APPENDIX S
BASELINE ECOLOGICAL RISK ASSESSMENT PROBLEM FORMULATION

FINAL
BASELINE ECOLOGICAL RISK ASSESSMENT PROBLEM FORMULATION

REMEDIAL INVESTIGATION/FEASIBILITY STUDY, NEWTOWN CREEK

Prepared by

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
µmol/g	micromole per gram
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-para-dioxin
ΣSEM-AVS	sum of simultaneously extracted metals-acid volatile sulfides
ADW	Animal Diversity Web
AECOM	AECOM Environment
Anchor QEA	Anchor QEA, LLC
ANOVA	analysis of variance
AOC	Administrative Order on Consent
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	area use factor
AVS	acid volatile sulfides
AVS/SEM	acid volatile sulfides/simultaneously extracted metals
BEHP	bis(2-ethylhexyl)phthalate
BERA	Baseline Ecological Risk Assessment
BSAF	biota-sediment accumulation factor
BW/day	body weight per day
CCME	Canadian Council of Ministers of the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Class SD	saline, Class D surface waterbody
cm	centimeter
CM	creek mile
COPEC	contaminant of potential ecological concern
CSM	conceptual site model
CSO	combined sewer overflow
CW	carapace width
DDD	dichloro-diphenyl-dichloroethane
DDE	dichloro-diphenyl-dichloroethene
DDT	dichloro-diphenyl-trichloroethane
DDx	2,4′ and 4,4′-DDD, -DDE, -DDT

DO	dissolved oxygen
DQO	data quality objective
DSR Submittal No. 1	*Phase 1 Remedial Investigation Field Program Data Summary Report – Submittal No. 1*
DSR Submittal No. 2	*Phase 1 Remedial Investigation Field Program Data Summary Report – Submittal No. 2*
EMAP	Environmental Monitoring and Assessment Program
EPC	exposure point concentration
ERA	Ecological Risk Assessment
ERED	Environmental Residue-Effects Database
FOD	frequency of detection
FS	Feasibility Study
HDR	HDR Engineering, Inc.
HQ	hazard quotient
kg	kilogram
L/kg	liter per kilogram
LC50	lethal concentration for 50 percent of the test organisms
LOAEL	lowest observed adverse effect level
LOED	lowest observable effects dose
mg	milligram
mg/kg	milligram per kilogram
mg/L	milligram per liter
MHW	mean high water
MLW	mean low water
mm	millimeter
MWL	mean water level
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
NOED	no observable effects dose
NRCC	National Research Council of Canada
NYC	New York City
NYCDEP	New York City Department of Environmental Protection

NYSDEC	New York State Department of Environmental Conservation
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofurans
PF	Problem Formulation
Phase 2 RI Work Plan Volume 1	*Phase 2 Remedial Investigation Work Plan – Volume 1*
ppth	parts per thousand
RAP	Risk Analysis Plan
Respondents	Newtown Creek Group Respondents
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RI/FS Work Plan	*Remedial Investigation/Feasibility Study Work Plan*
SAV	submerged aquatic vegetation
SLERA	Screening Level Ecological Risk Assessment
SLERA Technical Memorandum No. 1	*Screening Level Risk Assessment: Technical Memorandum No. 1*
SLERA Technical Memorandum No. 2	*Screening Level Ecological Risk Assessment: Technical Memorandum No. 2*
SMIA	Significant Maritime Industrial Area
SPDES	State Pollutant Discharge Elimination System
SPME	solid-phase microextraction
SVOC	semivolatile organic compound
TDI	total daily intake
TOC	total organic carbon
TPAH	total PAH
TRV	toxicity reference value
UCL	upper confidence limit
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

WBI	Weisberg Biotic Index
WHO	World Health Organization

1 INTRODUCTION

As part of the Remedial Investigation/Feasibility Study (RI/FS) for the Newtown Creek Study Area, this document presents the Baseline Ecological Risk Assessment (BERA) Problem Formulation (PF). Completion of the BERA PF document represents the Scientific Management Decision Point at the end of Step 3 of the eight-step Ecological Risk Assessment (ERA) process described in the U.S. Environmental Protection Agency (USEPA) ERA guidance document (USEPA 1997a). This work is being performed by the Newtown Creek Group Respondents (Respondents) under an Administrative Order on Consent (AOC) with the USEPA under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program.

As described in Section 3.2.8 of the *Remedial Investigation/Feasibility Study Work Plan* (RI/FS Work Plan; AECOM 2011), the goals of the BERA PF are as follows:

- Define the goals, breadth, and focus of the BERA based on the results of the Screening Level Ecological Risk Assessment (SLERA), Phase 1 Remedial Investigation (RI) field program results, habitat surveys, BERA PF Workshop, and ongoing feedback from USEPA and Respondents.
- Establish assessment endpoints (receptors and attributes) and exposure pathways to be evaluated under current and/or reasonable future conditions.
- Refine the list of contaminants of potential ecological concern (COPECs) to be evaluated (i.e., based on the outcome of the SLERA), including appropriate literature survey data.
- Formulate risk questions and define measurement endpoints.
- Establish an approach for assessing ecological risk that considers the urban background, continuing sources of contamination, and reasonable future conditions.

1.1 Project Background

Major components completed to date as part of the ERA for the Newtown Creek Study Area include the following items:

- *Screening Level Risk Assessment: Technical Memorandum No. 1* (SLERA Technical Memorandum No. 1). This memorandum discusses the overall approach for

conducting the SLERA, and presents the screening levels to be used. A final version of this memorandum was submitted to USEPA in February 2012 (Anchor QEA 2012a).

- ***Screening Level Ecological Risk Assessment: Technical Memorandum No. 2*** **(SLERA Technical Memorandum No. 2)**. This memorandum uses the Phase 1 RI surface water and sediment chemistry data to conduct the screening level analyses and identify the COPECs. A draft of this memorandum was submitted to USEPA in July 2013 (Anchor QEA 2013a; see Attachment 1). USEPA provided comments on the draft SLERA Technical Memorandum No. 2 in September 2013 (see Attachment 2). In those comments, USEPA stated that the draft SLERA Technical Memorandum No. 2 need not be revised but that its comments on the draft SLERA Technical Memorandum No. 2 be incorporated into the BERA.
- **Completion of the Phase 1 RI shoreline and biological surveys**. These surveys included shoreline, habitat, wildlife, benthic community, and fish community surveys. A shoreline survey and preliminary habitat and wildlife survey was conducted in November 2011, with a more comprehensive habitat and wildlife survey conducted in June 2012. Details on the survey methods and results are provided in the *Phase 1 Remedial Investigation Interim Data Report* (Anchor QEA 2012b); *Phase 1 Remedial Investigation Field Program Data Summary Report – Submittal No. 1* (DSR Submittal No. 1; Anchor QEA 2013b); and *Phase 1 Remedial Investigation Field Program Data Summary Report – Submittal No. 2* (DSR Submittal No. 2; Anchor QEA 2013c).
- **BERA PF Workshop with USEPA in August 2013**. This workshop presented the following: the COPECs to be carried forward in the BERA (as an outcome of the SLERA and further refinement in the BERA PF); a summary of the Phase 1 RI surveys and implications for selection of receptors for the BERA; a revised conceptual site model (CSM); proposed assessment endpoints, risk questions, and measurement endpoints; and a proposed approach for selecting reference areas. Since that time, USEPA provided additional feedback on the selection of receptors, as well as the assessment endpoints, measurement endpoints, and risk questions. This BERA PF document reflects the discussions and outcome of the workshop, as well as responses to subsequent feedback from USEPA on an October 2013 draft of the BERA PF.

1.2 Document Organization

Section 2 of this document provides an overview of the environmental setting for the Study Area. A further refinement of the COPECs identified in the SLERA is presented in Section 3, with a general description of their environmental fate presented in Section 4. A summary of the Phase 1 RI shoreline and biological surveys is provided in Section 5. This section includes the rationale for selecting representative receptors for the BERA based on the Phase 1 surveys, as well as feedback from USEPA following the BERA PF Workshop and review of the draft BERA PF. The updated CSM is presented in Section 6. Section 7 presents the assessment and measurement endpoints, as well as the data quality objectives (DQOs), how the information is to be used in the risk assessment, and the risk questions that are being posed. This section also provides an overview of the Phase 2 RI BERA data needs. Section 8 presents the Risk Analysis Plan (RAP), including an approach to evaluate confounding factors, such as low dissolved oxygen (DO), and elevated organic carbon in sediment. All citations are presented in Section 9.

2 ENVIRONMENTAL SETTING

The Newtown Creek RI/FS Study Area is defined in the AOC as the approximately 3.8-mile main channel of Newtown Creek plus its tributaries (Dutch Kills, Maspeth Creek, Whale Creek, East Branch, and English Kills) up to the ordinary high water mark[1]. The Study Area and the adjacent riparian and upland areas of the boroughs of Brooklyn and Queens have a history of extensive industrial development dating back to the 1800s that has been well documented (RI/FS Work Plan and Anchor QEA 2011a). Today, the predominant land use around the Study Area includes industrial, transportation, and utility facilities. Newtown Creek, its tributaries, and the surrounding land have been designated by New York City (NYC) as a Significant Maritime Industrial Area (SMIA), with the goal of supporting existing and future industrial waterfront uses. Most of the shoreline consists of bulkhead materials such as concrete, metal, wood, riprap, and rocks. Vegetation is sparse and typically exists along bulkheads. Drainage from the surrounding watershed that discharges into the Study Area has been extensively altered and now comprises an engineered system of conveyance channels, treatment facilities, point source discharges (outfalls), and groundwater intrusion. Circulation is typically controlled by semi-diurnal tides. There is limited natural freshwater flow to the system. Flows from combined sewer overflows (CSOs) and other point sources contribute freshwater during storm events. Dry-weather flows are contributed by point source discharges and groundwater.

[1] The Newtown Creek Superfund Site Study Area is described in the Administrative Order on Consent (AOC) as encompassing the body of water known as Newtown Creek, situated at the border of the boroughs of Brooklyn (Kings County) and Queens (Queens County) in the City of New York and the State of New York, roughly centered at the geographic coordinates of 40° 42' 54.69" north latitude (40.715192°) and 73° 55' 50.74" west longitude (-73.930762°), having an approximate 3.8-mile reach, including Newtown Creek proper and its five branches (or tributaries) known respectively as Dutch Kills, Maspeth Creek, Whale Creek, East Branch, and English Kills, as well as the sediments below the water and the water column above the sediments, up to and including the landward edge of the shoreline, and including also any bulkheads or riprap containing the waterbody, except where no bulkhead or riprap exists, then the Study Area shall extend to the ordinary high water mark, as defined in 33 Code of Federal Regulations §328(e) and the areal extent of the contamination from such area, but not including upland areas beyond the landward edge of the shoreline (notwithstanding that such upland areas may subsequently be identified as sources of contamination to the waterbody and its sediments or that such upland areas may be included within the scope of the Newtown Creek Superfund Site as listed pursuant to Section 105(a)(8) of Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]).

The aquatic habitat in the Study Area is mostly subtidal. Intertidal habitat exists primarily as sediment mounds located in the tributaries. During low tide, these sediment mounds or "mud flats" are evident in the vicinity of some active outfalls and bulkheaded areas (see descriptions of Phase 1 RI surface sediments in Anchor QEA 2013b Appendix A4-1 and photographs in Anchor QEA 2013b Appendix C-2). No rooted macrophytes were observed in the Study Area during the Phase 1 surveys (Anchor QEA 2013b).

The New York State Department of Environmental Conservation (NYSDEC) has classified the surface water of the Study Area as a saline, Class D surface waterbody (Class SD; NYSDEC Chapter X, Division of Water, Part 701.14). This classification includes the need to meet a DO concentration of 3.0 milligrams per liter (mg/L). The best usage of Class SD waters is fishing. These waters are considered suitable for fish survival but not fish propagation.

Given the highly urban and industrial land use and activities of the Study Area, suitable habitat for aquatic life and wildlife is limited. Benthic communities of the Study Area have been described as pollution-tolerant, and exhibiting low species diversity and abundance, especially in the upper reaches of the Study Area (NYCDEP 2011). The fish community of the Study Area has been reported to be sparse, especially during the summer months when DO concentrations can drop below 1 mg/L (NYCDEP 2011). Despite some of these limitations, birds such as double-crested cormorants, black-crowned night herons, and egrets have been observed in the Study Area (Anchor QEA 2013b). Raccoons appear to be present but sightings were rare. A small number of raccoons were observed in an abandoned car near the shoreline in English Kills, and raccoon tracks were observed in two locations in Dutch Kills in the mud beneath the overhang of building structures (Anchor QEA 2013b).

Further description of the Study Area can be found in the RI/FS Work Plan, *Reference Area Selection Technical Memorandum* (Anchor QEA 2011a), and SLERA Technical Memorandum No. 1 (Anchor QEA 2012a).

3 IDENTIFICATION OF PRELIMINARY COPECs

The SLERA for the Study Area was presented in two documents. SLERA Technical Memorandum No. 1 introduced a preliminary CSM and presented the screening levels and toxicity reference values (TRVs) to be used in the screening analyses (Anchor QEA 2012a). Following completion of the Phase 1 RI, the results of the screening level analyses were presented in a second technical memorandum (draft SLERA Technical Memorandum No. 2 [Anchor QEA 2013a; see Attachment 1]). The approach was conservative, minimizing the probability that receptors, media, and chemicals were not erroneously eliminated from further consideration. Following the RI/FS Work Plan, the SLERA included a conservative screen using maximum chemical concentrations with Tier 1 screening levels and a refined screen using exposure point concentrations (EPCs) based on the 95-percent upper confidence limit (UCL) on the mean with Tier 2 screening levels, as well as a screen based on the frequency of detection (FOD).

The preliminary COPECs identified in draft SLERA Technical Memorandum No. 2 are listed in Attachment 1, Table ES-1.

As discussed with USEPA following completion of draft SLERA Technical Memorandum No. 2, the Phase 1 RI data will be re-screened with the Phase 2 RI data prior to conducting the BERA risk analyses. Thus, the preliminary COPECs identified in draft SLERA Technical Memorandum No. 2 are not the definitive COPECs for the BERA but will be used to inform the Phase 2 RI data collection program.

The SLERA and refined screen will be updated after collection of the Phase 2 data.

4 ENVIRONMENTAL FATE AND TRANSPORT OF PRELIMINARY COPECs

4.1 Introduction

The purpose of this section is to provide an overview on the environmental fate and transport of the preliminary COPECs identified as a result of the SLERA conducted to date. This will help inform the planning of the BERA and the *Phase 2 Remedial Investigation Work Plan – Volume 1* (Phase 2 RI Work Plan Volume 1). Section 4.2 provides an overview of transport processes that affect the distribution of chemicals in the environment. Sections 4.3 through 4.8 discuss chemical fate processes that affect COPECs in each of the following categories: metals including methyl mercury, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxin/furans, semivolatile organic compounds (SVOCs), and pesticides. These are described in the following sections.

4.2 Chemical Transport in Newtown Creek

Concentrations of chemicals in the surface water reflect an integration of several chemical fate and transport processes. Chemicals may enter the water column from CSO outfalls, stormwater, individually permitted point source discharges, and groundwater flow. Chemicals can also enter the water column via transport from the East River during flood tide conditions. Processes affecting chemical fate and transport within the water column include upstream and downstream transport due to tidal currents, density-driven circulation, and freshwater inflow. Chemical distributions in surface water are also affected by partitioning between the particulate and dissolved phases, and biodegradation for certain chemicals and conditions. Chemicals in the water column can be volatilized to the atmosphere. Finally, chemicals in the water are exchanged with the underlying sediment bed as a result of the deposition and resuspension of sediments, and by dissolved-phase exchange processes (i.e., diffusion, porewater exchange flux, and porewater advection). Chemicals associated with upward groundwater flow in the native material can also enter the sediments from below. Within the sediment bed, fate and transport processes include: mixing (i.e., bioturbation) within the surface sediments; dispersion and advection of porewater; partitioning; and biodegradation. Deposition of less contaminated sediment from the water column results in the burial of historically contaminated sediment, as evidenced by the vertical patterns in surface and subsurface sediment data previously discussed.

4.3 Metals

The metals identified as preliminary COPECs include antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, methyl mercury, nickel, selenium, silver, tin, and zinc.

Once in the aquatic environment, the environmental fate of these metals depends upon a variety of factors such as pH, oxidation-reduction potential, nature and abundance of mineral phases and surface sites, salinity, alkalinity, concentrations of complex-forming ions, and particulate and dissolved organic matter (Wilson et al. 2010). These factors will determine whether these metals are in a dissolved, "free," phase in the water column or sediment porewater, and hence bioavailable, or whether they become sequestered in insoluble solid phases (e.g., the formation of lead and mercury sulfides under reducing conditions, or iron oxides and lead carbonates that form during interaction with oxygenated, slightly alkaline brackish surface water), rendering them less bioavailable. For example, it has been documented that in sediment, copper, cadmium, lead, nickel, zinc, and to some extent, silver, bind to excess sulfide forming insoluble metal sulfides. As a consequence, the bioavailability and toxicity of free metal in the porewater is reduced. Other constituents in the sediment porewater, such as organic carbon, can also bind free metal, further reducing bioavailability and hence toxicity (Di Toro et al. 1992, 2001; USEPA 2000a, 2000b, 2011).

Inorganic mercury can be methylated by bacteria in anaerobic environments (USEPA 2011). Methyl mercury is the form that bioaccumulates in food webs (Chen et al. 2008). Methylation in coastal sediments is largely controlled by bacterial activity and the bioavailability of inorganic mercury, which is highly dependent on sediment and porewater concentrations of organic carbon and sulfide. Organic content of sediments diminishes the bioavailability of methyl mercury to benthic fauna, which may result in lower levels of biotransfer from highly organic-rich sediments. Important properties influencing levels of mercury and methyl mercury in a waterbody include pH, anoxia, dissolved organic content, productivity, and turbidity (USEPA 1997b).

4.4 Polycyclic Aromatic Hydrocarbons

PAHs are a diverse class of organic compounds that include about 100 individual substances containing two or more fused benzene, or aromatic, rings. Low-molecular-weight PAHs

have fewer than four rings and include acenaphthene, acenaphthylene, anthracene, fluorine, naphthalene, 2-methylnaphthalene, and phenanthrene. High-molecular-weight PAHs have four or more rings and include benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, and pyrene.

The fate and behavior of PAHs in aquatic systems is influenced by physical, chemical, and biological processes (CCME 1999a). PAHs in water partition between dissolved and particulate fractions, depending upon the PAH solubility and the availability of binding substrates (Latimer and Zheng 2003). Within aquatic systems, most PAHs tend to be relatively nonvolatile and poorly soluble so they will become incorporated into bottom sediments, primarily by removal from the water column through their association with particulate matter (CCME 1999a; Latimer and Zheng 2003). Hence, sediments represent the major environmental sink for PAHs. Sorption of PAHs to sediments is directly proportional to the organic content of the sediments and the partition coefficients of the compounds (Konasewich et al. 1982).

4.5 Polychlorinated Biphenyls

PCBs are a group of commercially produced, synthetic halogenated aromatic hydrocarbons. They are extremely stable compounds and slow to chemically degrade under environmental conditions (Eisler 1986a). In general, PCBs are relatively insoluble in water but freely soluble in nonpolar organic solvents and biological lipids (WHO 1993). They are strongly adsorbed on sediments, and particulates in the environment, with levels usually highest in aquatic sediments containing microparticulates (Eisler 1986a; USEPA 1980). Adsorption of PCBs to solids is enhanced by increasing salinity and by decreasing particle size. Because of their persistence in the environment, cycling, rather than degradation, is the most important process affecting PCBs in the environment.

4.6 Dioxins and Furans

The chemical and environmental stability of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), coupled with their potential to accumulate in fat, has resulted in their detection throughout the global ecosystem. The most toxic isomer, 2,3,7,8-tetrachlorodibenzo-para-dioxin (2,3,7,8-TCDD), is very stable, and is readily

incorporated into aquatic and terrestrial ecosystems. Although PCDDs are highly persistent, volatilization and photolysis are removal processes (Eisler 1986b). Biodegradation is considered to be a relatively minor fate process in water (NRCC 1981). The majority of the PCDDs and PCDFs that are released into water form associations with dissolved and/or particulate organic matter in the water column, and sediments bed (MacDonald 1993).

Aquatic sediments provide a major sink for the PCDDs and PCDFs that enter the water column. The results of various studies indicate that most of the PCDDs and PCDFs that are added to model aquatic ecosystems partition almost entirely to the sediment phase (Corbet et al. 1988; Tsushimoto et al. 1982; Muir et al. 1985). Although direct uptake from the water column may be important for certain ecosystem components, sediments probably represent the most significant long-term source of PCDDs and PCDFs that are transferred into the food web (Carey et al. 1990).

4.7 Semivolatile Organics

Only two SVOCs have been identified as preliminary COPECs—biphenyl and bis(2-ethylhexyl)phthalate (BEHP). Volatilization and sorption into particulate matter are important in the transport of biphenyl in water (USEPA 1994a); however, greater than 90 percent of biphenyl in the environment resides in the atmosphere (WHO 1999). The main environmental fate processes for biphenyl in water are photolysis and microbial degradation (USEPA 1994a).

BEHP is a highly hydrophobic compound and has a strong tendency to partition to sediments from the water column (Al-Omran and Preston 1987). Sedimentation appears to be a significant environmental fate process (Konasewich et al. 1982). Some BEHP may desorb from the sediments back into the water column (Atwater et al. 1990). The most important processes influencing the distribution and transformation of BEHP in the environment include atmospheric photo-oxidation, partitioning to sediment and biota, and aerobic degradation (Howard 1989). Because BEHP has very slow rates of photolysis and chemical hydrolysis, metabolic breakdown by aerobic and anaerobic microorganisms is considered to be one of the major routes for environmental degradation (Juneson et al. 2001).

4.8 Pesticides

Only two pesticides have been identified as preliminary COPECs—total chlordane and 2,4' and 4,4'-DDD, -DDE, -DDT (DDx) compounds. Chlordane is sparingly soluble in water and has high lipid solubility so it will bind to detritus and the microscopic organic coating on sediments. Vaporization can occur depending on temperature, water turbulence, wind conditions, and composition of suspended matter (USACHPPM 2005).

Technical-grade dichloro-diphenyl-trichloroethane (DDT) is made up of DDT, dichloro-diphenyl-dichloroethene (DDE), and dichloro-diphenyl-dichloroethane (DDD) isomers (collectively referred to as DDx compounds). In water, adsorption to suspended particulates and subsequent deposition to aquatic sediments represents the most important fate process for DDx. However, considerable losses of DDx from water may occur through volatilization (CCME 1999b). DDx forms strong associations with sediment particles (ATSDR 1989). Association is enhanced by increasing salinity (Konasewich et al. 1982). Photooxidation has the potential to transform sediment-associated DDT; however, it is likely to be significant only in sediments that are periodically dewatered. Biodegradation is considered to be the most important transformation process (CCME 1999b). Biodegradation occurs more rapidly under anaerobic than aerobic conditions, and results primarily in the formation of DDD through reductive dechlorination. Under aerobic conditions, dehydrochlorination is the dominant reaction that facilitates the degradation of DDT primarily to DDE (ATSDR 1994; USEPA 2011).

5 RECEPTORS

The ecological receptors to be evaluated in the SLERA were included in the October 2011 draft SLERA Technical Memorandum No. 1 (Anchor QEA 2011b). The receptors selected were based on the preliminary CSM presented in the RI/FS Work Plan and best professional judgment. In its comments (December 2011), USEPA noted that it was premature to eliminate receptor guilds until completion of the Phase 1 habitat and shoreline surveys. Specifically, USEPA noted the following:

- Reptiles and amphibians should not be excluded from the receptor list or the CSM.
- The riparian bird and mammal feeding guilds should be included as a complete pathway until additional information can be collected.
- USEPA personnel have observed sandpiper, black-crowned night heron, belted kingfisher, multiple gull species, mallard duck, and Canada geese.
- The herbivorous feeding guild should be included.
- Muskrat, opossum, and Norway rats were also mentioned as potential mammalian receptors.

The preliminary CSM was modified to reflect USEPA's comments, while acknowledging that the selection of receptors or the identification of complete exposure pathways would depend on the results of the habitat and shoreline surveys. During the BERA PF Workshop, the results of the Phase 1 surveys were used to make recommendations on receptors for the BERA. Following the workshop and review of the draft BERA PF, USEPA provided feedback and its recommendations for the receptors to be included in the BERA. The following discussion on selection of receptors for the BERA reflects both the results of the Phase 1 surveys and USEPA's recommendations, as well as the Respondents' responses to these recommendations. A summary of the Phase 1 survey collection methods and findings is provided in Section 5.1, with additional detail provided in DSR Submittal No. 1 (Anchor QEA 2013b). Section 5.2 includes the rationale for selection of the receptors recommended for inclusion in the BERA.

5.1 Phase 1 Surveys

5.1.1 Collection Methods – Summary

The Phase 1 surveys included shoreline, habitat, wildlife, benthic community, and fish community surveys. A shoreline survey and preliminary habitat and wildlife survey was conducted in November 2011, with a more comprehensive habitat and wildlife survey conducted in June 2012. These surveys were primarily boat-based and included documentation of shoreline physical features (e.g., bulkhead material and condition), shoreline habitat and vegetation characteristics, the presence of submerged rooted aquatic vegetation, and wildlife presence and activities.

For shoreline physical features, this included documenting shoreline bulkhead material and condition along the entire reach of Newtown Creek or bare ground and vegetation when bulkheads were not present. Additional elements documented during the survey included outfalls, access points, utility crossings, seeps, and overwater features and navigational obstructions such as piers, docks, pilings, and bridge supports.

For shoreline habitat, this included documenting vegetation species and canopy type (tree, shrub, and herbaceous), size (height and trunk diameter), and approximate length and width of each vegetated area. The relative quality of the vegetation was categorized as either "poor," "moderate," or "good," depending upon the plant species diversity, how many of the three vegetative canopy layers were present, and how stressed the vegetation appeared. It should be noted that the quality levels were based on the differences in quality found at the site rather than based on a comparison with the quality of shoreline or riparian habitat that would be expected in less disturbed conditions. For rooted macrophytes, the entire shoreline was surveyed during low-tide conditions for the presence of rooted aquatic plants.

The wildlife surveys included documenting species, location, approximate numbers, and activity. Wildlife activities included bird species flying over the Study Area, perching on the shoreline, or floating in the Study Area, as well as any foraging activities.

Fish/shellfish surveys were conducted in five zones in the Study Area in the spring of 2012 to reflect higher DO conditions and spring migration patterns, and during the late summer of

2012 to reflect lower DO conditions. Zone 1 occupied the downstream end of Newtown Creek extending from creek mile (CM) 0.1 to CM 0.7. Dutch Kills was the target for Zone 2; however, due to the low bridge, it was not possible to sample upstream in Dutch Kills, even during low tide. Therefore, survey information was only collected at its mouth. Zone 3, mid-reach of Newtown Creek, extended from CM 1.4 to 2.1. Maspeth Creek was the target for Zone 4, but because this sub-tributary was shallow much of the time due to tidal fluctuations, survey information could also only be collected at its mouth. Zone 5 extended from CM 2.7 in Newtown Creek and included East Branch and English Kills. Multiple collection methods were used to sample species throughout the water column, including gillnetting, minnow traps, crab pots, and trawling.

For the benthic community surveys, surface sediment samples were collected from 34 stations in the Study Area in the spring and late summer of 2012 to reflect higher and lower DO conditions, respectively. Three discrete replicate samples were collected at each station for a total of 102 samples each season and were sent to Watershed Assessment Associates, LLC, for identification and enumeration of benthic macroinvertebrates.

5.1.2 Summary of Findings

Of the nearly 60,000 linear feet of shoreline, 99 percent consists of bulkhead material (concrete, metal, wood), riprap, and rock (see Figures 5-1a through 5-1g). Only 1 percent comprises natural materials. The shoreline vegetation ranges from dense canopies of trees and shrubs in a few locations to sparsely vegetated or bare ground at most locations. Vegetation communities are present in narrow patches, growing on top of or within bulkhead features, and trees are relatively small-growing and less than about 25 feet tall (Anchor QEA 2013b). Less than 14 percent of the shoreline was identified as providing "good" vegetation, with average vegetation width ranging from only 3 to 8 feet (see photographs on Figures 5-2a through 5-2c). Although not accounted for in categorizing the vegetation, a significant proportion of the vegetation consists of non-native invasive species that are highly adapted to altered urban habitats. No rooted macrophytes were observed.

Details of the wildlife observations are presented in DSR Submittal No. 1. In summary, 39 species of birds were observed. Many of the birds were species commonly found in urban

environments, such as gulls, pigeons, American crow, European starling, and Canada goose. Other species frequently observed included double-crested cormorant, mallard, and black-crowned night heron. Barn swallows, green heron, and great egret were only observed in the spring, and others such as sandpiper, great blue heron, and American bittern were only occasionally observed during both surveys. During the spring surveys, a pair of peregrine falcons was also observed on, and in the vicinity of, the Kosciuszko Bridge[2]. Only three species of mammals were observed—feral cats and Norway rats were seen almost daily, and raccoon were infrequently observed. No amphibians or reptiles were observed.

The dominant fish species collected were mummichog (spring and summer), Atlantic menhaden (spring and summer), spot (summer), and striped bass (spring). Mummichog and spot combined represented more than 50 percent of the overall catch for the summer. Dominant shellfish included the following epibenthic decapods: two shrimp species (spring and summer), blue crab (spring and summer), and rock crab (spring; see DSR Submittal No. 1 [Anchor QEA 2013b]).

The results of the spring benthic community surveys are presented in DSR Submittal No. 1 (Anchor QEA 2013b), and the results of the summer surveys are presented in DSR Submittal No. 2 (Anchor QEA 2013c). For the spring surveys, benthic invertebrates were found in all samples with the exception of one station in Dutch Kills. The dominant taxa were oligochaetes, polychaetes, and amphipods. For the summer, no benthic invertebrates were found in samples from all stations in Dutch Kills, Whale Creek, Maspeth Creek, English Kills, and East Branch, as well as from stations in the main stem of Newtown Creek upstream of the confluence with Maspeth Creek. For the remaining samples collected from Newtown Creek, dominant taxa were also oligochaetes, polychaetes, and amphipods.

5.2 BERA Receptor Selection

It is not possible to evaluate all of the species observed during the Phase 1 surveys in a BERA. Instead, it is common practice to select receptors that represent different feeding guilds and exposure pathways that are considered complete, or receptors that are considered to be

[2] The American bittern is a Species of Special Concern in the State of New York, and the peregrine falcon is designated as a state Endangered Species.

ecologically or culturally important. This ensures that species within the same feeding guild or exposed via the same pathways are accounted for, and species in need of special consideration are evaluated. Given this, the following provides recommendations for the receptors to be used for evaluation in the BERA. The recommendations consider USEPA's comments on the preliminary receptor selections, the results of the Phase 1 surveys, and feedback received from USEPA following the BERA PF Workshop and review of the draft BERA PF.

5.2.1 Aquatic Plants

5.2.1.1 Phytoplankton

Phytoplankton were not sampled during the Phase 1 surveys, but they are known to be present in the Study Area. For example, as part of the New York Harbor Water Quality Survey, New York City Department of Environmental Protection (NYCDEP) collected plankton samples at a station at the mouth of Newtown Creek in the spring, summer, and fall from 1991 to 1999 (NYCDEP 2011). A total of 64 phytoplankton species were collected, with diatoms and green algae being the dominant classes. Because phytoplankton play a key role in primary production in an aquatic food web, this receptor will be included for quantitative evaluation in the BERA.

5.2.1.2 Aquatic Macrophytes

In its review of the draft SLERA Technical Memorandum No. 1 (Anchor QEA 2011b), USEPA requested that the Phase 1 surveys include observations of rooted aquatic plants, or macrophytes. During the Phase 1 field work, the entire shoreline was surveyed during low tide for the presence of rooted aquatic plants. As presented in DSR Submittal No. 1 (Anchor QEA 2013b), none were documented within the Study Area.

In its feedback to the BERA PF Workshop, USEPA requested that aquatic macrophytes be included as a representative receptor. In response to this request, the availability of suitable habitat for aquatic macrophytes was evaluated to determine if rooted plants could reasonably be expected to grow in the Study Area, either under current or expected future conditions.

Two types of rooted plants occur in aquatic environments: submerged aquatic vegetation (SAV) and emergent aquatic vegetation. SAV, if present, would include species tolerant of brackish to saline conditions. Species that could potentially be found include widgeon grass (*Ruppia maritima*), wild celery (*Vallisneria americana*), horned pondweed (*Zannichellia palustris*), and sago pondweed (*Stukenia pectinata*). The presence of SAV is influenced by multiple factors, but several physical factors would likely be of greatest importance. One of the primary factors affecting SAV presence is light availability. Sunlight naturally attenuates in surface water with increasing depth. Turbidity in surface water further reduces light penetration and limits the depths at which photosynthesis can occur (Phillips 1960). Additional limits on the presence of SAV are the potential for excessive desiccation at low tide and wave exposure in near-surface waters.

The minimum depth of SAV in a tidal area can be estimated as one-half of the tidal amplitude below mean low water (MLW; Koch 2001), which in the Study Area is approximately 2 feet below MLW (-4.41 feet North American Vertical Datum of 1988 [NAVD88]). For estimation purposes, a maximum depth of 7 feet below mean water level (MWL) was used, cited as the maximum depth for eelgrass (*Zostera marina*) in Phillips (1960). An analysis of possible available habitat for SAV was performed, based on the criteria cited previously. This was calculated to be between 2 feet below MLW (-4.41 feet NAVD88) and 7 feet below MWL (-7.3 feet NAVD88). As shown on Figure 5-3a, possible habitat based on these criteria is limited (11.4 acres). Almost all of this possible habitat is located within the tributaries of the Study Area in the vicinity of CSOs (Maspeth Creek, East Branch, and English Kills), where the sediments are described in the Phase 1 field logs as "very wet, very soft, black silt, with a strong hydrogen sulfide odor" (Anchor QEA 2013b). In SAV species, high sulfide (greater than 1 to 2 millimolars) can reduce photosynthesis (Goodman et al. 1995) and growth (Kuhn 1992) and can cause mortality in some species (Carlson et al. 1994). Porewater sulfide, as well as Secchi depth, will be measured in the Study Area during Phase 2 to further evaluate the potential suitability of the Study Area for SAV.

Several factors limit the occurrence of emergent vegetation in the Study Area. Marshes develop in areas with gently sloping substrate, allowing tidal inundation and sediment stability. Vegetation within tidal salt marshes generally spans the range from MWL to spring high-water level, with low marsh, dominated by saltmarsh cordgrass (*Spartina alterniflora*),

occurring from MWL to mean high water (MHW). High marsh vegetation includes a mix of species and occurs above MHW (Dreyer and Neiring 1995). Slopes within developed tidal marshes typically range from less than 1 percent to 10 percent (Broome et al. 1988). Additionally, protection from wave and storm energy is required for development and long-term stability of tidal marsh vegetation (Mitsch and Gosselink 2000).

As described previously, much of the shoreline in the Study Area is protected with vertical bulkhead material, and there is very limited sloped shoreline for rooted emergent aquatic vegetation. Possible suitable habitat was estimated as the area above MWL (-0.3 foot NAVD88), and primarily the area with slope less than 10 percent. An upper limit for emergent vegetation was not set because vertical armoring of the shoreline limits the intertidal habitat. Emergent vegetation would likely be limited to low marsh habitat, dominated by saltmarsh cordgrass. There is approximately 2.9 acres above MWL in the Study Area, of which only 0.1 acre has slope less than 10 percent (see Figure 5-3b). Therefore, possible suitable habitat for emergent aquatic vegetation is extremely limited. Furthermore, exposure to wave action from daily barge and boat traffic against the armored shoreline will impact the possible establishment of emergent vegetation. Similar to SAV, elevated sulfide concentrations can be toxic to salt marsh plants, partially through reducing nitrogen uptake (Bradley and Dunn 1989; Weinstein and Kreeger 2000).

Based on these limitations, it is proposed that aquatic macrophytes only be evaluated qualitatively in the BERA, with the primary goal of further evaluating the suitability of habitat conditions within Newtown Creek for macrophytes.

