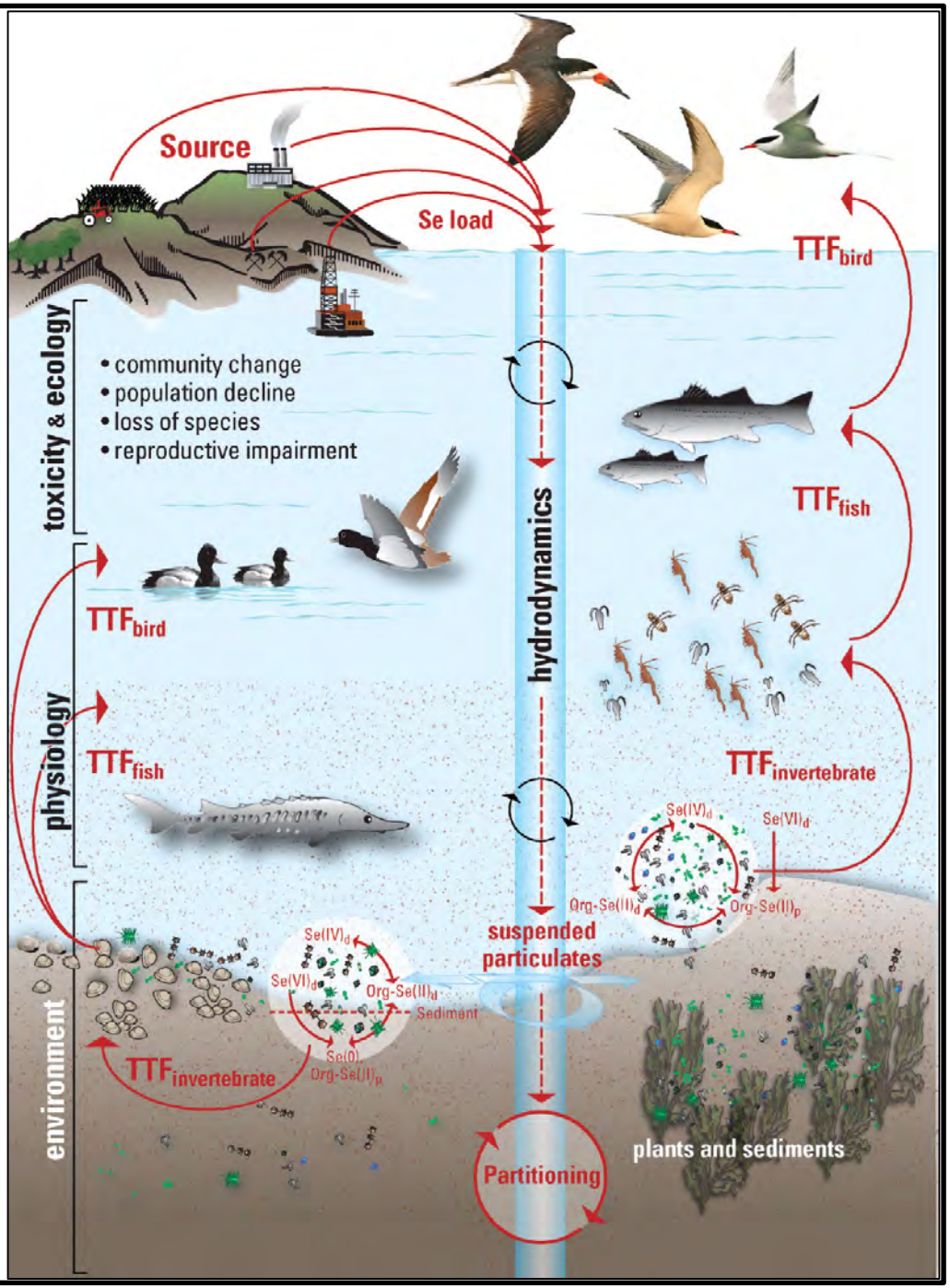
FIGURE 5-1



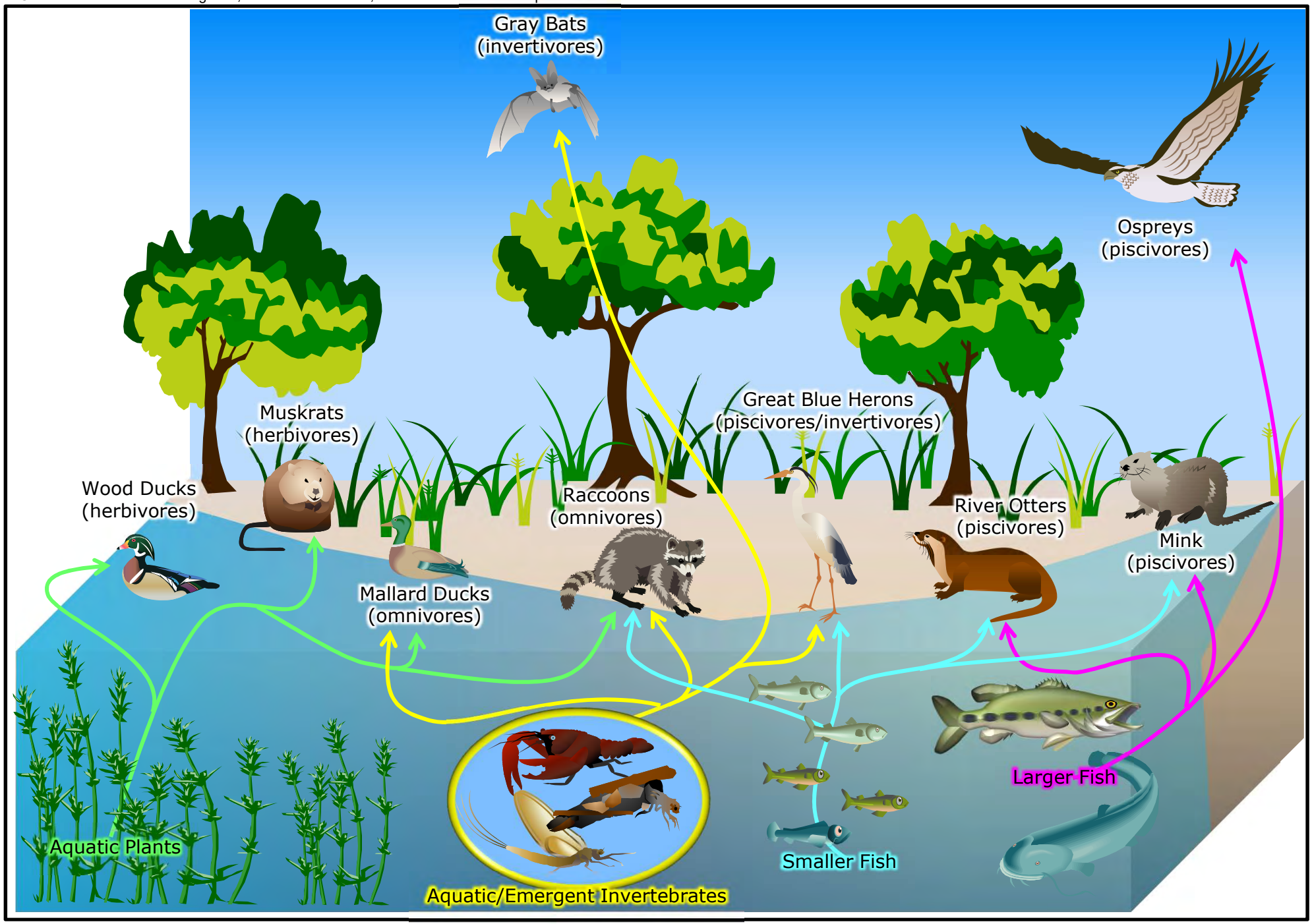
Above: Trophic transfer functions demonstrate that water to algae is the largest increase function in the food web.

Right: Conceptual model of selenium fate and effects emphasizing the roles of speciation, biogeochemical transformation, and trophic transfer factors in modeling two aquatic food webs: a water column food web and a benthic food web (Luoma and Presser 2009).

Org= organic
Subscript d = dissolved
Subscript p = particulate
Se= Selenium
TTF = trophic transfer factor



RAMBOLL		GENERIC SELENIUM CYCLE WITHIN AQUATIC FOOD WEB Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 5-2A
DRAFTED BY: PAL	DATE: 02/21/2019		



RAMBOLL

DRAFTED BY: PAL

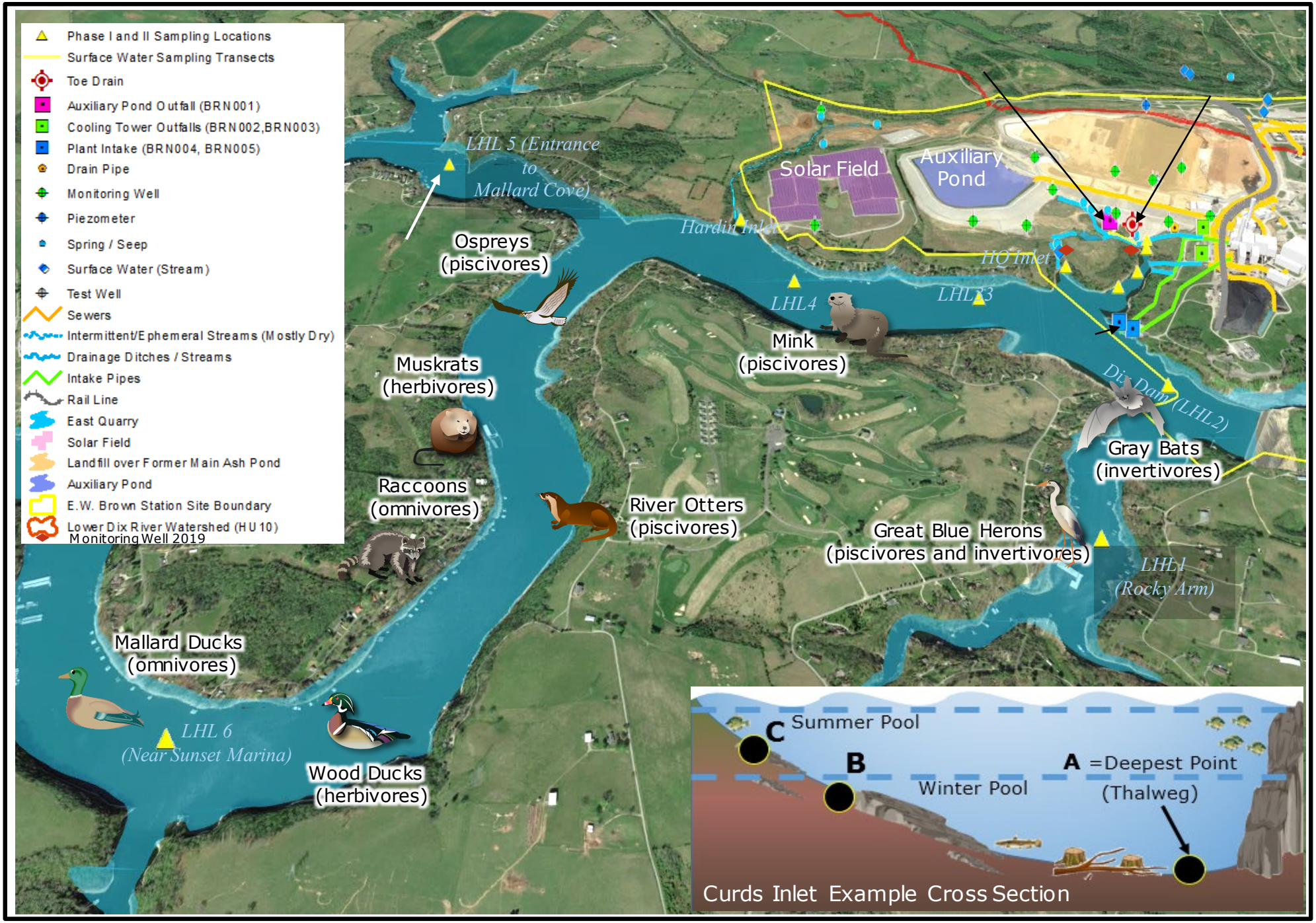
DATE: 02/21/2019

GRAPHICAL FOOD WEB FOR THE HERRINGTON LAKE ECOLOGICAL RISK ASSESSMENT

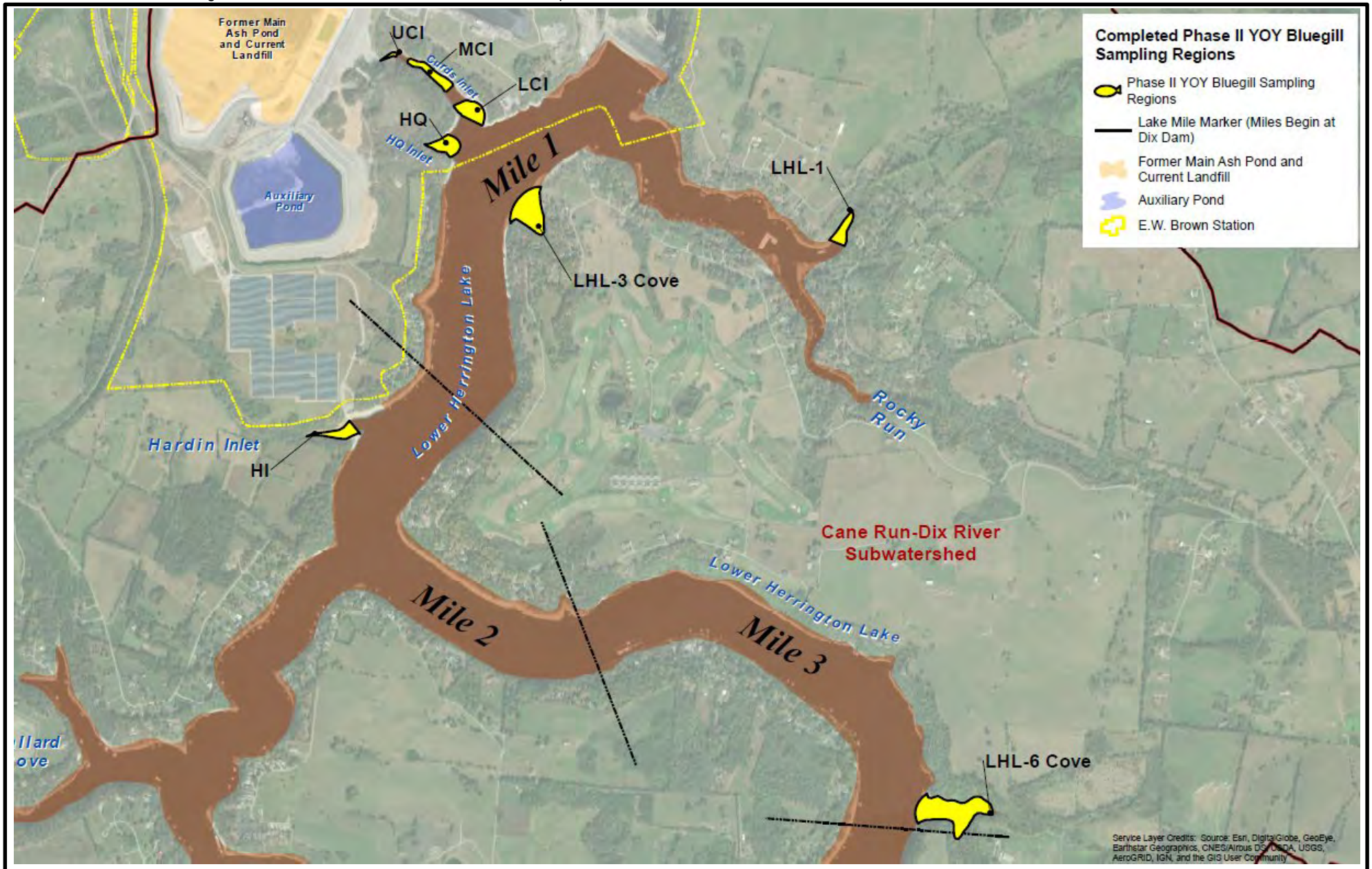
Corrective Action Site Investigation, Source Assessment,
and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