5.2.2 Aquatic Invertebrates

5.2.2.1 Zooplankton

Similar to phytoplankton, the Phase 1 surveys did not include sampling for zooplankton; however, these aquatic invertebrates are known to be present in the Study Area. NYCDEP (2011) reports that a total of 15 zooplankton species were collected at the mouth of Newtown Creek. Most of these consisted of protozoans and copepods. Because zooplankton play an important role as a food source at the base of an aquatic food web, this receptor will be included for quantitative evaluation in the BERA.

5.2.2.2 Benthic Invertebrates

Benthic invertebrates were collected from the Study Area during the Phase 1 surveys. The dominant taxa included polychaetes, oligochaetes, and amphipods (Anchor QEA 2013b). However, there were some locations sampled during the summer for which no taxa were found (Anchor QEA 2013c). These included locations in Dutch Kills (except at the mouth), Whale Creek, Maspeth Creek, East Branch, English Kills, and Newtown Creek stations upstream of the confluence with Maspeth Creek. Because benthic invertebrates are sessile and can, therefore, be used as indicators of local conditions within the Study Area, they will be retained as a receptor for quantitative evaluation in the BERA.

5.2.2.3 Epibenthic Invertebrates

The dominant epibenthic species caught during the Phase 1 fish surveys included two shrimp species (spring and summer), blue crab (spring and summer), and rock crab (spring; see DSR Submittal No. 1 [Anchor QEA 2013b]). Because blue crab represented 54 percent of the shellfish caught in the spring and summer, and because they represent both prey and predator, it is proposed they be used as a representative epibenthic invertebrate for quantitative evaluation in the BERA.

In its feedback to the BERA PF Workshop and review of the draft BERA PF, USEPA requested that shellfish (bivalves) be included as an additional representative receptor. However, because bivalves were only found at a few locations during the Phase 1 surveys (see DSR Submittal No. 1 [Anchor QEA 2013b], Table 3-31, and DSR Submittal No. 2 [Anchor QEA 2013c], Table 3-18), rather than attempt to field-collect bivalves, caged bivalves (ribbed mussels) will be deployed at several locations throughout the Study Area. Details on the behavior and feeding characteristics of the blue crab and mussels are provided in the following paragraphs.

Blue Crab

Blue crabs are found in bays and brackish coastal lagoons and estuaries from Massachusetts Bay south to the eastern coast of South America, with occasional occurrence from Maine to Nova Scotia (Hill et al. 1989). They are prey for semi-aquatic birds such as herons, and are considered both predators and scavengers at various stages of their life cycle (Hill et al. 1989).

They feed on a variety of items including dead and live fish, crabs, mollusks, shrimp, aquatic plants, and organic detritus (Hill et al. 1989). Many different fish and birds feed on blue crabs. The fish species include those that may be observed in the Study Area such as summer flounder, striped bass, and spot (Hines 2007). Yellow-crowned night herons are known to feed on crabs with a carapace width[3] (CW) up to 140 millimeters (mm), but crabs less than 75-mm CW are more commonly consumed and those less than 40 mm are preferred (Watts 1988). The reason there is a size preference may be due to prey handling efficiency; yellow-crowned night herons are less efficient at catching larger crabs because they spend more time handling the crabs and more frequently drop crabs that are greater than or equal to 75-mm CW (Riegner 1982).

Blue crabs spawn from spring to fall, with mating occurring in relatively low-salinity waters in the upper areas of estuaries/lower portions of rivers. Female blue crabs will migrate toward areas of higher salinity to spawn in the fall following mating season. Females extrude their fertilized eggs into a cohesive sponge attached to their abdomen until the larvae emerge. The ideal salinity range for egg hatching was reported to be from 23 to 28 parts per thousand (ppth; Kenney 2002). After spawning, females will remain in these higher salinity areas or migrate only a short distance (Hill et al. 1989). Males tend to remain in creeks, rivers, and upper estuaries. First stage blue crab larvae (zoeae) and the second stage megalopae tend to stay in the higher salinity offshore water until they molt into the first crab stage (Hill et al. 1989). However, there is evidence that megalopae migrate into lower salinity New York Harbor waters when the temperature is above 24 degrees Celsius (°C; Chenery 2002). As they grow, juveniles move into estuaries and utilize intertidal marshes, seagrass beds, and soft-sediment bottoms (Hill et al. 1989). The soft-sediment bottom of Newtown Creek and its tributaries offer potential habitat for larval and mature female and male blue crabs.

At maturity, female blue crabs molt a final time (terminal molt). Based on a study with commercial blue crab fishers in the Hudson River Estuary in 2001, a CW frequency evaluation of immature and mature female crabs provided information on size at terminal molt (Kenney 2002). Most of the mature females had CWs greater than 130 mm, and no

[3] In some studies, carapace widths are also described as carapace lengths, yet the measurement is the same from point to point across the back.

mature females had a CW less than 125 mm. The author suggested that many female blue crabs in the Hudson River Estuary undergo their terminal molt when CW is 110 to 125 mm. In another study, an age classifications system for New York Harbor was developed by Chenery (2002), where the age classes were the following:

- Age 0+: 5.4 to 29.6 mm, with a mean of 17.5 mm
- Age 1+: 62.1 to 113.8 mm, with a mean of 88 mm
- Age 2+: 89.4 to 153.3 mm, with a mean of 121.3 mm
- Mature females: Ranged from 96 to 123 mm

Ribbed Mussels

Ribbed Mussels (*Geukensia demissa*) are usually associated with cordgrass (*Spartina alterniflora*) in tidal marshes of eastern North America, where they are found in aggregations of individuals that can be partially embedded in marsh sediment. However, ribbed mussels are usually attached to each other or to the cordgrass rather than embedded in sediment (Bertness and Grosholz 1985; Franz 2001). Ribbed mussels are found at shore levels that are up to 50 percent of mean high tide (Franz 2001). Aggregations of mussels occur at shore levels over the entire vertical gradient occupied by cordgrass (Franz 2001). The fact that ribbed mussels are found at relatively high shore levels is in part due to their high temperature tolerances. Ribbed mussels can tolerate high temperatures, but mortality increases at peak temperatures of 45° C and higher (Jost and Helmuth 2007).

The ribbed mussel is a selective suspension feeder (Espinosa et al. 2008). Nannoplankton, microplankton, and bacterioplankton have been suggested to be the primary food of ribbed mussel (Wright et al. 1982; Kemp et al. 1990; Langdon and Newell 1990). Studies have shown that ribbed mussels are able to utilize bacterioplankton and heterotrophic flagellates (Kreeger and Newell 1996; Espinosa et al. 2008). In the Study Area, diatoms were the dominant class of phytoplankton, followed by dinoflagellates and green algae (NYCDEP 2011).

5.2.3 Reptiles and Amphibians

In its feedback to the BERA PF Workshop, USEPA requested that amphibians and reptiles be included as an additional representative receptor. Because the Study Area is an estuarine

waterbody, there is no habitat for amphibians. No amphibians were observed in the intertidal areas or along the shoreline during the Phase 1 surveys.

Similarly, no reptiles were observed in the Study Area during the Phase 1 surveys. Moreover, there is no mention of reptiles or amphibians in the *Newtown Creek Waterbody/Watershed Facility Plan Report* (NYCDEP 2011). Furthermore, according to HDR and CH2MHill (2011):

> *Five reptile species were identified as potentially occurring in brackish water habitats in and around the New York Harbor Estuary. Four species of marine turtles, all state and federally listed, are found in the waters surrounding New York City: loggerhead (Caretta caretta), green (Chelonia mydas), leatherback (Dermochelys coriacea), and Atlantic (Kemps) ridley (Lepidochelys kempii) (Table 2-1). Juvenile Atlantic ridley and adult loggerhead turtles regularly enter the New York Harbor and bays in the summer and fall. The other two turtle species may enter the higher salinity areas of the New York Harbor Estuary (USFWS, 1997). However, these four turtle species mostly inhabit Long Island Sound and Peconic and Southern Bay and do not nest in the New York Harbor Estuary, nor reside there year-round. Based on their distribution and the limited habitat available, it is highly unlikely these sea turtle species would enter the Gowanus Canal. The northern diamondback terrapin (Malaclemys t. terrapin), an estuarine species that feeds and nests in salt marshes and adjacent upland, has been observed in the wetlands of Jamaica Bay (USFWS, 1997). This species would not be present in the Gowanus Canal due to the lack of salt marshes and natural shorelines and the limited resources available within the canal.*

Similar habitat limitations in the Study Area make it unlikely that marine reptiles would be exposed to site-related contaminants. Given the limitations of the Study Area to provide suitable habitat for these species, it is proposed that amphibians and reptiles only be evaluated qualitatively in the BERA.

It is noted that because studies have shown fish to be more sensitive than amphibians for a majority of chemicals (Weltie et al. 2013), the quantitative risk assessment for mummichog, spot, and striped bass will cover risks for amphibians for most chemicals. For some chemicals present in the Study Area, there might be some uncertainty with the potential risks to

amphibians. For example, the relative sensitivity of amphibians and freshwater fish was evaluated by Weltie and coworkers using chronic data (no observable effects doses [NOEDs] for survival, growth, reproduction, and development [for amphibians]) for 52 chemicals (Weltie et al. 2013). Amphibians were more sensitive than fish for 11 of the 52 chemicals. Of those 11, 3 were CERCLA hazardous substances (bromide, chromium VI, and pentachlorophenol). In another study, acute toxicity (LC50) species sensitivity distributions were developed for 13 major taxonomic groups, including amphibians, fish, bivalves, and polychaetes (Kerby et al. 2010). The chemicals were grouped into three major groups—pesticides, metals, and phenols. Although amphibians were more sensitive to phenols than most of the other taxonomic groups, including fish, fish and other taxonomic groups were more sensitive than amphibians to metals and pesticides.

5.2.4 Fish

Mummichog and spot combined represented 79 percent of the fish caught in the spring and summer Phase 1 fish surveys (Anchor QEA 2013b). Because mummichog move throughout the water column in search of food and have a small home range, it is proposed they be selected as a representative fish species for quantitative evaluation in the BERA. Spot are also proposed as a representative fish species for quantitative evaluation in the BERA because they are primarily demersal, and as adults, represent a slightly larger fish than the mummichog. Information on the behavior and feeding habits of these fish is provided in the following sections.

5.2.4.1 Mummichog

Mummichog is a hardy stationary species, found within the entire mid-Atlantic coastal region. They are found close to the coast and in bays, estuaries, and tidal creeks. Mummichog are known for their hardiness and tolerance of a wide range of salinity, oxygen levels, temperature, and pollution in their environment (Abraham 1985).

Mummichog generally occupy a small home range of 36 to 38 meters along the banks of tidal creeks but have been documented moving as much as 375 meters. Mummichog are opportunistic omnivores best suited for surface feeding but also will feed in mid-water or on the bottom based on prey availability (Abraham 1985). Mummichog feed primarily at high

tide during daylight hours. The most commonly consumed food items are copepods, amphipods, and polychaetes. Other foods include a wide variety of organisms and plants, such as phytoplankton, mollusks, insect larvae, small fish, fish eggs, beetles, bivalves, and crustaceans (Abraham 1985).

Breeding mummichog have been documented in freshwater, brackish water, and saltwater but most commonly in estuarine and salt marsh environments. Spawning season is dependent on latitude; within the Study Area and surrounding waters, mummichog may spawn from June through August. Eggs are laid during spring high tide on algal mats or in empty shells. Newtown Creek and the surrounding waterways of NYC provide potential spawning habitat necessary for mummichog.

Although mummichog are fairly stationary, during the winter between spawning seasons, mummichog may burrow into the mud or migrate to the mouth of their resident tidal creek (Abraham 1985).

5.2.4.2 Spot

Spot, also known as the spot croaker, is one of the most common bottom-feeding fish species along the Atlantic coast (Hill 2005). They show no preference for substrate and can be found in sandy or muddy bottom areas. Spot display two distinct feeding modes during its life history: larvae are selective plankton-feeders, and juveniles and adults prey on infaunal and epibenthic invertebrates (Hill 2005). Larvae forage most actively during daylight hours until they reach juvenile status (Hill 2005). Spot are nocturnal as juveniles and adults and forage mostly in sandy or muddy bottoms. As juveniles and adults, spot most commonly consume worms, small crustaceans, and organic detritus from the bottom of the river or estuary.

Spot spawn from October to March on the offshore continental shelf of North America. The larvae are then passively transported to estuaries. During the first winter, juveniles may remain in the estuary or tidal creeks but move offshore during the following fall to spawn. Spawning away from the Study Area generally begins in September and continues through February. While offshore, spot inhabit sandy or muddy bottoms in depths of up to 60 meters (Hill 2005).

Because spot typically migrate offshore to spawn in the deeper waters of the Outer Continental Shelf, the inland waters of Newtown Creek and its tributaries are unlikely to provide spawning habitat for the species. Spot are seasonally migratory and are found within estuarine and coastal waters from Cape Cod to Mexico during the spring and summer between spawning seasons. They are most closely associated with tidal creeks and other shallow habitats, which provide ample bottom-dwelling prey and structural variability for physical refuge from predators (Hill 2005). Habitat features of Newtown Creek and its tributaries provide potential feeding habitat and refugia for this species.

5.2.4.3 Migratory Species

In providing feedback to the BERA PF Workshop and following review of the draft BERA PF, USEPA requested that striped bass be included as a top trophic-level fish, and that an alternate fish be selected as a secondary species such as American eel, bluefish, or other species that can be used in the human health risk assessment, if insufficient bass are collected in Phase 2. A secondary species will be selected during development of the Phase 2 RI Work Plan Volume 1 following further review of the Phase 1 data and collection methods to be used during Phase 2.

Striped Bass

Adult striped bass feed mainly on fish, such as alewives, flounder, sea herring, Atlantic menhaden, mummichog, silver hake, tomcod, smelt, silversides, and eels. They also consume lobsters, crabs, soft-shell clams, mussels, annelids, and squid. Juvenile striped bass are not highly selective and will feed on zooplankton, macroinvertebrates, small fish, and other food items based on availability (Bain and Bain 1982). Striped bass are migratory and have a large natural range that includes freshwater, estuarine, and marine habitats. Striped bass are anadromous; adults migrate inshore during spring to spawn in freshwater or nearly freshwater (Fay et al. 1983). Juvenile striped bass reside in the estuaries and bays of New York Harbor and western Long Island until they are large enough to join adult striped bass further off the coast. Juveniles typically develop to an adequate size for offshore migration within the first 2 years (Bain and Bain 1982). Thus, the juveniles that are found in the Study Area are likely in transit from the freshwater spawning areas to the open coastal waters that constitute their adult habitat, and thus, likely reflect exposure to chemicals over a wide area,

including the East River and New York Harbor. As a result, they will be exposed to contaminants from many locations other than those of the Study Area. Thus, any risk analyses will be highly uncertain because the source of exposure will be unknown.

5.2.5 Semi-Aquatic Birds

Several species of semi-aquatic birds were observed during the Phase 1 surveys representing piscivorous, invertivorous, and herbivorous feeding guilds.

5.2.5.1 Piscivore/Invertivore Feeding Guild

Examples of semi-aquatic birds in this feeding guild observed during the Phase 1 surveys include great egret, green heron, great blue heron, black-crowned night heron, and American bittern. Great egrets were infrequently observed in the spring, and great blue herons were occasionally observed in the fall and spring. Black-crowned night herons were frequently observed flying over much of the Study Area during both surveys, and were observed foraging particularly at dawn and dusk. Although the green heron was used in the SLERA (to be conservative because of its smaller size), in response to USEPA comments on the draft BERA PF, the black-crowned night heron is to also be included in the BERA. Details on the behavior and diet of these two herons are provided in the following paragraphs. Although the American bittern is a Species of Special Concern in New York State, its foraging habitat (shoreline and the water's edge) and diet (small fish, crustaceans, aquatic insects) means that potential risks to this bird will be addressed through assessment of the smaller green heron.

Green Heron

Green herons exhibit opportunistic feeding strategies depending on the availability of food (USEPA 1993). Their prey selection is very broad and includes a variety of fish and invertebrates. However, studies show that fish make up the greatest percentage of the biomass in their stomach (Davis and Kushlan 1994). When green herons were observed feeding on trout from ponds at a California hatchery, the herons fed on fish primarily from 1.5 to 4 inches (3.8 to 10.2 centimeters [cm]) in length (Jurek 1974). Larger fish up to nearly 6 inches long and fry less than 1 inch long were also consumed. However, the selection was

toward fish less than 6 inches in length because most of the fish hatchery ponds had fish greater than 6.5 inches (16.5 cm) in length.

Green herons prefer to feed under the cover of thick vegetation. Their most common feeding technique is to stand in a crouched position and look into the water for prey. They have the greatest capture success in water that is less than 10 cm deep and poorest success in water deeper than 20 cm. Because most of the Study Area shoreline consists of bulkhead material with very little vegetation, cover for the green heron while foraging is limited. In addition, the vertical nature of the bulkhead further limits the availability of shallow water needed for successful foraging.

Green herons often nest alone but in some circumstances may nest with other colonial birds (Davis and Kushlan 1994). Green herons nest in various habitats but require seclusion and proximity to wetland feeding habitat. Potential tree nesting within the Study Area and adjacent inland areas is limited because vegetation communities are present in narrow patches, growing on top of or within bulkhead features, and trees are relatively small growing and less than about 25 feet tall (Anchor QEA 2013b). Wetland habitat is not present within the Study Area or surrounding uplands, so there is no cattail vegetation that could be used by the heron for breeding habitat.

Spring migrants of green heron begin to arrive in the northeastern United States and in California in March to April; in New York, arrival is "rare before mid-April" (Bull 1974, as cited in Davis and Kushlan 1994).

Black-Crowned Night Heron

Black-crowned night herons are opportunistic foragers in shallow waters but rely heavily on fish and other freshwater and marine organisms as their primary food source (Day 2007; Hothem et al. 2010). Black-crowned night herons may also feed on a wide variety of terrestrial organisms such as amphibians, lizards, snakes, small mammals, and small birds (Hothem et al. 2010; Day 2007). Analysis of regurgitant collected from ten black-crowned night herons nestling at Hoffman Island generally support the omnivorous assumptions because fish species comprised the majority of the average bolus (i.e., 55 percent by weight; Bernick 2004). Main fish species identified in regurgitant included mummichog, Atlantic

silverside, winter flounder, and unidentified sunfish. Other items present in average boluses included unidentified marine shrimp (12 percent), unidentified crabs (9 percent), unidentified rodents (8 percent), and unidentified arthropods (1 percent). Adults feed their young regurgitant (Ehrlich et al. 1988).

Black-crowned night herons are most active during dusk and nighttime hours. Their preferred foraging habitat is shallow water of wetlands, ponds, and other aquatic features, with still water near the shoreline, typically near dense vegetation (Ehrlich et al. 1988; Peterson 1980). They will forage in freshwater and brackish habitats (Udvardy 1977).

Breeding habitat includes various wetland habitats, including salt, brackish, and freshwater marshes, swamps, streams, and lakes, and agricultural fields (Ehrlich et al. 1988; Peterson 1980). They build their nests on a platform of sticks placed in trees or cattails. They nest colonially, sometimes with more than a dozen nests in a single tree (Hothem et al. 2010).

Potential tree nesting within the Study Area and surrounding uplands is limited because vegetation communities are present in narrow patches, typically less than 15 feet wide, growing on top of or within bulkhead features, and trees are generally relatively small, growing less than about 25 feet tall (Anchor QEA 2013b). Wetland habitat is not present within the Study Area or surrounding uplands, so there is no cattail vegetation that could be used by the heron for breeding habitat.

The spring migrations north begin in March and April and continue through May. For the fall migration south, migration begins in September and October and continues to as late as December in Oregon (Hothem et al. 2010). Movements of two radio-telemetry-tracked black-crowned night herons near Staten Island suggest that herons leave the non-breeding habitat in October (Bernick 2005). Black-crowned night herons remained in the New York/New Jersey Harbor area after the breeding season; however, radio-telemetry signals were lost after the first major storm system in October (including heavy rain and northeasterly winds), suggesting migratory movement or dispersal beyond the Study Area and surrounding areas. Wintering herons that do migrate can be found in southern Texas and throughout much of Mexico and Central America (Ehrlich et al. 1988; Peterson 1980).

5.2.5.2 Piscivorous Feeding Guild

Examples of semi-aquatic birds in this feeding guild observed during the Phase 1 surveys include the belted kingfisher and double-crested cormorant. Double-crested cormorants were frequently observed flying or perching over the Study Area during both the fall and spring surveys, and were observed foraging. The belted kingfisher was only observed during the fall survey, and the site provides limited foraging habitat for this species. In its feedback to the BERA PF Workshop and in response to comments on the BERA PF, both species are to be included in the BERA for evaluation. Details on their behavior and diet are provided in the following paragraphs.

Belted Kingfisher

Although belted kingfishers rely heavily on fish as their major food source, they do not prefer any particular fish. Kingfishers take fish that are the most abundant and present in shallow water (Prose 1985; Kelly et al. 2009). Diet varies greatly with location and season (USEPA 1993). For belted kingfishers, the most essential habitat requirements to ensure successful foraging are clear waters and an unobstructed view of the prey. They will even abandon a fishing area if the water becomes too turbid after a heavy rainfall (USEPA 1993). The majority of fish are caught less than 60 cm below the water surface (USEPA 1993; Kelly et al. 2009). Most fish caught from streams by a kingfisher in Alabama and Michigan are small, typically less than 10 cm in length (Imhof 1962 as cited in Prose 1985; Salyer and Lagler 1946) and as small as 2.5 cm (Salyer and Lagler 1946). Maximum prey lengths have been observed to reach 14 cm when kingfishers caught fish from Ohio streams (Davis 1982) and 17.8 cm by kingfishers in Michigan (Salyer and Lagler 1946). Docks, pilings, or overhead branches are often used as perches to spot fish that swim by (Kelly et al. 2009). Belted kingfishers prefer stream riffles for foraging sites even when pools are more plentiful because of the higher concentration of fish at riffle edges (USEPA 1993; Kelly et al. 2009). The features of the Study Area, including the turbid nature of the surface water, are likely to limit the kingfisher's foraging success in the Study Area.

Belted kingfishers prefer to nest near suitable fishing areas, excavating into the banks to form nesting burrows (Kelly et al. 2009). The bulkhead material of the Study Area shoreline provides no nesting habitat for this species.

Most kingfishers migrate, some as far south as northern South America (Kelly et al. 2009). They begin their northward migration in March and April, arriving as early as March in upstate New York (Kelly et al. 2009). The migration south takes longer, occurring from September to November.

Double-Crested Cormorant

Double-crested cormorants are colonial water-birds that seek aquatic habitats large enough to support their almost entirely piscivorous diet. They eat a wide variety of fish, with more than 250 species documented (Hatch et al. 1999). Prey species are typically schooling fish or bottom-dwelling fish (Hatch et al. 1999). Double-crested cormorants generally eat fish from 1 to 18 cm in length (Blackwell et al. 1995; Duffy 1995). Maximum prey lengths have been observed to reach 40 cm, but less than 15 cm is preferred (Hatch and Weseloh 1999; Wires et al. 2001). On infrequent occasions, they will also prey on insects, crustaceans, or amphibians (Hatch et al. 1999; Ehrlich et al. 1988). Adult cormorants feed their young regurgitant (Ehrlich et al. 1988). Double-crested cormorants feed opportunistically on fishes that are readily available and often congregate where these fishes are most easily caught. Double-crested cormorants float low on the surface of water and dive to catch small fish. Cormorants can dive down to 25 feet and stay submerged for several minutes (Day 2007).

Cormorants tend to form breeding colonies in clusters of trees in or near water. Breeding areas can be located up to 40 miles from a feeding area (Hatch et al. 1999). Colonies of nests can be located in trees or on the ground but not both within the same colony (Ehrlich et al. 1988). In addition, cormorants need perching areas for the considerable amount of time they spend resting each day.

A survey of double-crested cormorant nesting activity between 2004 and 2008 on islands near the New York/New Jersey Harbor system found nesting activity on seven islands (Bernick and Craig 2008). Active nesting was observed on U Thant Island, which is near Newtown Creek. Double-crested cormorants are known to lay eggs in the St. Lawrence Estuary from May to July and in Ontario from April to August (Hatch et al. 1999).

In North America, double-crested cormorants winter on the coast and inland waters that include foraging habitat features similar to breeding habitat conditions (Peterson 1980;

Udvardy 1977). Double-crested cormorants are known to be a breeding resident in the NYC area (Bernick and Craig 2008). The potential northward migration of cormorants that feed in Newtown Creek should occur between late March and early April (Hatch and Weseloh 1999). By September, southward migration should be underway throughout the range (Hatch and Weseloh 1999).

5.2.5.3 Invertivorous, Sediment-Probing Feeding Guild

Examples of invertivorous sediment-probing birds observed during the Phase 1 surveys include the spotted sandpiper and sanderling. Only one sanderling was observed during the fall survey, and spotted sandpipers were infrequently observed during both surveys.

The spotted sandpiper obtains much of its diet by probing or "mining" soft sediments along shorelines and exposed mud flats in search of terrestrial and aquatic invertebrates. They prefer to forage in sandy or firm substrate but will also pick insects off aquatic vegetation, plants, and debris. As discussed earlier in this section, almost the entire shoreline of the Study Area is developed with bulkheads or other human-made features (see Figures 5-1a through 5-1g). Intertidal areas that could provide potential forage habitat are very limited and are mostly confined to the headwaters of Maspeth Creek. Analysis of the shoreline finds that at low tide, at most only 5 percent of the Study Area could potentially provide forage habitat for the sandpiper (see Figure 5-4). Due to the diurnal tidal patterns in the Study Area, this limited available foraging habitat will decrease rapidly as the tide rises and be close to zero percent at high tide, and thus, limiting potential forage habitat even further. In terms of habitat, it is likely that at least some of the existing foraging habitat will be eliminated as part of NYC's CSO abatement program: "DEP considers environmental dredging a legitimate CSO abatement alternative and a necessary first step to ecological restoration" and "the assumption is that dredging would occur prior to the CSO mound creating an impairment or nuisance condition" (NYCDEP 2011).

The availability of aquatic invertebrates as a dietary source for the sandpiper is limited. During the summer months, no aquatic invertebrates were found in samples from the tributaries of the Study Area (Dutch Kills, Whale Creek, Maspeth Creek, English Kills, and

the East Branch), or in samples from Newtown Creek upstream of the confluence with Maspeth Creek (Anchor QEA 2013c).

The spotted sandpiper requires dense vegetation for breeding and semi-open habitats, including sagebrush, grassland, and forests for nesting (USEPA 1993; Oring et al. 1997). As previously described, the Study Area vegetation is very limited at the shoreline (less than 1 percent of the total shoreline). Although there is some vegetation immediately adjacent to the shoreline (i.e., on or behind bulkheads or riprap), its average width is only 3 to 8 feet. Because of these limitations, the Study Area and adjacent inland vegetation do not offer any potential breeding habitat for the sandpiper.

Although the occasional spotted sandpiper has been observed in the Study Area (Anchor QEA 2013b), its migratory patterns are such that it is unlikely to be found in the Study Area for up to 6 months of the year during the winter months. The spotted sandpiper spends the winter season in coastal or near coastal portions of Washington, Oregon, and California, in the southern portion of the United States, and south throughout Central America, Bermuda, and the West Indies.

Because the spotted sandpiper represents a sediment-probing invertivorous feeding guild, it will be retained for quantitative evaluation in the BERA. However, as described previously, this evaluation will take into account the limited habitat available in the Study Area for birds in this feeding guild.

5.2.5.4 Herbivorous Feeding Guild

Examples of bird species within the herbivorous feeding guild observed during the Phase 1 surveys include the American black duck, mallard, and Canada goose. Because these birds primarily feed on vegetation, the lack of rooted macrophytes observed during the Phase 1 survey limits the contribution from this dietary component. In addition, species such as the Canada goose are known to frequently forage on grass in open fields and parks so their diet will not be exclusive to the Study Area. Canada geese are particularly drawn to fields and lawns for two reasons: they can digest grass, and when they are feeding with their young, manicured lawns give them a wide, unobstructed view of any approaching predators

(Mowbray et al. 2002). This preference will limit their use of the Study Area. During the Phase 1 surveys, much of the on-water foraging activity of these birds was observed taking place in the trash gyres that formed at several locations in the Study Area. For these reasons, the herbivorous feeding guild will not be included for quantitative evaluation in the BERA.

5.2.6 Riparian Birds

A number of riparian birds were observed during the Phase 1 surveys, including the American robin, eastern kingbird, song sparrows, barn swallows, rock doves, and gulls. Most of these birds feed on, for example, terrestrial-based seeds, berries, insects, and grubs, with no exposure pathway from the Study Area. Barn swallows can include aquatic-based emergent insects in their diet. However, because emergent insects were only found in 3 of 68 samples from the Phase 1 benthic community surveys (two in Maspeth Creek and one in Newtown Creek), the exposure pathway from the Study Area to the swallow is considered incomplete or minor. Furthermore, barn swallows are a long-distance migrant (Brown and Brown 1999). The timing of migration varies throughout the United States. For the spring migrations, barn swallows arrive in their northern breeding habitat in March and continue to arrive through June. In the fall, migration south begins early in July and continues through October for most locations, with some individuals staying as late as November and early December (Brown and Brown 1999). Barn swallows are not present in the New York area from about November through early March (Fisher and Bezener 1998). Gulls are omnivorous with a diet that often includes carrion, and in urban environments such as that of the Study Area, the diet is often trash. Similar to swallows, the exposure pathway from the Study Area to gulls is considered incomplete or minor. Given this, riparian birds are not proposed for quantitative evaluation in the BERA.

5.2.7 Carnivorous Birds

During the Phase 1 surveys, a pair of peregrine falcons was observed on, and in the vicinity of, the Kosciuszko Bridge (Anchor QEA 2013b). The peregrine falcon has New York State special status and is designated as a state Endangered Species (NYSDEC 2013a). Peregrine falcons catch prey in flight, stooping or dropping with their wings closed, sometimes reaching speeds of more than 230 miles per hour. Peregrine falcons do have other hunting methods, including level pursuit, picking birds out of large flocks, and occasionally even

hunting on the ground (White et al. 2002). Urban peregrines prefer to consume rock doves (pigeons; Nadareski 1991). Diets appear to vary considerably depending on the species common within each individual's territory (Migration Research Foundation 2013), but other typical prey includes starlings, gulls, and songbirds (White et al. 2002; Ehrlich et al. 1988; Peterson 1980). Sixteen falcon pairs are known to live throughout NYC. It is speculated that these birds remain because pigeons and other city-dwelling birds provide an abundant food source (NYCDEP 2013). Given that the exposure pathway from the Study Area to peregrine falcon is considered incomplete, it is not proposed for evaluation in the BERA.

5.2.8 Mammals

The only mammals observed during the Phase 1 surveys were feral cats, Norway rats, and raccoons. Other mammals mentioned by USEPA in their review of SLERA Technical Memorandum No. 1 (Anchor QEA 2012a) included the muskrat and opossum; however, these were not observed during the Phase 1 surveys.

Muskrats build lodges in or within a few feet of water, using mud and wetland vegetation such as cattail, bulrush, sedge, cordgrass, saltgrass, and rushes (Snyder 1993). Although muskrats are found in ponds, lakes, and swamps, their favorite locations are marshes, where the water level stays constant to prevent flooding of their dens. Muskrats are mainly herbivores, relying on aquatic vegetation (USEPA 1993; ADW 2013a), but may also eat agricultural crops and other terrestrial plants. Given that the shoreline of the Study Area consists of 99-percent bulkhead material, and is tidally influenced, there is almost no opportunity for the construction of dens, and potential foraging habitat is also limited.

Opossums typically seek shelter in abandoned dens of other mammals, culverts, brush piles, and beneath outbuildings (Burt 1980). A majority of the opossum diet is composed of terrestrial-based insects and carrion. They are scavengers and rarely prey on live animals (ADW 2013b). Although they are also opportunistic, feeding on trash in urban environments (Prange and Gehrt 2004; Smithsonian 2013), they are not as opportunistic as raccoons. Because of this, raccoons are more successful than opossum in an urban environment (Prange and Gehrt 2004).

Norway rats and feral cats are also opportunistic scavengers, which in an urban environment such as the Study Area can include trash. Because the exposure pathway from the Study Area to the muskrat, opossum, feral cats, and Norway rats is considered incomplete or minor, these mammals are not recommended for evaluation in the BERA. Although the Study Area provides only limited foraging opportunities for the raccoon, because this mammal is highly adapted to urban environments, it will be retained for quantitative evaluation in the BERA.

Raccoon

Raccoons were observed during the Phase 1 surveys, although infrequently (Anchor QEA 2013b). They are able to live in a diversity of habitats, provided they have a readily available food source and protected areas for denning. If available and accessible, they will forage along saline water and freshwater riparian habitats, in shallow water, in vegetation, and on the ground (Zeiner et al. 1988 to 1990). They are opportunistic feeders, consuming virtually any animal or vegetable matter. This makes the raccoon highly adapted to suburban and urban environments, where they can readily feed on garbage and discarded food items. Studies of raccoon scat by Hoffmann and co-workers (Hoffmann and Gottschang 1977) revealed the presence of aluminum foil, cellophane wrappers, string, paper, cloth, bits of plastic, and rubber bands, indicating that the raccoons in their study were eating garbage.

Because most of the shoreline of the Study Area is developed with vertical bulkhead (approximately 74 percent of the shoreline) and other anthropogenic features (see Figures 5-1a through 5-1g), access to the intertidal areas where raccoon might forage is limited. In addition, as discussed for the sandpiper, intertidal shoreline areas that could provide potential forage habitat for the raccoon are very limited. Lastly, given the opportunistic foraging habits of the raccoon, it is more likely that the raccoons observed are relying heavily on the available anthropogenic dietary sources rather than from sources with exposure to the Study Area surface water and sediment. Because the raccoon is highly adapted to an urban environment such as that surrounding the Study Area, this species will be retained for quantitative evaluation in the BERA.

6 REFINED CONCEPTUAL SITE MODEL

As stated in *Considerations for Developing Problem Formulations for Ecological Risk Assessments Conducted at Contaminated Sites under CERCLA* USEPA (2004) "….the conceptual model describes the key relationships between stressors and assessment endpoints. In so doing, the conceptual model provides a framework for predicting effects on ecological receptors and a template for generating risk questions and testable hypotheses (USEPA 1997a, 1998). The conceptual model also provides a means of highlighting what is known and what is not known about a site. In this way, the conceptual model provides a basis for identifying data gaps and designing monitoring programs to acquire the information necessary to complete the assessment."

More specifically, the CSM describes the primary and secondary sources of contaminants, ecological receptors, and exposure pathways that link the sources to the receptors. A preliminary CSM for Newtown Creek was presented in SLERA Technical Memorandum No. 1 (Anchor QEA 2012a). The purpose of this section is to provide an update to the CSM, based on the receptors selected for evaluation in Section 5. The refined CSM is presented on Figure 6-1 and discussed subsequently.

6.1 Sources

The Newtown Creek Study Area is highly urbanized, with an adjacent shoreline and surrounding land-use dominated by industrial and commercial infrastructure and activities. Because of this, conditions within the Study Area are influenced by a combination of chemical, physical, and biological characteristics that reflect its industrialized urban setting. Primary sources of CERCLA hazardous substances such as metals, pesticides, volatile organic compounds (VOCs), SVOCs, PAHs, and PCBs include industrial and private stormwater outfalls from contaminated sites under the State Superfund Program and Brownfield Cleanup Program, as well as permitted State Pollutant Discharge Elimination System (SPDES) discharges from industrial facilities and NYC CSOs. As in many urban areas, stormwater runoff from the surrounding streets, parking lots, buildings, and vacant lots is a potential source of hazardous substances to the Study Area, as is atmospheric deposition. Upland spills and releases also are primary sources. As a tributary to the East River, contaminants are likely tidally transported into the Newtown Creek Study Area from regional sources. These

primary sources contaminate secondary sources, which include surface water, surface and deep sediments including porewater, and groundwater.

Contaminants are likely present in the Study Area due to site-related releases as well as urban background sources. Additional details regarding sources and the fate and transport processes by which organisms become exposed to contaminants are or will be presented in the following documents:

- *Point Sources Sampling Approach Evaluation Memorandum* (Anchor QEA 2013d)
- *Sources Sampling Approach Memorandum* (Anchor QEA 2013e)
- RI Report

6.2 Receptors

As discussed in Section 5, it is neither feasible nor necessary to quantitatively evaluate potential risks to all the individual species associated with the Study Area. The receptors proposed for quantitative evaluation in Section 5 were observed during the Phase 1 surveys, are directly exposed to contaminants in Study Area surface water or sediment or indirectly exposed via their diet, and are species for which quantitative evaluation of potential risk addresses potential risk for other species. The following receptor groups and representative receptors will be evaluated quantitatively in the BERA (see Section 5):

- Aquatic plants – phytoplankton
- Zooplankton
- Benthic macroinvertebrates
- Epibenthic invertebrates – blue crab and bivalves (ribbed mussels)
- Fish – mummichog, spot, and striped bass
- Birds – belted kingfisher, double-crested cormorant, green heron, black-crowned night heron, and spotted sandpiper
- Mammals – raccoon

6.3 Exposure Pathways

As discussed in Section 4, once contaminants are released into an aquatic environment, they dissolve in surface water and porewater and sorb to particulates in the water column and in

the sediment bed. The concentrations of contaminants in each of these media depend on the physics of the creek (tidal circulation, freshwater inputs, stratification, sediment transport), the chemical properties of the contaminants (e.g., partitioning to particulate and dissolved organic carbon, complexation, precipitation, photodegradation), and biological transformations (e.g., dechlorination). Organisms are exposed via direct contact with sediments and water, uptake across breathing surfaces (gills), incidental consumption of sediment and water column particulate matter, and food chain transfer. Whole-body burdens and concentrations in specific tissues, which control biological effects, are determined by the balance between uptake, elimination, and metabolism, as well as by feeding behavior, migration and movement, bioenergetics, and reproduction. These processes will be represented quantitatively in the hydrodynamic, sediment transport, groundwater, chemical fate and transport, and bioaccumulation models that are under development.

For some receptors in the Study Area, exposure pathways are complete and significant, as in the following:

- Exposure of phytoplankton to contaminants in surface water
- Exposure of zooplankton to contaminants in surface water
- Exposure of benthic invertebrates to contaminants in surface water, surface sediment, porewater, and plant and animal tissue
- Exposure of epibenthic decapods to contaminants in surface water, surface sediment, and plant and animal tissue
- Exposure of epibenthic bivalves to contaminants in surface water, and phytoplankton
- Exposure of omnivorous and invertivorous fish to contaminants in surface water, surface sediment, porewater, and plant and/or animal tissue
- Exposure of invertivorous and piscivorous birds to contaminants in surface sediment and animal (invertebrate and small fish) tissue
- Exposure of sediment-probing invertivorous birds to contaminants in surface sediment and animal (benthic invertebrate) tissue
- Exposure of omnivorous mammals to contaminants in surface sediment and plant and animal tissue

Complete and significant pathways will be the focus of the quantitative risk analysis.

Some of the exposure pathways are complete but insignificant by comparison with the significant pathways (e.g., direct contact of piscivorous birds with surface sediment). These complete but insignificant pathways will be acknowledged but will not be the focus of the risk analyses. For some receptors, complete but insignificant pathways will be included in the quantitative exposure evaluation for completeness (e.g., surface water ingestion by birds and mammals).

Finally, other pathways are incomplete and will not be addressed in the risk analyses (e.g., sediment exposure of phytoplankton and zooplankton).

Figure 6-1 summarizes the sources and exposure pathways for the key receptors. This diagram provides the basis for the development of assessment endpoints, measurement endpoints, DQOs, and risk questions presented in Section 7.

7 ASSESSMENT ENDPOINTS, MEASUREMENT ENDPOINTS, DATA QUALITY OBJECTIVES, AND RISK QUESTIONS

7.1 Assessment Endpoints

Assessment endpoints are "an explicit expression of the environmental values (e.g., ecological resources) that are to be protected" (USEPA 1997a). The selection criteria for assessment endpoints include ecological relevance, susceptibility (exposure plus sensitivity), and relevance to management goals (USEPA 1997a, 1998). The assessment endpoints provide the foundation for the BERA because they focus the assessment activities on the key environmental values such as survival, growth, and reproduction of the representative receptors.

Several factors need to be considered when selecting assessment endpoints (USEPA 2004), including the following:

- The contaminants that occur in environmental media and their concentrations
- The fate of the contaminants to various groups of organisms
- The ecologically relevant receptor groups that are potentially sensitive to or highly exposed to the contaminant, based upon their natural history attributes
- The presence of potentially complete exposure pathways

As discussed in Section 3, a number of contaminants have been identified as preliminary COPECs for the Study Area including metals, SVOCs, PAHs, PCBs, and dioxins and furans. Receptors that come into direct contact with Study Area sediments (e.g., benthic and epibenthic invertebrates) and water (e.g., phytoplankton and zooplankton) are likely to be exposed to these preliminary COPECs. In addition, a number of the contaminants were identified as preliminary bioaccumulative COPECs, and therefore, have the potential to bioaccumulate in the prey of fish, birds, and mammals that forage in the Study Area.

The receptor groups that are present in the Study Area and can be exposed to Study Area contaminants, as well as the selection of representative receptors for quantitative evaluation in the BERA, are discussed in Sections 5 and 6.

The assessment endpoints for the BERA are the survival, growth, and reproduction of all the key receptors except for migratory fish. The current water quality classification of Newtown Creek is *SD* (suitable for fish survival; minimum DO of 3 mg/L). Because it is uncertain at this time whether future conditions in the Study Area will support a re-classification to *I* (suitable for fish propagation; minimum DO of 4 mg/L), it is assumed that the current classification will remain and that the assessment endpoint for migratory fish is for survival only. The assessment endpoint for each receptor group is presented in Table 7-1.

7.2 Measurement Endpoints

"A measurement endpoint is defined as 'a measurable ecological characteristic that is related to the valued characteristic that is selected as the assessment endpoint' and it is a measure of biological effects (e.g., mortality, reproduction, growth; USEPA 1997a)" (USEPA 2004). Thus, measurement endpoints describe specific observations or analyses that can be performed in the field or in the laboratory to answer the risk questions, and therefore, to address the assessment endpoints. They guide the collection of data. Measurement endpoints incorporate both measures of exposure (e.g., contaminant concentrations in sediment porewater or tissue) and measures of effect (e.g., benchmarks, toxicity-based values, survival, or growth of amphipods in 10-day toxicity tests; USEPA 2004). The measurement endpoints to be used in the BERA are presented in Table 7-1. These are described in more detail in the RAP (see Section 8). Details of data collection efforts will be provided in the Phase 2 RI Work Plan Volume 1.

7.3 Data Quality Objectives

The DQOs define the type, quality, quantity, purpose, and intended uses of data (USEPA 2006). For the Newtown Creek RI/FS, these DQOs will be developed to guide the Phase 2 RI data collection to support the BERA measurement endpoints. The DQOs include several steps such as describing the goals of the study, identifying the data needs, developing the analytical approach including the performance criteria, and developing the data collection plan. These will be described in detail in the Phase 2 RI Work Plan Volume 1.

7.4 Use in Ecological Risk Assessment

The key components for the use of the measurement endpoint information in the BERA are also provided in Table 7-1. Details on how this information and the data are to be used in the BERA are provided in the RAP (see Section 8).

7.5 Risk Questions

Risk questions guide the analyses for a BERA. The questions describe testable hypotheses as to whether or not a potential risk to the assessment endpoint exists (USEPA 1997a, 2004). The typical format for a risk question is shown in the following two examples:

- Are the levels of contaminants in surface sediments and porewater from the Study Area greater than benchmarks for the survival, growth, or reproduction of benthic invertebrates?
- Is the accumulation of contaminants in Study Area blue crab tissue sufficient to cause adverse effects to blue crab, and to consumers of prey represented by crab?

Several lines of evidence (measurement endpoints) are typically used to answer the risk questions. The risk questions that will be addressed in the BERA are also presented in Table 7-1.

7.6 Data Needs

Based on the risk questions and measurement endpoints, Table 7-1 also presents the key data needs for the BERA. These data are to be collected during the Phase 2 RI following the study design and procedures described in the Phase 2 RI Work Plan Volume 1. The data are either needed to fill gaps in the Phase 1 RI data or to reduce the uncertainties identified by conducting the preliminary SLERA analyses. For example, potential risks to birds were estimated based on modeled prey contaminant concentrations. To reduce the uncertainties associated with modeled data, contaminant concentrations will be measured in prey tissue instead. Because only reconnaissance data were collected from the candidate reference areas during Phase 1, the data needs include the reference areas as well as the Study Area. Other data needed to provide more realistic estimates of risk are described in the RAP. These include, for example, data on the proportion of particular prey items in the diet for a receptor, or the amount of time a receptor might spend foraging in the Study Area. Some of

these data will be collected during the Phase 2 field activities and others will be gathered from literature searches.

7.7 Background or Reference

Lastly, Table 7-1 identifies whether reference area data are to be used as background contaminant data for comparison with Study Area contaminant data or to be used as a reference in a biological assessment such as a toxicity test or a benthic community evaluation.

8 RISK ANALYSIS PLAN

8.1 Introduction and Overall Approach

A RAP includes descriptions of the overall design of the risk assessment, data requirements, measurements that will be made, and methods for conducting the analysis phase of the risk assessment (USEPA 1997a). Data gaps and uncertainties associated with the risk assessment are also identified.

The risk analyses planned for the BERA will use a weight-of-evidence approach that includes calculating hazard quotients (HQs) as well as other lines of evidence such as toxicity test results and community surveys. HQs will be calculated by comparing EPCs, or for wildlife, total daily intakes (TDIs), to toxicity-based values for a particular contaminant or group of contaminants. EPCs will be calculated in several ways, focusing first on the 95-percent UCL on the mean contaminant concentration but potentially including other measures as well, for example the mean. For some receptors (benthic macroinvertebrates in particular), the exposure assessment will take into account contaminant bioavailability by measuring contaminant concentrations in sediment porewater or using other techniques such as measuring sediment acid volatile sulfides/simultaneously extracted metals (AVS/SEM) for metals or soot carbon for PAHs. Toxicity-based values (e.g., benchmarks or TRVs) will be selected from a number of sources including national and state criteria or guidelines, or from the peer-reviewed literature. Both acute and chronic values will be used depending on the assessment endpoint under evaluation. If sufficient exposure and toxicity data are available for a particular contaminant, consideration will be given to probabilistic analysis, if such an approach will aid in refining the decision-making process.

For the Newtown Creek Study Area, the interpretation of the BERA data and the evaluation of risks are complicated by the urban nature of the Study Area and surrounding riparian and upland areas. Within the Study Area, biological responses (including benthic toxicity and benthic community structure) and wildlife exposure (habitat requirements, foraging range, migratory behavior) are clearly influenced by factors that are not within the purview of a Superfund investigation. These potentially confounding factors include but are not limited to low DO, elevated sediment organic carbon, physical alteration of the site, ongoing disturbance due to human activity, and biological factors such as invasive species and algal

blooms. Therefore, this RAP also includes a description of data collection efforts designed to investigate the potential influence of these potentially confounding factors on the evaluation of the impacts of COPECs on the receptor species. In addition, the selection of appropriate reference areas and the characterization of reference conditions is a critical component of the BERA process and will provide critical information for distinguishing the impacts of the confounding factors from the impacts of COPECs. Therefore, this RAP also includes a discussion of the reference area selection process.

The risk evaluation will be conducted on a Study Area-wide basis and will also consider sub-areas within Newtown Creek if the data indicate that there are important differences between subareas. These sub-areas will be delineated based upon the distributions of contaminant concentrations in sediments, water, and biota, and spatial patterns of confounding factors such as total organic carbon (TOC), as well as fish and wildlife foraging habitat and behavior. For more sessile receptors, such as benthic macroinvertebrates, the risk evaluations may be considered on a much smaller, location-by-location basis.

By way of an example, several lines of evidence will be developed to evaluate risks to benthic invertebrates. These include calculation of HQs (sediment concentrations compared to benchmarks, tissue concentrations compared to critical tissue residues), sediment toxicity tests, and benthic community structure. These will be evaluated in an integrated fashion to address the extent to which risks exist due to site-related releases of CERCLA hazardous substances, pollutants, and contaminants. It is anticipated that the weight-of-evidence evaluation will incorporate all of the various contributing factors, considering their potential reliability.

To distinguish the impacts of COPECs from the impacts of confounding factors, the weight-of-evidence approach will also incorporate measurements of confounding factors in the Study Area, as well as measurements of biological responses, contaminants, and confounding factors in the reference areas. Reference area data, and in particular data pertaining to biological responses, will be compared with the Study Area data using a reference envelope approach, which considers the distribution of results from the reference areas.

Uncertainty analysis will be incorporated into all BERA components. The uncertainty analysis will include both qualitative evaluations (e.g., the toxicological rigor of benchmarks and TRVs) as well as more quantitative evaluations (e.g., sensitivity analysis of wildlife exposure estimates and comparison of the distribution of measured contaminant concentrations with distributions of toxicological data underlying benchmarks where data permit). The uncertainty analysis also will include an evaluation of the degree to which confounding factors contribute uncertainty to the risk estimates for the different receptor groups, with the goal of differentiating total site risk from risks caused by exposure to CERCLA hazardous substances, pollutants, and contaminants.

The following Sections 8.2 through 8.9 describe the RAP for the receptor groups presented in Table 7-1. The structure of these sections follows the assessment endpoints and risk questions in Table 7-1. For each receptor group or representative receptor, the risk question(s) is/are presented, followed by a discussion of the data needed, the measurement endpoints, and how these will be used in the risk analyses. These are described with as much specificity as is appropriate at this stage of the project. A complete, detailed description of the quantitative analysis will be provided in the BERA, considering the specifics of the data (e.g., outliers, confounding factors, nature of the data distribution). Section 8.10 provides a more complete description of potential confounding factors that will be considered in the uncertainty analyses of the BERA, and Section 8.11 includes a detailed description of the reference area selection process.

8.2 Risk Analysis Plan for Plankton

Risk questions:

- **Are the levels of contaminants in surface water from the Study Area greater than surface water toxicity-based values for the survival or growth of phytoplankton?**
- **Are the levels of contaminants in surface water from the Study Area greater than surface water toxicity-based values for the survival, growth, or reproduction of zooplankton?**

The data needs for this line of evidence consist of water column contaminant concentrations, along with other analytes that may be necessary to evaluate contaminant bioavailability (e.g.,

dissolved organic carbon content, temperature, salinity). An extensive sampling program was conducted in the Study Area in Phase 1, including the collection of monthly samples at multiple locations (Anchor QEA 2013b, 2013c, 2013f). It is anticipated that this dataset will form the primary source of information for this component of the risk assessment. Phase 2 measurements will include water column measurements in the reference areas to assess the extent to which contaminant concentrations in the Study Area represent site-related releases. For comparability with the Phase 2 reference data, a limited program of water column sampling will be conducted during Phase 2 in the Study Area.

In the BERA, surface water contaminant concentrations will be compared with toxicity-based values (e.g., national recommended water quality criteria or the toxicity data used to develop those criteria) for the protection of aquatic life.

The analysis of these data will consist of graphical comparisons including figures showing the spatial distribution of the measured data compared with toxicity-based values, as well as cumulative probability plots. Statistical testing may be conducted to assess the degree to which average surface water contaminant concentrations in the Study Area are significantly different from the toxicity-based values. This may include tests such as Student's t-tests, as well as comparisons of toxicity-based values with reasonable bounds on the central tendency (e.g., 95-percent confidence intervals). Concentrations measured in the Study Area will also be compared graphically and statistically with concentrations measured in the reference areas to provide the information needed to assess releases of the contaminants that are site-related. The statistical comparisons may include parametric tests such as analysis of variance (ANOVA), as well as non-parametric approaches.

These evaluations will be performed for the entire Study Area as well as sub-areas where appropriate. The sub-areas will be delineated based on an analysis of spatial patterns in the Phase 1 and Phase 2 data.

8.3 Risk Analysis Plan for Aquatic Macrophytes

Risk question:

- **Do aquatic macrophytes occur in the Study Area to the extent that exposure to contaminants in surface water and surface sediments may impair survival and growth?**

As discussed in Section 5.2.1, no rooted macrophytes were observed during the Phase 1 surveys, and possible habitat for aquatic macrophytes is very limited in the Study Area. This is likely due to a number of factors including depth limitations, the armored shoreline, and a very soft, very silty, high-sulfide substrate in many areas. Given the limitations of the Study Area to provide suitable habitat for these species, rooted macrophytes will only be evaluated qualitatively in the BERA. This will build upon the qualitative evaluation presented in Section 5.2.3, by further evaluating the potential for the Study Area to provide suitable habitat for these species, including porewater sulfide concentrations and Secchi depth.

8.4 Risk Analysis Plan for Bivalves

Risk questions:

- **Are the levels of contaminants in surface water from the Study Area greater than surface water toxicity-based values for the survival, growth, or reproduction of bivalves?**
- **Is the accumulation of bioaccumulative contaminants in mussels sufficient to cause adverse effects to Study Area bivalves?**
- **Are the levels of contaminants in the mussels from the Study Area sufficiently elevated to adversely affect the survival, growth, or reproduction of selected avian and mammalian receptors?**

Exposure of bivalves as epibenthic organisms to contaminants occurs via direct exposure to water and indirectly through their diet. The assessment design for bivalves will be a caged bivalve study using ribbed mussels as the representative receptor. Contaminant concentrations measured in the surface water will be compared to surface water toxicity-based values for the survival, growth, or reproduction of bivalves. Contaminant concentrations measured in tissues will be used for a comparison with tissue-based threshold

effect concentrations and as part of the dietary intake for selected avian and mammalian receptors. The selection of contaminants will be discussed in the Phase 2 RI Work Plan Volume 1.

The analysis of surface water contaminant data (from Phase 1 and Phase 2) will consist of graphical comparisons, including figures showing the spatial distribution of the measured data compared with toxicity-based values, as well as cumulative probability plots. Statistical testing may be conducted to assess the degree to which average surface water contaminant concentrations in the Study Area are significantly different from the toxicity-based values. This may include tests such as Student's t-tests, as well as comparisons of toxicity-based values with reasonable bounds on the central tendency (e.g., 95-percent confidence intervals), if the data allow. The statistical comparisons may include parametric tests such as ANOVA, as well as non-parametric approaches. These evaluations will be performed for the entire Study Area as well as sub-areas where appropriate. The sub-areas will be delineated based on an analysis of spatial patterns in the Phase 1 and Phase 2 data.

Potential effects on bivalve populations will also be assessed using a body burden (critical body residue) approach. This measurement endpoint takes into account water and dietary exposure pathways. The U.S. Army Corps of Engineers Environmental Residue-Effects Database (ERED; 2013) will be the primary source for selection of effects thresholds for the BERA. A review of the ERED sources, as well as other literature sources, will be performed during the BERA to identify any additional studies that could add to the body of information currently available for selecting measures of effect. Both point estimates (the HQ approach, expressed as the ratio of the estimated body burden to the critical body burden) and concentration-response relationships will be used, where published data support it. The extent to which critical body burdens are exceeded will be evaluated and considered in light of the likelihood of population-level effects. Both NOED/no observed adverse effect level (NOAEL) and lowest observable effects dose (LOED)/ lowest observed adverse effect level (LOAEL) values will be considered in the analysis. In addition, the relationship between surface water and tissue concentrations will be evaluated graphically and statistically; this will be performed using Phase 1 and Phase 2 surface water data averaged over sub-areas of the Study Area that match the location of caged mussels. Sub-areas will be selected based on an evaluation of the Phase 1 and Phase 2 data.

8.5 Risk Analysis Plan for the Benthic Invertebrate Community

Benthic macroinvertebrates are exposed to contaminants by direct contact with surface water, direct contact with surface sediment and porewater in the biologically active zone, and ingestion of surface sediment and tissue. A sediment quality triad approach will be used to provide the primary lines of evidence for estimating potential impacts on benthic invertebrates. The triad includes the following:

- Sediment chemistry
- Benthic community
- Sediment toxicity

This is a commonly used approach (Long and Chapman 1985; Chapman 1990; USEPA 1992; NYSDEC 2013b). In addition, the potential effects of bioaccumulative contaminants will be evaluated by comparing benthic invertebrate tissue concentrations with applicable benchmarks. Surface water exposure will also be evaluated by comparing surface water contaminant concentrations with applicable benchmarks. Confounding factors such as DO, TOC, and grain size (described in Section 8.10) will be considered, as necessary, in evaluating the impacts of COPECs and will also be incorporated into the uncertainty analysis based on measurements conducted in the Study Area and reference areas. The data for all these lines of evidence will be collected synoptically, both in the Study Area and in the reference areas.

8.5.1 Sediment, Porewater, and Surface Water Chemistry

Risk question:

- **Are the levels of contaminants in surface water, surface sediments, and porewater from the Study Area greater than benchmarks for the survival, growth, or reproduction of benthic macroinvertebrates?**

The data requirements for this line of evidence consist of surface water, bulk surface sediment, and sediment porewater concentrations of contaminants, along with other analytes that may be necessary to evaluate contaminant bioavailability (e.g., sediment organic carbon content, acid volatile sulfides [AVS]). The Phase 2 measurements will be designed to supplement the data already available from the Phase 1 investigations (surface water and

surface sediment bulk concentrations of contaminants). As described in Section 8.2, it is anticipated that the Phase 1 dataset will form the primary source of surface water data for Phase 2. Phase 2 sediment sample locations will be coincident with sample locations for benthic community and sediment toxicity samples. Concentrations will also be measured in reference areas to provide the information needed to assess releases of the contaminants that are site-related.

To evaluate the direct exposure pathway for the benthic community, contaminant concentrations in sediment and porewater (e.g., 95-percent UCL) will be compared with published benchmarks and toxicity-based values for benthic invertebrates. Concentrations exceeding the benchmarks and toxicity-based values will be considered as lines of evidence in the risk characterization. These lines of evidence will include the following:

- Benchmarks for bulk surface sediment: These may include values from the published literature such as effects-range low values or threshold effect levels.
- For bulk sediment:
    - A value of 1.0 for the ratio of simultaneously extracted metals toacid volatile sulfides (ΣSEM/AVS)
    - For ΣSEM-AVS/fraction of organic carbon (foc), values of 130 micromoles per gram (μmol/g) organic carbon (below which toxicity is unlikely) and 3,000 μmol/g organic carbon (above which toxicity is likely; USEPA 2005)
- Mineralogical analysis for metal speciation using X-ray diffraction, electron microprobe, and sequential extraction
- Solid-phase microextraction (SPME) porewater toxic unit thresholds for organic contaminants (e.g., Arp et al. 2011)

The analysis of these data will consist of graphical comparisons including figures showing the spatial distribution of the measured data along with benchmark values, as well as cumulative probability plots. Statistical testing may be conducted to assess the degree to which average surface sediment contaminant concentrations in the Study Area are significantly different from the benchmarks or from the distribution of toxicity data used to develop benchmarks. This may include tests such as Student's t-tests, as well as comparisons of benchmarks with reasonable bounds on the central tendency (e.g., 95-percent confidence intervals). Concentrations measured in the Study Area will also be compared graphically and

statistically with concentrations measured in the reference areas to provide the information needed to assess releases of the contaminants that are site-related. The statistical comparisons may include parametric tests such as ANOVA, as well as non-parametric approaches.

For surface water, contaminant concentrations (e.g., 95-percent UCL) will be compared with published benchmarks and toxicity-based values for the protection of benthic macroinvertebrates. Concentrations exceeding the benchmarks and toxicity-based values will be considered in the risk characterization weight of evidence. The analysis of these data will be similar to that described for plankton in Section 8.2, using graphical presentation of the data and statistical testing for comparison with toxicity-based values as well as with reference area data.

For both surface water and sediment, the evaluations will be performed for the entire Study Area as well as sub-areas where appropriate. The sub-areas will be delineated based on an analysis of spatial patterns in the Phase 1 and Phase 2 data.

8.5.2 Benthic Community Structure

Risk question:

- **Is the abundance and diversity of the benthic macroinvertebrate community in the Study Area similar to that of reference locations?**

A number of benthic community indices will be used to evaluate the potential impacts of contaminants on benthic community structure. Examples include the following:

- Benthic community diversity
- Abundance
- Species composition
- Relevant regional indices (e.g., the Weisberg Biotic Index [WBI; Adams et al. 1998])

To evaluate the impacts of site-related contaminant releases within the Study Area on the benthic community, the Study Area benthic community indices will be compared with the same indices measured in benthic communities from reference areas. In addition, other

sources of relevant data will be incorporated, pending a review of data quality (e.g., Environmental Monitoring and Assessment Program [EMAP] and Regional EMAP Program [Adams et al. 1998]).

The data needs consist of samples of the Study Area and reference area benthic organisms to permit identification and enumeration of the benthic community, and concentrations of contaminants, as well as potentially confounding factors in surface sediments and in bottom water column samples (ammonia, sulfides, DO). The measurements conducted in Phase 2 will follow the same methods as used in Phase 1. As in Phase 1, two rounds of sample collection will be performed in spring and summer.

The analysis of benthic community structure will include a combination of correlation and hypothesis testing approaches. The analyses will be both graphical and statistical, including but not limited to the following approaches:

- Cross-plots of benthic community metrics versus contaminant concentrations
- Bar plots comparing contaminant concentrations and benthic community metrics in the Study Area with data collected in the reference areas
- Calculation of correlation coefficients between community metrics and contaminant concentrations, and their significance
- Calculation of student's T-tests or ANOVA or similar statistics comparing the Study Area and reference areas

Additional more complex analyses may be considered as well, including, for example, multivariate statistical analyses.

A full triad study will be conducted in spring. The decision to conduct a second triad study in late summer will depend upon the results of the spring study and discussions with USEPA. The results of the benthic community evaluation will be integrated with the results of the other two legs of the triad (benthic toxicity and sediment chemistry), as well as the bioaccumulation tests. A weight-of-evidence approach will be taken, relying not only on statistical significance but also on an understanding of underlying biological mechanisms and the consistency amongst all the benthic lines of evidence.

Confounding factors will be incorporated into the evaluation, using a combination of graphical and statistical analyses, supplemented by understanding of underlying mechanisms. Analyses will include the following:

- Integrated evaluation of the relationships between biological response, contaminant concentrations, and confounding factors within the Study Area (graphics, multivariate statistics)
- Comparison of the Study Area with reference areas in each of the key categories (with CSO contribution versus without significant CSO contribution; industrial versus non-industrial land use): This will include the same types of correlation and statistical analyses previously indicated. The reference data, along with acceptable non-site-related regional data, will be used to establish a range of values for the benthic indices that are expected in this urban environment in the absence of the site-related releases of contaminants.

An example of a correlation analysis that may be included in the BERA is presented here using the Phase 1 benthic community data. Figure 8-1 shows the relationship between benthic community structure and the concentration of one contaminant (total PAH, or TPAH) and two potentially confounding factors (TOC and DO). All data were collected in the Study Area during the spring and summer 2012 Phase 1 RI surveys. The response metric is WBI (Adams et al. 1998), which comprises several metrics and was developed using USEPA EMAP data collected in the Virginia Province, which includes the New York Harbor area. WBI appears to be well-correlated with DO, somewhat less correlated with TOC, and poorly correlated, if at all, with TPAH. One strength of this analysis is that it integrates both the spring and summer 2012 data, which showed different responses as well as different values for DO. This analysis suggests (but does not prove) that for this metric, the confounding factor DO is probably the leading determinant of benthic community structure, and the contaminant, TPAH, likely plays, at most, a secondary role. A full analysis would include more in-depth evaluation of outliers, carbon normalization, and other statistical tools such as multivariate regression in an effort to evaluate the degree of uncertainty caused by low DO on the risk estimates for the CERCLA hazardous substances. This type of data evaluation provides a line of evidence concerning the roles of contaminants and confounding factors in controlling biological response.

8.5.3 Sediment Toxicity

Risk question:

- **Do Study Area surface sediments exhibit a similar toxicity to *Ampelisca* or *Leptocheirus* as reference area sediments?**

Laboratory-based whole sediment bioassays using benthic invertebrate species, coupled with synoptic whole sediment and porewater chemistry analyses, will be performed. Specifically, the survival and growth of benthic invertebrates in Study Area, reference area, and laboratory control sediments will be evaluated. The tests will be conducted with laboratory test organisms that are appropriate for the varied grain sizes and salinities that occur in the Study Area and in the reference areas. Two candidate test organisms are amphipods, *Ampelisca abdita* and *Leptocheirus plumulosus.* Initial testing of Study Area sediments with these organisms is recommended and will be discussed with USEPA to finalize organism selection and test design. Additional information regarding the selection of species and the determination of specific test conditions will be provided in the Phase 2 RI Work Plan Volume 1.

Primary measurements will include survival and growth. Concentrations of contaminants and additional analytes such as TOC in the laboratory sediments will be measured as well. The selection of contaminants will be discussed in the Phase 2 RI Work Plan Volume 1.

Potentially confounding factors must also be evaluated and controls established before the start of tests and during the conducting of the tests. Controls and/or monitoring will be conducted for TOC, ammonia, and sulfide following standard protocols. To the extent that modification of standard protocols may be required due to the high TOC content of some of the Study Area sediments, discussions will be held with USEPA and the laboratory prior to finalization of the test protocols.

One component of the strategy for evaluating potentially confounding factors is to perform testing in reference areas that span a range of conditions (industrialization of the adjacent uplands, CSO impacts). These will be performed in parallel with tests performed using the Study Area sediments, and under the same conditions.

Thus, the data requirements for this line of evidence consist of the survival and growth (and possibly other metrics) of test organisms under laboratory conditions using sediments collected in the Study Area and reference areas. The final design of the program will be developed during Phase 2, with the goal of also completing the final toxicity tests during Phase 2.

The analysis of these data will follow standard approaches. The biological responses (e.g., survival) will be compared with contaminant concentrations in sediment and porewater graphically to explore possible concentration-response relationships. These relationships will be tested statistically as well. Responses will be control-corrected. Responses measured in reference area sediments will be incorporated into these analyses to support distinguishing any potential impacts of site-related contaminant releases from contaminants present in regional background, as well as from confounding factors such as organic enrichment, and to evaluate the degree of uncertainty in the risk estimates of the CERCLA hazardous substances caused by these factors.

The results of the benthic toxicity tests will be integrated with the results of the other two legs of the triad (benthic community structure and sediment chemistry), as well as the bioaccumulation tests. A weight-of-evidence approach will be taken, relying not only on statistical significance but also on an understanding of underlying biological mechanisms and the consistency amongst all the benthic lines of evidence.

8.5.4 Tissue Residues

Risk question:

- **Is the accumulation of contaminants from Study Area surface sediments in *Neanthes* sufficient to cause adverse effects to receptors represented by test organisms, and to consumers of prey represented by test organisms?**

Exposure will be assessed using a body burden (critical body residue) approach for benthic invertebrates. This measurement endpoint takes into account every exposure pathway. Tissue concentrations will also be used as part of the dietary intake for selected fish and avian receptors.

It is likely that it will be difficult or impossible to collect sufficient biomass of benthic invertebrates to measure bioaccumulation in the field. Therefore, laboratory bioaccumulation tests will be performed using commonly used test organisms (e.g., the polychaete *Neanthes virens* [formerly known as *Nereis virens*]; the selection of the test organism will be discussed in the Phase 2 RI Work Plan Volume 1) and standard procedures. Tests will be performed using the Study Area sediments to evaluate the potential for differences in contaminant bioavailability. The selection of contaminants will be discussed in the Phase 2 RI Work Plan Volume 1. Initial testing of Study Area sediments with these organisms is recommended and will be discussed with USEPA to finalize organism selection and test design.

Tissue-based threshold effect concentrations will be evaluated. The primary source of tissue-based effect concentrations is the U.S. Army Corps of Engineers ERED (2013). The ERED is a compilation of literature effects data from studies published between 1964 and 2011 in which tissue concentrations were measured in invertebrates along with a biological response. A copy of the most current database (last updated July 2013) will be obtained from the U.S. Army Corps of Engineers. At present, the database contains only those results where an observed effect is reported as being directly related to a chemical in the tissue. The ERED includes the effects data presented in Jarvinen and Ankley (1999), as well as multiple other sources. This will be the primary source for selection of effects thresholds for the BERA. A review of the ERED sources, as well as other literature sources, will be performed during the BERA to identify any additional studies that could add to the body of information currently available for selecting measures of effect.

Data requirements for this endpoint are bioaccumulation test results performed in the laboratory using sediments collected from the Study Area.
Measurements will consist of contaminant concentrations in benthic invertebrate tissue, along with concentrations of the same contaminants and supplementary analytes in sediment that may be important for interpretation (e.g., TOC, soot carbon, AVS/SEM, porewater contaminant concentrations).

The analysis will involve comparison of measured tissue concentrations with the distribution of reported invertebrate tissue residues found in the ERED, supplemented by other literature sources as appropriate.

Both point estimates (the HQ approach, expressed as the ratio of the estimated body burden to the critical body burden) and concentration-response relationships will be used, where published data support it. The extent to which critical body burdens are exceeded will be evaluated and considered in light of the likelihood of population-level effects. Both NOED/NOAEL and LOED/LOAEL values will be considered in the analysis. The final set of metrics for comparing Study Area values with ERED results will be developed following an analysis of the data.

In addition, the extent of bioaccumulation will be evaluated by comparing matched bulk sediment and porewater contaminant concentrations with the invertebrate tissue concentrations. If appropriate, biota-sediment accumulation factors (BSAFs) will be calculated. Regression techniques will also be considered.

8.5.5 Risk Characterization

The weight-of-evidence approach to risk characterization for the benthic invertebrate community will be based on the following five lines of evidence discussed in the preceding subsections:

- Sediment and sediment porewater chemistry
- Benthic community structure
- Sediment toxicity
- Tissue residues
- Surface water chemistry

The weight given to each line of evidence will depend on its reliability, considering the following:

- **Site-specificity**. Responses measured directly in the Study Area (e.g., sediment toxicity and benthic community structure) will be given priority over more generic analyses, in particular, comparison with published benchmarks.

- **Statistical considerations.** The weight given to relationships between biological response and concentrations of individual analytes will be considered in light of the strength of correlations, as well as the contribution of outliers.
- **Uncertainty.** Concentration/response relationships in toxicity studies, correlations between benthic community structure, and potential causative factors, as well as bioaccumulation tests, can exhibit considerable uncertainty. Lines of evidence that exhibit relatively greater uncertainty will be given less weight.

In addition, these five lines of evidence will include an evaluation of site-specific chemical bioavailability, both for the purpose of assessing overall risk and for evaluating the relative contributions of individual analytes or analyte groups to risk. Several parameters are included in the Phase 2 RI Work Plan Volume 1 that will permit evaluation of bioavailability, some of which are measurement endpoints in their own right, and some of which are additional measurements. These will provide supporting evidence regarding the potential role of specific contaminants in any observed biological responses. They include the following:

- **Organic carbon content**. Carbon normalization of the concentrations of certain contaminants can provide a more realistic representation of bioavailability.
- **Soot carbon content**. Soot carbon generally sorbs organic compounds to a much greater degree than natural organic carbon. The concentration of soot carbon will provide a line of evidence regarding the potential bioavailability of organic compounds.
- **ΣSEM/AVS and ΣSEM-AVS/foc**. This is a measure of the bioavailability of divalent metals.
- **Porewater chemical concentrations**. Porewater data provide a direct measure of chemical bioavailability, and will permit evaluation of the relative bioavailability of chemicals in the Study Area compared with reference areas.

The risk characterization will also include an evaluation of confounding factors as indicated in Section 8.5.2 for the benthic community and Section 8.5.3 for toxicity testing. These analyses will provide information on the uncertainties associated with the risk estimates of the CERCLA contaminants because of other stressors in the Study Area and will evaluate the degree to which these other stressors contribute to the total risk estimates.

8.6 Risk Analysis Plan for Epibenthic Decapods

Risk question:

- **Is the accumulation of contaminants in blue crab tissue sufficient to cause adverse effects to blue crab, and to consumers of prey represented by crab?**

Exposure of epibenthic decapods to contaminants occurs via direct exposure to water and sediment, and indirectly through their diet. Potential effects on epibenthic populations will be assessed using a body burden (critical body residue) approach. This measurement endpoint takes into account all exposure pathways. Tissue concentrations will also be used as part of the dietary intake for selected fish, avian, and mammalian receptors.

The assessment design for epibenthic decapods focuses on the collection of tissues, measurement of contaminant concentrations, and comparison of these concentrations with tissue residue benchmarks. Tissues will be collected in the reference areas as well, to support an evaluation of the role of site-related releases of contaminants.