5-2B



RAMBOLL	**CONCEPTUAL SITE MODEL FOR THE ECOLOGICAL RISK ASSESSMENT PERFORMED FOR HERRINGTON LAKE** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 5-2C
DRAFTED BY: PAL	DATE: 02/21/2019	



HI	Hardin Inlet
HQ	HQ Inlet
LCI	Lower Curds Inlet
LHL	Lower Herrington Lake
MCI	Middle Curds Inlet
UCI	Upper Curds Inlet
YOY	Young-of-Year

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

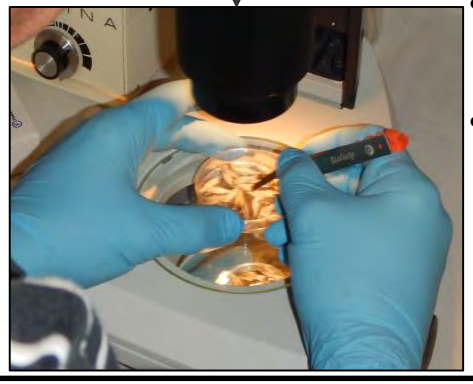
YOUNG-OF-THE- YEAR (YOY) ASSESSMENT AND TISSUE COLLECTION SAMPLE LOCATIONS

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

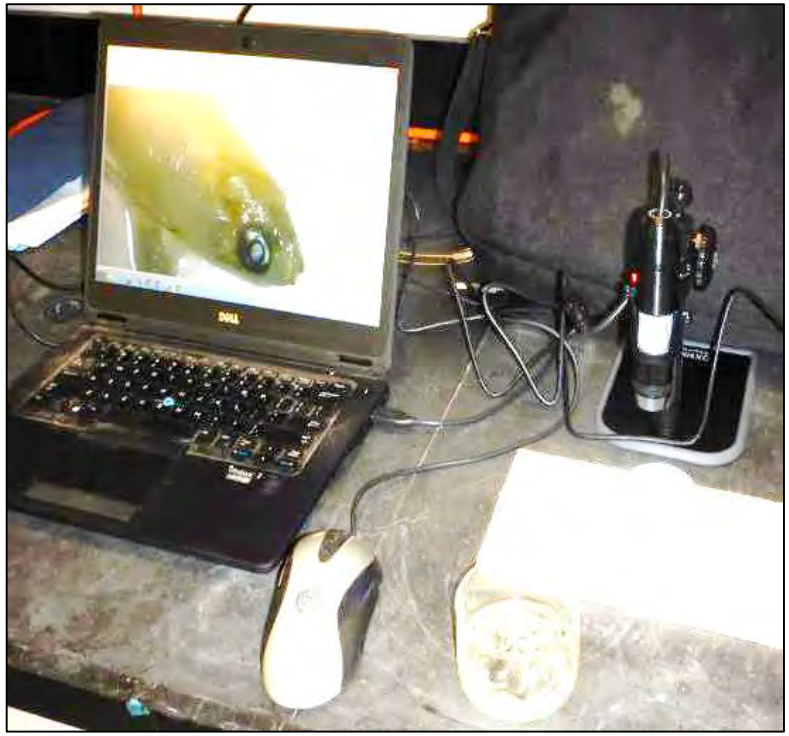
5-3

Examined in small groups by area using 10x to 80x magnification



- ~3,600 young of year fish collected for assessment
- Each fish examined for typical spinal, facial, fin, and tail deformities, per SOP

Individual fish examined and digital imaging microscope used to document fish with abnormalities



Third party validation

- 100% of young of year fish with anomalies
- 25% of young of year normal fish

RAMBOLL

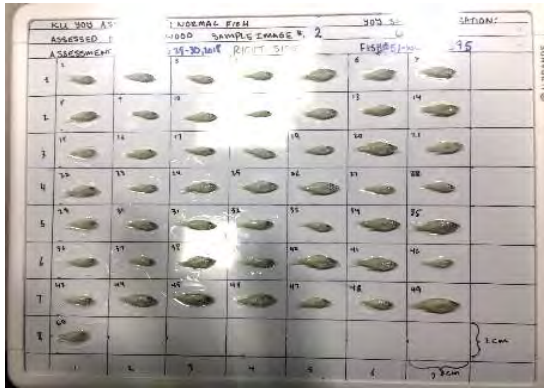
DRAFTED BY: PAL | DATE: 3/3/2019

YOUNG-OF-THE-YEAR (YOY) DEFORMITIES ASSESSMENT METHODS

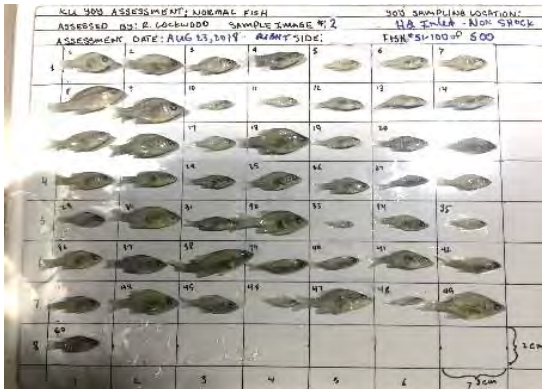
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE 5-4

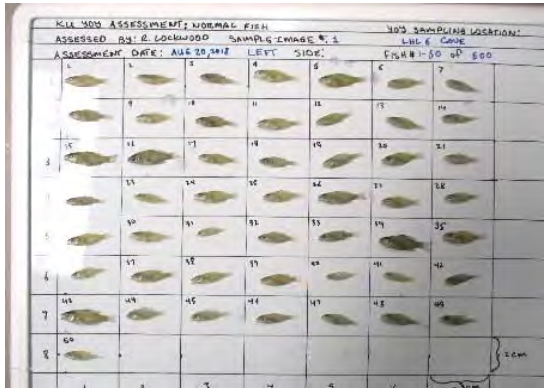
Upper Curds Inlet



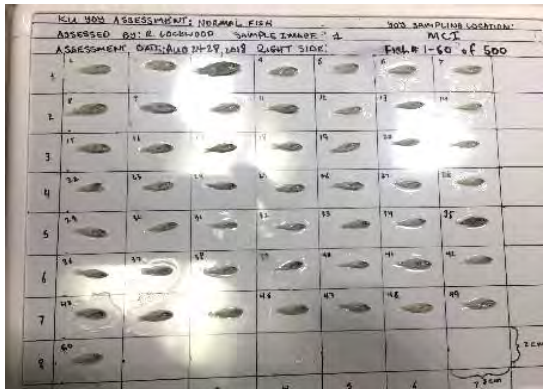
HQ Inlet



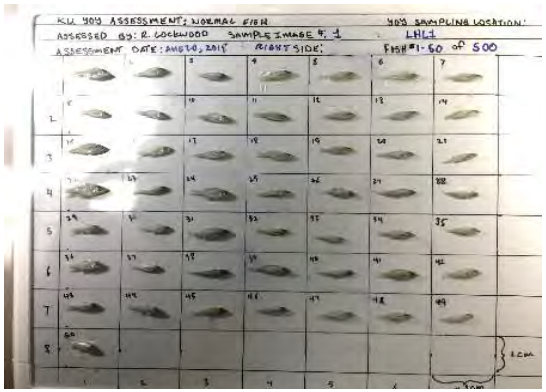
Hardin Inlet



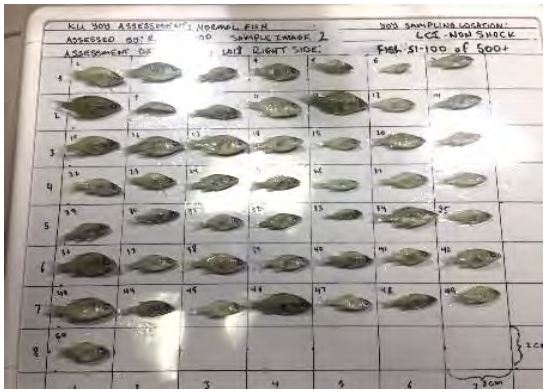
Middle Curds Inlet



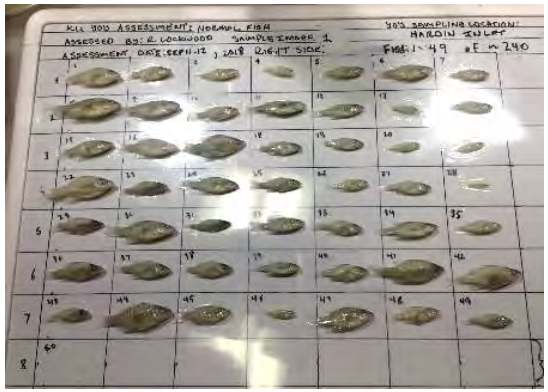
LHL1



Lower Curds Inlet



LHL6



Notes:
One example assessed-normal young of year bluegill group digital image is presented from each sampling region.

The vast majority of the collected young of year bluegill were assessed-normal.

Example young of year fish size can also be seen.

LHL1	Lower Herrington Lake 1
LHL6	Lower Herrington Lake 6

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

EXAMPLE NORMAL YOUNG-OF-THE-YEAR (YOY) BLUEGILLS

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

5-5

Area	# Fish	# Skeletal, Facial, Fin, Tail, Deformities	Skeletal, Facial, Fin, Tail Deformity Rate (%)
UCI	600	5 (tail deformities)	0.83%
MCI	674	5 (scoliosis, lordosis, facial, caudal)	0.74%
LCI	524	2 (scoliosis)	0.38%
HQ	486	5 (scoliosis, lordosis, mouth/head)	1.0%
LHL1	524	11 (scoliosis, lordosis, facial)	2.1%
LHL6	607	4 (mouth, facial, operculum, scoliosis)	0.66%
HI	209	2 (abbreviated dorsal spine)	0.96%
Total	3,624	35	0.97%

%	Percentage
HI	Hardin Inlet
HQ	HQ inlet
LCI	Lower Curds Inlet
LHL1	Lower Herrington Lake 1
LHL6	Lower Herrington Lake 6
MCI	Middle Curds Inlet
UCI	Upper Curds Inlet
YOY	Young-of-Year

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

TOTAL NUMBER OF DEFORMITIES OBSERVED IN YOUNG-OF-THE-YEAR ASSESSMENT SAMPLES

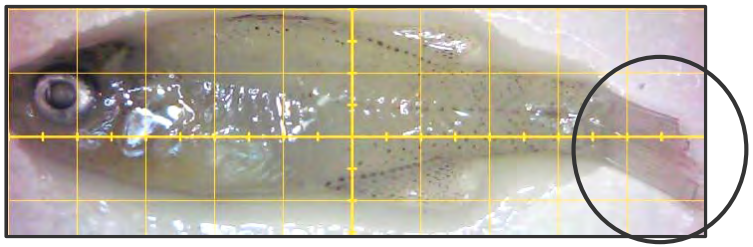
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

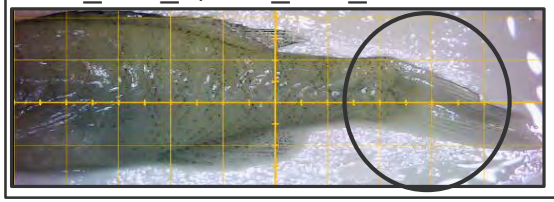
5-6

Young-of-Year Location	Total # of Fish	# Skeletal, Facial, Fin, Tail Deformities	Deformity Type
UCI	600	5	tail

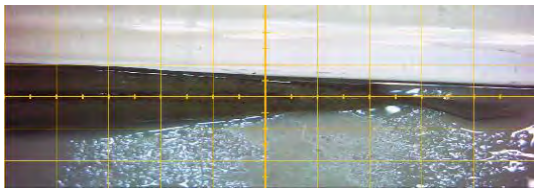
UCI_001_L2, UCI_001_D
Tail deformity



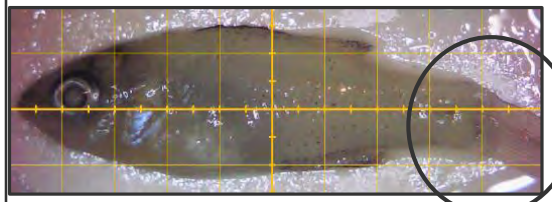
UCI_003_L, UCI_003_D



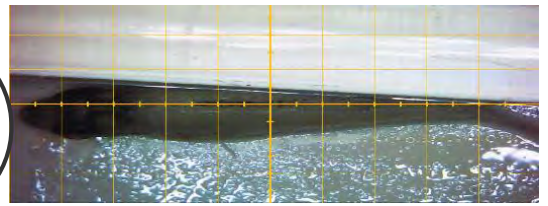
- Tail deformity



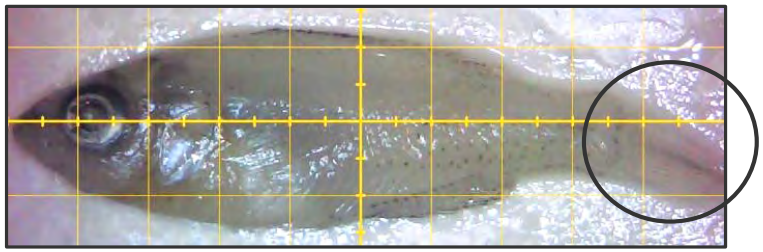
UCI_004_L2, UCI_004_D2



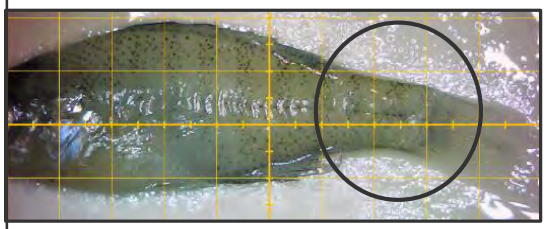
- Tail deformity



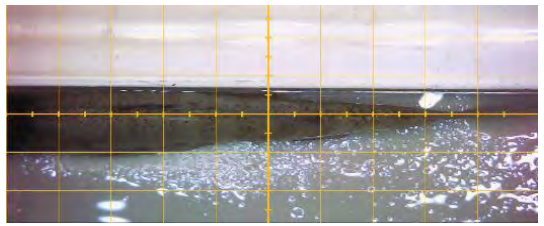
UCI_002_L2, UCI_002_D
Tail deformity



UCI_005_L2, UCI_005_D2



- Tail deformity



#	Number
D	Dorsal side view
L	Left side view
UCI	Upper Curds Inlet

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

UPPER CURDS INLET YOUNG-OF-THE-YEAR (YOY) SKELETAL, FACIAL, FIN, AND TAIL DEFORMITIES

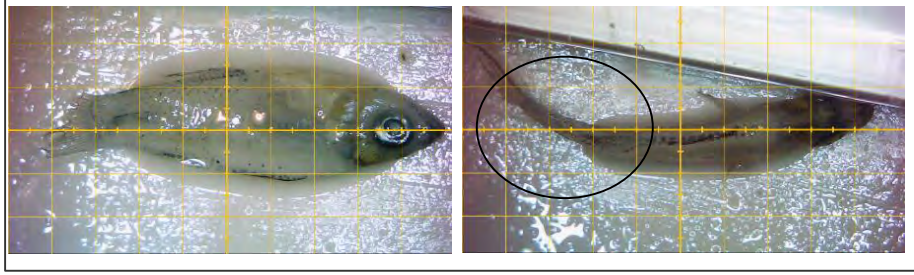
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

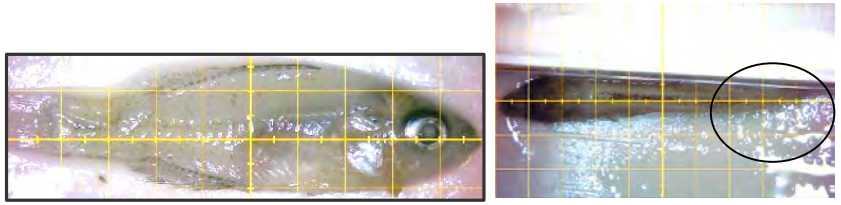
5-7A

Young-of-Year Location	Total # of Fish	# Skeletal, Facial, Fin, Tail Deformities	Deformity Type
MCI	674	5	scoliosis, lordosis, facial, caudal fin

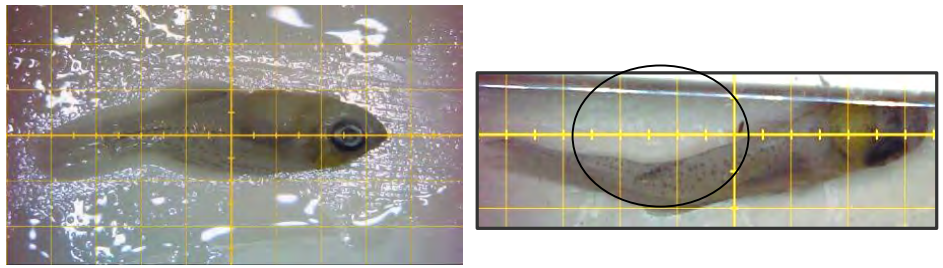
MCI_001_L, MCI_001_D Lordosis



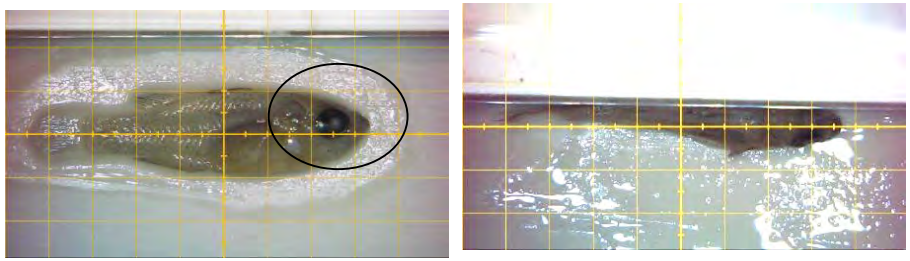
MCI_005_L, MCI_005_D Scoliosis



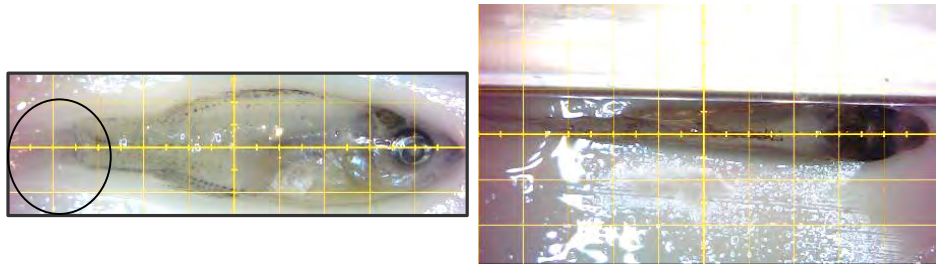
MCI_003_L, MCI_003_D Scoliosis



MCI_002_R, MCI_002_D Head / Facial



MCI_004_R, MCI_004_D Tail Twisted



#	Number
D	Dorsal side view
L	Left side view
MCI	Middle Curds Inlet
R	Right side view

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

MIDDLE CURDS INLET YOUNG-OF-THE-YEAR (YOY) SKELETAL, FACIAL, FIN, AND TAIL DEFORMITIES

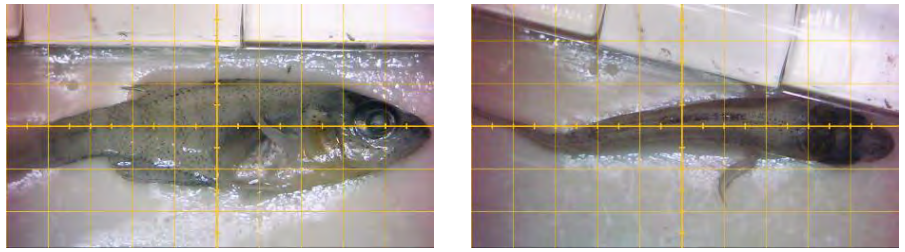
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

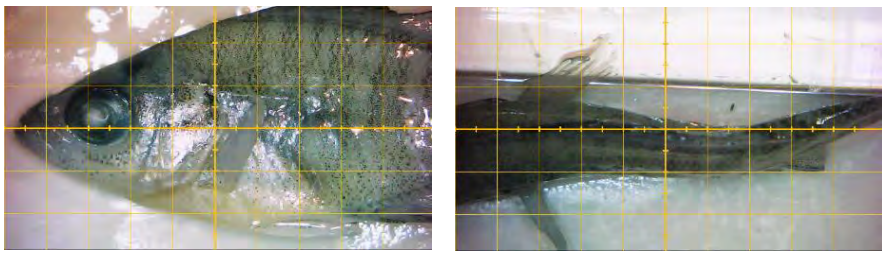
5-7B

Young-of-Year Location	Total # of Fish	# Skeletal, Facial, Fin, Tail Deformities	Deformity Type
LCI	524	2	Scoliosis

LCI_002_R, LCI_002_D Scoliosis



LCI_003_L1, LCI_003_D2 Scoliosis



#	Number
D	Dorsal side view
L	Left side view
LCI	Lower Curds Inlet
R	Right side view

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

LOWER CURDS INLET YOUNG-OF-THE-YEAR (YOY) SKELETAL, FACIAL, FIN, AND TAIL DEFORMITIES

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

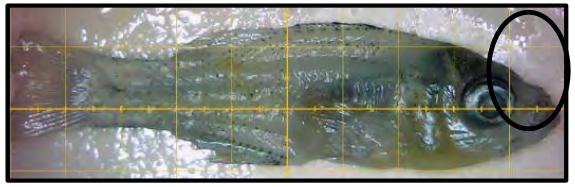
FIGURE

5-7C

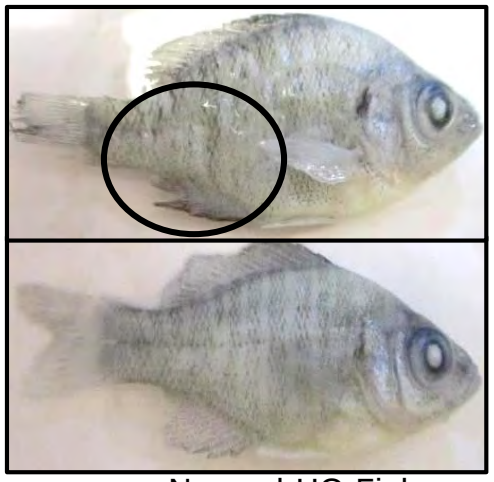
Young-of-Year Location	Total # of Fish	# Skeletal, Facial, Fin, Tail Deformities	Deformity Type
HQ	486	5	scoliosis, lordosis, facial

HQ_002D.JPG Scoliosis

HQ_003R.jpg Facial deformity and emaciated

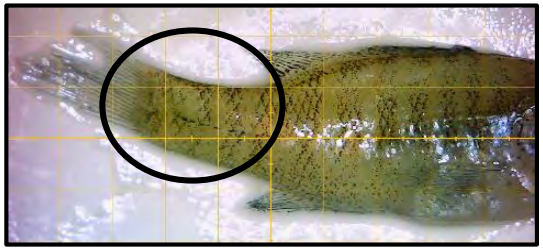


HQ_005L.jpg Compressed Peduncle



Normal HQ Fish

HQ_006R2.jpg Lordosis



HQ_001D.jpg Scoliosis

#	Number
D	Dorsal side view
HQ	HQ Inlet
L	Left side view
R	Right side view

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

HQ INLET YOUNG-OF-THE-YEAR (YOY) SKELETAL, FACIAL, FIN, AND TAIL DEFORMITIES

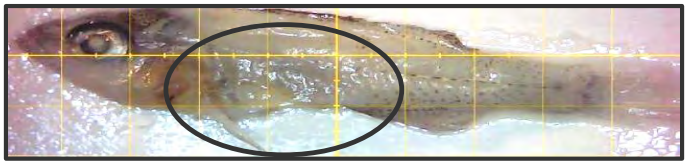
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

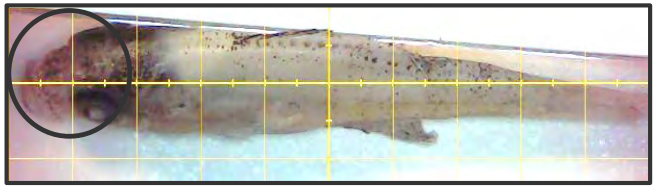
5-7D

Young-of-Year Location	Total # of Fish	# Skeletal, Facial, Fin, Tail Deformities	Deformity Type
LHL1	524	11	scoliosis, lordosis, facial

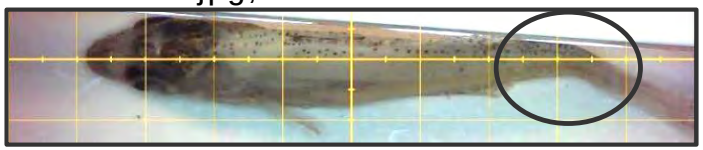
LHL1 002L.jpg, Protruding stomach (trauma from sampling?)