Blue crab will be targeted to represent epibenthic decapods in the Study Area. Blue crabs measuring less than or equal to 7.5 cm in length will be targeted; for blue crabs larger than this size class, exposure will likely be averaged over an area larger than the Study Area, and thus, their body burdens would likely not reflect Study Area-related releases. Water quality parameters (e.g., DO, temperature) will be measured in bottom waters at the time of collection. The selection of contaminants will be discussed in the Phase 2 RI Work Plan Volume 1.

The analysis will be the same as for the bioaccumulation tests for benthic invertebrates; the ERED will be the primary source for selection of effects thresholds for the BERA. A review of the ERED sources, as well as other literature sources, will be performed during the BERA to identify any additional studies that could add to the body of information currently available for selecting measures of effect.

The approach to analysis will be similar to the approach used for the benthic invertebrate bioaccumulation endpoint. Both point estimates (the HQ approach, expressed as the ratio of

the estimated body burden to the critical body burden) and concentration-response relationships will be used, where published data support it. The extent to which critical body burdens are exceeded will be evaluated and considered in light of the likelihood of population-level effects. Both NOED/NOAEL and LOED/LOAEL values will be considered in the analysis. In addition, the relationship between sediment and tissue concentrations will be evaluated graphically and statistically; this will be performed using Phase 1 and Phase 2 surface sediment data averaged over sub-areas of the Study Area that match the location of capture of the crabs. Sub-areas will be selected based on an evaluation of the Phase 1 and Phase 2 data. Finally, tissue concentrations measured in the Study Area and in the reference areas will be compared graphically (e.g., box plots) and statistically (e.g., ANOVA) to determine the contribution of site-related releases of contaminants.

Similar to the risk characterization for benthic macroinvertebrates, the risk characterization for epibenthic decapods will also include an evaluation of confounding factors (see Section 8.10). Likewise, these analyses will provide information on the uncertainties associated with the risk estimates of the CERCLA contaminants because of other stressors in the Study Area and will evaluate the degree to which these other stressors contribute to the total risk estimates.

8.7 Risk Analysis Plan for Amphibians and Reptiles

Risk question:

- **Do amphibians and reptiles occur in or use the Study Area to the extent that exposure to contaminants in surface water and surface sediments may impair survival, growth, or reproduction?**

As discussed in Section 5.2.3, no amphibians or reptiles were observed during the Phase 1 surveys. Although some species of turtles have been observed in the New York Harbor Estuary, as discussed, they mostly inhabit Long Island Sound and Peconic and Southern Bay. The lack of salt marshes and available upland habitat in the Study Area means that it is very unlikely reptiles would be present in the Study Area. Given the limitations of the Study Area to provide suitable habitat for these species, amphibians and reptiles will only be evaluated qualitatively in the BERA. This will build upon the qualitative evaluation

presented in Section 5.2.3, by further evaluating the potential for the Study Area to provide suitable habitat for these species.

8.8 Risk Analysis Plan for Fish

Fish are identified in Section 5 as being potentially exposed to contaminants at the site. Exposure can occur by direct exposure to water and sediment, and indirectly through their diet.

Potential risks to fish will be assessed using several lines of evidence. These include comparing contaminant concentrations in surface water to surface water toxicity-based values for fish, comparing tissue residues measured in field-collected fish with critical body residues from the literature, and comparing contaminant dose received via dietary intake to dose-based TRVs.

8.8.1 Surface Water Chemistry

Risk question:

- **Are the levels of contaminants in surface water and porewater from the Study Area greater than surface water toxicity-based values for the survival, growth, and reproduction of resident fish, and the survival of migratory fish?**

The data needs for this line of evidence consist of surface water and porewater contaminant concentrations. As previously discussed, an extensive sampling program was conducted in the Study Area in Phase 1 that included the collection of monthly samples at multiple locations (Anchor QEA 2013b, 2013c, 2013f). It is anticipated that this dataset will form the primary source of surface water data for this component of the risk assessment. Phase 2 measurements will include water column measurements in the reference areas to assess the extent to which contaminant concentrations in the Study Area represent site-related releases. For comparability with the Phase 2 reference data, a limited program of surface water sampling will be conducted during Phase 2 in the Study Area. Porewater data collected as part of the benthic invertebrate sediment quality triad program described in Section 8.5 will be used as one line of evidence to evaluate potential risks to fish.

Surface water and porewater contaminant concentrations (e.g., 95-percent UCL) will be compared with published benchmarks and toxicity-based values for the protection of resident and migratory fish. Concentrations exceeding the benchmarks and toxicity-based values will be considered in the risk characterization weight of evidence. The analysis of these data will be similar to that described for plankton in Section 8.2, using graphical presentation of the data and statistical testing for comparison with toxicity-based values as well as with reference area data.

As for other receptors, the evaluations will be performed for the entire Study Area as well as sub-areas where appropriate. The sub-areas will be delineated based on an analysis of spatial patterns in the Phase 1 and Phase 2 data.

8.8.2 Tissue Residues

Risk questions:

- **Are the levels of contaminants in whole-body spot and mummichog from the Study Area greater than critical body residues for the survival, growth, and reproduction of fish, and to consumers of prey represented by spot and mummichog?**
- **Are the levels of contaminants in whole-body striped bass from the Study Area greater than critical body residues for the survival of migratory fish?**

The data needs for this line of evidence include the concentrations of contaminants in whole-body samples of spot, mummichog, and striped bass. Spot and mummichog measuring less than or equal to 15 cm in length will be targeted because these are likely to exhibit sufficient site fidelity so that their body burdens represent site exposure. For fish larger than this size class (e.g., striped bass), exposure will likely be averaged over an area larger than the Study Area, resulting in body burdens that do not reflect Study Area exposure. Tissue concentrations in spot and mummichog will be used as part of the dietary intake for selected fish, avian, and mammalian receptors.

Fish will also be collected in the reference areas to support an assessment of the role of site-related contaminant releases.

The measure of effect for this measurement endpoint will be tissue-based threshold effect concentrations for survival. The primary source of tissue-based effect concentrations is the ERED. As for invertebrates, a review of the ERED sources, as well as other literature sources, will be performed during the BERA to identify any additional studies that could add to the body of information currently available for selecting measures of effect. Both NOED/NOAEL and LOED/LOAEL values will be considered.

The approach to analysis will be similar to the approach used for the benthic and epibenthic invertebrate bioaccumulation endpoint. However, the analysis will focus solely on survival because of the water quality classification of SD for Newtown Creek. Both point estimates and concentration-response relationships will be used (the HQ approach, expressed as the ratio of the estimated body burden to the critical body burden), where published data support it. The extent to which critical body burdens are exceeded will be evaluated and considered in light of the likelihood of population-level effects. Both NOED/NOAEL and LOED/LOAEL values will be considered in the analysis. Data may be averaged over sub-areas of the Study Area, depending on spatial patterns that may be observed in the Phase 2 data. Finally, tissue concentrations measured in the Study Area and in the reference areas will be compared graphically (e.g., box plots) and statistically (e.g., ANOVA) to determine the contribution of site-related releases of contaminants.

8.8.3 Dietary Intake

Risk question:

- **Do the estimated average daily doses of selected bioaccumulative contaminants in the diets of the fish receptors exceed dose-based TRVs for the survival, growth, and reproduction of resident fish, and the survival of migratory fish?**

Data needs for this line of evidence include the concentrations of contaminants in the tissues of benthic and epibenthic invertebrates and in sediments (for incidental ingestion). The selection of contaminants will be discussed in the Phase 2 RI Work Plan Volume 1. The TDI, or dose, will be calculated using the same approach as that for wildlife (see Section 8.8), with the exception that ingestion of water is not included for fish.

The bioaccumulation tests that will be performed as a measurement endpoint for benthic invertebrates will provide the necessary benthic invertebrate prey item data. Tissue residues measured in field-collected blue crab will provide the data needed for the epibenthic prey items. Sediment data are available from Phase 1 and will be supplemented with Phase 2 data. These programs also include reference area data. Additional data needs will be discussed in the Phase 2 RI Work Plan Volume 1.

The measure of effect for this measurement endpoint will be prey-based threshold effect concentrations, either measured as concentration in food (milligram per kilogram [mg/kg]) or as dose (mg/kg per day). TRV(s) will be selected based on a literature search. Both NOED/NOAEL and LOED/LOAEL values will be considered.

The approach to analysis will be similar to the approach used for the fish body burden approach. Both point estimates (the HQ approach, expressed as the ratio of the estimated EPC to the TRV) and dose-response relationships will be used, where published data support it. The extent to which TRVs are exceeded will be evaluated and considered in light of the likelihood of population-level effects. Both NOED/NOAEL and LOED/LOAEL values will be considered. Data may be averaged over sub-areas of the Study Area, depending on spatial patterns that may be observed in the Phase 2 data. Finally, prey concentrations measured in the Study Area and in the reference areas will be compared graphically (e.g., box plots) and statistically (e.g., ANOVA) to determine the contribution of site-related releases of contaminants.

8.8.4 Fish Community Surveys

Risk question:

- **Is the abundance and diversity of the fish community in the Study Area similar to that of reference area locations?**

The data need for the fish community surveys consists of abundance of individuals by species, including characterization of life stage (adult, juvenile). The methods used in the Phase 1 surveys will be used in Phase 2.

The analysis of these data will include calculation of metrics such as abundance, species diversity, and species richness. The fish community survey will be used as a supporting line of evidence in the risk assessment but not as a quantitative measurement endpoint, for several reasons. First, the fish community of the Study Area is likely tightly associated with fish populations that range throughout the larger New York/New Jersey Harbor area; thus, the composition of the fish community in the Study Area likely reflects regional factors acting on the population. Second, habitat conditions (e.g., food availability, DO) are likely a dominant factor controlling the extent to which regional fish populations make use of the Study Area. Thus, the evaluation of the potential impacts of site-related contaminants on the fish community would probably be a third-order phenomenon, impossible to distinguish from regional and habitat-related factors. Finally, to adequately characterize the fish community at any one location to perform a rigorous community assessment, multiple monitoring events would be needed. The fish community surveys that are planned for Phase 2 in the Study Area and reference areas, along with the Phase 1 surveys, will provide only 2 years of information, which is insufficient to do such a rigorous assessment. In sum, fish community surveys will be conducted during Phase 2, and the information from these surveys will be used as a qualitative line of evidence in the characterization of risks to the Study Area fish.

8.8.5 Risk Characterization

The weight-of-evidence approach to risk characterization will be based on the following three lines of evidence discussed in the previous subsections:

- Surface water chemistry
- Tissue residues
- Dietary intake

The weight given to each line of evidence will depend on its reliability, considering the following:

- **Ecological relevance of toxicity-based values, critical body residues, and dose-based TRVs.** These measures of effect can vary in reliability due to the selection of endpoint; endpoints related to potential population-level impacts (e.g., survival will

be considered more appropriate than endpoints with a less direct relationship [e.g., biochemical or behavioral responses]).

- **Reliability of toxicity-based values, critical body residues, and dose-based TRVs.** Measures of effect will be considered more reliable to the extent that they are based on studies with multiple dose levels and adequate quality control. Measures of effect developed based on species that may be present in the Study Area will be considered more appropriate than measures of effects based on, for example, freshwater species.
- **The relative reliability of the critical tissue residue versus dietary dose-based approaches for specific chemicals.** For example, the body burden approach is considered relatively uncertain for metals (USEPA 2007). The reliability of each approach will be considered on a chemical-specific basis.
- **Uncertainty.** The uncertainty associated with each line of evidence will be included in the interpretation of the data, including variation in observed water column and biota tissue concentrations, as well as uncertainty in the parameters that comprise the dietary dose calculation.

The fish community metrics will be incorporated in a qualitative fashion. Community metrics (e.g., abundance, richness, and diversity) measured in the Study Area will be compared with the same metrics measured in the reference areas. These comparisons will be interpreted in light of information concerning the range of variation in fish communities in the New York/New Jersey Harbor area, as well as habitat factors that likely affect fish populations in the Study Area.

An evaluation of confounding factors will be an important component of the risk characterization for COPECs. Habitat factors are likely to influence the presence and activity of fish in the Study Area. Risks to populations depend on the extent to which populations make use of the Study Area; many individual fish that are found within the Study Area constitute part of a larger population that may extend throughout the East River or even beyond for migratory species. Population-level impacts of contaminants within the Study Area, therefore, depend on the extent to which members of the larger population feed within the Study Area, which may be limited due to factors that include the size of the waterbody, circulation, DO levels, and availability of prey.

The evaluation of confounding factors will be informed by the fish community surveys. The fish community surveys will provide important information on which species are present and active, as well as their relative abundance. Community surveys in the reference areas within each of the four categories (industrial and non-industrial, CSO-dominated, and sites without large CSOs) will be used to assess the degree to which habitat-related factors may be limiting the ability of fish to use food resources within the Study Area.

USEPA requested that fish community metrics associated with abundance and diversity be included as a measurement endpoint. For several reasons, this document proposes the use of a fish community survey as a supporting line of evidence in the risk assessment but not as a quantitative measurement endpoint. First, the fish community of the Study Area is likely tightly associated with fish populations that range throughout the larger New York/New Jersey Harbor area; thus, the composition of the fish community in the Study Area likely reflects regional factors acting on the population. Second, habitat conditions (e.g., food availability, DO) are likely a dominant factor controlling the extent to which regional fish populations make use of the Study Area. Thus, the evaluation of the potential impacts of site-related contaminants on the fish community would probably be a third-order phenomenon, impossible to distinguish from regional and habitat-related factors. Finally, to adequately characterize the fish community at any one location, multiple monitoring events would be needed. For example, to evaluate a reference condition for biological index development for a benthic community or for fish, multiple tiers of data collection would be needed (Gibson et al. 2000). Although fish community surveys are planned for Phase 2 in the Study Area and reference areas, these will not be completed over multiple years. At most, they will be conducted over two seasons, likely the spring and the summer, for comparison with the Phase 1 surveys in the Study Area. In sum, fish community surveys will be conducted during Phase 2, and it is anticipated that the information from these surveys will be used as a qualitative line of evidence in the characterization of risks to the Study Area fish.

8.9 Risk Analysis Plan for Wildlife (Birds and Mammals)

8.9.1 Contaminant Concentrations in Diet

Risk questions:

- **Are the levels of contaminants in the diets of the bird receptors from the Study Area (including invertebrates and whole-body fish) sufficiently elevated to adversely affect the survival, growth, or reproduction of avian receptors?**
- **Are the levels of contaminants in the diets of the receptor mammals from the Study Area (including invertebrates and whole-body fish) sufficiently elevated to adversely affect the survival, growth, or reproduction of omnivorous mammals?**

Six wildlife receptors—green heron, black-crowned night heron, belted kingfisher, double-crested cormorant, spotted sandpiper, and raccoon—were identified as representative receptors in Section 5. The exposure pathways for wildlife to contaminants identified in Section 6 is through the ingestion of contaminated water, sediment, and/or biota. The primary measure of exposure selected for wildlife is the dietary ingestion exposure pathway.

8.9.1.1 Measures of Exposure

Ingestion exposure will be characterized using a TDI model of the contaminant on a body-weight-normalized basis (milligrams [mg] of contaminant per kg body weight per day [BW/day]). The exposure model representing TDI from environmental media is expressed as follows:

$$TDI_{All} = TDI_{water} + TDI_{sediment} + TDI_{biota} \qquad \text{(Equation 8-1)}$$

where:

TDI_{all} = Total daily intake of contaminant from all sources (e.g., mg COPEC/kg BW/day)

TDI_{water} = Total daily intake of contaminants from incidental and/or drinking water ingestion

$TDI_{sediment}$ = Total daily intake of contaminants from incidental sediment ingestion

TDI_{biota} = Total daily intake of contaminants from ingestion of food items

Exposure models to calculate TDI for different media are discussed in the following subsections.

8.9.1.1.1 Ingestion of Biota

The exposure model for biota ingestion is adapted from the USEPA (1993) and is represented as follows:

$$TDI_{biota} = \left(\sum_{k=1}^{m} \left(C_{k,food} \times IR_k \times EMF_{k,i} \right) \right) \Big/ BW \qquad \text{(Equation 8-2)}$$

where:

TDI_{biota} = Potential average daily dose (mg contaminant/kg BW/day)

$C_{k, food}$ = Contaminant concentration in k^{th} type of food (mg contaminant/kg food)

IR_k = Ingestion rate of k^{th} type of food on dry-weight basis (kg food/kg BW/day)

$EMF_{k,i}$ = Exposure modifying factor for food item *i* (e.g., area use factor, bioavailability)

BW = Receptor body weight (kg)

m = Number of contaminated food types

Each input variable is discussed in more detail in the following sections. Parameterization of each variable for representative receptors is discussed in the following subsections. The chemical concentration in each item of food ($C_{k,food}$) will be measured. However, in the absence of measured concentrations, the chemical concentration in each food item can be estimated using literature-based BSAFs.

Contaminant Concentration in the k^{th} Type of Food ($C_{k, food}$)

Concentrations of contaminants in the diet will be estimated using field-collected tissue data. This term will be specifically defined for each representative receptor depending on its diet. The number of prey groups (k) will be a function of the diet composition of the

representative receptor, including consideration of specific prey species and size of prey, and the availability of empirical site data for different prey groups.

The data requirement for the exposure assessment for wildlife is tissue concentrations in Study Area prey tissue (fish and aquatic invertebrates).

Fish and aquatic invertebrates will be targeted for collection in the Study Area and reference areas and analyzed for the list of contaminants identified for each receptor. Collection and analysis of fish less than or equal to 15 cm in length and invertebrates will be targeted; fish and aquatic invertebrates larger than this size class will rarely, if ever, be consumed by representative receptors. Within the overall target size classes (fish less than or equal to 15 cm; invertebrates less than or equal to 12.5 cm), specific trophic levels and size classes will also be targeted to collect representative data for the different feeding guilds and diet compositions of the wildlife representative receptors. The fish collected for the fish assessment endpoint and the bioaccumulation tests conducted with invertebrates will also provide information needed for the estimation of wildlife exposure. Additional samples in any of these media that may be required for the wildlife assessment endpoint will be discussed in the Phase 2 RI Work Plan Volume 1.

8.9.1.1.2 Incidental Ingestion of Sediment

To account for incidental sediment ingestion, the following equation will be adopted from USEPA (1993):

$$TDI_{sediment} = \left(C_{SD} \times FS \times IR_{total} \times EMF_s\right) / BW \qquad \text{(Equation 8-3)}$$

Where:

$TDI_{sediment}$ = Total daily intake of contaminants through incidental ingestion of sediment (mg/kg BW/day)

C_{SD} = Concentration in the sediment on a dry-weight basis (mg/kg)

FS = Faction of sediment in diet (as percentage of diet on a dry-weight basis; unitless)

IR_{total} = Water ingestion rate on a dry-weight basis; for equations using estimating IR_{total} on a wet-weight basis, conversion to dry-weight ingestion rates would be necessary (mg food/kg BW/day)

EMF_s = Exposure modifying factor for incidental sediment ingestion (e.g., area use factor, bioavailability)

BW = Body weight (kg)

Concentration in Sediment within Foraging Areas (C_{SD})

This term represents the concentration of a contaminant in sediment that a receptor would incidentally ingest while at the site. Incidental ingestion may occur while foraging or handling prey items with sediment on them, or during preening activities. This term will be calculated using whole sediment chemistry data collected at the site. Spatial characterization of sediments to which a receptor may be exposed will be performed on a receptor-specific basis. Some areas of the site may not be available to specific receptors depending on their foraging behavior and other factors (e.g., wading by birds in subtidal areas).

Within the defined foraging area, it is anticipated that receptors will be assumed to average their exposure (i.e., incidental ingestion) over the entire area. Estimates of exposure within a foraging area will be calculated using a surface weighted average concentration.

Fraction of Sediment Ingested

Fraction of sediment ingested will represent the incidental ingestion of sediment during feeding, preening, and other activities. Models are not available to estimate incidental ingestion by wildlife species, and empirical measurements of sediment ingestion are sparse (USEPA 1993; Beyer et al. 1994). Given the uncertainty in this parameter, a range of values will be considered. The primary source for fraction of sediment ingested calculations will be USEPA (1993) and Beyer et al. (1994). For receptors without a reported fraction of sediment ingestion, best professional judgment will be used.

8.9.1.1.3 Total Daily Intake from Water

Due to the brackish nature of the water in the Study Area, the ingestion of surface water as drinking water to satisfy the metabolic needs of birds and mammals is expected to be

minimal. However, incidental ingestion during feeding and preening may occur and will be quantified. Therefore, the TDI_{water} term will be calculated as follows:

$$TDI_{water} = \left(C_{water} \times IR_{water} \times EMF_{w}\right) / BW \qquad \text{(Equation 8-4)}$$

where:

TDI_{water} = Total daily intake of contaminants through incidental ingestion of sediment (mg/kg BW/day)

C_{water} = Concentration in the water (mg/L)

IR_{water} = Food ingestion rate on a liter per kilogram (L/kg) body weight basis

EMF_{w} = Exposure modifying factor for incidental water ingestion (e.g., area use factor, bioavailability)

BW = Body weight (kg)

8.9.1.1.4 Receptor-Specific Model Input Parameters

This section discusses and identifies receptor-specific parameters for representative aquatic-dependent wildlife receptors. Relevant information used to identify model variable inputs is summarized here. For each receptor, the following receptor-specific values were identified:

- Body weight
- Allometric relationships for water consumption and food uptake
- Composition of diet
- Fraction of sediment in diet
- Area use factor (AUF)
- Foraging subareas for the site

All other terms are products of one or more variables above or are based on Study Area-specific values. During the screening level assessment (Anchor QEA 2013a), simplified, conservative assumptions were used regarding the diet of receptors to limit the probability that a contaminant that is likely to pose a substantive risk would be eliminated from the risk assessment prior to the BERA. In general, the most conservative component of a receptor's diet was taken to constitute 100 percent of the diet in the screening and refinement steps (e.g., 100-percent invertebrates in the omnivorous mammal diet). For the development of

receptor-specific input parameters, however, a more critical review of the receptor's diet will be performed and a more precise estimate of different dietary components developed. These diet adjustments will, for example, affect omnivorous mammals and piscivorous birds, which may include components of their diet that are not exposed to Study Area contaminants (e.g., terrestrial animals and plants).

The TDI calculations presented in Equations 8-2, 8-3, and 8-4 assume that a receptor spends 100 percent of its time foraging at the site (i.e., the AUF is equal to 1). For many receptors, this assumption is likely to be overly conservative, particularly if the size of the Study Area is small relative to the foraging area requirements of a particular receptor. The TDI calculations can be modified by the use of AUF values that are less than 1, if this is a valid assumption for the receptor under consideration.

The AUF is a function of a number of different habitat quality and use factors for each of the aquatic-dependent wildlife receptors. For example, Study Area usage by wildlife receptors is affected by the overall size and quality of the habitat in the Study Area, the availability of food, competition with other feeding guilds for food, and potential to migrate or move away from the site. For all the wildlife receptors, the available habitat at the Study Area is not optimal, which may preclude nesting for birds and den building for raccoons near the site. Phase 2 field work will include additional field observations designed to evaluate the relationship between habitat characteristics (e.g., bulkheaded shoreline, sparse vegetation, disturbance), foraging success, and site use by the kingfisher, green heron, and raccoon.

During the completion of the BERA, receptor-specific AUFs will be developed based on information presented in previous documents for the Study Area, along with any additional observations. Information available for the reference areas will be used as well to inform the relative availability of appropriate foraging conditions in the Study Area.

Foraging subareas for the Study Area may be identified for receptors based on their behavioral characteristics relative to the habitat setting of the site. Generally, it is expected that receptors will average their exposure over all foraging areas that are available to them at the site. However, if fragmented habitat occurs within the site and contaminant

concentrations (C_k) vary significantly across foraging subareas, the number of foraging areas may be greater than one.

8.9.1.2 Measures of Effect

Measures of effect for aquatic-dependent wildlife include dietary-based threshold effect concentrations for contaminants. LOAEL- and NOAEL-based TRV values will be included in the evaluation.

As part of the SLERA, the toxicity literature was searched and single-chemistry toxicity data for aquatic-dependent wildlife receptors were compiled. Identification of threshold effect concentrations focused on ecologically relevant effects such as survival, reproduction, and growth. Derivation of TRVs is provided in the selection for SLERA Technical Memorandum No. 1 (Anchor QEA 2012a; see Attachment 1). This will be the primary source for selection of effects thresholds for the BERA. A review of the recent literature will be performed during the BERA to identify any additional studies that could add to the body of information currently available for selecting measures of effect. Any changes to TRVs based on additional studies identified during the BERA will be discussed.

8.9.2 Avian Community Analysis

Risk question:

- **Is the abundance and diversity of the avian community in the Study Area similar to that of reference locations?**

The bird community surveys will provide critical information on which species are present and active, as well as their relative abundance and an estimate of diversity. As for fish, and for the same reasons, the use of a bird community survey will be a supporting line of evidence in the risk assessment but not as a quantitative measurement endpoint. The avian community surveys that are planned for Phase 2 in the Study Area and reference areas, along with the Phase 1 surveys, will provide only 2 years of information, which is insufficient to do such a rigorous assessment. In sum, avian community surveys will be conducted during Phase 2, and the information from these surveys will be used as a qualitative line of evidence in the characterization of risks to the Study Area birds.

8.9.3 Risk Characterization

Potential risks to wildlife due to uptake from surface water and sediment/biota exposure pathways will be characterized by comparing calculated TDI values with TRVs derived from the literature. Both point estimates (the HQ approach, expressed as the ratio of the estimated EPC to the TRV) and dose-response relationships will be used, where published data support it. The extent to which TRVs are exceeded will be evaluated and considered in light of the likelihood of population-level effects. The analysis of these data will include graphical comparisons and statistical testing. These evaluations will be performed for the entire Study Area and will be considered for sub-areas; the sub-areas will be delineated based on an analysis of spatial patterns in the Phase 1 and Phase 2 data. Concentrations measured in the Study Area will be compared graphically and statistically with concentrations measured in the reference areas to provide the information needed to assess releases of the contaminants that are site-related. Uncertainty will be incorporated into the assessment.

The avian community metrics will be incorporated in a qualitative fashion. Community metrics (e.g., diversity, species richness) measured in the Study Area will be compared with the same metrics measured in the reference areas. These comparisons will be interpreted in light of information concerning the range of variation in avian communities in the New York/New Jersey Harbor area, as well as habitat factors that likely affect avian populations in the Study Area.

The weight-of-evidence approach to risk characterization for individual chemicals will consider the following:

- **Ecological relevance of TRVs.** TRVs based on published toxicity studies can vary in reliability due to the selection of endpoint; endpoints related to potential population-level impacts (e.g., survival, reproduction) will be considered more appropriate than endpoints with a less direct relationship (e.g., biochemical or behavioral responses).
- **Reliability of TRVs**. TRVs will be considered more reliable to the extent that they are based on studies with multiple dose levels and adequate quality control. TRVs developed based on species that may be present in Study Area will be considered more appropriate than benchmarks based on species that are unlikely to live in the Study Area.

- **Uncertainty**. The uncertainty associated with each line of evidence will be included in the interpretation of the data, including variation in observed water column and biota tissue concentrations, as well as uncertainty in the parameters that comprise the dietary dose calculation.

The evaluation of potential importance of confounding factors will be a critical component of the risk characterization. Habitat factors are likely to influence the presence and activity of wildlife using the Study Area. Risks to populations depend on the extent to which populations make use of the Study Area; many individual birds that are found using the Study Area constitute part of a larger population that may extend over the East River or even beyond for migratory species. Population-level impacts of contaminants in the Study Area, therefore, depend on the extent to which members of the larger population use the Study Area for feeding, which may be limited due to factors that include the size of the waterbody, circulation, DO levels, and availability of prey.

The bird community surveys will provide critical information on which species are present and active, as well as their relative abundance. Community surveys in the reference areas within each of the four categories (industrial and non-industrial, CSO-dominated, and sites without large CSOs) will be used to assess the degree to which habitat-related factors may be limiting the ability of wildlife to use food resources within the Study Area.

USEPA requested that bird community metrics associated with abundance and diversity be included as a measurement endpoint. As for fish, and for the same reasons, this document proposes the use of a bird community survey as a supporting line of evidence in the risk assessment but not as a quantitative measurement endpoint.

Much of the required data will be collected to satisfy other components of the risk assessment. The bioaccumulation tests that will be performed as a measurement endpoint for benthic invertebrates, along with the field measurements of epibenthic tissue concentrations, will provide estimates of the concentrations of contaminants in invertebrate food. Field measurements of tissue concentrations in small fish will provide estimates of the concentrations of contaminants in fish prey. Sediment and water column data are available from Phase 1 and will be supplemented with Phase 2 data. These programs also include

reference area data. Additional samples in any of these media that may be required for the wildlife assessment endpoint will be discussed in the Phase 2 RI Work Plan Volume 1.

8.10 Confounding Factors

As discussed in the RI/FS Work Plan (see Sections 2.2.1, 2.2.2, and 2.2.3), for an urban waterway such as the Newtown Creek Study Area, physical, chemical, and biological characteristics likely affect biological communities. These confounding factors will result in uncertainties associated with the risk estimates of CERCLA contaminants in the Study Area. These factors include high sediment organic carbon, ammonia, sulfide levels, and low DO levels in the bottom strata of the water column. In addition, physical characteristics such as shoreline modification and biological stressors such as sparse shoreline vegetation are factors that could limit the use of the Study Area by aquatic life and wildlife. These potentially confounding factors are discussed briefly in the following subsection.

8.10.1 Dissolved Oxygen and Organic Carbon

DO is a key determinant of the composition and health of aquatic communities. For example, if low DO conditions are sustained over a period of time, which in temperate regions occurs particularly during summer months when water temperatures are elevated and the bacterial degradation of organic matter is accelerated, the resulting hypoxic (defined as less than 2 mg/L in Gray et al. 2002) or anoxic conditions can impact the benthic communities. Studies by Brown et al. (2000) found more species diversity, greater biota abundance, and higher proportions of certain feeding groups at sites with higher DO (greater than 5 mg/L) than at lower DO (i.e., hypoxic) sites. Dominant species also differed, with crustaceans and mollusks more dominant at high DO sites; although, worms dominated in low DO environments. In an experimental study in the Chesapeake Bay, Llanso (1992) found that intermittent hypoxia resulted in significant decreases in macrobenthic abundance and the local extinction of several worm taxa.

Although it is recognized that sediment organic matter is an important source of food for benthic fauna (Pearson and Rosenberg 1978), at higher concentrations, the benthic community becomes dominated by pollution-tolerant species, until the sediments are so enriched that only bacterial mats are found. As sediment organic carbon increases, DO

decreases, and the levels of toxic by-products such as ammonia and sulfide increase (Diaz and Rosenberg 1995; Hyland et al. 2005; Norton et al. 2002; Pelletier et al. 2011). In a review of models of benthic response to eutrophication, Gray et al. (2002) suggested that the major mechanism by which elevated organic matter affects the benthic community is through the resulting decline in DO.

In Newtown Creek, DO can be reduced due to a combination of factors, including the decomposition of organic matter released from CSOs and organic matter residing in the sediments, decomposition of algal blooms that result from elevated nutrient loads, limited water circulation, and possibly reduced air exchange due to surface oil slicks.

All of these processes are active in the Study Area (NYCDEP 2011; Dueker and O'Mullan 2009). Based on the Phase 1 RI surveys, there are some locations in the Study Area where the sediment organic content is greater than 10 percent, and exceeds 15 percent in a few locations (Anchor QEA 2013b), suggesting that elevated organic matter in the sediments of the creek contribute to reduced DO. Algal blooms resulting from eutrophication are evident in Newtown Creek (Dueker and O'Mullan 2009; NYCDEP 2011), and thus, contributing to organic matter loads to the system. Oil periodically seeps into the creek (NYCDEP 2011), and circulation is limited in the Study Area.

The impacts of these processes on DO in the Study Area are strongly evident. DO measured during the Phase 1 ecological surface water profiling in August 2012 were below the New York State saline surface water SD classification of 3 mg/L at several locations within the Study Area and below 0.5 mg/L at a number of locations in upper portions of the Study Area (Anchor QEA 2013c). Benthic communities in upper portions of the Study Area were absent or very impacted during the August 2012 survey (Anchor QEA 2013c), suggesting an important role of reduced DO in controlling benthic communities in the Study Area.

8.10.2 Salinity

Benthic communities are generally more diverse and more abundant at high-salinity ranges (greater than 25 ppth; Brown et al. 2000; Gaston et al. 1998), and contain less subsurface deposit feeders (Gaston et al. 1998).

Stability in the salinity range is also an important factor. For example, studies in Galveston Bay have shown that benthic communities are more diverse in areas with stable salinity and less diverse where salinity fluctuations are more frequent and over a greater range (Lester and Gonzales 2002). Similarly, in a north Florida estuary, Montague and Ley (1993) observed that the total benthic organism density was negatively correlated with the standard deviation of bottom salinity.

The Study Area can be categorized as polyhaline. Salinity generally ranges between 20 and 25 ppth, occasionally rising to 35 ppth, and surface salinities occasionally dropping to near zero. Thus, both average salinities and variation in salinity may affect benthic communities in the Study Area.

8.10.3 Physical and Biological Characteristics

As described in the RI/FS Work Plan, there are a number of physical characteristics of the Study Area that have the potential to limit its use by aquatic organisms and wildlife. These include periodic dredging for navigation purposes, channelization of the main channel and its tributaries, and disturbance from industrial- and commercial-related activities, as well as bulkheading and filling in of shoreline areas. For example, NYC is proposing to conduct maintenance dredging from the mouth of Newtown Creek up to where the Pulaski Bridge crosses the creek, as well as in the channel close to Whale Creek and the lower reach of Whale Creek itself.

Evidence of extensive bulkheading was observed during the Phase 1 RI surveys—99 percent of the shoreline at the waterline consists of bulkhead material (concrete, metal, wood, rock, and riprap), with only 1 percent categorized as natural, consisting of bare ground or vegetation (see Figures 5-1a through 5-1g). Vegetation, where present, is typically very sparse, and is often located on the bulkhead material. As described in DSR Submittal No. 1

(Anchor QEA 2013b), the Phase 1 RI surveys qualitatively categorized the vegetation as "poor," "moderate," or "good," depending on its overall apparent health. These categories were developed within the context of the heavily urbanized setting for the Study Area, and are as follows:

- **Good** indicates that habitat contained all three canopy layers of trees, shrubs, and herbaceous groundcover, with a variety of tree and shrub species usually present. Vegetation growth appeared healthy.
- **Moderate** indicates that habitat contained two of the three canopy layers, and patches of bare ground usually present in the understory, with width generally narrow. Vegetation growth appeared stressed.
- **Poor** indicates that habitat typically consisted of patches of grass and weedy herbaceous species with large areas of bare ground, and occasionally included a few isolated trees or shrubs that appeared to be stressed and not healthy.

Less than 14 percent of the Study Area supports "good" vegetation. In addition, although the categories did not account for invasive species, it is noted that non-native plants comprise a significant proportion of the vegetation, including the "good" vegetation. As noted in DSR Submittal No. 1, non-native species are typically better adapted to thrive in disturbed areas than native plant species. The average width of the vegetation is also limited, ranging from just 3 feet for "poor" vegetation to 8 feet for "good" vegetation. This is in contrast to contiguous vegetation into undisturbed inland areas that would be characteristic of pre-developed conditions. Photographs showing examples of the shoreline vegetation in each category are presented on Figures 5-2a through 5-2c. Lastly, no wetlands were identified during the Phase 1 RI surveys and no rooted macrophytes were observed.

For birds that typically feed at the shoreline or by wading in shallow water, such as the green heron, black-crowned night heron, egret, and great blue heron, foraging opportunities are limited by the vertical bulkheads and riprap material. For these birds as well as others, the industrial and commercial activities within the Study Area and adjacent riparian and upland areas surrounding the Study Area disturb and interrupt foraging on a daily basis. For example, a disturbance-free zone up to 100 meters is needed around a potential foraging habitat for the great blue heron (Short and Cooper 1985). Great egrets usually forage in shallow water areas near the margins of wetlands or the banks of inland rivers (Chapman and

Howard 1984). It is also highly likely that the industrial and commercial activities inhibit their breeding and reproductive success. Short and Cooper (1985) report that the great blue heron is so sensitive to human activity that even a casual disturbance may impact successful reproduction. Similarly, for the great egret, human disturbance and habitat alteration are the two factors considered most responsible for its decline (Chapman and Howard 1984).