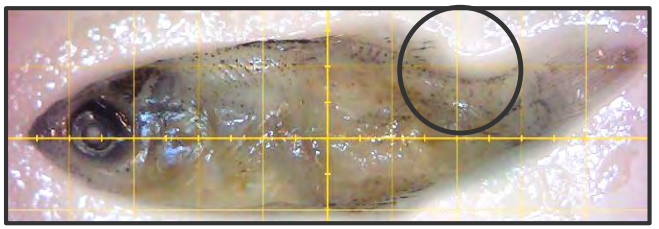
LHL1 004D.jpg, Mouth



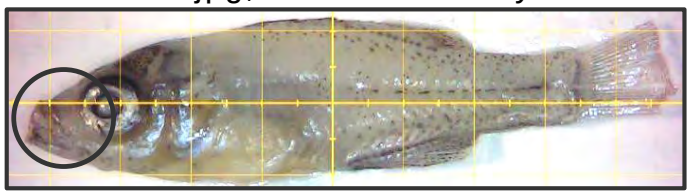
LHL1 003D.jpg, scoliosis



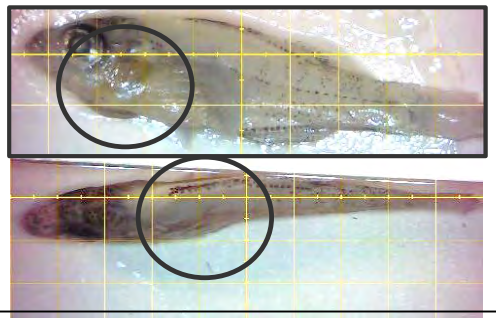
LHL1 005L.jpg, Lordosis



LHL1 010L.jpg, Mouth deformity



LHL1 001L.jpg Operculum and scoliosis



#	Number
D	Dorsal side view
L	Left side view
LHL1	Lower Herrington Lake 1

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

LOWER HERRINGTON LAKE 1 YOUNG-OF-THE-YEAR (YOY) SKELETAL, FACIAL, FIN, AND TAIL DEFORMITIES

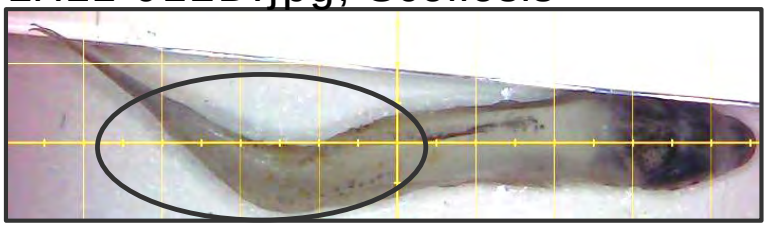
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

5-7E

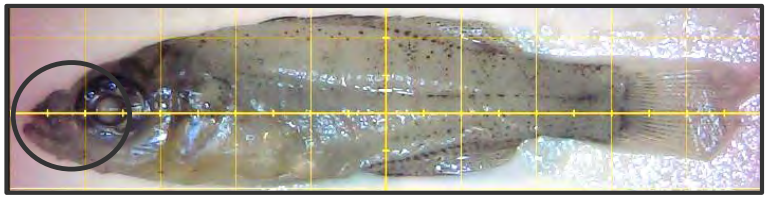
Young-of-Year Location	Total # of Fish	# Skeletal, Facial, Fin, Tail Deformities	Deformity Type
LHL1 (continued)	524	11	scoliosis, lordosis, facial

LHL1 012D.jpg, Scoliosis

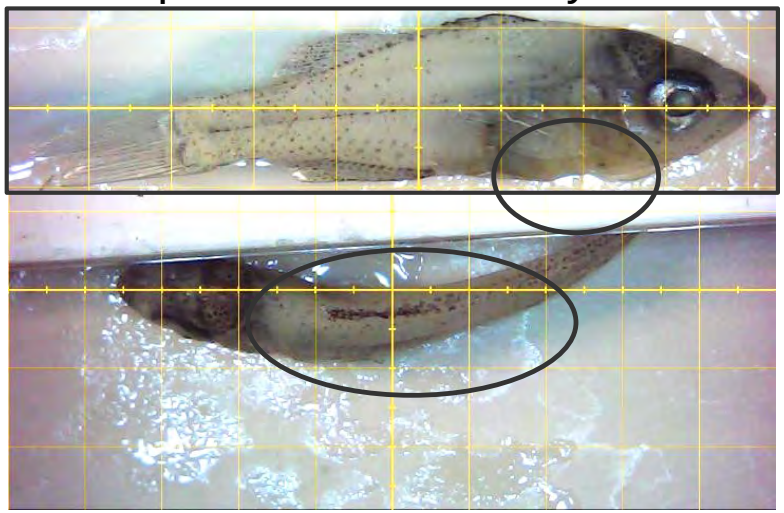


LHL1 009L.jpg, Operculum deformity

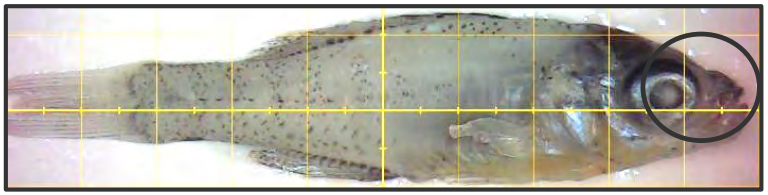
LHL1 008L.jpg, Facial/mouth



LHL1 007R.jpg, Operculum deformity and



LHL1 011R.jpg, Facial/mouth



#	Number
D	Dorsal side view
L	Left side view
LHL1	Lower Herrington Lake 1
R	Right side view

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

LOWER HERRINGTON LAKE 1 YOUNG-OF-THE-YEAR (YOY) SKELETAL, FACIAL, FIN, AND TAIL DEFORMITIES (CONTINUED)

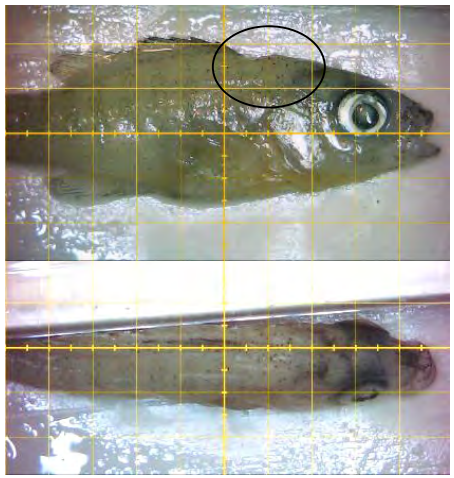
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

5-7F

Young-of-Year Location	Total # of Fish	# Skeletal, Facial, Fin, Tail Deformities	Deformity Type
HI	209	2	abbreviated dorsal spine

HI_001_R, HI_001_D
Abbreviated spine



HI_002_R, HI_002_D
Abbreviated spine

#	Number
D	Dorsal side view
HI	Hardin Inlet
R	Right side view

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

HARDIN INLET YOUNG-OF-THE-YEAR (YOY) SKELETAL, FACIAL, FIN, AND TAIL DEFORMITIES

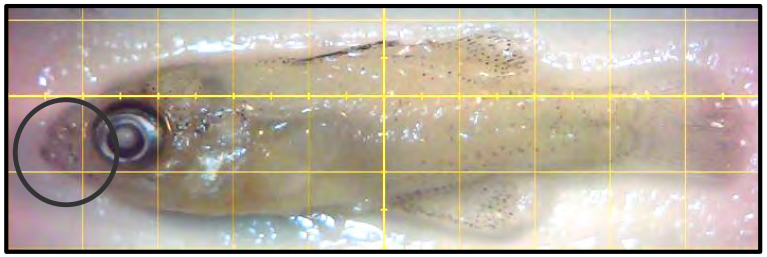
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

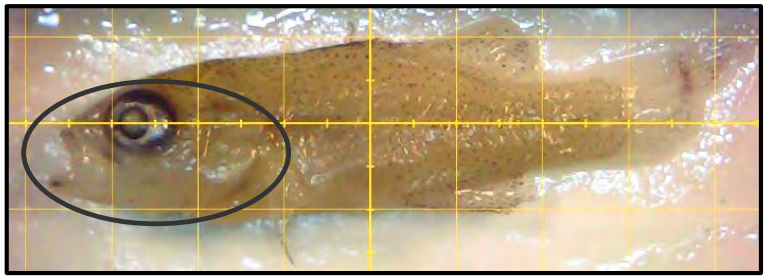
5-7G

Young-of-Year Location	Total # of Fish	# Skeletal, Facial, Fin, Tail Deformities	Deformity Type
LHL6	607	4	facial, mouth, operculum, scoliosis

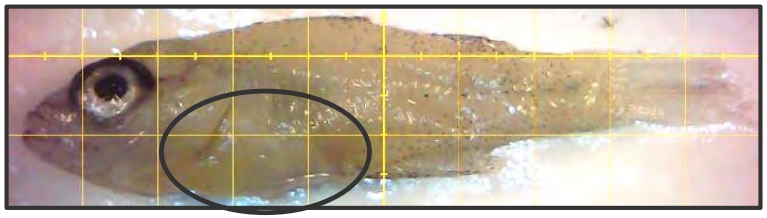
LHL6 001L.jpg Mouth Deformity



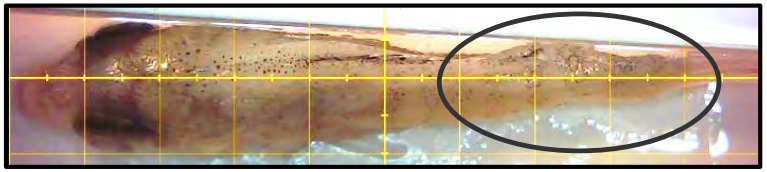
LHL6 003L.jpg Craniofacial Deformity



LHL6 002L.jpg Operculum Deformity



LHL6 004D.jpg Scoliosis



#	Number
D	Dorsal side view
L	Left side view
LHL6	Lower Herrington Lake 6

RAMBOLL

DRAFTED BY: PAL

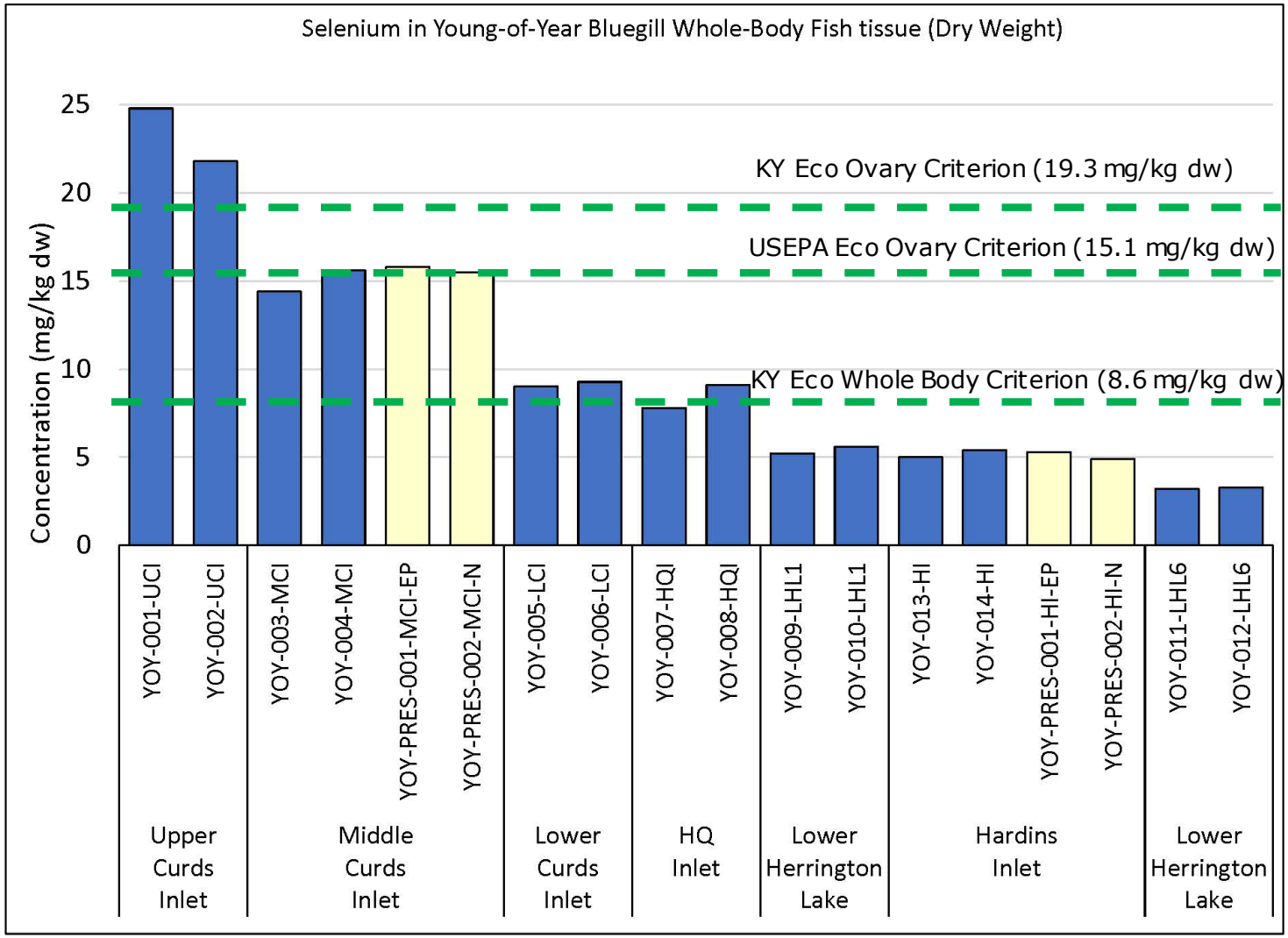
DATE: 3/3/2019

LOWER HERRINGTON LAKE 6 YOUNG-OF-THE-YEAR (YOY) SKELETAL, FACIAL, FIN, AND TAIL DEFORMITIES

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

5-7H



HI	Hardin Inlet
HQ	HQ Inlet
KY Eco	Kentucky Ecological
LCI	Lower Curds Inlet
LHL1	Lower Herrington Lake 1
LHL6	Lower Herrington Lake 6
MCI	Middle Curds Inlet
Mg/kg dw	Milligrams per kilogram dry weight
UCI	Upper Curds Inlet
USEPA Eco	United States Environmental Protection Agency Ecological
YOY	Young-of-the-Year

RAMBOLL

DRAFTED BY: PAL | DATE: 3/3/2019

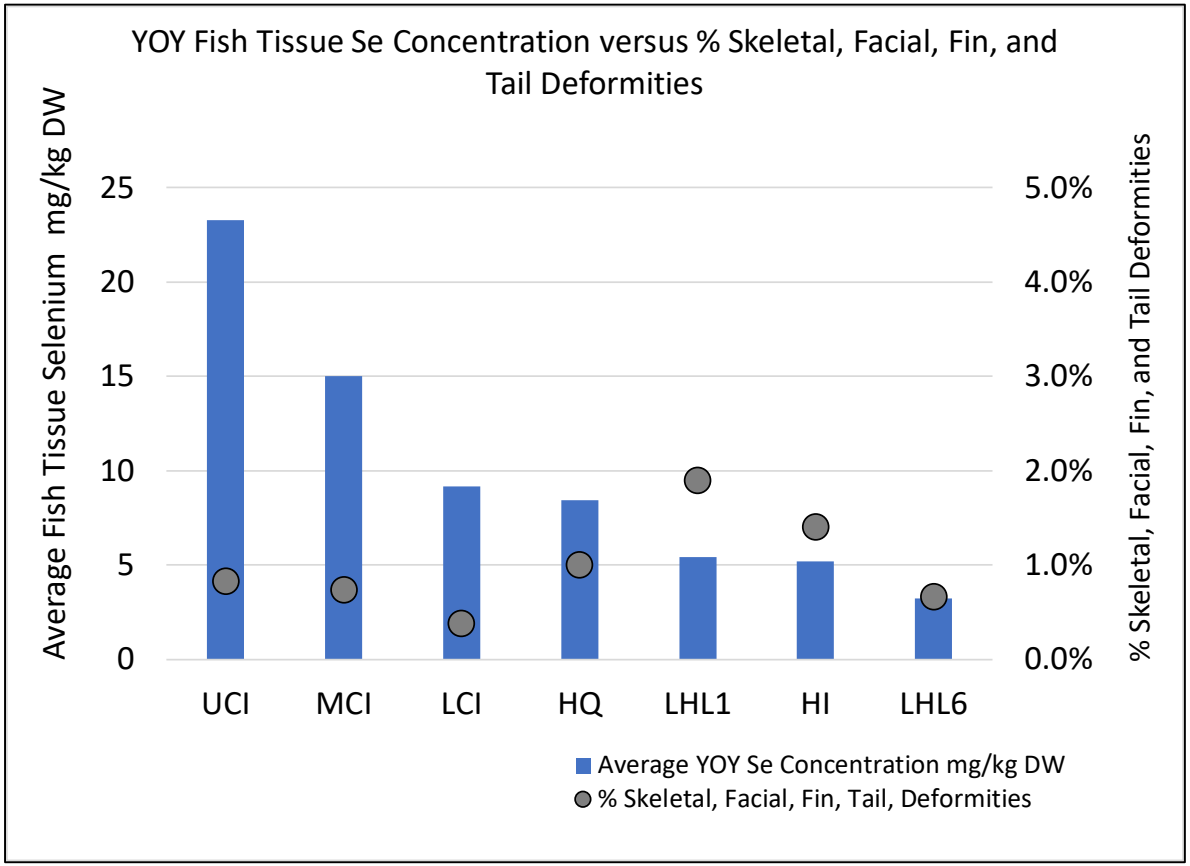
SELENIUM IN YOUNG-OF-YEAR (YOY) FISH TISSUES

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

5-8A

Area	Skeletal, Facial, Fin, Tail Deformity Rate (%)	Average Young-of-Year Fish Concentrations (mg/kg)
UCI	0.83%	23.3
MCI	0.74%	15
LCI	0.38%	9.14
HQ	1.0%	8.4
LHL1	2.1%	5.4
HI	0.96%	5.2
LHL6	0.66%	3.24
Total	0.97%	--



%	Percentage
DW	Dry Weight
HI	Hardin Inlet
HQ	HQ Inlet
LCI	Lower Curds Inlet
LHL1	Lower Herrington Lake 1
LHL6	Lower Herrington Lake 6
MCI	Middle Curds Inlet
Mg/kg	Milligrams per kilogram
Se	Selenium
UCI	Upper Curds Inlet
YOY	Young-of-Year

RAMBOLL

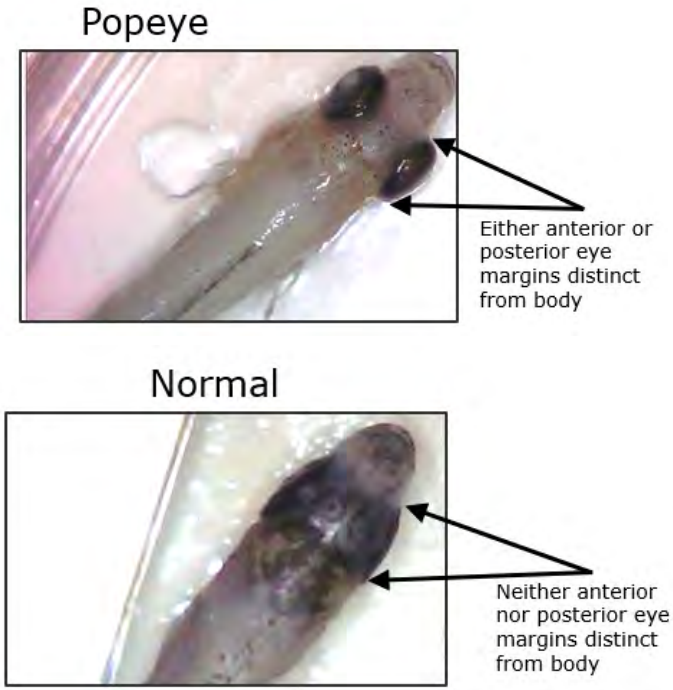
DRAFTED BY: PAL | DATE: 3/3/2019

EVALUATION OF POTENTIAL DOSE RESPONSE FOR SELENIUM VS. SKELETAL, FACIAL, FIN, & TAIL DEFORMITIES BY LOCATION

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

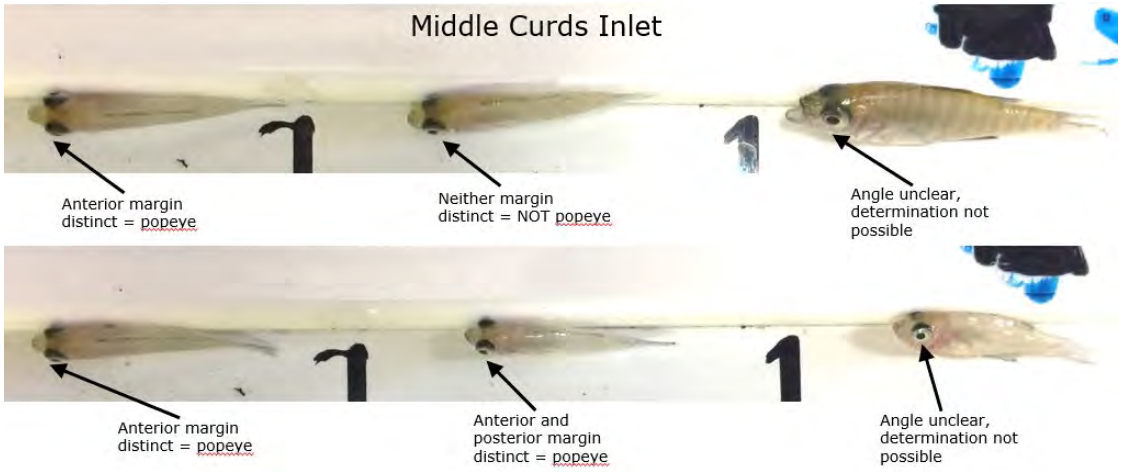
FIGURE
5-8B

Area	# Fish	# With Popeye Condition	% With Popeye Condition
UCI	600	0	0%
MCI	674	93	14%
LCI	524	0	0%
HQ	486	1	0.2%
LHL1	524	0	0%
LHL6	607	0	0
HI	209	86	41%
Total	3624	180	5%



Notes
- Among the ~3,600 fish examined, approximately 5% of fish have condition known as exophthalmia (popeye).
- Popeye was not seen in the 2016 bass Young-of-Year in Curds Inlet.

~	Approximately
#	Number
%	Percentage
HI	Hardin Inlet
HQ	HQ Inlet
LCI	Lower Curds Inlet
LHL1	Lower Herrington Lake 1
LHL6	Lower Herrington Lake 6
MCI	Middle Curds Inlet
UCI	Upper Curds Inlet



RAMBOLL

DRAFTED BY: PAL | DATE: 3/3/2019

POPEYE IN YOUNG-OF-THE-YEAR (YOY) FISH ASSESSMENT SAMPLES

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

5-9A

Young-of-Year Location	Young-of-Year Analytical Sample	# Fish Evaluated	# Fish w/Popeye	% Popeye	Avg Popeye Per Location %
UCI	Sample 1 of 2	69	16	23.2%	3.2%
	Sample 2 of 2	49	7	14.3%	
	Assessment Sample	600	0	0.0%	
MCI	Sample 1 of 2	108	71	66%	25.4%
	Sample 2 of 2	69	52	75%	
	Assessment Sample	674	93	14%	
LCI	Sample 1 of 2	31	0	0%	0.2%
	Sample 2 of 2	30	1	3.3%	
	Assessment Sample	524	0	0%	
HQ	Sample 1 of 2	19	0	0%	0.2%
	Sample 2 of 2	26	0	0%	
	Assessment Sample	486	1	0.2%	
LHL1	Sample 1 of 2	83	7	8%	8.1%
	Sample 2 of 2	100	50	50%	
	Assessment Sample	524	0	0%	
HI	Sample 1 of 2	11	1	9%	37.2%
	Sample 2 of 2	19	2	11%	
	Assessment Sample	209	86	41%	
LHL6	Sample 1 of 2	31	0	0%	0.0%
	Sample 2 of 2	47	0	0%	
	Assessment Sample	607	0	0%	
Total Average (Assessment and Tissue Samples)		4316	387	9.0%	

#	Number
%	Percentage
HI	Hardin Inlet
HQ	HQ inlet
LCI	Lower Curds Inlet
LHL1	Lower Herrington Lake 1
LHL6	Lower Herrington Lake 6
MCI	Middle Curds Inlet
UCI	Upper Curds Inlet
w/	With

RAMBOLL

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POPEYE IN YOUNG-OF-THE-YEAR (YOY) TISSUE SAMPLES

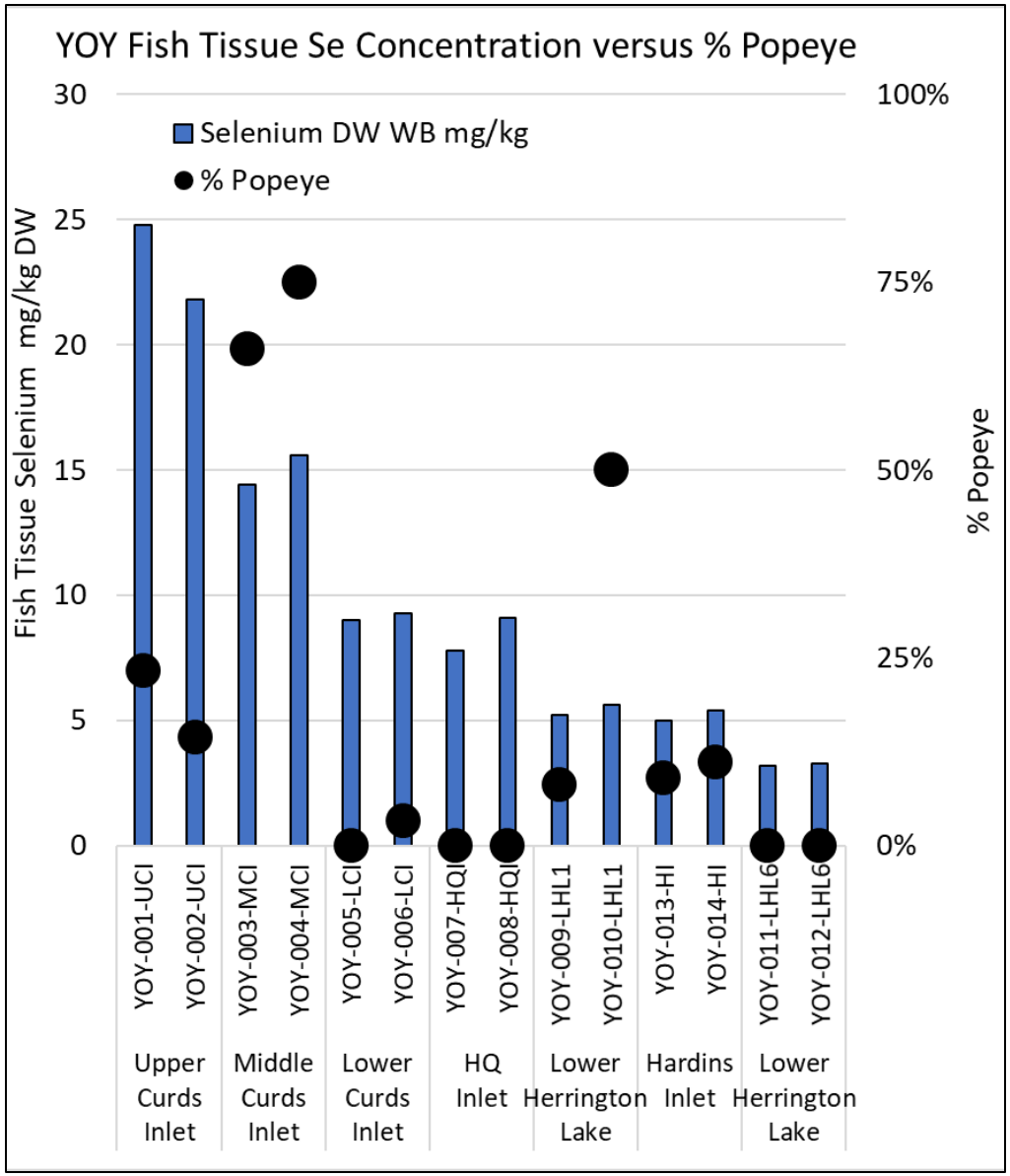
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

5-9B

Young-of-Year Location	Young-of-Year Analytical Sample	# Fish Eval-uated	# Fish w/ Popeye	% Popeye
UCI	1 of 2	69	16	23.2%
	2 of 2	49	7	14.3%
MCI	1 of 2	108	71	66%
	2 of 2	69	52	75%
LCI	1 of 2	31	0	0%
	2 of 2	30	1	3.3%
HQ	1 of 2	19	0	0%
	2 of 2	26	0	0%
LHL1	1 of 2	83	7	8%
	2 of 2	100	50	50%
HI	1 of 2	11	1	9%
	2 of 2	19	2	11%
LHL6	1 of 2	31	0	0%
	2 of 2	47	0	0%