For the benthic invertebrate community, sediment grain size is known to be a key factor controlling community structure, including species composition, species diversity, and organism abundance. Smaller grain size fractions (silt/clay) have been observed to contain more surface deposit feeding benthos, as opposed to suspension feeders (Rhoads and Young 1970; Levinton 1972; Day et al. 1989; Peterson 1991). Brown et al. (2000) showed that in the northern Gulf of Mexico estuaries, diversity and organism density were lower at muddy versus sandy sites. From the Phase 1 RI surveys, the sediments of the Study Area were found to be predominantly silty muds. Most of the particle sizes were reported to be in the fine to medium silt range. Anthropogenic particles, such as small (less than 1 cm) pieces of plastic and metal, were also present.

Overall, these factors result in a loss of habitat and limit the extent to which aquatic life and wildlife use the Study Area and adjacent riparian and upland areas under current conditions. Possible future conditions will also need to be considered in the BERA as well as in the Feasibility Study (FS) when developing preliminary remediation goals and clean-up levels. Although the impacts of some of these factors may decrease in the future (e.g., a decrease in CSO discharges following implementation of the City-Wide Long-term CSO Control Planning Project and a decrease in low DO levels with implementation of NYC's aeration system), it is likely that the overall performance of the system will continue to be constrained relative to a system less impacted by these confounding factors. One of the strategies for selection of reference areas is to encompass a range of conditions that might reflect future conditions in the Study Area. This is discussed further in Section 8.11.

8.11 Reference and Background Evaluation

The primary objective of the ERA process under CERCLA is to evaluate total risks to ecological receptors at a site. The primary objective of the risk management phase under

CERCLA is to separate site-related risks from total risks, determine whether site-related risks are unacceptable, and develop remedial goals for the site that will reduce unacceptable site-related risks to acceptable levels. As described in the previous section, adverse effects to ecological receptors can occur for reasons that are not related to exposure to site-related COPECs, and data from the site itself cannot be used alone to determine whether adverse effects have occurred solely as a result of exposure to these site-related chemical contaminants. In order to determine whether actual impacts are related to site contamination, site data must be compared with data collected at other sites, which are similar to the site in question in all respects except for the site-related chemical contamination. These data are called "background" data, and the sites where background data are collected are called "reference areas."

Consistent with these objectives, selection of suitable reference areas is a critical component of the Superfund risk assessment process. The CERCLA process explicitly incorporates the concept of reference areas and background information (USEPA 2002). In the risk assessment process, background information is used to support risk management decisions, that is, when determining cleanup goals. It is not used to eliminate COPECs during the risk assessment itself. USEPA guidance entitled *Role of Background in the CERCLA Cleanup Program* (USEPA 2002) includes the following definitions:

- Background: "Substances or locations that are not influenced by releases from a site, and are usually described as naturally occurring or anthropogenic:
  - Naturally occurring – substances present in the environment in forms that have not been influenced by human activity; and
  - Anthropogenic – natural and human-made substances present in the environment as a result of human activities (not specifically related to the CERCLA release in question)."
- Reference Area: "The area where background samples are collected for comparison with samples collected on site. The reference area should have the same physical, chemical, geological, and biological characteristics as the site being investigated, but has not been affected by activities on the site."

USEPA guidance entitled *Selecting and Using Reference Information in Superfund Risk Assessments* (USEPA 1994b) provides the following further clarification on the selection and use of reference areas:

- "Ecological risk assessments at Superfund sites estimate the adverse effects of chemical contaminants on the plant and animal life inhabiting the area associated with the site. This process depends on the collection of data from the impacted areas of the Superfund site; however, these data alone often cannot show whether adverse ecological effects have occurred or might occur as a result of site contamination. To evaluate actual impacts or likely ecological risks more completely, site data normally are compared to reasonable expectations for the site. Such expectations commonly are referred to as reference information.
- Preferably, reference samples are collected from a reference site. Reference sites should match the Superfund site in all aspects except contamination: the former should be upstream, upwind, or higher in the drainage system but otherwise located as close as possible to the latter. A general guideline is to select reference locations that reflect the overall environmental conditions that can reasonably be expected in the site area given current uses other than those associated with the contamination under investigation."

Given the definition of and uses for reference areas, the primary use of reference areas is to establish conditions for site-specific, CERCLA-related releases. This overall use of reference areas defines the following two specific objectives for data collected in reference areas:

- **Reference comparison** is performed to determine whether potential risks to ecological receptors measured in the Study Area are different from reasonable expectations for the site in the absence of CERCLA-related releases. Specifically, this can include comparisons of the results of benthic toxicity and benthic community studies and evaluations of doses to wildlife receptors, as well as the overall use of the site and reference areas by wildlife populations. This specific use of reference area data allows for the evaluation of total risks versus site-related risks within the Study Area.
- **Background chemistry** is used to determine what the chemical signature would be at the site in the absence of CERCLA-related releases to the Study Area. This specific use allows for the determination of the level of risk reduction that is achievable at the

site. Sometimes risk assessments result in target chemical concentrations that are lower than background, which refers to the concentration to which a site would be re-contaminated if it were remediated to a lower concentration.

8.11.1 Reference Area Selection Process

For Newtown Creek, the selection of the appropriate reference condition is complicated by the fact that there is no unimpacted upstream location and no nearby waterbody that is sufficiently similar. The approach taken to address this issue involves the selection of several reference areas that span a range of conditions, including sites within the NYC urban area that exhibit a range of industrialization in the bordering upland areas, and a range of CSO impacts. The reference area selection process for the BERA and the Newtown Creek RI has focused to date on identifying candidate reference areas that are suitable for one or both of the anticipated uses for reference areas, as previously described. The RI/FS Work Plan described the overall selection process, including some of the important physical, chemical, and biological attributes of the Study Area to consider in the selection of reference areas, and also proposed a preliminary list of candidate reference sites. Subsequent documents and memoranda completed during the period from November 2011 through October 2012 expanded the list of candidate reference areas and refined the list of attributes that should be considered in the selection process. These documents and memoranda include the following:

- *Reference Area Selection Technical Memorandum* (Anchor QEA 2011a)
- *Phase 1 Remedial Investigation Work Plan Addendum* (Anchor QEA 2012c)
- *Phase 1 Remedial Investigation Work Plan Addendum: Reference Area Memorandum* (Anchor QEA 2012d)
- *Phase 1 Remedial Investigation Work Plan Addendum: Reference Area Memorandum No. 2* (Anchor QEA 2012e)

The most important outcome of this process was a decision to collect reconnaissance-level sediment chemistry (chemical contaminants, TOC, and percent fines), surface water column conventional parameters, and shoreline/habitat observational data at a selected number of candidate reference areas in October 2012. Multiple discussions with USEPA to select the candidate sites where data would be collected resulted in the following important decisions:

- Candidate reference areas would be grouped into four categories based on the degree of industrialization within and surrounding the candidate reference area and the degree to which CSO discharges influence conditions within the candidate reference area. The four categories are as follows:
  - Industrialized/with CSOs
  - Industrialized/without CSOs
  - Non-industrialized/with CSOs
  - Non-industrialized/without CSOs
- The list of 34 candidate reference areas that had been identified to date was reduced to a smaller, more-manageable list of 18 areas that were: 1) judged to span the range of industrialization and CSO influence captured within the four defined categories; 2) geographically widespread throughout the NYC metropolitan area; 3) on balance, deemed the most physically, chemically, and biologically similar to the Study Area; and/or 4) considered to be suitable for collection of background COPEC data.

Ultimately, 14 areas were selected for reconnaissance sampling. Four other areas were also considered to be suitable for ongoing consideration but were not included in the reconnaissance sampling effort. The 18 candidate reference areas are listed in Table 8-1 and are grouped by category.

The results of the reconnaissance sampling program are reported in DSR Submittal No. 2 and *Phase 1 Remedial Investigation Field Program Data Summary Report – Submittal No. 3* (Anchor QEA 2013c, 2013f). These data, when combined with other available data in some of the 18 candidate reference areas from historical studies, and ongoing evaluations of readily available data from aerial photographs and National Oceanic and Atmospheric Administration (NOAA) charts, provide an adequate dataset to narrow down the list of 18 candidate reference areas to an appropriate number that will be used in the BERA.

8.11.2 Determination of Background Contamination

Background contamination will be determined based on several lines of evidence. In addition to the measurements of COPECs in the reference areas, COPEC concentrations will be measured in Study Area CSO discharges (described in the Phase 2 RI Work Plan

Volume 1), and in sediments and on water column particulates collected near the mouth of Newtown Creek (described in the Phase 2 RI Work Plan Volume 1). In addition, non-project regional data that are of sufficient quality will be considered (Anchor QEA 2012f). All of these data will be incorporated into a weight-of-evidence evaluation of background contamination.

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TABLES

Table 7-1
Newtown Creek Ecological Data Quality Objectives, Data Needs, Assessment Measurement Endpoints, and Risk Questions for the Baseline Ecological Risk Assessment

Receptor Group	Assessment Endpoint	Representative Receptor	Candidate Measurement Endpoint	Data Quality Objective	Use in Ecological Risk Assessment	Risk Question	Data Need	Background or Reference
Aquatic plants	Survival and growth of aquatic plants	Phytoplankton	Contaminant concentrations in surface water	Evaluate the potential effects of contaminants on phytoplankton	Comparison of contaminant concentrations in surface water to surface water toxicity-based values for phytoplankton	Are the levels of contaminants in surface water from the Study Area greater than surface water toxicity-based values for the survival or growth of phytoplankton?	Contaminant concentrations in surface water	Background
		Aquatic macrophytes	None – qualitative only	Qualitatively evaluate the potential for exposure of aquatic macrophytes to contaminants in water and sediments of the Study Area	Qualitative evaluation of exposure potential to contaminants in surface water and surface sediments	Do aquatic macrophytes occur in the Study Area to the extent that exposure to contaminants in surface water and surface sediments may impair survival and growth?	Qualitative evaluation of exposure potential for aquatic plants	NA
Zooplankton	Survival, growth, and reproduction of zooplankton	Zooplankton	Contaminant concentrations in surface water	Evaluate the potential effects of contaminants on zooplankton	Comparison of contaminant concentrations in surface water to surface water toxicity-based values for zooplankton	Are the levels of contaminants in surface water from the Study Area greater than surface water toxicity-based values for the survival, growth, or reproduction of zooplankton?	Contaminant concentrations in surface water	Background
Bivalves	Survival, growth, and reproduction of bivalves	Mussels	Contaminant concentrations in surface water	Evaluate the potential effects of contaminants on bivalves	Comparison of contaminant concentrations in surface water to surface water toxicity-based values for bivalves	Are the levels of contaminants in surface water from the Study Area greater than surface water toxicity-based values for the survival, growth, or reproduction of bivalves?	Contaminant concentrations in surface water	Background
			Selected bioaccumulative contaminant concentrations in tissue	Evaluate the bioaccumulation of contaminants by bivalves in the Study Area and provide input to food web model	Comparison of contaminant concentrations in mussel tissue to critical body residues for bivalves and for input into food web models for selected avian and mammalian receptors	Is the accumulation of bioaccumulative contaminants in mussels sufficient to cause adverse effects to Study Area bivalves? Are the levels of contaminants in the mussels from the Study Area sufficiently elevated to adversely affect the survival, growth, or reproduction of selected avian and mammalian receptors?	Contaminant concentrations in mussel tissue	NA

Table 7-1
Newtown Creek Ecological Data Quality Objectives, Data Needs, Assessment Measurement Endpoints, and Risk Questions for the Baseline Ecological Risk Assessment

Receptor Group	Assessment Endpoint	Representative Receptor	Candidate Measurement Endpoint	Data Quality Objective	Use in Ecological Risk Assessment	Risk Question	Data Need	Background or Reference
Benthic macroinvertebrates (BMI)	Survival, growth, and reproduction of BMI	BMI	Contaminant concentrations in surface water, surface sediment, and porewater	Evaluate the potential effects of contaminants on BMI	Comparison of contaminant concentrations in surface water, surface sediment, and porewater to benchmarks for benthic invertebrates	Are the levels of contaminants in surface water, surface sediment, and porewater from the Study Area greater than benchmarks for the survival, growth, or reproduction of BMI?	Contaminant concentrations in surface water, surface sediment, and porewater	Background
			BMI community metrics associated with abundance and diversity	Evaluate the abundance and diversity of the BMI community in the Study Area in comparison to that of reference and regional locations	Comparison of metrics to reference locations	Is the abundance and diversity of the BMI community in the Study Area similar to that of reference locations?	BMI survey	Reference
			Ampelisca or *Leptocheirus* 10-day laboratory toxicity tests (survival)	Evaluate the toxicity of Study Area sediments to *Ampelisca* or *Leptocheirus*	Comparison of survival of amphipods in Study Area sediments to reference area sediments	Do Study Area surface sediments exhibit similar toxicity to *Ampelisca* or *Leptocheirus* as reference area sediments?	Toxicity test	Lab control[1] and reference
			Leptocheirus 28-day laboratory toxicity tests on survival, growth, and reproduction	Evaluate the toxicity of Newtown Creek sediments to *Leptocheirus*	Comparison of survival, growth, and reproduction of amphipods in Study Area sediments to reference area sediments	Do Study Area surface sediments exhibit similar toxicity to *Leptocheirus* as reference area sediments?	Toxicity test	Lab control[1] and reference
			Bioaccumulation in 28-day laboratory bioaccumulation tests with *Neanthes* (formerly known as *Nereis*)	Evaluate the bioaccumulation of contaminants by BMI in the Study Area and provide input to food web models	Comparison of contaminant concentrations in tissue to critical body residues for BMI; input into food web models	Is the accumulation of contaminants from Study Area surface sediments in *Neanthes* sufficient to cause adverse effects to receptors represented by test organisms, and to consumers of prey represented by test organisms?	Bioaccumulation test	Lab control[1]
Epibenthic/decapod macroinvertebrates	Survival, growth, and reproduction of blue crab	Blue crab	Selected bioaccumulative contaminant concentrations in blue crab soft tissue	Evaluate the potential effects of contaminants on epibenthic invertebrates in the Study Area; evaluate the relationship between sediment and blue crab contaminant concentrations, including calculation of BSAFs and including uncertainty analysis associated with various mathematical formulations of the relationship; and provide input to food web models	Comparison of contaminant concentrations in tissue to critical body residues for invertebrates and for input into food web models	Is the accumulation of bioaccumulative contaminants in blue crab tissues sufficient to cause adverse effects to blue crab, and to consumers of prey represented by crab?	Contaminant concentrations in blue crab soft tissue	Background
Amphibians and reptiles	Survival, growth, and reproduction of amphibians and reptiles	Amphibians and reptiles	Qualitative general discussion regarding potential exposure of amphibians and reptiles and potential likelihood of effects to amphibians and reptiles from contaminants in the sediment and surface water in the Study Area	Qualitatively evaluate the potential for exposure of amphibians and reptiles to contaminants in water and sediment of the Study Area	Qualitative evaluation of exposure potential to contaminants in surface water and surface sediment	Do amphibians and reptiles occur in or use the Study Area to the extent that exposure to contaminants in surface water and surface sediments may impair survival, growth, or reproduction?	Qualitative evaluation of exposure potential for amphibians and reptiles	NA

Table 7-1
Newtown Creek Ecological Data Quality Objectives, Data Needs, Assessment Measurement Endpoints, and Risk Questions for the Baseline Ecological Risk Assessment

Receptor Group	Assessment Endpoint	Representative Receptor	Candidate Measurement Endpoint	Data Quality Objective	Use in Ecological Risk Assessment	Risk Question	Data Need	Background or Reference
Fish	Survival, growth, and reproduction of resident fish and survival of migratory fish	Fish (general)	Contaminant concentrations in surface water and porewater	Evaluate the potential effects of contaminants on fish in the Study Area	Comparison of contaminant concentrations in surface water and porewater to surface water toxicity-based values for fish	Are the levels of contaminants in surface water and porewater from the Study Area greater than surface water toxicity-based values for the survival, growth, or reproduction of fish?	Contaminant concentrations in surface water and porewater	Background
			Fish community metrics associated with abundance and diversity	Fish community metrics associated with abundance and diversity in the Study Area and reference areas	Evaluate qualitatively the abundance and diversity of the fish community in the Study Area creek in comparison to that of reference areas and	Is the abundance and diversity of the fish community in the Study Area similar to that of reference area locations?	Fish surveys in the Study Area and reference areas	Reference
		Spot, mummichog, and striped bass	Contaminant concentrations in the diets of spot, mummichog, and striped bass	Evaluate the dose received by fish through dietary exposures	Food web modeling and comparison with TRVs	Do the estimated average daily doses of selected bioaccumulative contaminants in the diets of the fish receptors exceed dose-based TRVs for the survival, growth, and reproduction of resident fish, and the survival of migratory fish?	Selected contaminant concentrations in BMI (based on the results of laboratory bioaccumulation tests), epibenthic decapods (based on field-collected blue crab), and fish (based on field-collected fish)	Background
		Spot	Contaminant concentrations in whole-body spot	Evaluate the potential for contaminants to impact fish using the Study Area	Comparison of contaminant concentrations in whole-body spot to critical body residues and for input into food web models	Are the levels of contaminants in whole-body spot from the Study Area greater than critical body residues for the survival, growth, and reproduction of fish, and to consumers of prey represented by spot?	Contaminant concentrations in whole-body spot	Background
		Mummichog	Contaminant concentrations in whole-body mummichog	Evaluate the potential for contaminants to impact fish using the Study Area	Comparison of contaminant concentrations in whole-body mummichog to critical body residues and for input into food web models	Are the levels of contaminants in whole-body mummichog from the Study Area greater than critical body residues for the survival, growth, and reproduction of fish, and to consumers of prey represented by mummichog?	Contaminant concentrations in whole-body mummichog	Background
		Striped bass	Contaminant concentrations in whole-body striped bass	Evaluate the potential for contaminants to impact fish using the Study Area	Comparison of contaminant concentrations in whole-body striped bass to critical body residues	Are the levels of contaminants in whole-body striped bass from the Study Area greater than critical body residues for the survival of migratory fish?	Contaminant concentrations in whole-body striped bass	Background

Table 7-1
Newtown Creek Ecological Data Quality Objectives, Data Needs, Assessment
Measurement Endpoints, and Risk Questions for the Baseline Ecological Risk Assessment

Receptor Group	Assessment Endpoint	Representative Receptor	Candidate Measurement Endpoint	Data Quality Objective	Use in Ecological Risk Assessment	Risk Question	Data Need	Background or Reference
Birds	Survival, growth, and reproduction of piscivorous, invertivorous, and sediment-probing birds	Birds (general)	Avian community metrics associated with abundance and estimated diversity	Avian community metrics associated with abundance and estimated diversity in the Study Area and reference areas	Evaluate qualitatively the abundance and estimated diversity of the avian community in the Study Area in comparison to that of reference areas, and regional locations	Is the abundance and estimated diversity of the avian community in the Study Area similar to that of reference locations?	Avian surveys in the Study Area and reference areas	Reference
		Belted kingfisher, double-crested cormorant, green heron, black-crowned night heron, spotted sandpiper	Contaminant concentrations in environmental media ingested by piscivorous, invertivorous, and sediment-probing birds	Evaluate the dietary exposure to birds using the Study Area	Food web modeling	Are the levels of contaminants in the diets of the bird receptors from the Study Area (including invertebrates and whole-body fish) sufficiently elevated to adversely affect the survival, growth, or reproduction of avian receptors?	Contaminant concentrations in surface water (drinking water), surface sediment (incidental ingestion), and prey (BMI, bivalves, blue crab, and whole-body fish[2])	Background
Mammals	Survival, growth, and reproduction of omnivorous mammals	Raccoon	Contaminant concentrations in environmental media ingested by omnivorous mammals)	Evaluate a range of dietary exposure to omnivorous mammals using the Study Area	Food web modeling	Are the levels of contaminants in the diets of the receptor mammals from the Study Area (including invertebrates and whole-body fish) sufficiently elevated to adversely affect the survival, growth, or reproduction of omnivorous mammals?	Contaminant concentrations in surface water (drinking water), surface sediment (incidental ingestion), and prey (bivalves, blue crab, and whole-body fish[2])	Background

Notes:.
1 = The purpose of the laboratory control is to assess the acceptability of the test and for normalizing test results.
2 = Fish prey for these receptors include forage fish (mummichog, Atlantic menhaden, Atlantic silverside) and spot.
BMI = benthic macroinvertebrates
BSAF = biota-sediment accumulation factor
NA = not applicable
TRV = toxicity reference value

Table 8-1
Candidate Reference Area Matrix

Category	With CSO	Without CSO
Industrial	Westchester Creek, Brooklyn Navy Yard, Flushing Creek, Coney Island Creek	Head of Bay, Steinway Creek, Mill Basin, Lower East River/Newtown Creek, **Gowanus Bay, Red Hook/Atlantic Basin**
Non-Industrial	Spring Creek, Fresh Creek Basin, Upper East River/Throgs Neck, **Lower Bronx River**	Gerritsen Creek, Hendrix Creek, Sheepshead Bay, **Alley Creek**

Notes:
Reference areas listed in **blue** were not sampled during the October 2012 reconnaissance sampling effort.
CSO = combined sewer overflow

FIGURES

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ANCHOR QEA

Figure 5-1a
Study Area Shoreline Material and Vegetation Health
BERA Problem Formulation
Newtown Creek RI/FS

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ANCHOR QEA

Figure 5-1b
Study Area Shoreline Material and Vegetation Health
BERA Problem Formulation
Newtown Creek RI/FS

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ANCHOR QEA

Figure 5-1c
Study Area Shoreline Material and Vegetation Health
BERA Problem Formulation
Newtown Creek RI/FS

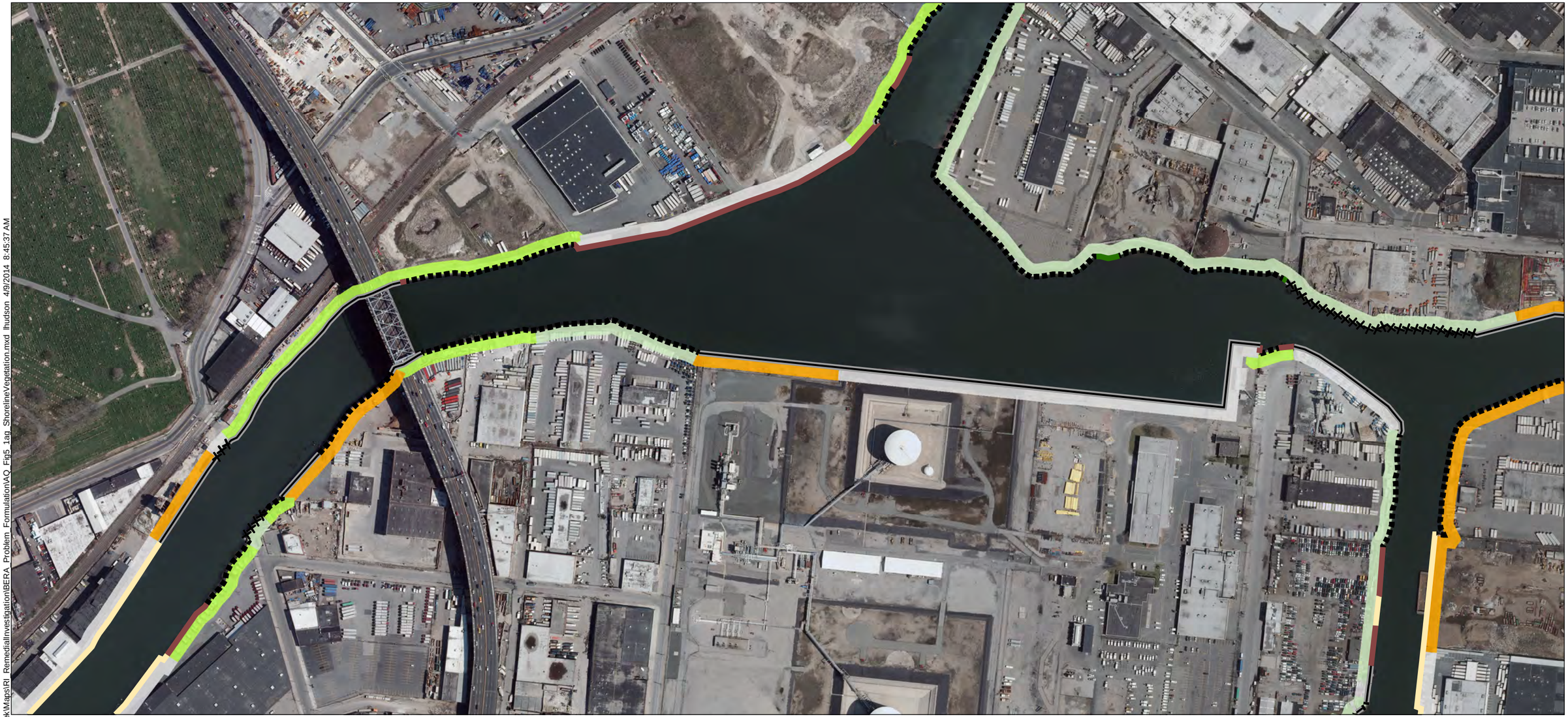

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Figure 5-1d
Study Area Shoreline Material and Vegetation Health
BERA Problem Formulation
Newtown Creek RI/FS

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ANCHOR QEA

Figure 5-1e
Study Area Shoreline Material and Vegetation Health
BERA Problem Formulation
Newtown Creek RI/FS

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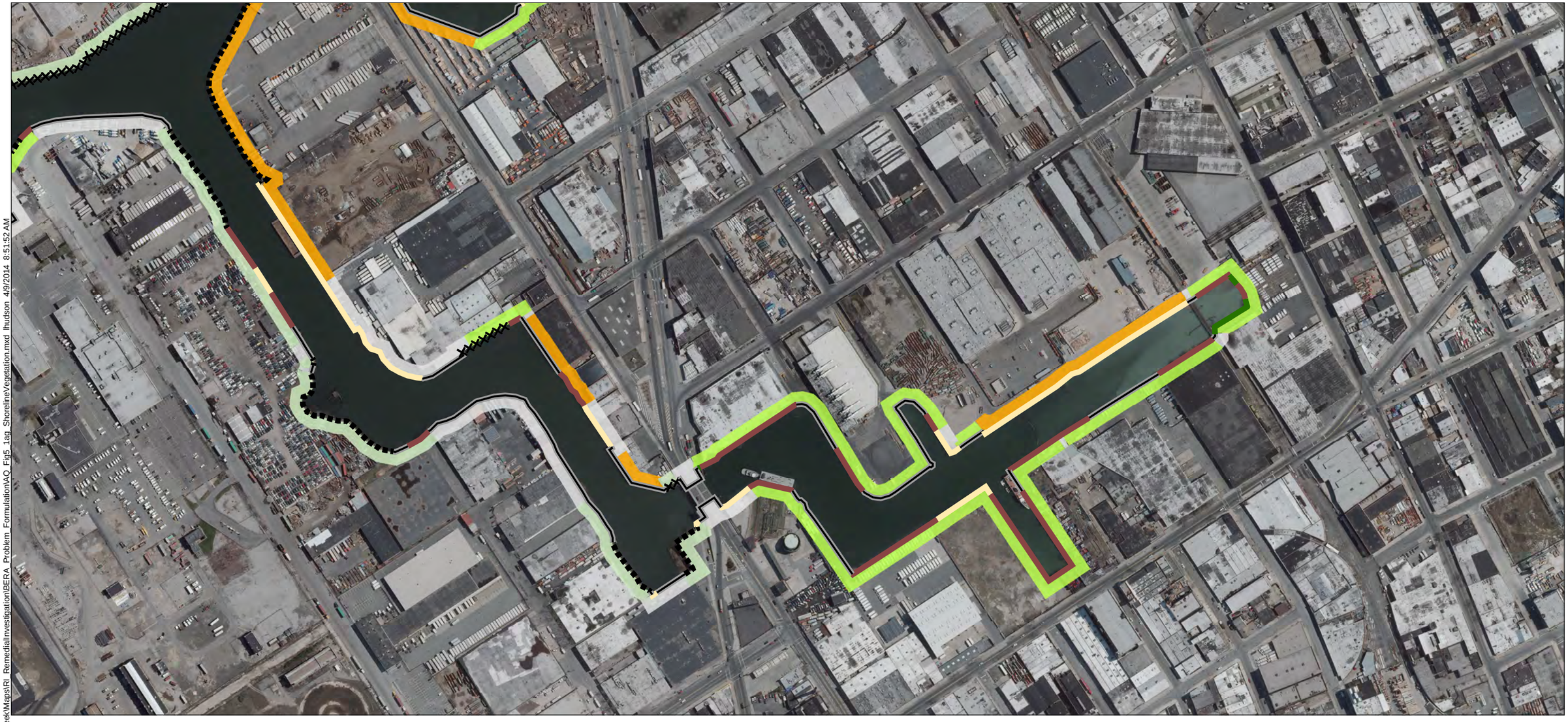
ANCHOR QEA

Figure 5-1f
Study Area Shoreline Material and Vegetation Health
BERA Problem Formulation
Newtown Creek RI/FS



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ANCHOR QEA

Figure 5-1g
Study Area Shoreline Material and Vegetation Health
BERA Problem Formulation
Newtown Creek RI/FS

Newtown Creek Section 1

Dutch Kills

Figure 5-2a
Phase 1 Habitat Survey – "Poor" Vegetation (Average Width 3.0 feet)
BERA Problem Formulation
Newtown Creek RI/FS

ANCHOR QEA

Newtown Creek Section 1

Dutch Kills

ANCHOR QEA

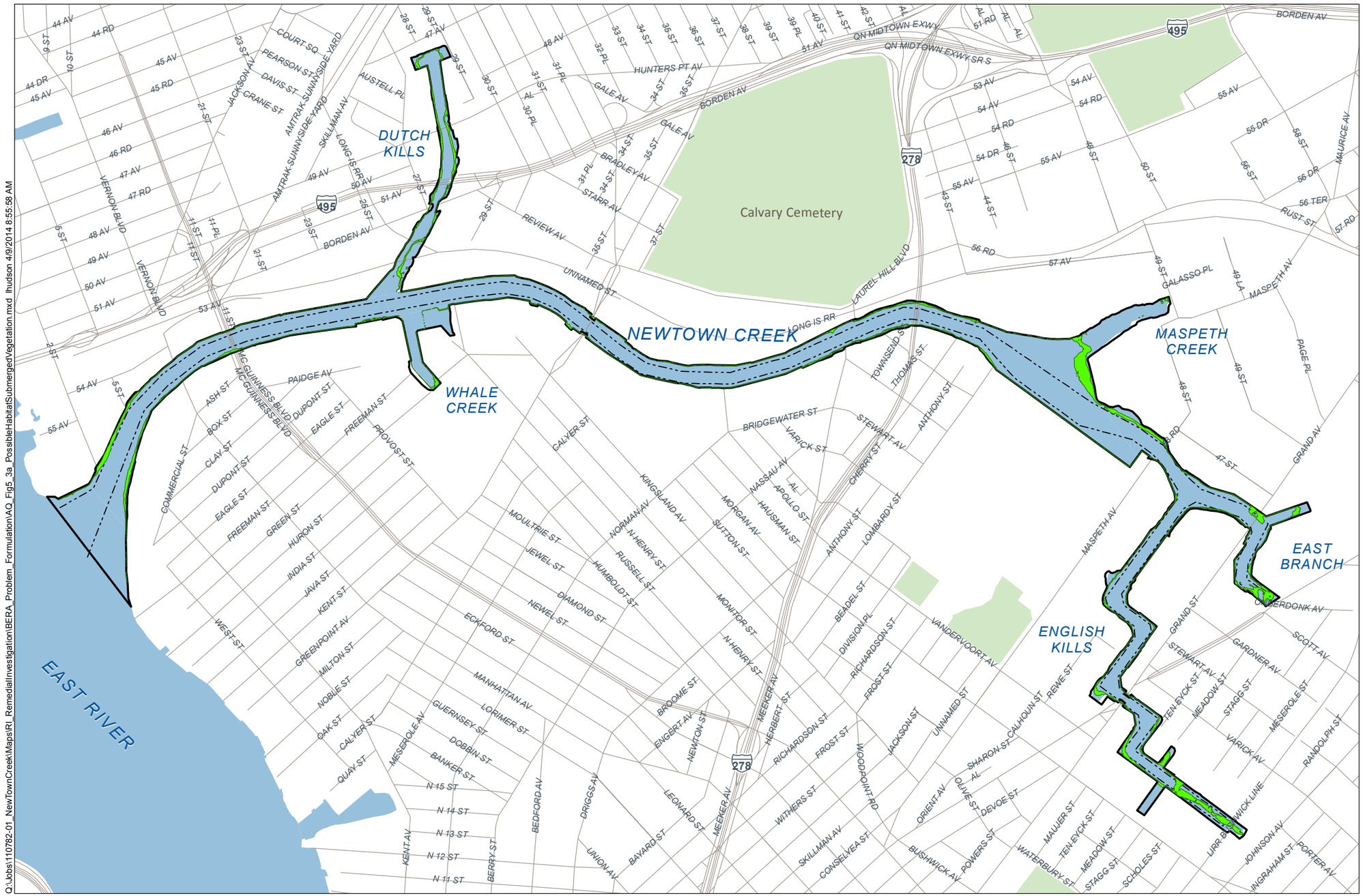
Figure 5-2b
Phase 1 Habitat Survey – "Moderate" Vegetation (Average Width 6.7 feet)
BERA Problem Formulation
Newtown Creek RI/FS

Maspeth Creek

Newtown Creek Section 3

ANCHOR QEA

Figure 5-2c
Phase 1 Habitat Survey – "Good" Vegetation (Average Width 8 feet)
BERA Problem Formulation
Newtown Creek RI/FS



LEGEND

- Submerged Aquatic Vegetation
  ≤ -4.41 ft and ≥ -7.3 ft (NAVD88)
  ≤ -4.11 ft and ≥ -7 ft (MWL) *
- Newtown Creek Study Area
- Waterbody
- Open Space

Notes:
* Mean low water (MLW) is 2.11 feet below the mean water level (MWL), which occurs at -0.3 foot North American Vertical Datum of 1988 (NAVD88) in Newtown Creek.
Submerged aquatic vegetation was mapped from 2 feet below MLW (-4.41 feet NAVD88/-4.11 feet below MWL) to 7 feet below MWL (-7.3 feet NAVD88). These elevations were set to account for potential wave exposure and dessication (Koch 2001) and to account for light attenuation (Phillips 1960).

0 500 1,000 1,500 Feet

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ANCHOR QEA

Figure 5-3a
Possible Habitat Suitable for Submerged Aquatic Vegetation
BERA Problem Formulation
Newtown Creek RI/FS

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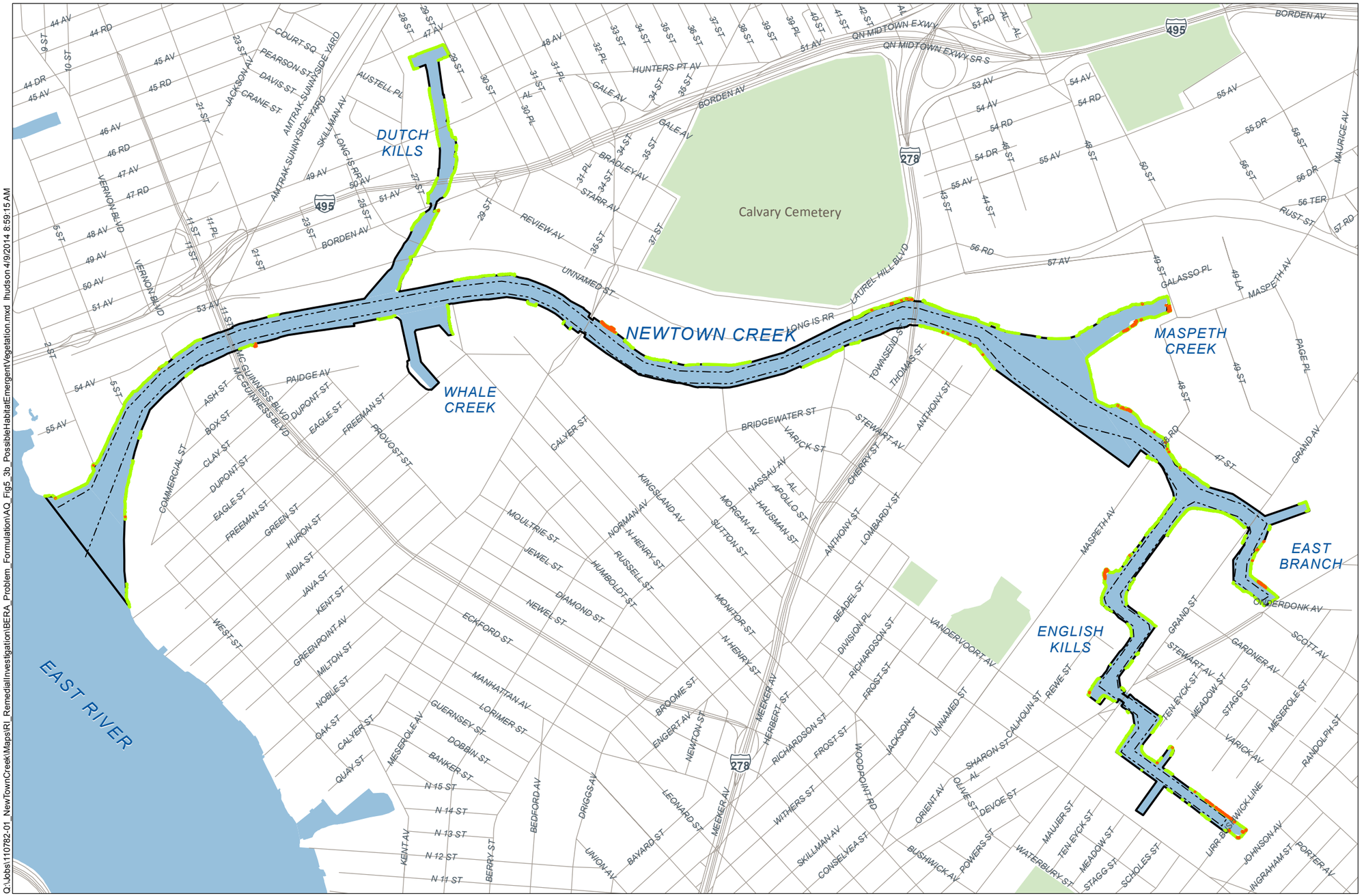


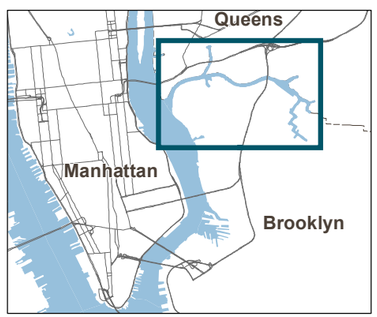
LEGEND

Emergent Vegetation ≥ -0.3 ft (NAVD88) *

- Slope > 10%
- Slope < 10%
- Newtown Creek Study Area
- Waterbody
- Open Space

Notes:
* The lower limit of emergent vegetation was set at the mean water level (MWL) (-0.3 foot North American Vertical Datum of 1988 (NAVD88)), as measured at the Williamsburg Bridge Station. This elevation was set based on Dreyer and Neiring (1995).

0 500 1,000 1,500 Feet



ANCHOR QEA

Figure 5-3b
Possible Habitat Suitable for Emergent Vegetation
BERA Problem Formulation
Newtown Creek RI/FS

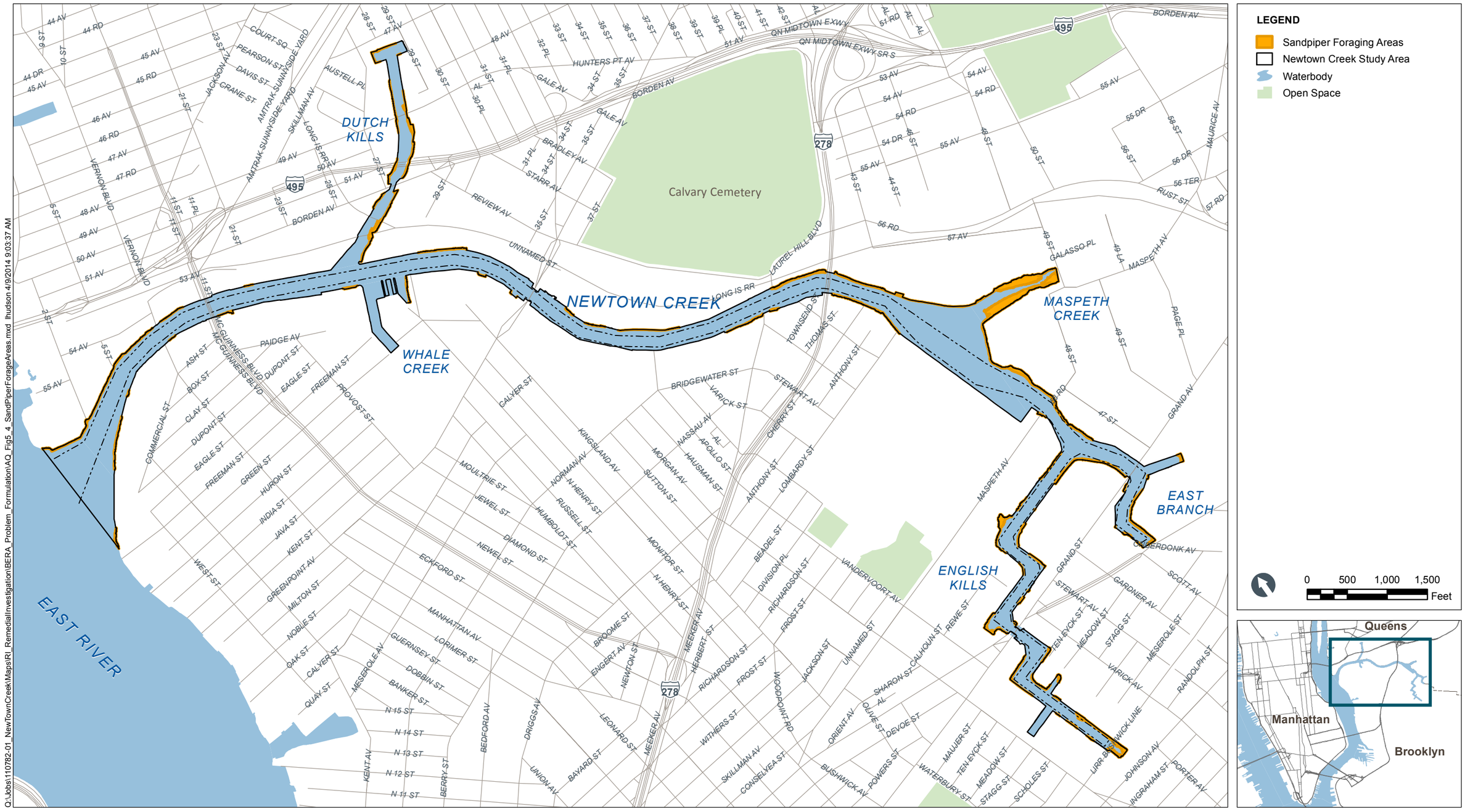


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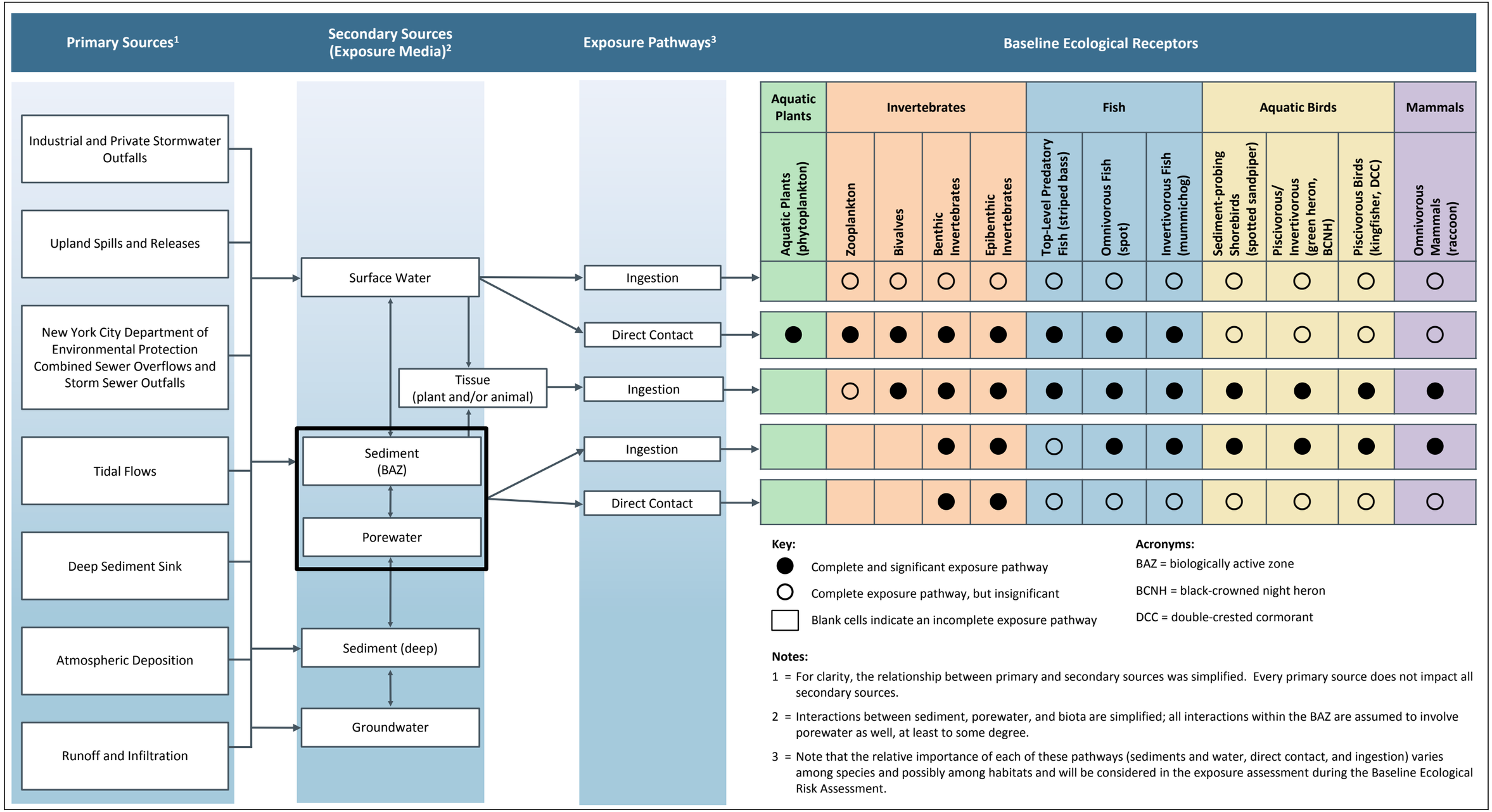
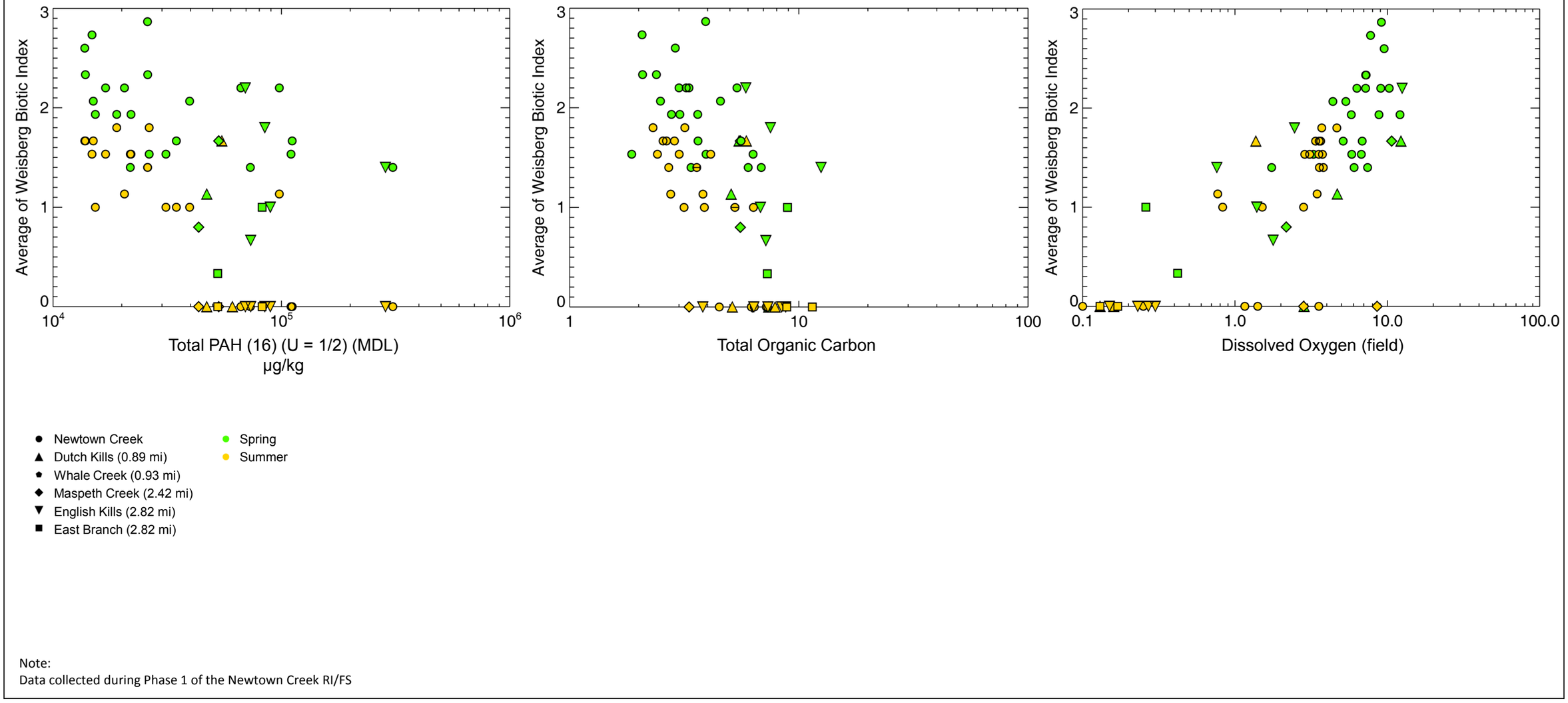
Figure 5-4
Maximum Spatial Extent of Potential Sandpiper Foraging Habitat in the Study Area
BERA Problem Formulation
Newtown Creek RI/FS



ANCHOR QEA

Figure 6-1
Refined Conceptual Site Model
BERA Problem Formulation
Newtown Creek RI/FS



Note:
Data collected during Phase 1 of the Newtown Creek RI/FS

ANCHOR QEA

Figure 8-1
Example of One Approach to the Analysis of Benthic Community Structure, Incorporating Confounding Factors
BERA Problem Formulation
Newtown Creek RI/FS

ATTACHMENT 1
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT TECHNICAL MEMORANDUM NO. 2

DRAFT
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT: TECHNICAL MEMORANDUM NO. 2 IDENTIFICATION OF PRELIMINARY COPECS

REMEDIAL INVESTIGATION/FEASIBILITY STUDY, NEWTOWN CREEK

Prepared by

Anchor QEA, LLC

305 West Grand Avenue, Suite 300

Montvale, New Jersey 07645

August 2013

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT:
TECHNICAL MEMORANDUM NO. 2
IDENTIFICATION OF PRELIMINARY COPECs
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
NEWTOWN CREEK

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August 2013

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LIST OF ACRONYMS AND ABBREVIATIONS

µm	micrometer
95% UCL	95 percent upper confidence limit of the arithmetic mean
Anchor	Anchor Environmental, L.L.C.
Anchor QEA	Anchor QEA, LLC
AOC	Administrative Order on Consent
ATSDR	Agency for Toxic Substances and Disease Registry
BAF	bioaccumulation factor
BERA	Baseline Ecological Risk Assessment
BSAF	biota-sediment accumulation factor
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
COPEC	constituent of potential ecological concern
CSM	conceptual site model
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DDx	2,4' and 4,4'-DDD, -DDE, -DDT
DSR Submittal No. 1	*Phase 1 Remedial Investigation Field Program Data Summary Report – Submittal No. 1*
EPC	exposure point concentration
FOD	frequency of detection
HPAH	high-molecular-weight polycyclic aromatic hydrocarbon
HQ	hazard quotient
kg	kilogram
LPAH	low-molecular-weight polycyclic aromatic hydrocarbon
MDAC	minimum data acceptance criteria
mg	milligram
NOAEL	no-observable adverse effect level
NYCDEP	New York City Department of Environmental Protection

NYCDEP	New York State Department of Environmental Conservation
OU6 RI	*Remedial Investigation Report, Operable Unit 6*
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PF	problem formulation
RI/FS Work Plan	*Remedial Investigation/Feasibility Study Work Plan*
SAV	submerged aquatic vegetation
SLERA	Screening Level Ecological Risk Assessment
SLERA Technical Memorandum No. 1	Screening Level Risk Assessment: Technical Memorandum No. 1
SL	screening level
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TEF	toxicity equivalent factor
TEQ	toxicity equivalent
TDI	total daily intake
TRV	toxicity reference value
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
WHO	World Health Organization

EXECUTIVE SUMMARY

This document constitutes the second Screening Level Ecological Risk Assessment (SLERA) technical memorandum of the Newtown Creek Phase 1 Remedial Investigation (RI). It presents the results of the ecological screening level risk analyses using the Phase 1 RI data. The first SLERA technical memorandum (SLERA Technical Memorandum No. 1) presented the approach and the screening levels to be used in risk analyses.

The analyses are based on the direct exposure to organisms from contaminants in the surface water and surface sediment of the Study Area, as well as the indirect exposure of birds and mammals to bioaccumulative contaminants in their diet. As envisioned in the *Remedial Investigation/Feasibility Study Work Plan* (AECOM 2011), the overall approach consists of several steps. For the direct exposure pathways, the first step is the most conservative, comparing maximum surface water or sediment concentrations to Tier 1 screening levels (SLs). The Tier 1 SLs are New York Marine Screening Benchmarks recommended by USEPA (2010). For surface water, these are either New York State water quality standards and guidance values (NYSDEC 1998) or USEPA chronic water quality criteria (2009). For sediment, these are the New York State guidance values for screening contaminated sediments (NYSDEC 1999). A refined screen is performed in a second step that includes a screen based on the frequency of detection followed by a screen that compares the 95 percent upper confidence limit of the arithmetic mean (95% UCL) surface water or sediment concentration against Tier 2 SLs. The Tier 2 SLs were selected from a variety of sources, including standards, guidelines, and benchmarks from other state agencies or recognized literature sources.

For wildlife, only those chemicals considered by USEPA to be potentially bioaccumulative were selected for evaluation in the first step. In a second step, the total daily intake (TDI) of a chemical was compared to a dose-based toxicity reference value (TRV) for that chemical. The birds and mammals selected for evaluation included the sandpiper, the double crested cormorant, the green heron, and the raccoon. These species were selected as representative of different feeding guilds and are based on observations made in the Study Area and adjacent shoreline. Consistent with a screening level analysis, conservative assumptions were used in generating exposure concentrations and deriving TDIs for wildlife.

A summary of the preliminary constituents of potential ecological concern (COPECs) identified based on the screening level analyses is presented in Table ES-1. Seven chemicals were identified as COPECs for surface water. These include cyanide, three metals, carbon disulfide, total 2,4′ and 4,4′-DDD, -DDE, -DDT (DDx), and polychlorinated biphenyl (PCB) Aroclors. For the direct sediment exposure pathway, 51 compounds were identified as COPECs, including 14 metals; 21 polycyclic aromatic hydrocarbon (PAHs; total high-molecular-weight PAH [HPAH], low-molecular-weight PAH [LPAH], and PAH); 4,4-dichlorodiphenyldichloroethylene (DDD), dichlorodiphenyldichloroethylene (DDE), and dichlorodiphenyltrichloroethane (DDT), as well as total DDx; alpha chlordane and total chlordane; dioxin/furans; Aroclor 1254, total PCB Aroclors, and total PCB congeners; and two semivolatile organic compounds, 1,1-biphenyl and bis(2-ethylhexyl)phthalate. For wildlife, 34 of the Phase 1 analytes were identified as COPECs based on maximum TDIs, while 28 were identified as COPECs based on 95% UCL TDIs. Of the 28, this included nine metals, methyl mercury, the HPAHs and total PAHs as a group, PCBs as Aroclors, total congeners, and as congener toxicity equivalents, dioxin/furans and one pesticide, dieldrin.

1 INTRODUCTION

This technical memorandum presents the screening level risk analyses that comprise the Newtown Creek Screening Level Ecological Risk Assessment (SLERA).

This document was envisioned in the *Screening Level Risk Assessment: Technical Memorandum No. 1* (SLERA Technical Memorandum No. 1; Anchor QEA 2012a; see Attachment 1). The SLERA Technical Memorandum No. 1 reflected the approach described in the *Remedial Investigation/Feasibility Study Work Plan* (RI/FS Work Plan; AECOM 2011). Furthermore, the final version of SLERA Technical Memorandum No. 1 addressed comments provided by the U.S. Environmental Protection Agency (USEPA) Region 2 on a draft version of the memorandum, as well as follow-up conference calls with USEPA Region 2 during its finalization.

In SLERA Technical Memorandum No. 1, the SLERA Technical Memorandum No. 2 was described as follows: "In Technical Memorandum No. 2, the SLERA analyses will be presented. This will involve comparing the Phase 1 surface water and sediment data, along with any useable historical data, to the SLs presented in Technical Memorandum No. 1. Any modifications to the SLs presented in Technical Memorandum No. 1 that result from agency discussions will be incorporated."

The analyses presented here are based on the direct exposure to organisms from contaminants in the surface water and surface sediment, as well as the indirect exposure of birds and mammals to bioaccumulative contaminants in their diet. Consistent with a screening level analysis, conservative assumptions were used in generating exposure concentrations and deriving total daily intakes (TDIs) for wildlife. Further refinement of the constituents of potential ecological concern (COPECs) is discussed in the baseline ecological risk assessment (BERA) problem formulation (PF). These refinements include consideration of naturally occurring concentrations, the magnitude of the hazard quotients (HQs), and the spatial distribution of the COPECs in the Study Area. Once a final list of COPECs has been identified, the BERA risk analyses will use more realistic assumptions to identify the constituents of concern (COCs). These assumptions are presented in the BERA PF and

described in more detail in the Phase 2 Remedial Investigation (RI) Work Plan. The Phase 2 RI Work Plan will also describe the data needed to support the BERA risk analyses.

The remainder of this technical memorandum is organized in the following manner. The chemistry data used for the screening analyses is discussed in Section 2. The surface water and sediment direct screening analyses are presented in Section 3. By way of introduction, this section also includes an overview of the screening process and the screening levels (SLs) used. The screening analyses for the indirect exposure of wildlife are presented in Section 4, which also includes an overview of the process and the toxicity reference values (TRVs) used. Conclusions are presented in Section 5, and references are included in Section 6.

2 DATA USED FOR THE SCREENING LEVEL ANALYSES

The surface water and surface sediment chemistry data used in these analyses were collected as part of the *Phase 1 Remedial Investigation Field Program Data Summary Report – Submittal No. 1* (DSR Submittal No. 1; Anchor QEA 2013a). As discussed in the SLERA Technical Memorandum No. 1, data collected from the Newtown Creek Study Area[1] under three previous programs were evaluated for use in the screening analyses. The three programs were as follows: 1) *Expanded Site Inspection Report Newtown Creek Brooklyn/Queens, New York*. (Weston Solutions 2009); 2) *Maintenance Dredging Newtown Creek and Whale Creek Canal Analytical Report – Sediment* (NYCDEP 2009); and 3) *Remedial Investigation Report, Operable Unit 6* (OU6 RI; Anchor 2007). These were the only programs referred to in the RI/FS Work Plan and the only programs evaluated for these analyses. Data from two of these programs (Weston Solutions 2009; NYCDEP 2009) did not meet all of the minimum data acceptance criteria (MDACs) prescribed in the draft *Data Applicability Report* (Anchor QEA 2012b); these data were not considered suitable for quantitative risk analyses. Data from the third program, the draft OU6 RI (Anchor 2007), did meet all the MDACs. However, because of differences in analytical methods, the spatial distribution of sample locations, as well as the concentrations of some analytes compared with the Phase 1 data, these data were also not included in the screening analyses (see Attachment 2 for further information on review of the historical OU6 RI data). .

[1] The Newtown Creek Superfund Site Study Area is described in the Administrative Order on Consent (AOC) as encompassing the body of water known as Newtown Creek, situated at the border of the boroughs of Brooklyn (Kings County) and Queens (Queens County) in the City of New York and the State of New York, roughly centered at the geographic coordinates of 40° 42' 54.69" north latitude (40.715192°) and 73° 55' 50.74" west longitude (-73.930762°), having an approximate 3.8-mile reach, including Newtown Creek proper and its five branches (or tributaries) known respectively as Dutch Kills, Maspeth Creek, Whale Creek, East Branch, and English Kills, as well as the sediments below the water and the water column above the sediments, up to and including the landward edge of the shoreline, and including also any bulkheads or riprap containing the waterbody, except where no bulkhead or riprap exists, then the Study Area shall extend to the ordinary high water mark, as defined in 33 Code of Federal Regulations (CFR) §328(e) and the areal extent of the contamination from such area, but not including upland areas beyond the landward edge of the shoreline (notwithstanding that such upland areas may subsequently be identified as sources of contamination to the waterbody and its sediments or that such upland areas may be included within the scope of the Newtown Creek Superfund Site as listed pursuant to Section 105(a)(8) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Phase 1 surface water samples were collected monthly over a 1-year period (February 2012 through January 2013) from 15 stations throughout the Study Area. A 16th station was added in October 2012 to fill a spatial data gap between two existing stations in Newtown Creek. Where depth allowed, water samples were collected from upper and lower depths in the water column, as well as mid-depth. At each depth, samples for volatile organic compounds (VOCs) were collected first using a Kemmerer bottle. Once VOC collection was complete, sample collection for the remaining analytes was performed using two peristaltic pumps and laboratory-supplied sample tubing. Water samples were transferred directly from the sample tubing into laboratory-supplied containers. Subsamples for that analysis of dissolved metals were filtered in the field using 0.45-micrometer (µm) filters. Collected samples were stored on ice and packaged in the field facility prior to pick-up by a laboratory courier.

Surface sediment was collected in the Spring of 2012 from 133 stations in the Study Area for the standard Phase 1 list of analytes and at 25 percent of these for a sub-set of Phase 1 analytes[2].. The samples were collected in transects extending across the channel; at each transect, three samples were collected, one near each bank and one mid-channel. Grab samples were collected from a target depth of 0 to 15 centimeters, primarily using a 0.05-square-meter Ekman sampler. A smaller Ekman was used if the substrate was too dense or where the water depth was too shallow for the sampling vessel. A larger modified van Veen grab was used in locations at the mouth of Newtown Creek, as well as a few other locations with larger grain sizes or debris. Samples were processed in the field on board the sampling vessel. A subsample was taken immediately for VOCs and total sulfides to minimize loss of these analytes.

Sediment for the remaining analyses was then mixed in a stainless steel mixing bowl to a uniform color and texture. Sufficient material was removed from each grab sample, so all jars necessary for all required analyses could be filled from a single homogenate.

[2] Additional sediment samples were collected in the summer of 2012. These were only analyzed for conventional parameters, iron, and manganese and, therefore, were not included in this analysis.

Details on station locations, collection methods, sample processing, analysis, and data quality objectives are described in the project *Field Sampling and Analysis Plan* (Anchor QEA 2011a) and the project *Quality Assurance Project Plan* (Anchor QEA 2011b).

All validated data are maintained in EarthSoft's EQuIS Professional (Version 5.5) data management system. This includes the data qualifiers, method detection limits, reporting limits, and summary statistics. Chemical summations, for example total polychlorinated biphenyl (PCB) congeners, total 2,4′ and 4,4′-DDD, -DDE, -DDT (DDx), high- and low-molecular-weight polycyclic aromatic hydrocarbons (HPAHs and LPAHs), and total polycyclic aromatic hydrocarbons (PAHs) are generated upon output[3].

The Phase 1 data have been reported in three separate DSRs (Anchor QEA 2013a, 2013b, 2013c).

[3] Chemical summations were calculated in two ways, using a value of zero and using one-half the reporting limit. For the screening level analyses, chemical summations calculated using one-half the reporting limit were used.

3 SURFACE WATER AND SEDIMENT SCREENING LEVEL ANALYSES (DIRECT EXPOSURE PATHWAY)

3.1 Screening Level Process

As described in SLERA Technical Memorandum No. 1, organisms that inhabit the water column and those that inhabit or are in close contact with the surface sediment, can be exposed directly to contaminants in the Study Area surface water and surface sediment. For surface water, these organisms include, for example, phytoplankton, zooplankton, ichthyoplankton, as well as pelagic fish. For sediment, these organisms include benthic and epibenthic invertebrates, as well as demersal fish. As described in SLERA Technical Memorandum No.1, the overall process used to evaluate the exposure of these organisms to contaminants in the water column comprises two primary steps (see Figure 1). Step 1 is the most conservative, comparing maximum surface water or sediment concentrations from any location within the Study Area to Tier 1 SLs. The Tier 1 SLs are New York Marine Screening Benchmarks recommended by USEPA (2010). For surface water, these are either New York State water quality standards and guidance values (NYSDEC 1998) or USEPA chronic water quality criteria (2009). For sediment, these are the New York State guidance values for screening contaminated sediments (NYSDEC 1999).

For chemicals exceeding the Tier 1 SL or for chemicals without a Tier 1 SL, a second step was completed. Step 2, a refined screen, differed from the Tier 1 screen in Step 1 as follows:

- The frequency of detection (FOD) of the chemical in the Phase 1 dataset was incorporated.
- The 95 percent upper confidence limit of the arithmetic mean (95% UCL) surface water or sediment concentration was used. These were calculated on a Study Area-wide basis.
- Tier 2 SLs were used.

The Tier 2 SLs were selected, as described in the RI/FS Work Plan and Technical Memorandum No. 2. They originated from a variety of sources, including standards, guidelines, and benchmarks from other state agencies or recognized literature sources. As described in SLERA Technical Memorandum No. 1, a hierarchy was used to select the SLs. All the SLs considered, as well as those selected for screening, were presented in SLERA

Technical Memorandum No. 1 (Appendix A of that document for surface water and Appendix B for sediment).

Chemicals without a Tier 2 SL or chemicals with an FOD less than 5 percent but for which the maximum reporting limit exceeded the SL, were categorized as uncertain COPECs.

The three minor modifications to these steps are as follows:

- First, a preliminary screen was completed as part of Step 1 to eliminate chemicals from the Phase 1 analyte list intended for other purposes. The chemicals that were not included in the SLERA were the following:
  - Chemicals collected for forensic purposes, such as the n-alkanes, isoprenoids, thiophenes, and alkylated PAHs
  - Chemicals considered to be conventional parameters or nutrients, such as ammonia, nitrates, nitrites, Kjeldahl nitrogen, phosphorus, calcium, magnesium, potassium, and sodium
  - Individual chemicals that are evaluated as "totals," such as individual dioxins and furan congeners, and individual PCB congeners
- Second, for chemicals for which the Tier 1 and/or Tier 2 sediment SL was derived on an organic carbon basis, sample-specific organic carbon was used to normalize the sediment dry weight chemical concentration[4].
- Third, Figure 1 has been updated to show the uncertain COPECs as a separate group. These include chemicals with less than 5 percent detected samples but for which the maximum reporting limit exceeded the Tier 2 SL, as well as chemicals for which a Tier 2 SL could not be found.

[4] Screening levels based on equilibrium partitioning are derived on a carbon basis (milligrams [mg] chemical/kilograms [kg] organic carbon). In the RI/FS Work Plan and in the SLERA Technical Memorandum No.1, these were reported on a dry weight basis (mg/kg dry sediment weight) by multiplying by the average carbon content of 8.7 percent, which was calculated using all Study Area data available at the time. The screening level analysis presented here was performed in a more precise manner using each sample's organic carbon content.

3.2 Exposure Point Concentrations

For Step 1 of the SLERA, exposure point concentrations (EPCs) were the maximum detected surface water or sediment concentrations from any sample in the Study Area. If all concentrations for a chemical were qualified as non-detected, half the maximum reporting limit for that chemical was selected as the EPC.

For Step 2, the EPC was defined as the 95% UCL for a given chemical. The 95% UCLs were calculated using USEPA's ProUCL software (Version 4.1). The upper confidence limit (UCL) recommended by ProUCL was used in every case. If a 95% UCL concentration was calculated to be higher than the maximum value, the maximum value was selected instead.

3.3 Screening Level Risk Estimates

3.3.1 Surface Water

The chemicals identified as preliminary COPECs from direct surface water exposure are summarized in Table 1.

The details of the screening analyses are provided in Appendix A. The tables in the appendix provide information on the number of samples collected, the frequency with which the chemicals were detected, the maximum concentration, and whether this is based on a detected or non-detected result, the reporting limits, the 95% UCL concentrations, the Tier 1 or Tier 2 SL, and the hazard quotients (HQs). These tables also provide a short description of the result indicating whether a chemical is identified as a preliminary COPEC, eliminated from further analysis, or identified as an uncertain COPEC. Tables A-1 and A-2 present the Step 1 and Step 2 COPECs, respectively. Table A-3 presents all those chemicals that were eliminated, and Table A-4 shows those chemicals categorized as uncertain COPECs.

Sixteen chemicals were identified as preliminary COPECs in Step 1 based on an HQ of greater than 1.0 (i.e., a maximum concentration exceeding the Tier 1 SL; see Table A-1), and more than 100 were identified as uncertain COPECs due to the lack of a Tier 1 SL. In Step 2, seven chemicals were identified as preliminary COPECs (based on a 95% UCL concentration exceeding the Tier 2 SL; see Table A-2 and Table 1). By including an FOD screen in Step 2, 51 of the chemicals were eliminated due to an FOD of less than five percent and a reporting

limit below the Tier 2 SL (see Table A-3). Fifty two of the chemicals were eliminated based on an HQ of less than 1.0. In contrast to Step 1, only 29 of the chemicals were identified as uncertain due to the lack of a Tier 2 SL, and 29 were identified as uncertain because a reporting limit exceeded the Tier 2 SL (see Table A-4).

For the chemicals identified as preliminary COPECs in Step 2, the HQs ranged from 1.1 for copper and carbon disulfide to 5.2 for barium (see Table 1). The other COPECs include cyanide, aluminum, total dichlorodiphenyl compounds (DDx), and total PCB Aroclors. For cyanide, the screening analyses may be compromised by the lack of information on free cyanide (the toxic fraction). Aluminum and barium may simply reflect concentrations anticipated for estuarine waters in this region. These analytes will be evaluated further in the BERA PF.

Chemicals identified as uncertain COPECs will also be evaluated further in the BERA PF. For most of these, the FOD is less than 5 percent and often zero. Given the large dataset used in the screening analyses and the implementation of a rigorous sample collection and data validation program, it is likely that these chemicals are either not present in the surface water or, if present, are at such low concentrations that they will not be risk drivers. Lastly, with more than 350 surface water samples collected, USEPA's requirement for a dataset with a minimum of 20 samples was met. Therefore, no chemicals were identified as uncertain because of a small sample size.

3.3.2 Sediment

The chemicals identified as COPECs from direct exposure to the Study Area sediment are summarized in Table 2.

Details of the screening analyses are provided in Appendix B. The tables provide the same type of information as that described for the surface water. In these tables, it should be noted that the units indicate those chemicals for which screening levels are derived on a carbon basis (milligrams [mg] chemical/kilograms [kg] organic carbon). Tables B-1 and B-2 present the Step 1 and Step 2 COPECs, respectively. Table B-3 presents all those chemicals that were eliminated, and Table B-4 shows those chemicals categorized as uncertain either due to the lack of an SL or a reporting limit that exceeded the SL.

In Step 1, 36 chemicals were identified as preliminary COPECs based on an HQ of greater than 1.0 (i.e., a maximum concentration exceeding the Tier 1 SL; see Table B-1). Almost 150 of the chemicals were identified as uncertain COPECs due to the lack of a Tier 1 SL. In Step 2, 51 chemicals were identified as preliminary COPECs (based on a 95% UCL concentration exceeding the Tier 2 SL; see Table B-2 and Table 2) [5]. By including a screen based on the FOD in Step 2, 26 of the chemicals were eliminated due to an FOD of less than 5 percent and a reporting limit below the Tier 2 SL. Thirty-eight were eliminated based on an HQ of less than 1.0 (see Table B-3). Forty-five of the chemicals were identified as uncertain due to the lack of a Tier 2 SL, and 31 were identified as uncertain because a reporting limit exceeded the Tier 2 SL (See Table B-4).