#	Number
%	Percentage
DW	Dry Weight
HI	Hardin Inlet
HQ	HQ Inlet
LCI	Lower Curds Inlet
LHL1	Lower Herrington Lake 1
LHL6	Lower Herrington Lake 6
MCI	Middle Curds Inlet
Mg/kg	Milligrams per kilogram
Se	Selenium
UCI	Upper Curds Inlet
YOY	Young-of-Year



Note:
This graphic shows Young-of-Year

RAMBOLL

DRAFTED BY: PAL

DATE: 3/3/2019

EVALUATION OF POTENTIAL DOSE RESPONSE RELATIONSHIP: SELENIUM IN YOY FISH TISSUE VS POPEYE IN YOUNG-OF-YEAR (YOY) FISH

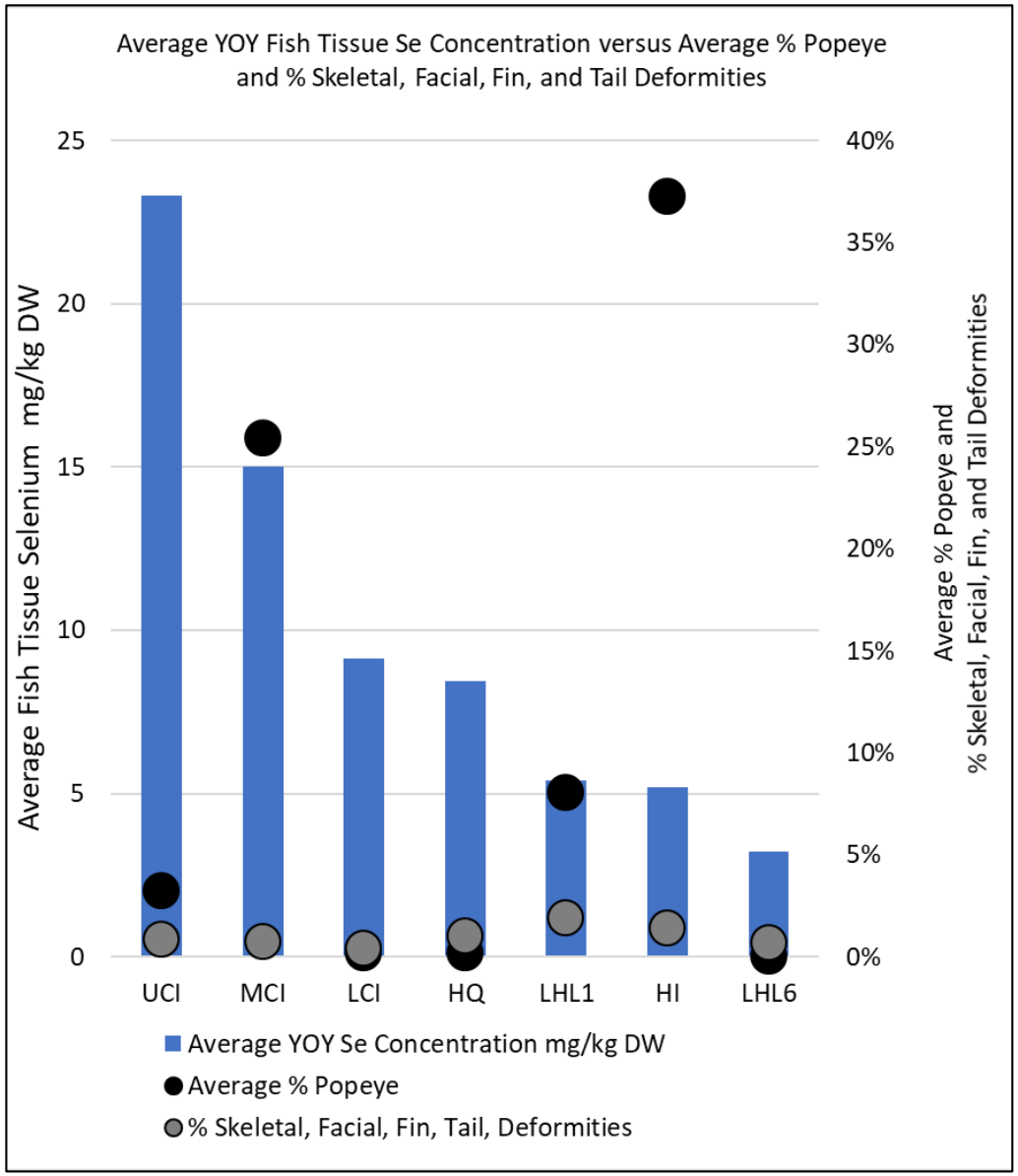
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

5-10A

Young-of-Year Location	Avg Popeye Per Location %	Skeletal, Facial, Fin, Tail Deformity Rate (%)	Average Young-of-Year Fish Conc (mg/kg)
UCI	3.2%	0.83%	23.3
MCI	25.4%	0.74%	15
LCI	0.2%	0.38%	9.14
HQ	0.2%	1.0%	8.4
LHL1	8.1%	2.1%	5.4
HI	37.2%	0.96%	5.2
LHL6	0%	0.66%	3.24

%	Percentage
Avg	Average
DW	Dry Weight
HI	Hardin Inlet
HQ	HQ Inlet
LCI	Lower Curds Inlet
LHL1	Lower Herrington Lake 1
LHL6	Lower Herrington Lake 6
MCI	Middle Curds Inlet
Mg/kg	Milligrams per kilogram
Se	Selenium
UCI	Upper Curds Inlet
YOY	Young-of-Year



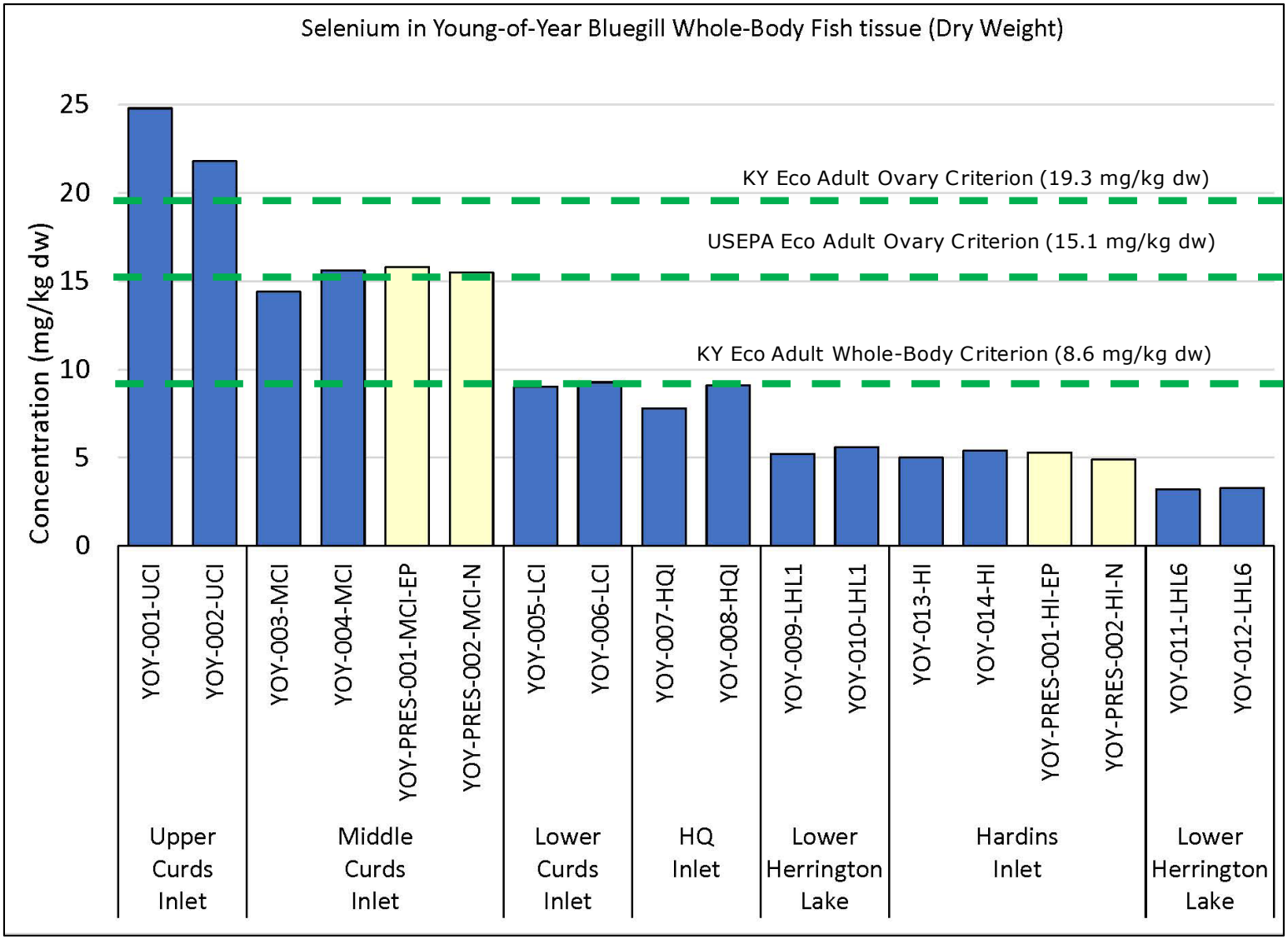
RAMBOLL

DRAFTED BY: PAL | DATE: 3/3/2019

EVALUATION OF POTENTIAL DOSE RESPONSE RELATIONSHIPS: SELENIUM IN YOUNG-OF-YEAR (YOY) FISH TISSUE VS. POPEYE AND SKELETAL, FACIAL, FIN, AND TAIL DEFORMITIES BY LOCATION

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
5-10B



Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological (KY Eco), Lower Curds Inlet (LCI), Lower Herrington Lake 1 (LHL1), Lower Herrington Lake 6 (LHL6), Middle Curds Inlet (MCI), Milligrams per kilograms dry weight (mg/kg dw), Upper Curds Inlet (UCI), United States Environmental Protection Agency Ecological (USEPA Eco), Young-of-the-Year (YOY)

RAMBOLL

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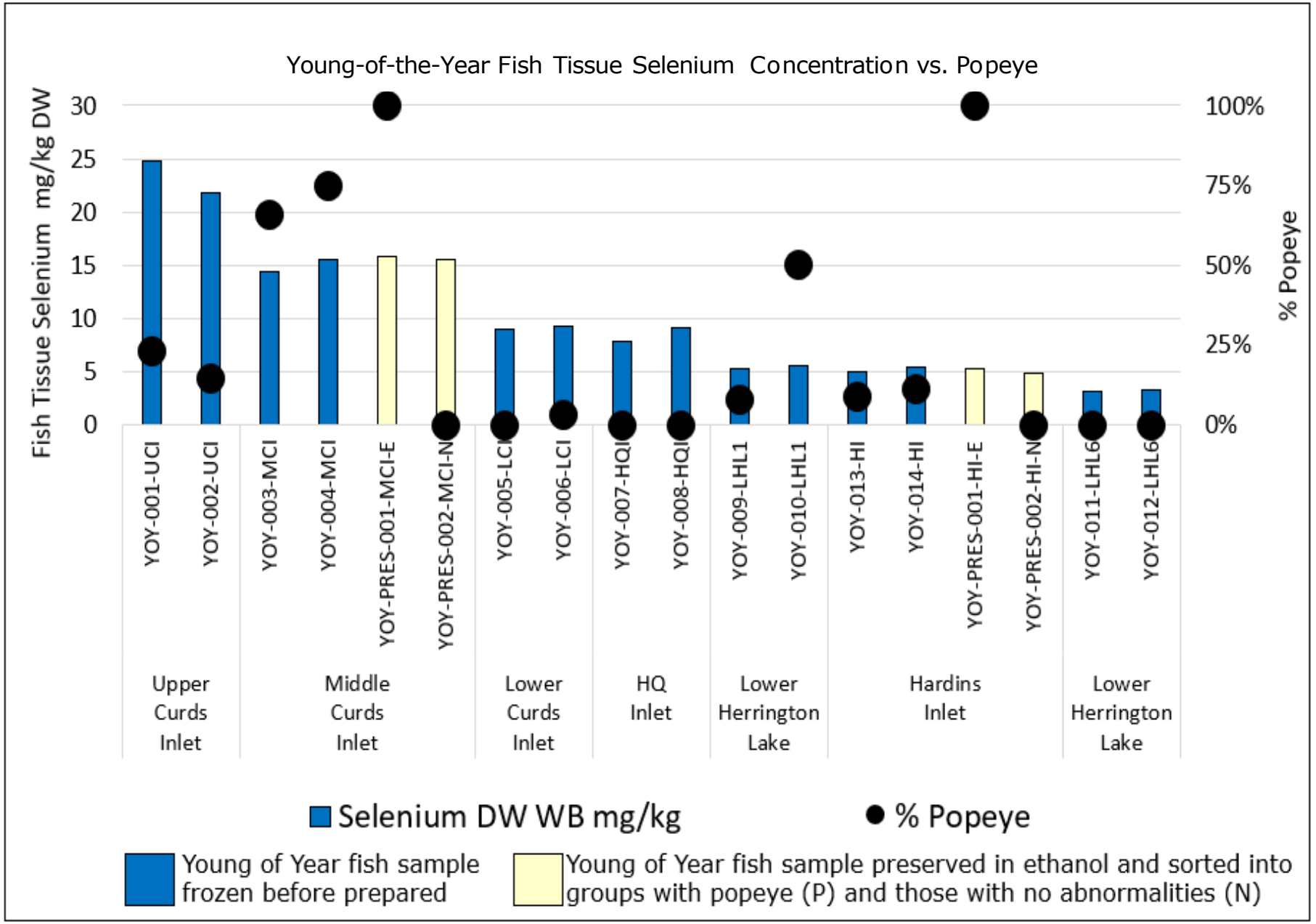
SELENIUM CONCENTRATIONS FOR ALL YOUNG-OF-YEAR (YOY) FISH (ANALYZED VIA KDOW SOP AND PRESERVED FISH)

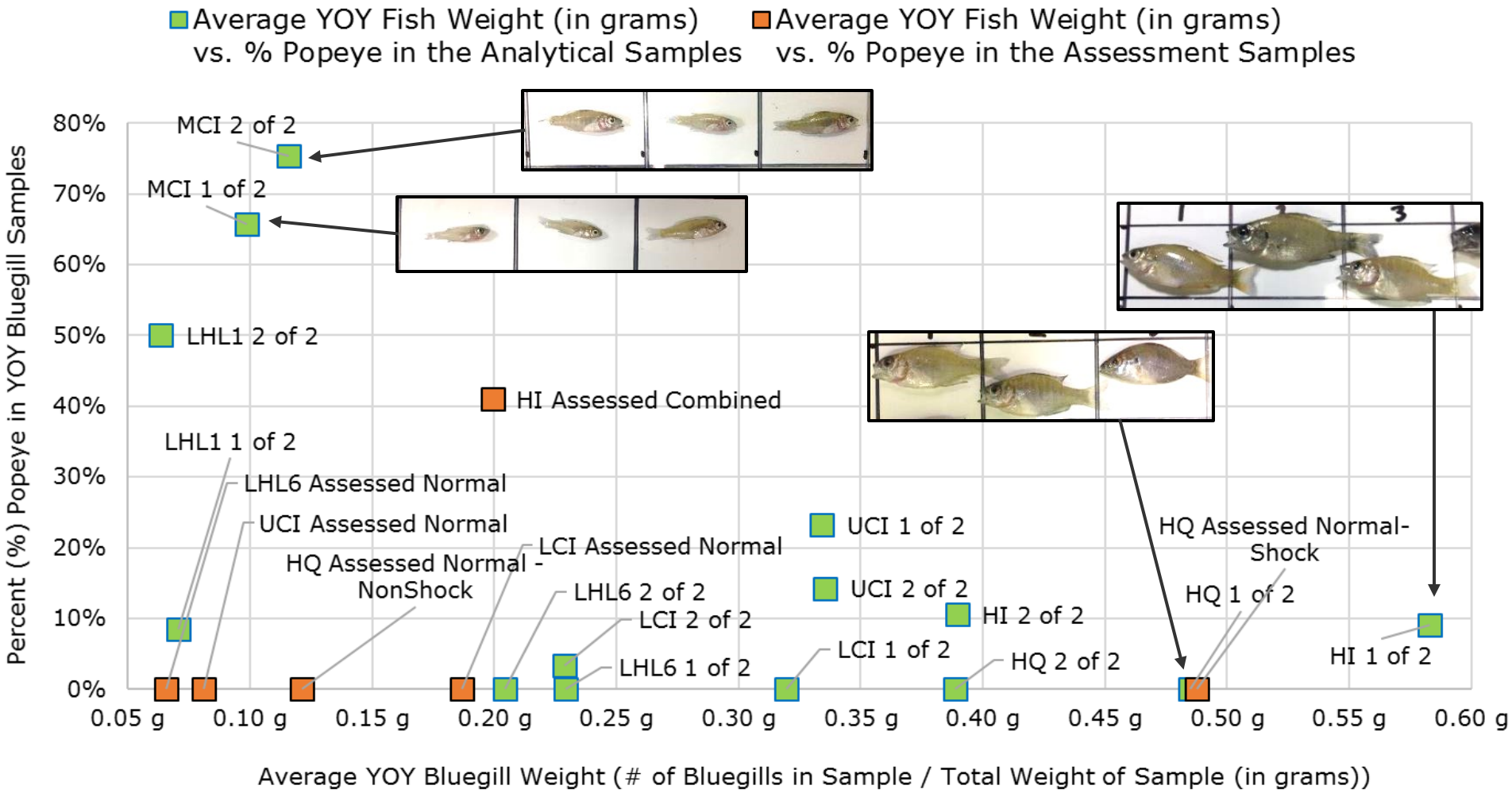
Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE
5-11A



RAMBOLL		**YOY FISH TISSUE SELENIUM CONCENTRATION VS. POPEYE** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 5-11B
DRAFTED BY: PAL	DATE: 02/01/2019		

CAP Phase II Young-of-the-Year (YOY) Bluegill Samples: Average Fish Weight (in grams) vs. Percent (%) Popeye



g	Grams	LHL6	Lower Herrington Lake 6
HI	Hardin Inlet	MCI	Middle Curds Inlet
HQ	HQ inlet	Mg/kg DW	Milligrams per kilogram dry weight
LCI	Lower Curds Inlet	UCI	Upper Curds Inlet
LHL1	Lower Herrington Lake 1	YOY	Young of Year

RAMBOLL

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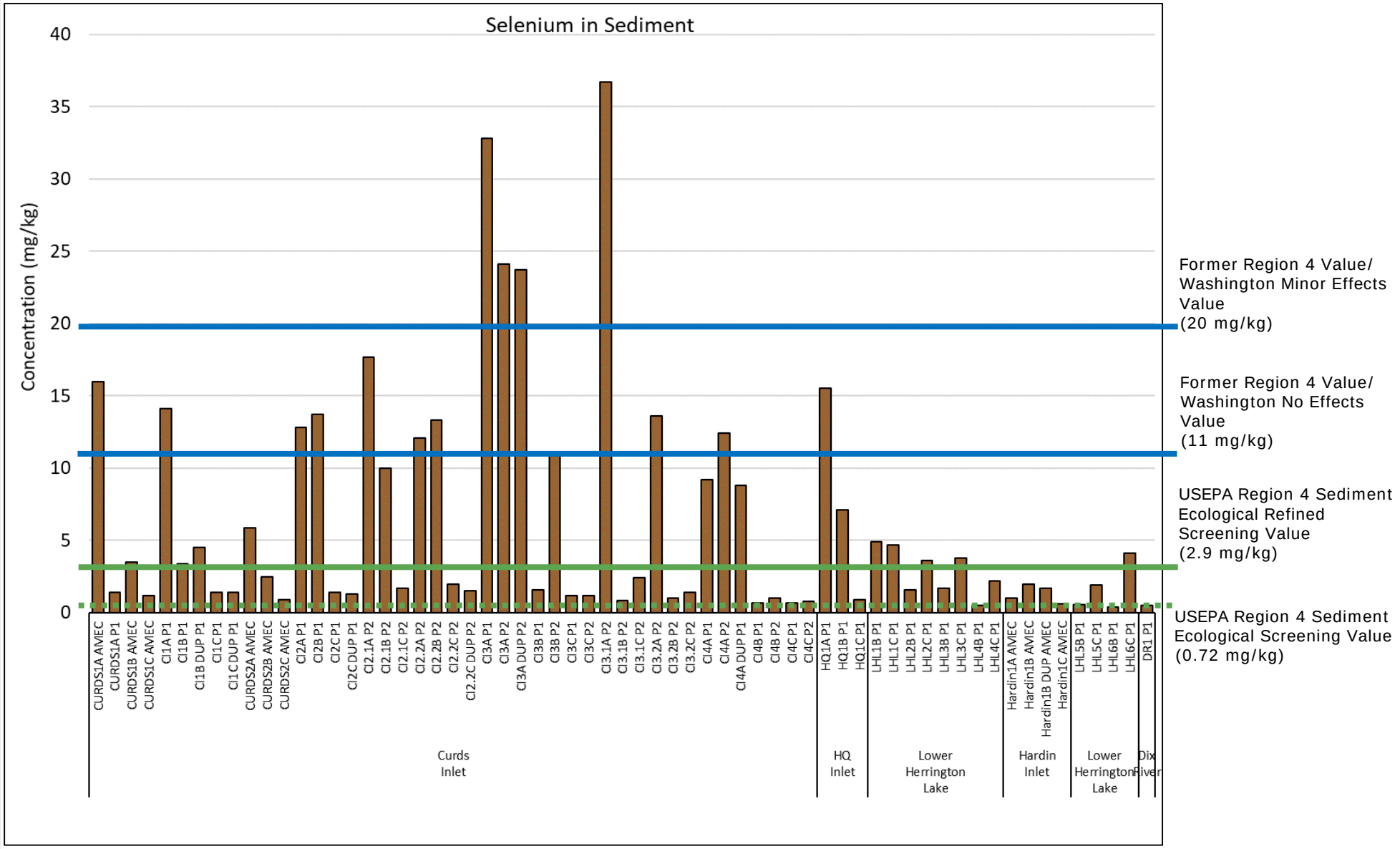
HERRINGTON LAKE YOUNG-OF-YEAR BLUEGILL ANALYTICAL SAMPLE AVERAGE INDIVIDUAL FISH WEIGHT VS. OCCURRENCE OF POPEYE

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report

E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

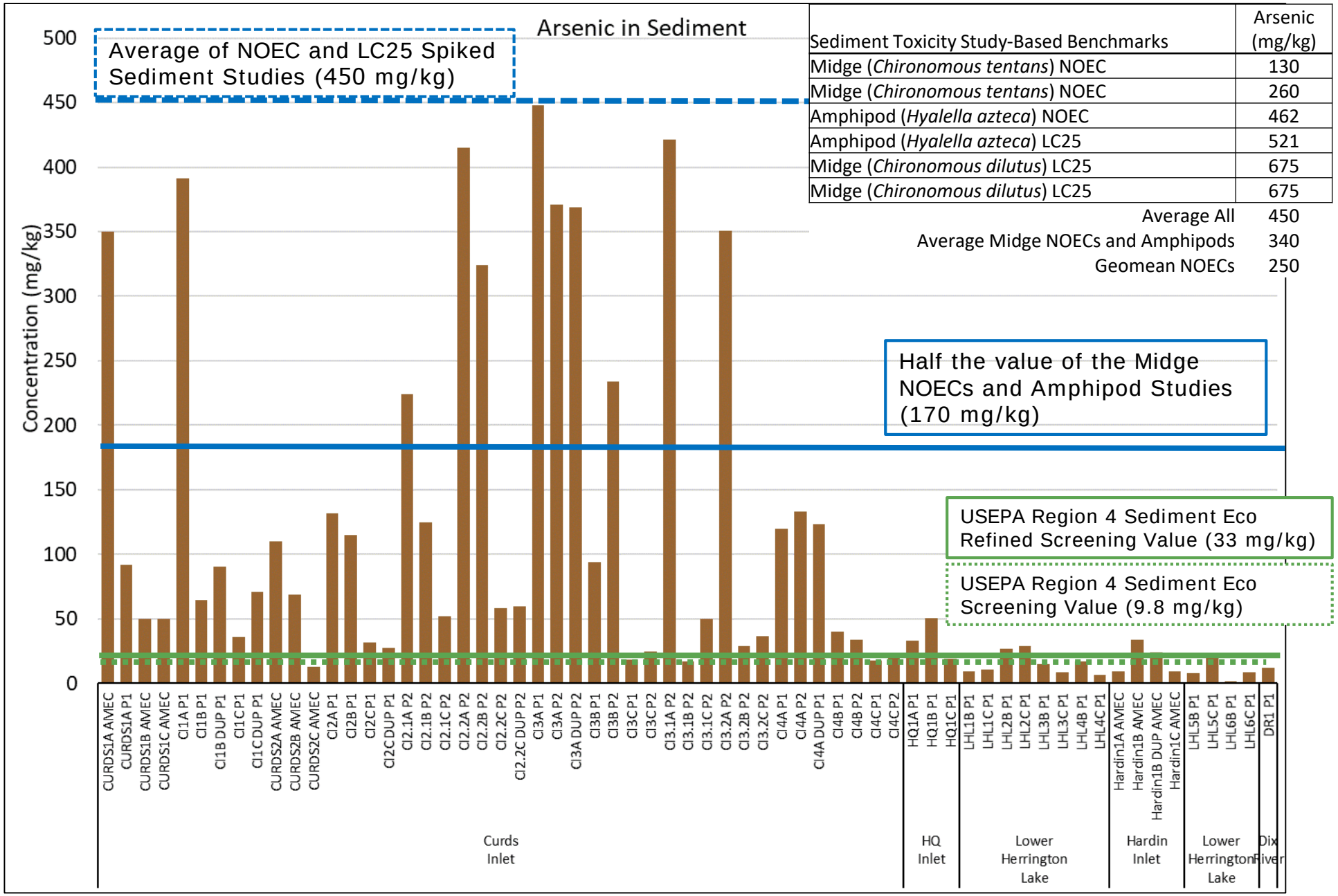
FIGURE

5-12



Data from AMEC (AMEC), Curds Inlet (CI), Duplicate sample (DUP), HQ Inlet (HQ), Lower Herrington Lake (LHL), Dix River (DR), Milligrams per kilogram (mg/kg), Phase I (P1), Phase II (P2)

RAMBOLL		**SELENIUM IN SEDIMENT WITH ADDITIONAL RISK-BASED CRITERIA FOR CONSIDERATION** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 5-13A
DRAFTED BY: PAL	DATE: 02/01/2019		



Sediment Toxicity Study-Based Benchmarks	Arsenic (mg/kg)
Midge (*Chironomous tentans*) NOEC	130
Midge (*Chironomous tentans*) NOEC	260
Amphipod (*Hyalella azteca*) NOEC	462
Amphipod (*Hyalella azteca*) LC25	521
Midge (*Chironomous dilutus*) LC25	675
Midge (*Chironomous dilutus*) LC25	675
Average All	450
Average Midge NOECs and Amphipods	340
Geomean NOECs	250

Data from AMEC (AMEC), Curds Inlet (CI), Data from AMEC (AMEC), Dix River (DR), Duplicate (DUP), HQ Inlet (HQ), Lower Herrington Lake (LHL), Milligrams per kilogram (mg/kg)