For the preliminary COPECs, HQs ranged from slightly higher than 1.0 for barium and manganese to more than 200 for total PCB congeners. Most of the COPECs exhibited HQs between 10 and 100, including cyanide, seven metals, three pesticides, 18 PAHs (as well LPAH and HPAH totals), and 1,1-biphenyl. COPECs with HQs more than 100 included the PCBs, total DDx, three PAHs, and bis(2-ethylhexyl)phthalate.

Similar to the surface water COPECs, chemicals such as aluminum and manganese will be evaluated further in the BERA PF because they may simply reflect naturally occurring concentrations. Likewise, chemicals identified as uncertain COPECs will also be evaluated further in the BERA PF. For many, the FOD is less than 5 percent and often 0. Given the large dataset used in the screening analyses and the implementation of a rigorous sample collection and data validation program, it is likely that these chemicals are either not present in the sediment, or if present, are at such low concentrations that they will not be risk drivers. With more than 140 surface sediment samples collected for the standard analyte list and more than 30 collected for a sub-set of analytes, USEPA's requirement for a dataset with a minimum of 20 samples was met. Therefore, no chemicals were identified as uncertain because of a small sample size.

[5] More chemicals were identified as COPECs in Step 2 than in Step 1 because there were more Tier 2 SLs than Tier 1 SLs.

4 WILDLIFE SCREENING LEVEL ANALYSES (INDIRECT EXPOSURE PATHWAY)

4.1 Selection of Representative Receptors

As discussed in SLERA Technical Memorandum No. 1, final selection of representative receptors for the screening level assessment was to be made following completion of the Phase 1 habitat and shoreline surveys. Those surveys were completed in June 2012, and the findings were reported in DSR Submittal No. 1 (Anchor QEA 2013a).

The receptors proposed in SLERA Technical Memorandum No.1 included the sandpiper, the green heron, and the double-crested cormorant, as semi-aquatic birds representing different feeding guilds. The raccoon was selected as a representative semi-aquatic mammal.

Sandpipers are invertivores that forage by probing for benthic invertebrates in shallow-sloping shorelines and tidal/mud flats. They could be exposed to Study Area chemicals through the ingestion of invertebrates and through the incidental ingestion of sediment. The green heron is a carnivore that also feeds at the edge of the water. This bird could be exposed to Study Area chemicals through the ingestion of small fish and crustaceans, as well as the incidental ingestion of sediment.

Double-crested cormorants are piscivorous and could be exposed to Study Area chemicals by feeding on fish (diving) and possibly by the incidental ingestion of sediment. The raccoon was selected as a representative mammal because it is highly adaptable and often found in urban environments, such as that surrounding the Study Area. They are opportunistic feeders; common foods include berries, nuts, insects, small rodents, and shellfish. In suburban and urban areas, raccoons often forage through trashcans for food. The raccoon could be exposed to Study Area chemicals by foraging at the shoreline for shellfish or occasionally for fish, as well as through the incidental ingestion of sediment.

The results of the Phase 1 surveys support the selection of these receptors for the screening level analyses. Although several other birds were observed within the Study Area and adjacent shoreline, and were also noted by USEPA in their comments on a draft of the SLERA Technical Memorandum No. 1, the ones selected represent a range of feeding guilds and conservative exposure pathways consistent with a screening level assessment. For

example, great blue heron and egrets belong to the same feeding guild as the green heron. However, the green heron was preferentially selected for screening purposes because of its smaller size[6]. Canada geese and mallard ducks were also observed in the Study Area during the Phase 1 surveys. Both are herbivorous and feed primarily on vegetation and occasionally on aquatic invertebrates. Because no submerged aquatic vegetation was observed during the Phase 1 surveys, this exposure pathway is considered either incomplete or minor[7]. Canada geese forage also in upland areas, as well as in the water, so their diet is not exclusive to the Study Area. In addition, the mallard ducks were often observed foraging in the trash gyres rather than dabbling for vegetation or prey items.

Reptiles and amphibians were also included in the preliminary CSM in response to comments from USEPA. Because no reptiles or amphibians were observed during the Phase 1 surveys, for screening purposes, this exposure pathway was also considered incomplete or minor and was not evaluated quantitatively. The selection of receptors for the BERA CSM is discussed in greater detail in the BERA PF.

4.2 Screening Level Process

As originally described in SLERA Technical Memorandum No. 1, and as illustrated in Figure 2, the overall SLERA process for the indirect exposure pathway (i.e., the wildlife screening level assessment) includes two primary steps. As presented in the RI/FS Work Plan, the primary exposure pathway for wildlife is via the diet. Therefore, Step 1 of the wildlife assessment involved selecting only those chemicals with the potential to bioaccumulate. These chemicals were selected from those evaluated by USEPA in a report on bioaccumulative testing (USEPA 2000; see Appendix C of SLERA Technical Memorandum No. 1).

Step 2 of the assessment, the actual screening level analysis, is as described in SLERA Technical Memorandum No. 1 except that rather than calculating HQs by comparing a

[6] Based on allometric equation for all birds, a smaller bird will receive a higher dose relative to its body weight than a larger bird.

[7] In their review of SLERA Technical Memorandum No. 1, USEPA had requested that observations for submerged aquatic vegetation be included in the Phase 1 RI surveys.

back-calculated sediment SL to sediment EPCs, HQs were calculated by directly comparing a receptor's TDI of a chemical with a dose-based TRV for that chemical:

$$HQ = \frac{TDI}{TRV} \quad \text{(Equation 1)}$$

Where:

HQ = Hazard quotient (set equal to 1.0)
TDI = Total daily intake of chemical (mg chemical/kg body weight-day)
TRV = Toxicity reference value (mg chemical/kg body weight-day)

This approach was applied because exposure includes both direct sediment ingestion, which is calculated using the dry weight-based sediment concentration, and indirect prey ingestion, which is calculated using a carbon-based biota-sediment accumulation factor (BSAF). Thus, TDIs were calculated for each sample by incorporating both these pathways in the calculation as follows:

$$TDI_{all} \approx TDI_{sed} + TDI_{food} = \frac{IR_f}{BW} \times \left(C_s \times P_s \times EMF_s + \sum_i \left(C_{f,i} EMF_{f,i} \right) \right) \quad \text{(Equation 2)}$$

Where:

TDI_{all} = Total daily intake of chemical from sediment and food (mg chemical/kg body weight-day)
TDI_{sed} = Total daily intake of chemical from sediment (mg chemical/kg body weight-day)
TDI_{food} = Total daily intake of chemical from sediment (mg chemical/kg body weight-day)
IR_f = Food ingestion rate (kg/day)
BW = Receptor body weight (kg)
C_s = Chemical concentration in sediment (mg/kg)
P_s = Proportion of sediment in the diet (as a fraction of food intake)
EMF_s = Exposure modifying factor for incidental sediment ingestion (e.g., area use factor, bioavailability)
$C_{f,i}$ = Chemical concentration in each item of food (mg/kg)

$EMF_{f,i}$ = Exposure modifying factor for food item i (e.g., area use factor, bioavailability)

$$C_{f,i} = C_s \times \text{BSAF} \quad \text{(Equation 3)}$$

Where:

BSAF = Biota-Sediment Accumulation Factor on a lipid-carbonbasis (kg organic carbon/kg lipid)

The TRVs were the no-observable adverse effect levels (NOAELs) reported in the scientific literature for avian test species, such as quail, mallard, and chicken, and for mammalian test species, such as rats, mice, and dogs. TRVs were selected from several sources, including USEPA's ecological soil SL documents (2005), Sample et al. (1996), Agency for Toxic Substances and Disease Registry (ATSDR; 1997), and Integrated Risk Information System (USEPA 2011b), as well as other sources from the scientific literature. The ecological soil SL documents were the primary source for TRV selection. The TRVs and their sources are presented in SLERA Technical Memorandum No. 1, Appendix D-1 for avian species and Appendix D-2 for mammalian species.

A conservative screening level analysis was performed by comparing maximum TDIs (calculated using maximum prey item bioaccumulation factors [BAFs] or BSAFs) to TRVs based on avian or mammalian NOAELs (see SLERA Technical Memorandum No. 1, Appendices D-1 and D-2, respectively). An additional, but still conservative screening level analysis, was performed by comparing 95% UCL TDIs (i.e., the 95% UCL of all of the TDI values, in which each TDI value was calculated using 95% UCL BAFs or BSAFs) to the avian or mammalian NOAELs. Chemicals that were not eliminated and for which the FOD in the Study Area sediment was greater than 5 percent were identified as preliminary bioaccumulative COPECs. Chemicals with an FOD less than 5 percent were identified as uncertain COPECs, as were chemicals without a BAF or BSAF or a TRV.

4.3 Biota-Sediment Accumulation Factors

Site-specific tissue concentration data are not available for the prey items (benthic and epibenthic invertebrates, as well as fish). Therefore, literature-based, BSAFs were used to estimate the TDIs from the Study Area sediment[8]. Lipid/carbon normalized BSAFs were selected primarily from the following two sources: 1) the USEPA BSAF dataset (2011a); and 2) the U.S. Army Corps of Engineers (USACE) BSAF database (2011). These databases contain BSAFs for many different species, with sometimes up to ten values for each. Many of the species included in these databases were observed in the Study Area during the Phase 1 surveys. These include, for example, blue crab, spot croaker, and mummichog. BSAFs for freshwater fish were included in this analysis in an effort to increase the sample size. In the absence of BSAFs from either of these two sources, BAFs from the Calcasieu Estuary BERA (CDM 2002)[9] were used. These are not lipid/carbon normalized. BAFs were used for all metals and the organic chemicals hexachloroethane, hexachlorobutadiene, pentachlorophenol, endosulfan I, endosulfan II, and endrin. All the BAFs are for marine species, many of which are similar to those found in the Study Area, such as the Gulf killifish (similar to the Study Area mummichog), Gulf menhaden (similar to the Study Area Atlantic menhaden), and shrimp (similar to the Study Area shrimp spp.) A methyl mercury BSAF was estimated from several studies that included paired methyl mercury sediment and biota data (Lawrence and Mason 2001; Parametrix 1998; Taylor et al. 2012).

Where possible, BAFs or BSAFs were selected for the most appropriate prey item (e.g., benthic invertebrates for the sandpiper or fish for the cormorant). However, for many chemicals, it was necessary to use a combination of prey item groups or even "all prey items" when there were either no, or few, prey item-specific values. If, for example, all prey items had to be used, then the average of the maximum for benthic invertebrates, epibenthic invertebrates, migratory fish, and non-migratory fish, was used in calculating the TDI. If BSAFs were used rather than BAFs, the BSAFs were normalized based on the sample-specific

[8] This approach is based on the assumption that all the chemical concentration in the biota originates from the Study Area. To the extent that chemicals are accumulated from elsewhere, as might be the case for migratory species, this approach over estimates the site contribution. Furthermore, to the extent that chemical concentrations are elevated in the Study Area relative to the rest of the organisms' feeding range, this approach over estimates exposure.

[9] The BAFs from the Calcasieu risk assessment are in fact biota-sediment accumulation factors, but because they are not normalized for sediment organic carbon or tissue lipid content, they are referred to as BAFs.

organic carbon content and the prey item specific (literature based) lipid content. The BSAFs and BAFs from which the selections were made are presented in SLERA Technical Memorandum No. 1 and Tables E-1 and E-2, respectively[10].

4.4 Total Daily Intakes

For the screen based on the Study Area 95% UCL TDI, unique TDIs were calculated for each potentially bioaccumulative chemical at every sediment station in the Study Area. These were calculated using the 95% UCL BAF or BSAF, based on the most appropriate prey item group where possible, noting, as previously described, that it was often necessary to use a combination of prey item groups so that a value could be calculated. Then, the Study Area 95% UCL TDI for each chemical was calculated using USEPA's ProUCL software, Version 4.1.

The exposure parameters used to calculate the TDIs for the avian and mammalian receptors (e.g., body weights and food ingestion rates) are presented in Table 4-1 of SLERA Technical Memorandum No. 1. As noted, the lowest gender body weights were selected, if available, and conservative assumptions were used in estimating sediment ingestion as a percentage of the diet.

For screening purposes, conservative assumptions were used for those factors that can modify exposure. For example, it was assumed that the receptors feed exclusively within the Study Area, and they are resident year-round (i.e., no migration). Given the urban and industrial setting of the Study Area and adjacent shoreline, it is unlikely that these receptors will forage exclusively in the Study Area. In addition, several of the bird species are known to be migratory and, therefore, will also not be foraging year-round in the Study Area. These factors, among others, will be taken into account in the BERA when estimating TDIs for wildlife and, therefore, provide more realistic estimates of risk.

For some of the bioaccumulative chemicals, TDIs were based on chemical summations. For PAHs, screening was performed for total PAHs, for the summation of HPAHs and LPAHs, as

[10] With the exception of methyl mercury for which, as noted above, BSAFs were derived from original literature (Lawrence and Mason 2001; Parametrix 1998; Taylor et al. 2012).

well as for some individual PAHs. For dioxins and furans, individual congeners were evaluated as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxicity equivalents (TEQs). Concentrations of the relevant congeners in the sediment were multiplied by toxicity equivalent factors (TEFs) to estimate the toxicity of the congeners relative to TCDD. The TEFs used were those published by the World Health Organization (WHO) for birds (Van den Berg et al. 1998) and for mammals (Van den Berg et al. 2006). Congener specific BSAFs were then used to calculate congener-specific TEQ TDIs. The congener-specific TEQ TDIs were then summed to calculate the overall TCDD TEQ TDI for each sediment sample. The PCB screen was performed for total Aroclors as well as individual Aroclors, for total PCB congeners (but not individual congeners), as well as PCB congener TEQs to account for those PCB congeners with dioxin-like effects. PCB congener TEQ TDIs were calculated in a similar manner to that described for the dioxin and furan congeners using PCB congener-specific TEFs and BSAFs.

4.5 Screening Level Risk Estimates

The chemicals identified as preliminary COPECs for wildlife based on maximum exposure assumptions are summarized in Table 3. Details of the screening level analyses are provided in Appendix C. The tables in the appendix provide information on the frequency with which the chemicals were detected in the sediment, the TDI, the TRV used, the BAF or BSAF used, and the HQ. Table C-1 (preliminary COPECs) also provides information on which receptors are the basis for identification of the COPEC. The chemicals that were eliminated based on the maximum exposure assumptions are presented in Table C-2. Table C-3 shows those chemicals that were identified as uncertain COPECs and the basis for this outcome (e.g., no TRV or no BSAF). Note that these also include those chemicals for which the HQ is greater than or equal to 1, but for which the FOD is less than 5 percent.

The chemicals identified as COPECs for wildlife include nine metals, methyl mercury, PAHs (total, LPAH and HPAH, and as a number of individual PAHs), pesticides (4,4-dichlorodiphenyldichloroethane [DDD] and 4,4- dichlorodiphenyldichloroethylene [DDE], as well as dieldrin), TCDD congener TEQs, and PCBs (as Aroclors, total PCB congeners, and as PCB congener TEQs). Of the metals, cadmium, copper, lead, nickel, and selenium exhibited HQs greater than 100 for the sandpiper; for the heron, only cadmium and

copper HQs exceeded 100, while for the cormorant, only copper exhibited an HQ greater than 100. For the raccoon, HQs exceeded 100 for cadmium, copper, and nickel. For silver, HQs were less than 5 for all receptors. For zinc, chromium, and arsenic, HQs were less than 50 for all receptors. Methyl mercury HQs ranged from 24 for the sandpiper to 4.5 for the raccoon. Of the organic chemicals, the HQs for the PCBs as a group were higher than those for PAHs, the pesticides, and the dioxin furans. Overall, the HQs for the pesticides, for all receptors, were the lowest, ranging from less than 1 for 4,4, DDD, to slightly more than 9 for dieldrin.

The chemicals identified as preliminary COPECs for wildlife based on 95% UCL exposure assumptions are summarized in Table 4. Details of the screening analyses are provided in Appendix D, Table D-1 for the preliminary COPECs, Table D-2 for those that were eliminated, and Table D-3 for those identified as uncertain COPECs.

While the maximum value and 95% UCL screens identified the same chemical groups and many of the same chemicals as preliminary COPECs, the HQs were an order of magnitude lower in the 95% UCL screen. Of the 72 chemicals evaluated as potentially bioaccumulative, 31 were eliminated based on an HQ of less than 1.0. In contrast to the maximum value screen, the 95% UCL screen eliminated all pesticides with the exception of dieldrin for the raccoon (HQ less than 2). Most of the metals, with the exception of copper and selenium, were eliminated for the cormorant, and PAHs were eliminated for the sandpiper, with the exception of benzo(a)anthracene (HQ of 1.6). For methyl mercury, the HQs were also lower, ranging from just over 6 for the sandpiper to just over 1 for the raccoon. Overall, copper, and PCBs as a group, exhibited the highest overall HQs. Lastly, more chemicals were eliminated based on the 95% UCL screen and fewer were identified as uncertain. With more than 140 surface sediment samples collected for the standard analyte list and more than 30 collected for a sub-set of analytes, USEPA's requirement for a dataset with a minimum of 20 samples was met. Thus, no chemicals were identified as uncertain because of a small sample size.

5 CONCLUSIONS

Of the approximately 200 Phase 1 analytes screened for in the surface water and surface sediment of the Study Area, seven were identified as COPECs for surface water, 51 were identified as COPECs in sediment based on direct exposure, and for wildlife, 29 were identified as COPECs based on 95% UCL TDIs. For surface water, these included cyanide, three metals, carbon disulfide, total DDx, and PCB Aroclors. For the direct sediment exposure pathway, these included 14 metal; 21 PAHs (total HPAH, LPAH, and PAH); 4,4-DDD, DDE, and dichlorodiphenyltrichloroethane (DDT), as well as total DDx; alpha chlordane and total chlordane; dioxin/furans; Aroclor 1254, total PCB Aroclors, and total PCB congeners; and two semivolatile organic compounds, 1,1-biphenyl and bis(2-ethylhexyl)phthalate. For wildlife, the COPECs included nine metals, methyl mercury, the HPAHs and total PAHs as a group, PCBs as Aroclors, total congeners, and as congener TEQs, dioxin/furans and one pesticide, dieldrin.

Consistent with a screening level analysis, conservative assumptions were used in generating exposure concentrations and deriving TDIs for wildlife. Following further refinement in the BERA PF, the BERA risk analyses will use more realistic assumptions in deriving risk estimates, including, for example, evaluating sub-areas rather than the Study Area-wide evaluation of the SLERA and accounting for chemical bioavailability in sediment rather than relying on bulk sediment chemistry. For wildlife, this will include using site-specific measured prey tissue concentrations rather than predicted concentrations using generic bioaccumulation factors or biota-sediment accumulation factors, incorporating information on area use factors rather than assuming 100 percent use of the area, and accounting for seasonal migration rather than assuming year-round exposure.

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TABLES

Table ES-1

Summary of Preliminary COPECs

Chemical Name	Surface Water	Surface Sediment	Wildlife
Conventional Parameters			
Cyanide, total	✓	✓	
Metals			
Aluminum	✓		
Antimony		✓	
Arsenic		✓	✓
Barium	✓	✓	
Cadmium		✓	✓
Chromium		✓	✓
Copper	✓	✓	✓
Lead		✓	✓
Manganese		✓	
Mercury		✓	
Nickel		✓	✓
Selenium		✓	✓
Silver		✓	✓
Tin		✓	
Zinc		✓	✓
Organometallics			
Methyl Mercury			✓
Volatile Organic Compounds			
Carbon disulfide	✓		
Semivolatile Organics			
Biphenyl (1,1'-Biphenyl)		✓	
Bis(2-ethylhexyl)phthalate		✓	
Polycyclic Aromatic Hydrocarbons			
Total HPAH (9 of 16) (U = 1/2)		✓	✓
Total LPAH (7 of 16) (U = 1/2)		✓	
Total PAH (16) (U = 1/2)		✓	✓
Pesticides			
Total Chlordane		✓	
Dieldrin			✓
Total DDx	✓	✓	

Table ES-1

Summary of Preliminary COPECs

Chemical Name	Surface Water	Surface Sediment	Wildlife
Dioxin Furans		✓	✓
Total PCB Aroclors	✓	✓	✓
Total PCB Congeners		✓	✓
PCB Congener TEQs			✓

Notes:
COPEC = constituent of potential ecological concern
DDx = 2,4' and 4,4'-DDD, -DDE, -DDT
HPAH = high-molecular-weight polycyclic aromatic hydrocarbon
LPAH = low-molecular-weight polycyclic aromatic hydrocarbon
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
TEQ = toxic equivalent

Table 1
Surface Water Preliminary COPECs

Chemical Name	Hazard Quotient
Conventional Parameters	
Cyanide, total	3.5
Metals [1]	
Aluminum	1.3
Barium	5.2
Copper	1.1
Volatile Organic Compounds	
Carbon disulfide	1.1
Pesticides	
Total DDx (U = 1/2)	4.1
PCB Aroclors	
Total PCB Aroclors (U = 1/2)	1.7

Notes:
1 = Exceedances are based on dissolved metals concentrations, except for aluminum, which is based on total concentration.
COPEC = constituent of potential ecological concern
DDx = 2,4' and 4,4'-DDD, -DDE, -DDT
PCB = polychlorinated biphenyl
U = 1/2 – Total chemical concentrations (summations) calculated using one half the reporting limit for non-detects

Table 2
Surface Sediment Preliminary COPECs

Chemical Name	HQ = 1 to 2	HQ = 2 to 10	HQ = 10 to 100	HQ = 100 to 1000
Conventional Parameters				
Cyanide, total			14	
Metals				
Antimony		5.8		
Arsenic		5.0		
Barium	1.4			
Cadmium			23	
Chromium		2.8		
Copper			54	
Lead			12	
Manganese	1.3			
Mercury			17	
Nickel			14	
Selenium		5.1		
Silver		9.8		
Tin			13	
Zinc			13	
Semivolatile Organics				
Biphenyl (1,1'-Biphenyl)			14	
Bis(2-ethylhexyl)phthalate				180
Polycyclic Aromatic Hydrocarbons				
1-Methylnaphthalene			63	
1-Methylphenanthrene				170
2,6-Dimethylnaphthalene				120
2-Methylnaphthalene			35	
Acenaphthene				190
Acenaphthylene			33	
Anthracene			54	
Benzo(a)anthracene			29	
Benzo(a)pyrene			12	
Benzo(b)fluoranthene			37	
Benzo(g,h,i)perylene			62	
Benzo(j,k)fluoranthene			71	
Chrysene			20	
Dibenzo(a,h)anthracene and dibenzo(a,c)anthracene			16	
Fluoranthene			26	
Fluorene			65	
Indeno(1,2,3-c,d)pyrene			60	
Naphthalene			38	
Perylene			21	

Table 2
Surface Sediment Preliminary COPECs

Chemical Name	HQ = 1 to 2	HQ = 2 to 10	HQ = 10 to 100	HQ = 100 to 1000
Phenanthrene			28	
Pyrene			19	
Total HPAH (9 of 16) (U = 1/2)			44	
Total LPAH (7 of 16) (U = 1/2)			44	
Total PAH (16) (U = 1/2)			25	
Pesticides				
4,4'-DDD (p,p'-DDD)			75	
4,4'-DDE (p,p'-DDE)			30	
4,4'-DDT (p,p'-DDT)		6.3		
Chlordane, alpha- (cis-Chlordane)			31	
Total Chlordane (U = 1/2)			93	
Total DDx (U = 1/2)				150
Dioxin Furans				
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)		9.7		
PCB Congeners				
Total PCB Congener (U = 1/2)				240
PCB Aroclors				
Aroclor 1254		3.8		
Total PCB Aroclors (U = 1/2)				180

Notes:

COPEC = constituent of potential ecological concern

DDD = dichlorodiphenyldichloroethane

DDE = dichlorodiphenyldichloroethylene

DDT = dichlorodiphenyltrichloroethane

DDx = 2,4' and 4,4'-DDD, -DDE, -DDT

HQ = hazard quotient

HPAH = high-molecular-weight polycyclic aromatic hydrocarbon

LPAH = low-molecular-weight polycyclic aromatic hydrocarbon

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

U = 1/2 – Total chemical concentrations (summations) calculated using one half the reporting limit for non-detects

Table 3
Wildlife Preliminary COPECs – Maximum Exposure Assumptions

Chemical Name	Sandpiper HQs	Heron HQs	Cormorant HQs	Raccoon HQs
Metals				
Arsenic	**42**	**19**	**22**	**20**
Cadmium	**650**	**204**	**28**	**390**
Chromium	**40**	9.2	2.9	7.3
Copper	**3200**	**2000**	**250**	**370**
Lead	**130**	**25**	**19**	**14**
Nickel	**140**	**43**	**12**	**350**
Selenium	**120**	**73**	**67**	**59**
Silver	4	1.5	0.69	0.25
Zinc	**40**	**23**	**14**	**11**
Organometallics				
Methyl mercury	**24**	**13**	6.9	4.5
Polycyclic Aromatic Hydrocarbons				
Anthracene	5.7	0.74	0.35	0.42
Benzo(a)anthracene	**120**	**42**	**20**	**81**
Benzo(a)pyrene	1.1	0.4	0.19	**39**
Benzo(b)fluoranthene	0.82	0.24	0.11	**24**
Benzo(g,h,i)perylene	1	0.33	0.16	**33**
Benzo(j,k)fluoranthene	1.5	0.36	0.17	**36**
Chrysene	1.5	0.52	0.25	**52**
Dibenzo(a,h)anthracene and dibenzo(a,c) anthracene	0.79	0.27	0.13	**26**
Fluoranthene	**26**	4.4	2.1	**440**
Indeno(1,2,3-c,d)pyrene	1.1	0.42	0.2	**42**
Phenanthrene	2.0	0.35	0.16	0.2
Pyrene	2.1	0.41	0.19	**42**
Total HPAH (9 of 16) (U = 1/2)	**19**	6.7	3.2	**670**
Total LPAH (7 of 16) (U = 1/2)	**11**	1.9	0.92	1.1
Total PAH (16) (U = 1/2)	**29**	**10**	5.0	**1000**
Pesticides				
4,4'-DDD (p,p'-DDD)	2.2	0.5	0.24	1.2
4,4'-DDE (p,p'-DDE)	6.5	2.6	1.2	6.1
Dieldrin	2.0	1.7	0.82	9.2
Dioxin Furans				
TCDD Congeners TEQ (U = 1/2)	**82**	**16**	7.5	**110**

Table 3
Wildlife Preliminary COPECs – Maximum Exposure Assumptions

Chemical Name	Sandpiper HQs	Heron HQs	Cormorant HQs	Raccoon HQs
PCBs				
Aroclor 1242	**45**	**21**	9.8	**44**
Aroclor 1254	**55**	**24**	**11**	**160**
Total PCB Aroclors (U = 1/2)	**530**	**220**	**100**	**1400**
PCB Congeners TEQ (U = 1/2)	**440**	**390**	**190**	**2400**
Total PCB Congener (U = 1/2)	**200**	**82**	**39**	**1800**

Notes:

Shaded cells indicate COPECs with HQ > 10.

COPEC = constituent of potential ecological concern

DDD = dichlorodiphenyldichloroethane

DDE = dichlorodiphenyldichloroethylene

DDT = dichlorodiphenyltrichloroethane

HPAH = high-molecular-weight polycyclic aromatic hydrocarbon

HQ = hazard quotient

LPAH = low-molecular-weight polycyclic aromatic hydrocarbon

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin

TEQ = toxic equivalent

U = 1/2 – Total chemical concentrations (summations) calculated using one half the reporting limit for non-detects

Table 4
Wildlife Preliminary COPECs – 95% UCL Exposure Assumptionss

Chemical Name	Sandpiper HQs	Heron HQs	Cormorant HQs	Raccoon HQs
Metals				
Arsenic	3.7	1.2	0.45	1.3
Cadmium	**47**	8.6	0.6	**17**
Chromium	5.6	0.71	0.22	0.72
Copper	**150**	**80**	4.8	**15**
Lead	**26**	2.5	0.69	1.7
Nickel	9.5	1.3	0.25	**12**
Selenium	**15**	6.8	3	5.6
Silver	1.2	0.46	0.22	0.078
Zinc	5.7	2.7	0.98	1.3
Organometallics				
Methyl mercury	6.1	3.3	1.7	1.1
Polycyclic Aromatic Hydrocarbons				
Benzo(a)anthracene	1.6	1	0.47	2.1
Benzo(a)pyrene	0.032	0.015	0.0068	1.6
Benzo(b)fluoranthene	0.088	0.036	0.017	3.7
Benzo(g,h,i)perylene	0.0	0.0	0.0	0.1
Benzo(j,k)fluoranthene	0.12	0.051	0.025	5.1
Chrysene	0.047	0.019	0.0088	2
Dibenzo(a,h)anthracene and dibenzo(a,c) anthracene	0.047	0.024	0.011	2.4
Fluoranthene	0.24	0.1	0.049	10
Indeno(1,2,3-c,d)pyrene	0.043	0.017	0.008	1.7
Pyrene	0.067	0.021	0.0095	2.4
Total HPAH (9 of 16) (U = 1/2)	0.35	0.16	0.074	**17**
Total PAH (16) (U = 1/2)	0.45	0.21	0.096	**22**
Pesticides				
Dieldrin	0.32	0.33	0.16	1.8
Dioxin Furans				
TCDD Congeners TEQ (U = 1/2)	2.8	3.9	1.8	**32**
PCBs				
Aroclor 1242	3.9	1.7	0.8	3.7
Aroclor 1254	3.9	1.7	0.79	**11**
Total PCB Aroclors (U = 1/2)	**24**	**12**	5.8	**78**
PCB Congeners TEQ (U = 1/2)	**100**	**31**	**15**	**150**
Total PCB Congener (U = 1/2)	**16**	7.9	3.7	**180**

Notes:
Shaded cells indicate COPECs with HQ > 10.
COPEC = constituent of potential ecological concern
HPAH = high-molecular-weight polycyclic aromatic hydrocarbon
HQ = hazard quotient
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ = toxic equivalent
U = 1/2 – Total chemical concentrations (summations) calculated using one half the reporting limit for non-detects
UCL = upper confidence limit

FIGURES

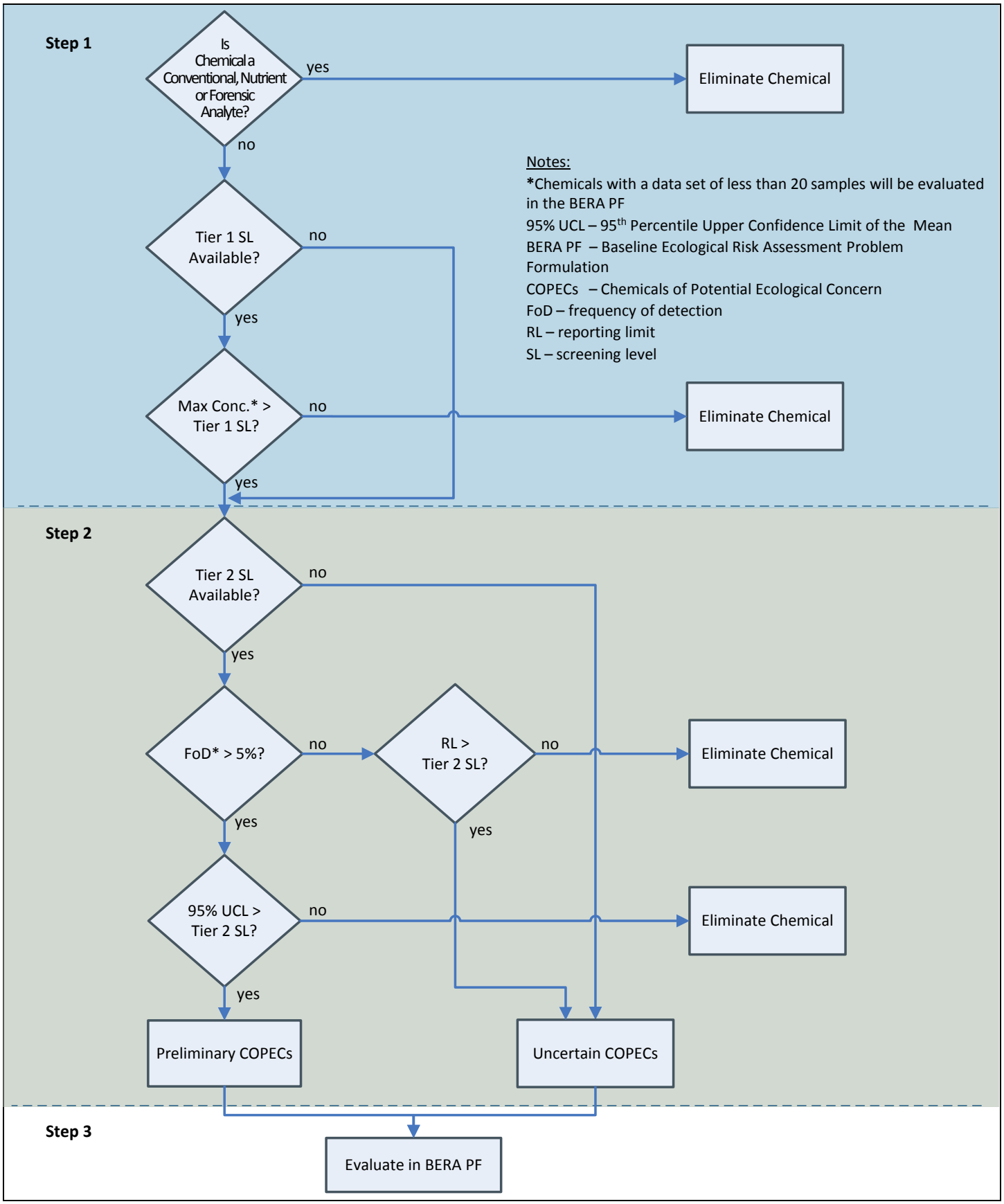

Figure 1
Screening Level Risk Assessment Process for Surface Water and Sediment
Newtown Creek RI/FS

ANCHOR QEA

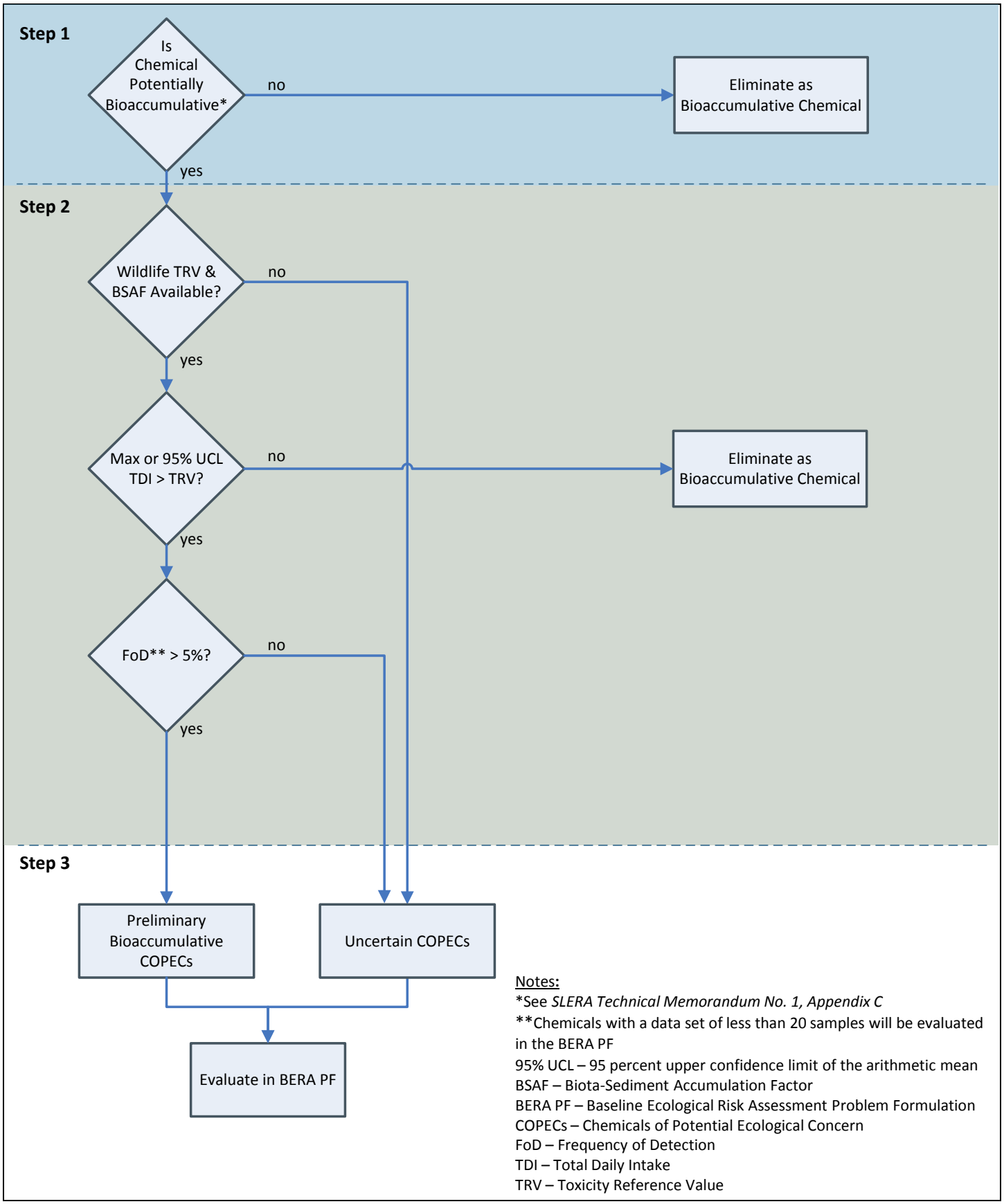

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Figure 2
Screening Level Risk Assessment Process for Wildlife
Newtown Creek RI/FS

APPENDIX A
SURFACE WATER SCREENING LEVEL ANALYSES

Table A-1 Surface Water – Preliminary Step 1 COPECs

Table A-2 Surface Water – Preliminary Step 2 COPECs

Table A-3 Surface Water – Step 1 and Step 2 Eliminated Chemicals

Table A-4 Surface Water – Step 1 and Step 2 Uncertain Chemicals

Table A-1
Surface Water – Preliminary Step 1 COPECs

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	Tier 1 Screening Level[1]	Tier 1 Hazard Quotient[1]	Step 1 Results
CONV	CYANIDE, TOTAL	MG/L	57-12-5	353	61	0.052	D	0.001	52	Prelim-COPEC_Tier1 HQ
METDISS	COPPER	UG/L	7440-50-8	353	44	160	D	3.4	46	Prelim-COPEC_Tier1 HQ
METDISS	LEAD	UG/L	7439-92-1	353	1.1	16	D	8	2	Prelim-COPEC_Tier1 HQ
METDISS	NICKEL	UG/L	7440-02-0	353	50	120	D	8.2	15	Prelim-COPEC_Tier1 HQ
METDISS	SILVER	UG/L	7440-22-4	353	0	25	ND	1.9	6.6	Prelim-COPEC_Tier1 HQ
METDISS	ZINC	UG/L	7440-66-6	353	8.5	97	D	66	1.5	Prelim-COPEC_Tier1 HQ
SVOC	HEXACHLOROCYCLOPENTADIENE	UG/L	77-47-4	306	0	1.1	ND	0.07	7.9	Prelim-COPEC_Tier1 HQ
PESTICIDES	CHLORDANE, ALPHA- (CIS-CHLORDANE)	UG/L	5103-71-9	353	0	0.013	ND	0.004	1.6	Prelim-COPEC_Tier1 HQ
PESTICIDES	DIELDRIN	UG/L	60-57-1	353	0	0.013	ND	0.0019	3.4	Prelim-COPEC_Tier1 HQ
PESTICIDES	ENDRIN	UG/L	72-20-8	353	0	0.013	ND	0.0023	2.8	Prelim-COPEC_Tier1 HQ
PESTICIDES	HEPTACHLOR	UG/L	76-44-8	353	4.5	0.0076	D	0.0036	2.1	Prelim-COPEC_Tier1 HQ
PESTICIDES	MIREX	UG/L	2385-85-5	353	2.8	0.0014	D	0.001	1.4	Prelim-COPEC_Tier1 HQ
PESTICIDES	TOTAL DDX (U = 0)	UG/L	tDDT_0N	353	47	0.025	D	0.001	25	Prelim-COPEC_Tier1 HQ
PESTICIDES	TOTAL DDX (U = 1/2)	UG/L	tDDT_N	353	47	0.049	D	0.001	49	Prelim-COPEC_Tier1 HQ
PESTICIDES	TOXAPHENE	UG/L	8001-35-2	353	0.28	0.026	D	0.005	5.2	Prelim-COPEC_Tier1 HQ
PCB	TOTAL PCB AROCLORS (U = 0)	UG/L	tPCB_0N	353	16	0.19	D	0.03	6.3	Prelim-COPEC_Tier1 HQ
PCB	TOTAL PCB AROCLORS (U = 1/2)	UG/L	tPCB_N	353	16	0.45	D	0.03	15	Prelim-COPEC_Tier1 HQ
PCBCONG	TOTAL PCB CONGENER (U = 0)	NG/L	tPCBCong_0N	101	100	91	D	30	3	Prelim-COPEC_Tier1 HQ
PCBCONG	TOTAL PCB CONGENER (U = 1/2)	NG/L	tPCBCong_N	101	100	92	D	30	3.1	Prelim-COPEC_Tier1 HQ

Notes:

1 = These values were rounded to 2 significant figures. Calculations were performed prior to rounding.