RAMBOLL

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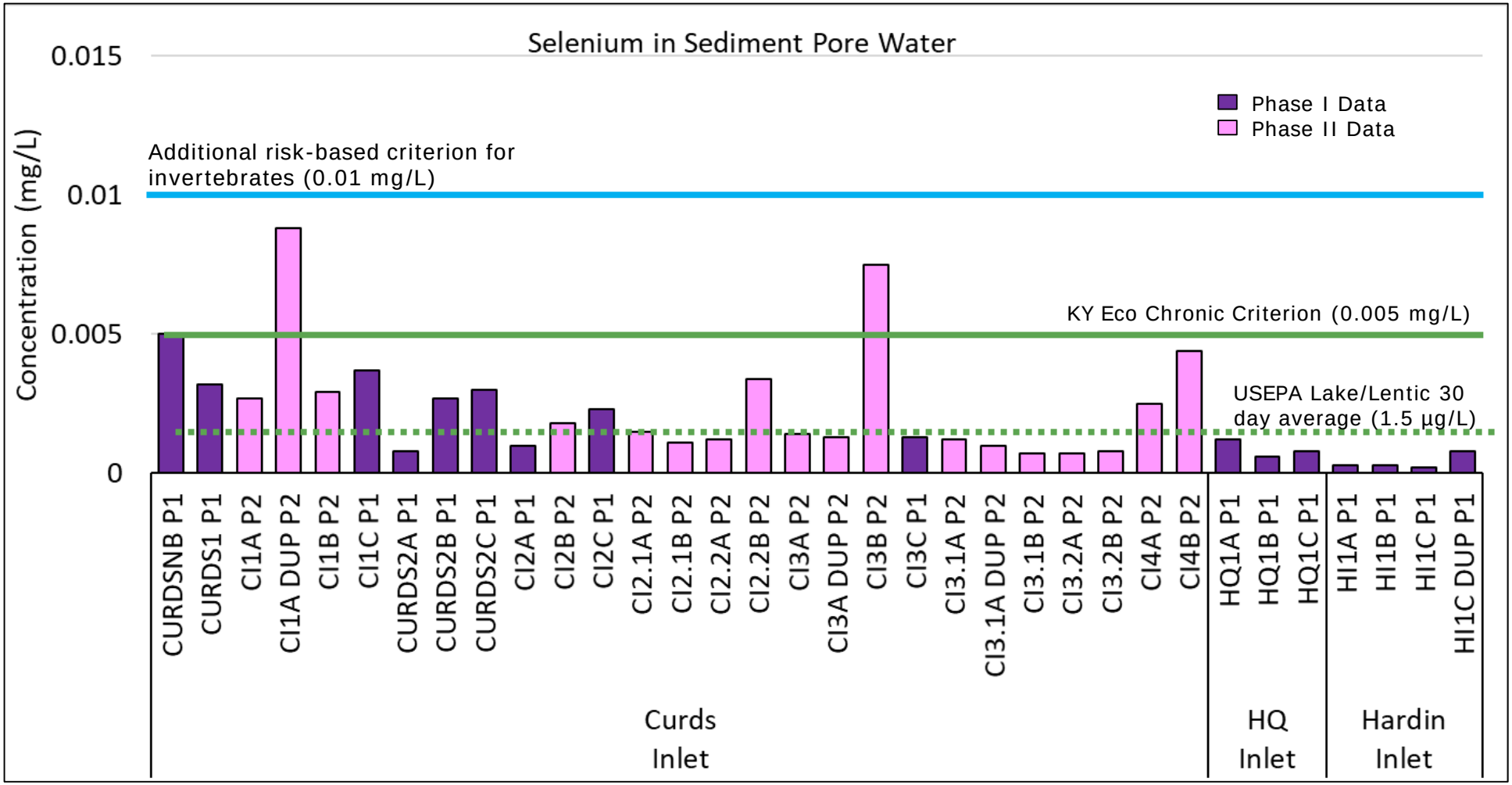
DATE: 02/01/2019

ARSENIC IN SEDIMENT WITH ADDITIONAL RISK-BASED CRITERIA FOR CONSIDERATION

Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report
E.W. Brown Station, Herrington Lake, Mercer County, Kentucky

FIGURE

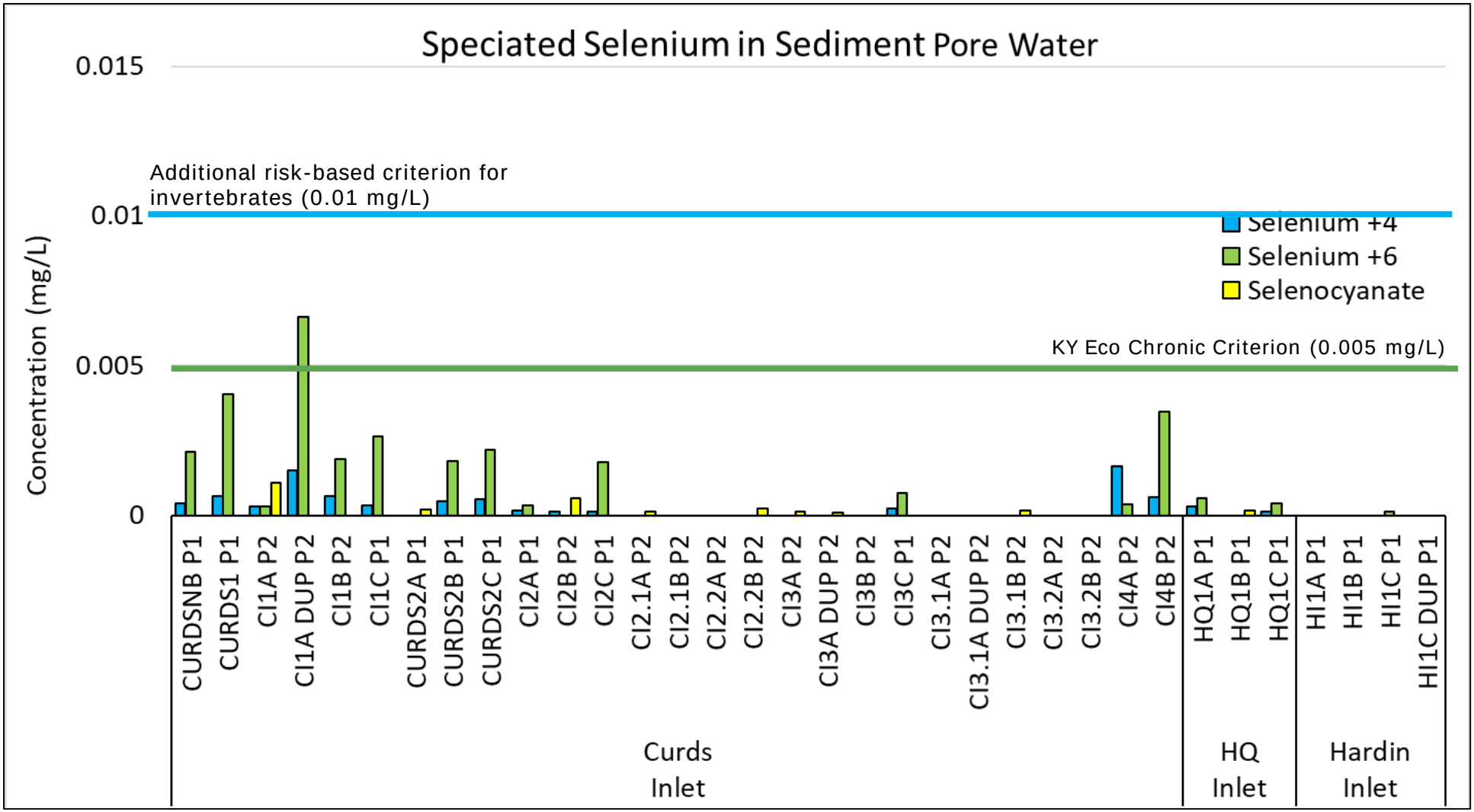
5-13B



Curds Inlet (CI), Dissolved (D), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Criterion (KY Eco Chronic Criterion), micrograms per liter (µg/L), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), Total Unfiltered (T), United States Environmental Protection Agency (USEPA)

Additional risk-based criterion for invertebrates (0.01 mg/L) is based on selenium USEPA ECOTOX data for low/no-effect data in 7 day studies for crustaceans, insects, and worms shows that 95% of the 98 species are protected by a selenium concentration of 0.01 mg/L. This is detailed in Appendix I2.

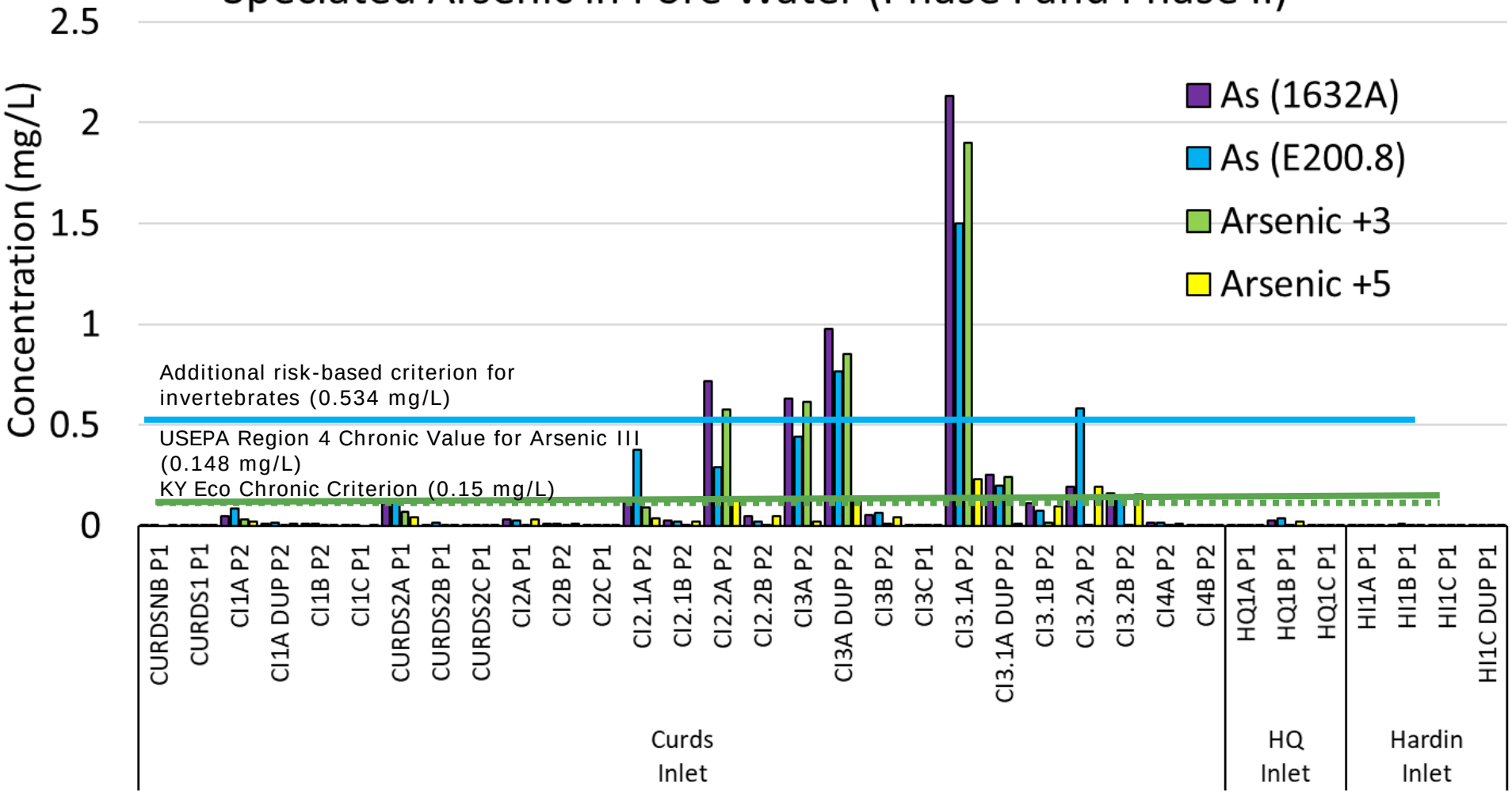
RAMBOLL	**SELENIUM IN SEDIMENT PORE WATER WITH ADDITIONAL RISK-BASED CRITERIA FOR CONSIDERATION** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 5-13C
DRAFTED BY: PAL	DATE: 02/01/2019	



Curds Inlet (CI), Duplicate (DUP), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Criterion (KY Eco Chronic Criterion), micrograms per liter (µg/L), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

Additional risk-based criterion for invertebrates (0.01 mg/L) is based on selenium USEPA ECOTOX data for low/no-effect data in 7 day studies for crustaceans, insects, and worms shows that 95% of the 98 species are protected by a selenium concentration of 0.01 mg/L. This is detailed in Appendix I2.

RAMBOLL		**SPECIATED SELENIUM IN SEDIMENT PORE WATER WITH ADDITIONAL RISK-BASED CRITERIA FOR CONSIDERATION** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 5-13D
DRAFTED BY: PAL	DATE: 02/01/2019		



Arsenic (As), Curds Inlet (CI), Dissolved (D), Duplicate (Du), Environmental Protection Agency (EPA), EPA Method 1632A (1632A), EPA Method 200.8 (E200.8), Hardin Inlet (HI), HQ Inlet (HQ), Kentucky Ecological Chronic Water Quality Criterion (Kentucky Eco Chronic Criterion), milligrams per liter (mg/L), Phase I (P1), Phase II (P2), United States Environmental Protection Agency (USEPA)

The additional risk-based criterion for invertebrates is based on USEPA ECOTOX data for As3+ shows the most sensitive 4-day test (which used *Gammarus pseudolimnaeus*, a freshwater, sediment-dwelling amphipod) has a LC50 of 875 ug/L. Comparing the geometric mean values for acute and chronic tests for similar invertebrates yields an acute-to-chronic ratio of about 1.6, which suggests a chronic value of 534 ug/L (0.534 mg/L) as an alternate risk-based criterion. This is detailed in Appendix I2.

RAMBOLL		**SPECIATED ARSENIC IN SEDIMENT PORE WATER WITH ADDITIONAL RISK-BASED CRITERIA FOR CONSIDERATION** Corrective Action Site Investigation, Source Assessment, and Risk Assessment Report E.W. Brown Station, Herrington Lake, Mercer County, Kentucky	FIGURE 5-13E
DRAFTED BY: PAL	DATE: 02/01/2019		