µg/L = microgram per liter
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
CONV = conventional
D = detect
DDx = 2,4' and 4,4'-DDD, -DDE, -DDT
HQ = hazard quotient
METDISS = metals, dissolved
mg/L = milligram per liter
ng/L = nanogram per liter
ND = non-detect
PCB = polychlorinated biphenyl
PCBCONG = polychlorinated biphenyl congener
PEST = pesticide
RN = registry number
SVOC = semivolatile organic compound

Step 1 Result Definitions:

Prelim-COPEC_Tier1 HQ = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; the maximum overall result exceeds the Tier 1 screening level.

Data Treatment:

The screening level analyses are based on the Phase 1 RI surface water data (February to October).

PAHs evaluated in the surface water screen were analyzed by Method 8270CSIM; results from Method 8270C were excluded.

Non-detects are reported at the reporting limit (RL).

Non-detect data were screened at half the RL in the Step 1 screen.

Non-detect data were screened at half the RL in the Step 1 screen.

Table A-2
Surface Water – Preliminary Step 2 COPECs

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]	Step 1 Result	Step 2 Result
CONV	CYANIDE, TOTAL	MG/L	57-12-5	353	61	0.052	D	0.0035	95% KM (BCA) UCL	0.001	0.001	52	3.5	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
MET	ALUMINUM	UG/L	7429-90-5	353	60	1700	D	110	95% KM (BCA) UCL	NA	87	NA	1.3	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
METDISS	BARIUM	UG/L	7440-39-3	353	99	49	D	20	95% KM (BCA) UCL	NA	3.9	NA	5.2	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
METDISS	COPPER	UG/L	7440-50-8	353	44	160	D	3.9	95% KM (% Bootstrap) UCL	3.4	3.4	46	1.1	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
VOC	CARBON DISULFIDE	UG/L	75-15-0	353	7.4	2.8	D	0.99	95% KM (t) UCL	NA	0.92	NA	1.1	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PESTICIDES	TOTAL DDX (U = 1/2)	UG/L	tDDT_N	353	47	0.049	D	0.0041	95% KM (% Bootstrap) UCL	0.001	0.001	49	4.1	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PCB	TOTAL PCB AROCLORS (U = 1/2)	UG/L	tPCB_N	353	16	0.45	D	0.05	95% KM (% Bootstrap) UCL	0.03	0.03	15	1.7	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ

Notes:

1 = These values were rounded to 2 significant figures. Calculations were performed prior to rounding.

µg/L = microgram per liter
BCA = bias corrected accelerated bootstrap method
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
CONV = conventional
D = detect
DDx = 2,4' and 4,4'-DDD, -DDE, -DDT
FOD = frequency of detection
HQ = hazard quotient
KM = Kaplan-Meier
MET = metals
METDISS = metals, dissolved
mg/L = milligram per liter
NA = not available or not calculated
ND = non-detect
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PEST = pesticide
RL = reporting limit
RN = registry number
SL = screening level
UCL = upper confidence limit
USEPA = U.S. Environmental Protection Agency
VOC = volatile organic compound

Step 1 Result Definitions:

Prelim-COPEC_Tier1 HQ = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; the maximum overall result exceeds the Tier 1 screening level.
Prelim-COPEC_No Tier1 SL = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; there are no Tier 1 screening levels available.

Step 2 Result Definitions:

Prelim-COPEC_Tier2 HQ = The chemical was identified as a preliminary COPEC; the EPC (95% UCL or maximum value) exceeds the Tier 2 screening level, and the frequency of detection is greater than 5 percent.

Data Treatment:

The screening level analyses are based on the Phase 1 RI surface water data (February to October).
PAHs evaluated in the surface water screen were analyzed by Method 8270CSIM; results from Method 8270C were excluded.
Non-detects are reported at the reporting limit (RL).
Non-detect data were screened at half the RL in the Step 1 screen.
95% UCLs were calculated using USEPA's ProUCL (Version 4.1) for all data distributions.
95% UCLs were calculated for chemicals with an FOD of greater than 5 percent and at least four distinct, detected observations.
95% UCLs were calculated with non-detects reported at the RL.
UCLs were selected from the 95% UCL results based on ProUCL's recommendation. If the recommended 95% UCL was greater than the maximum detected result or if there are fewer than four detected observations, the maximum detected concentration was selected.
Chemicals with a FOD of less than 5% are not evaluated in the Tier 2 screen.

Table A-3
Surface Water – Step 1 and Step 2 Eliminated Chemicals

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type
CONV	AMMONIA UNIONIZED	MG/L	7664-41-7UI	353	94	0.03	D	0.0041	95% KM (BCA) UCL
MET	ANTIMONY	UG/L	7440-36-0	353	22	91	D	5.6	95% KM (BCA) UCL
MET	IRON	UG/L	7439-89-6	353	70	3500	D	390	95% KM (BCA) UCL
METDISS	ARSENIC	UG/L	7440-38-2	350	94	2.2	D	1.1	95% KM (BCA) UCL
METDISS	CADMIUM	UG/L	7440-43-9	353	2.3	2.5	D	NA	NA
METDISS	CHROMIUM	UG/L	7440-47-3	353	18	6.5	D	3.1	95% KM (t) UCL
METDISS	MANGANESE	UG/L	7439-96-5	353	100	310	D	72	95% KM (BCA) UCL
METDISS	MERCURY	UG/L	7439-97-6	353	58	0.0051	D	0.00057	95% KM (t) UCL
METDISS	NICKEL	UG/L	7440-02-0	353	50	120	D	3.9	95% KM (% Bootstrap) UCL
METDISS	SELENIUM	UG/L	7782-49-2	353	8.5	2.5	D	1.3	95% KM (t) UCL
METDISS	TIN	UG/L	7440-31-5	353	2.3	8.9	D	NA	NA
METDISS	VANADIUM	UG/L	7440-62-2	353	34	14	D	3.2	95% KM (% Bootstrap) UCL
METDISS	ZINC	UG/L	7440-66-6	353	8.5	97	D	23	95% KM (% Bootstrap) UCL
METORG	METHYL MERCURY	UG/L	22967-92-6	353	72	0.00092	D	0.000089	95% KM (BCA) UCL
VOC	1,1,1-TRICHLOROETHANE	UG/L	71-55-6	353	0.57	0.66	D	NA	NA
VOC	1,1,2,2-TETRACHLOROETHANE	UG/L	79-34-5	353	0	0.5	ND	NA	NA
VOC	1,1,2-TRICHLOROETHANE	UG/L	79-00-5	353	0	0.75	ND	NA	NA
VOC	1,1,2-TRICHLOROTRIFLUOROETHANE	UG/L	76-13-1	353	0	10	ND	NA	NA
VOC	1,1-DICHLOROETHANE	UG/L	75-34-3	353	0	0.75	ND	NA	NA
VOC	1,1-DICHLOROETHENE	UG/L	75-35-4	353	0	0.5	ND	NA	NA
VOC	1,2,3-TRICHLOROBENZENE	UG/L	87-61-6	353	0	2.5	ND	NA	NA
VOC	1,2,4-TRICHLOROBENZENE	UG/L	120-82-1	353	0	2.5	ND	NA	NA
VOC	1,2-DICHLOROBENZENE	UG/L	95-50-1	353	0.57	0.24	D	NA	NA
VOC	1,2-DICHLOROETHANE	UG/L	107-06-2	353	0	0.5	ND	NA	NA
VOC	1,2-DICHLOROETHENE, CIS-	UG/L	156-59-2	353	26	3.9	D	0.38	95% KM (% Bootstrap) UCL
VOC	1,2-DICHLOROETHENE, TRANS-	UG/L	156-60-5	353	0	0.75	ND	NA	NA
VOC	1,2-DICHLOROPROPANE	UG/L	78-87-5	353	0	1.8	ND	NA	NA
VOC	1,3-DICHLOROBENZENE	UG/L	541-73-1	353	0	2.5	ND	NA	NA
VOC	1,4-DICHLOROBENZENE	UG/L	106-46-7	353	0.57	0.3	D	NA	NA
VOC	2-BUTANONE (MEK)	UG/L	78-93-3	353	0	5	ND	NA	NA
VOC	2-HEXANONE (METHYL BUTYL KETONE)	UG/L	591-78-6	353	0	5	ND	NA	NA
VOC	ACETONE	UG/L	67-64-1	353	40	12	D	3	95% KM (% Bootstrap) UCL
VOC	BENZENE	UG/L	71-43-2	353	19	1	D	0.34	95% KM (t) UCL
VOC	BROMODICHLOROMETHANE	UG/L	75-27-4	353	0	0.5	ND	NA	NA
VOC	BROMOFORM (TRIBROMOMETHANE)	UG/L	75-25-2	353	0	2	ND	NA	NA
VOC	BROMOMETHANE (METHYL BROMIDE)	UG/L	74-83-9	353	1.1	0.6	D	NA	NA
VOC	CARBON TETRACHLORIDE (TETRACHLOROMETHANE)	UG/L	56-23-5	353	0	0.5	ND	NA	NA
VOC	CHLOROBENZENE	UG/L	108-90-7	353	2	1	D	NA	NA
VOC	CHLOROETHANE	UG/L	75-00-3	353	0	1	ND	NA	NA
VOC	CHLOROFORM	UG/L	67-66-3	353	5.1	0.39	D	0.25	95% KM (% Bootstrap) UCL

Table A-3
Surface Water – Step 1 and Step 2 Eliminated Chemicals

Group	Chemical	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]	Step 1 Result	Step 2 Result
CONV	AMMONIA UNIONIZED	0.035	0.035	0.87	0.12	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
MET	ANTIMONY	NA	500	NA	0.011	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
MET	IRON	NA	1000	NA	0.39	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
METDISS	ARSENIC	36	36	0.061	0.03	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
METDISS	CADMIUM	7.7	8.8	0.32	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
METDISS	CHROMIUM	50	50	0.13	0.062	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
METDISS	MANGANESE	NA	80	NA	0.9	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
METDISS	MERCURY	0.94	0.94	0.0054	0.00061	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
METDISS	NICKEL	8.2	8.2	15	0.48	Prelim-COPEC_Tier1 HQ	Eliminate_Tier2 HQ
METDISS	SELENIUM	71	71	0.036	0.018	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
METDISS	TIN	NA	73	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
METDISS	VANADIUM	NA	19	NA	0.17	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
METDISS	ZINC	66	81	1.5	0.28	Prelim-COPEC_Tier1 HQ	Eliminate_Tier2 HQ
METORG	METHYL MERCURY	NA	0.0028	NA	0.032	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	1,1,1-TRICHLOROETHANE	NA	3100	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,1,2,2-TETRACHLOROETHANE	NA	900	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,1,2-TRICHLOROETHANE	NA	550	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,1,2-TRICHLOROTRIFLUOROETHANE	NA	9400	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,1-DICHLOROETHANE	NA	47	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,1-DICHLOROETHENE	NA	2200	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,2,3-TRICHLOROBENZENE	5	5	0.25	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	1,2,4-TRICHLOROBENZENE	5	5.4	0.25	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	1,2-DICHLOROBENZENE	5	42	0.048	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	1,2-DICHLOROETHANE	NA	1100	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,2-DICHLOROETHENE, CIS-	NA	590	NA	0.00064	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	1,2-DICHLOROETHENE, TRANS-	NA	1200	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,2-DICHLOROPROPANE	NA	2400	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,3-DICHLOROBENZENE	5	29	0.25	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	1,4-DICHLOROBENZENE	5	20	0.06	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	2-BUTANONE (MEK)	NA	14000	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	2-HEXANONE (METHYL BUTYL KETONE)	NA	99	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	ACETONE	NA	560000	NA	0.0000054	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	BENZENE	190	190	0.0053	0.0018	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	BROMODICHLOROMETHANE	NA	6400	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	BROMOFORM (TRIBROMOMETHANE)	NA	640	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	BROMOMETHANE (METHYL BROMIDE)	NA	120	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	CARBON TETRACHLORIDE (TETRACHLOROMETHANE)	NA	1500	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	CHLOROBENZENE	5	110	0.2	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	CHLOROETHANE	NA	47	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	CHLOROFORM	NA	820	NA	0.0003	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ

Table A-3
Surface Water – Step 1 and Step 2 Eliminated Chemicals

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type
VOC	CHLOROMETHANE	UG/L	74-87-3	353	0.28	0.28	D	NA	NA
VOC	DIBROMOCHLOROMETHANE	UG/L	124-48-1	353	0	0.5	ND	NA	NA
VOC	DICHLOROMETHANE (METHYLENE CHLORIDE)	UG/L	75-09-2	353	2	0.61	D	NA	NA
VOC	ETHYLBENZENE	UG/L	100-41-4	353	0	0.5	ND	NA	NA
VOC	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE OR (MIBK))	UG/L	108-10-1	353	0	5	ND	NA	NA
VOC	STYRENE	UG/L	100-42-5	353	0	1	ND	NA	NA
VOC	TETRACHLOROETHENE (PCE)	UG/L	127-18-4	353	7.4	0.73	D	0.26	95% KM (% Bootstrap) UCL
VOC	TOLUENE	UG/L	108-88-3	353	4.2	0.37	D	NA	NA
VOC	TOTAL XYLENE (U = 0)	UG/L	tXylene_0N	353	0	1	ND	NA	NA
VOC	TOTAL XYLENE (U = 1/2)	UG/L	tXylene_N	353	0	1	ND	NA	NA
VOC	TRICHLOROETHENE (TCE)	UG/L	79-01-6	353	2.5	2.8	D	NA	NA
VOC	TRICHLOROFLUOROMETHANE (FLUOROTRICHLOROMETHANE)	UG/L	75-69-4	353	0	2.5	ND	NA	NA
VOC	VINYL ACETATE	UG/L	108-05-4	353	0	5	ND	NA	NA
VOC	VINYL CHLORIDE	UG/L	75-01-4	353	3.1	0.35	D	NA	NA
SVOC	1,2,4,5-TETRACHLOROBENZENE	UG/L	95-94-3	353	0	1.9	ND	NA	NA
SVOC	2,4,5-TRICHLOROPHENOL	UG/L	95-95-4	353	0	1.9	ND	NA	NA
SVOC	2,4,6-TRICHLOROPHENOL	UG/L	88-06-2	353	0	1.9	ND	NA	NA
SVOC	2,4-DICHLOROPHENOL	UG/L	120-83-2	353	0.28	0.1	D	NA	NA
SVOC	2,4-DIMETHYLPHENOL	UG/L	105-67-9	353	0.28	0.25	D	NA	NA
SVOC	2,4-DINITROPHENOL	UG/L	51-28-5	353	0	9.6	ND	NA	NA
SVOC	2,4-DINITROTOLUENE	UG/L	121-14-2	353	1.1	1.8	D	NA	NA
SVOC	2,6-DINITROTOLUENE	UG/L	606-20-2	353	0.28	2.1	D	NA	NA
SVOC	2-CHLOROPHENOL	UG/L	95-57-8	353	0	1.9	ND	NA	NA
SVOC	2-METHYLPHENOL (O-CRESOL)	UG/L	95-48-7	353	0	1.9	ND	NA	NA
SVOC	2-NITROPHENOL	UG/L	88-75-5	353	0	1.9	ND	NA	NA
SVOC	3,3'-DICHLOROBENZIDINE	UG/L	91-94-1	347	0	1.9	ND	NA	NA
SVOC	4-CHLOROANILINE	UG/L	106-47-8	353	0.57	0.13	D	NA	NA
SVOC	4-NITROPHENOL	UG/L	100-02-7	353	0	9.6	ND	NA	NA
SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	117-81-7	353	11	63	D	2.1	95% KM (% Bootstrap) UCL
SVOC	BUTYLBENZYL PHTHALATE	UG/L	85-68-7	353	29	2.6	D	0.29	95% KM (% Bootstrap) UCL
SVOC	DI-N-BUTYL PHTHALATE	UG/L	84-74-2	353	2.8	0.3	D	NA	NA
SVOC	DI-N-OCTYL PHTHALATE	UG/L	117-84-0	353	0.28	2.2	D	NA	NA
SVOC	DIBENZOFURAN	UG/L	132-64-9	353	0	1.9	ND	NA	NA
SVOC	DIETHYL PHTHALATE	UG/L	84-66-2	353	15	1.7	D	0.34	95% KM (% Bootstrap) UCL
SVOC	DIMETHYL PHTHALATE	UG/L	131-11-3	353	0	1.9	ND	NA	NA
SVOC	HEXACHLOROBUTADIENE (HEXACHLORO-1,3-BUTADIENE)	UG/L	87-68-3	353	0	0.38	ND	NA	NA
SVOC	HEXACHLOROETHANE	UG/L	67-72-1	353	0	1.9	ND	NA	NA
SVOC	ISOPHORONE	UG/L	78-59-1	353	0	1.9	ND	NA	NA
SVOC	N-NITROSODI-N-PROPYLAMINE	UG/L	621-64-7	353	0.28	2.7	D	NA	NA
SVOC	N-NITROSODIPHENYLAMINE	UG/L	86-30-6	353	0	1.9	ND	NA	NA

Table A-3
Surface Water – Step 1 and Step 2 Eliminated Chemicals

Group	Chemical	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]	Step 1 Result	Step 2 Result
VOC	CHLOROMETHANE	NA	2700	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	DIBROMOCHLOROMETHANE	NA	6400	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	DICHLOROMETHANE (METHYLENE CHLORIDE)	NA	6400	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	ETHYLBENZENE	4.5	4.5	0.056	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE OR (MIBK))	NA	120000	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	STYRENE	NA	910	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	TETRACHLOROETHENE (PCE)	NA	45	NA	0.0057	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	TOLUENE	92	92	0.004	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	TOTAL XYLENE (U = 0)	19	19	0.026	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	TOTAL XYLENE (U = 1/2)	19	19	0.026	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	TRICHLOROETHENE (TCE)	NA	970	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	TRICHLOROFLUOROMETHANE (FLUOROTRICHLOROMETHANE)	NA	6400	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	VINYL ACETATE	NA	16	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	VINYL CHLORIDE	NA	930	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	1,2,4,5-TETRACHLOROBENZENE	NA	130	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2,4,5-TRICHLOROPHENOL	NA	12	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2,4,6-TRICHLOROPHENOL	NA	61	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2,4-DICHLOROPHENOL	NA	37	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2,4-DIMETHYLPHENOL	NA	42	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2,4-DINITROPHENOL	NA	49	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2,4-DINITROTOLUENE	NA	310	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2,6-DINITROTOLUENE	NA	6.2	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2-CHLOROPHENOL	NA	270	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2-METHYLPHENOL (O-CRESOL)	NA	1000	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2-NITROPHENOL	NA	300	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	3,3'-DICHLOROBENZIDINE	NA	73	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	4-CHLOROANILINE	NA	230	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	4-NITROPHENOL	NA	300	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	NA	3	NA	0.7	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
SVOC	BUTYLBENZYL PHTHALATE	NA	3.4	NA	0.087	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
SVOC	DI-N-BUTYL PHTHALATE	NA	3.4	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	DI-N-OCTYL PHTHALATE	NA	3.4	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	DIBENZOFURAN	NA	65	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	DIETHYL PHTHALATE	NA	3.4	NA	0.1	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
SVOC	DIMETHYL PHTHALATE	NA	3.4	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	HEXACHLOROBUTADIENE (HEXACHLORO-1,3-BUTADIENE)	0.3	0.32	0.63	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
SVOC	HEXACHLOROETHANE	NA	94	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	ISOPHORONE	NA	130	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	N-NITROSODI-N-PROPYLAMINE	NA	120	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	N-NITROSODIPHENYLAMINE	NA	33000	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL

Table A-3
Surface Water – Step 1 and Step 2 Eliminated Chemicals

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type
SVOC	NITROBENZENE	UG/L	98-95-3	353	0	3.8	ND	NA	NA
SVOC	PENTACHLOROPHENOL	UG/L	87-86-5	353	0	1.9	ND	NA	NA
SVOC	PHENOL	UG/L	108-95-2	353	2	0.7	D	NA	NA
PAH	1,6,7-TRIMETHYLNAPHTHALENE	UG/L	2245-38-7	353	29	0.026	D	0.0057	95% KM (% Bootstrap) UCL
PAH	2,6-DIMETHYLNAPHTHALENE	UG/L	581-42-0	353	42	0.17	D	0.012	95% KM (t) UCL
PAH	2-METHYLNAPHTHALENE	UG/L	91-57-6	353	71	0.13	D	0.0086	95% KM (BCA) UCL
PAH	ACENAPHTHENE	UG/L	83-32-9	353	84	0.21	D	0.035	95% KM (Chebyshev) UCL
PAH	BENZO(J,K)FLUORANTHENE	UG/L	BKJFLANTH	353	65	0.036	D	0.006	95% KM (BCA) UCL
PAH	DIBENZO(A,H)ANTHRACENE AND DIBENZO(A,C)ANTHRACENE	UG/L	215-58-753-70-3	353	7.4	0.013	D	0.0044	95% KM (t) UCL
PAH	FLUORENE	UG/L	86-73-7	353	49	0.06	D	0.0086	95% KM (% Bootstrap) UCL
PAH	NAPHTHALENE	UG/L	91-20-3	353	72	0.47	D	0.028	95% KM (Chebyshev) UCL
PAH	PHENANTHRENE	UG/L	85-01-8	353	80	0.22	D	0.013	95% KM (BCA) UCL
PESTICIDES	ALDRIN	UG/L	309-00-2	351	2	0.0085	D	NA	NA
PESTICIDES	ENDOSULFAN-ALPHA (I)	UG/L	959-98-8	353	0	0.013	ND	NA	NA
PESTICIDES	ENDOSULFAN-BETA (II)	UG/L	33213-65-9	353	2.5	0.0034	D	NA	NA
PESTICIDES	HEPTACHLOR EPOXIDE	UG/L	1024-57-3	353	0.85	0.0021	D	NA	NA
PESTICIDES	HEXACHLOROBENZENE	UG/L	118-74-1	353	35	0.0084	D	0.0006	95% KM (% Bootstrap) UCL
PESTICIDES	HEXACHLOROCYCLOHEXANE, ALPHA (BHC)	UG/L	319-84-6	353	1.7	0.0017	D	NA	NA
PESTICIDES	HEXACHLOROCYCLOHEXANE, DELTA (BHC)	UG/L	319-86-8	353	26	0.012	D	0.00085	95% KM (% Bootstrap) UCL
PESTICIDES	HEXACHLOROCYCLOHEXANE, GAMMA- (BHC) (LINDANE)	UG/L	58-89-9	353	6.8	0.029	D	0.0012	95% KM (% Bootstrap) UCL
PESTICIDES	METHOXYCHLOR	UG/L	72-43-5	353	0.85	0.0015	D	NA	NA
PESTICIDES	NONACHLOR, CIS-	UG/L	5103-73-1	353	8.8	0.00046	D	0.00025	95% KM (% Bootstrap) UCL
PESTICIDES	TOTAL DDX (U = 0)	UG/L	tDDT_0N	353	47	0.025	D	0.00084	95% KM (% Bootstrap) UCL
PCB	AROCLOR 1254	UG/L	11097-69-1	353	11	0.072	D	0.0088	95% KM (% Bootstrap) UCL
PCB	TOTAL PCB AROCLORS (U = 0)	UG/L	tPCB_0N	353	16	0.19	D	0.012	95% KM (t) UCL
PCBCONG	TOTAL PCB CONGENER (U = 0)	NG/L	tPCBCong_0N	101	100	91	D	12	95% Chebyshev (Mean, Sd) UCL
PCBCONG	TOTAL PCB CONGENER (U = 1/2)	NG/L	tPCBCong_N	101	100	92	D	8.6	95% H-UCL

Table A-3
Surface Water – Step 1 and Step 2 Eliminated Chemicals

Group	Chemical	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]	Step 1 Result	Step 2 Result
SVOC	NITROBENZENE	NA	670	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	PENTACHLOROPHENOL	7.9	7.9	0.12	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
SVOC	PHENOL	NA	58	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
PAH	1,6,7-TRIMETHYLNAPHTHALENE	NA	9.8	NA	0.00058	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PAH	2,6-DIMETHYLNAPHTHALENE	NA	26	NA	0.00045	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PAH	2-METHYLNAPHTHALENE	4.2	72	0.031	0.00012	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PAH	ACENAPHTHENE	6.6	56	0.032	0.00063	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PAH	BENZO(J,K)FLUORANTHENE	NA	0.64	NA	0.0093	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PAH	DIBENZO(A,H)ANTHRACENE AND DIBENZO(A,C)ANTHRACENE	NA	0.28	NA	0.015	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PAH	FLUORENE	2.5	39	0.024	0.00022	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PAH	NAPHTHALENE	16	190	0.03	0.00014	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PAH	PHENANTHRENE	1.5	19	0.15	0.00066	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTICIDES	ALDRIN	1.3	1.3	0.0065	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTICIDES	ENDOSULFAN-ALPHA (I)	0.0087	0.0087	0.75	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTICIDES	ENDOSULFAN-BETA (II)	0.0087	0.0087	0.39	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTICIDES	HEPTACHLOR EPOXIDE	0.0036	0.0036	0.58	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTICIDES	HEXACHLOROBENZENE	NA	130	NA	0.0000047	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTICIDES	HEXACHLOROCYCLOHEXANE, ALPHA (BHC)	NA	1400	NA	NA	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
PESTICIDES	HEXACHLOROCYCLOHEXANE, DELTA (BHC)	NA	500	NA	0.0000017	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTICIDES	HEXACHLOROCYCLOHEXANE, GAMMA- (BHC) (LINDANE)	0.16	0.16	0.18	0.0076	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTICIDES	METHOXYCHLOR	0.03	0.03	0.05	NA	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTICIDES	NONACHLOR, CIS-	NA	0.004	NA	0.063	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTICIDES	TOTAL DDX (U = 0)	0.001	0.001	25	0.84	Prelim-COPEC_Tier1 HQ	Eliminate_Tier2 HQ
PCB	AROCLOR 1254	NA	0.03	NA	0.29	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PCB	TOTAL PCB AROCLORS (U = 0)	0.03	0.03	6.3	0.39	Prelim-COPEC_Tier1 HQ	Eliminate_Tier2 HQ
PCBCONG	TOTAL PCB CONGENER (U = 0)	30	30	3	0.39	Prelim-COPEC_Tier1 HQ	Eliminate_Tier2 HQ
PCBCONG	TOTAL PCB CONGENER (U = 1/2)	30	30	3.1	0.29	Prelim-COPEC_Tier1 HQ	Eliminate_Tier2 HQ

Table A-3
Surface Water – Step 1 and Step 2 Eliminated Chemicals

Notes:

1 = These values were rounded to 2 significant figures. Calculations were performed prior to rounding.

µg/L = microgram per liter
BCA = bias corrected accelerated bootstrap method
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
CONV = conventional
D = detect
DDT = dichlorodiphenyltrichloroethane
FOD = frequency of detection
HERB = herbicide
HQ = hazard quotient
KM = Kaplan-Meier
MET = metals
METDISS = metals, dissolved
METORG = metals, organic
mg/L = milligram per liter
ng/L = nanogram per liter
NA = not available or not calculated
ND = non-detect
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PCBCONG = polychlorinated biphenyl congener
PEST = pesticide
RL = reporting limit
RN = registry number
SL = screening level
SVOC = semivolatile organic compound
UCL = upper confidence limit
USEPA = U.S. Environmental Protection Agency
VOC = volatile organic compound

Step 1 Result Definitions:

Eliminate_Tier1 HQ = The chemical can be eliminated from the risk assessment; the hazard quotient is less than Tier 1 screening level.

Prelim-COPEC_Tier1 HQ = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; the maximum overall result exceeds the Tier 1 screening level.

Prelim-COPEC_No Tier1 SL = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; there are no Tier 1 screening levels available.

Step 2 Result Definitions:

Eliminate_FOD<5 and RL<SL = The chemical was eliminated from the risk assessment; the frequency of detection is less than 5 percent, and the reporting limit is less than the screening level.

Eliminate_Tier1 HQ = The chemical was eliminated from the risk assessment based on the results of the Tier 1 screen.

Eliminate_Tier2 HQ = The chemical was eliminated from the risk assessment; the hazard quotient is less than 1.

Data Treatment:

The screening level analyses are based on the Phase 1 RI surface water data (February to October).

PAHs evaluated in the surface water screen were analyzed by Method 8270CSIM; results from Method 8270C were excluded.

Non-detects are reported at the reporting limit (RL).

Non-detect data were screened at half the RL in the Step 1 screen.

95% UCLs were calculated using USEPA's ProUCL (Version 4.1) for all data distributions.

95% UCLs were calculated for chemicals with an FOD of greater than 5 percent and at least four distinct, detected observations.

95% UCLs were calculated with non-detects reported at the RL.

UCLs were selected from the 95% UCL results based on ProUCL's recommendation. If the recommended 95% UCL was greater than the maximum detected result or if there are fewer than four detected observations, the maximum detected concentration was selected.

Chemicals with a FOD of less than 5% are not evaluated in the Tier 2 screen.

Table A-4
Surface Water – Step 1 and Step 2 Uncertain Chemicals

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type
MET	THALLIUM	UG/L	7440-28-0	353	3.4	28	D	NA	NA
METDISS	BERYLLIUM	UG/L	7440-41-7	353	0	25	ND	NA	NA
METDISS	COBALT	UG/L	7440-48-4	353	4	0.4	D	NA	NA
METDISS	LEAD	UG/L	7439-92-1	353	1.1	16	D	NA	NA
METDISS	SILVER	UG/L	7440-22-4	353	0	25	ND	NA	NA
VOC	1,2-DIBROMO-3-CHLOROPROPANE	UG/L	96-12-8	353	0	2.5	ND	NA	NA
VOC	1,3-DICHLOROPROPENE, CIS-	UG/L	10061-01-5	353	0	0.5	ND	NA	NA
VOC	1,3-DICHLOROPROPENE, TRANS-	UG/L	10061-02-6	353	0	0.5	ND	NA	NA
VOC	BROMOCHLOROMETHANE	UG/L	74-97-5	353	0	2.5	ND	NA	NA
VOC	CYCLOHEXANE	UG/L	110-82-7	353	0	10	ND	NA	NA
VOC	DICHLORODIFLUOROMETHANE	UG/L	75-71-8	353	0	5	ND	NA	NA
VOC	ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE)	UG/L	106-93-4	353	0	2	ND	NA	NA
VOC	ISOPROPYLBENZENE (CUMENE)	UG/L	98-82-8	353	0	0.5	ND	NA	NA
VOC	METHYL ACETATE	UG/L	79-20-9	353	0	10	ND	NA	NA
VOC	METHYL TERT-BUTYL ETHER (MTBE)	UG/L	1634-04-4	353	12	0.6	D	0.31	95% KM (t) UCL
VOC	METHYLCYCLOHEXANE	UG/L	108-87-2	353	0	10	ND	NA	NA
SVOC	2-NITROANILINE	UG/L	88-74-4	353	0	9.6	ND	NA	NA
SVOC	3-NITROANILINE	UG/L	99-09-2	350	0	9.6	ND	NA	NA
SVOC	4-BROMOPHENYL-PHENYL ETHER	UG/L	101-55-3	353	0	1.9	ND	NA	NA
SVOC	4-CHLORO-3-METHYLPHENOL	UG/L	59-50-7	353	0.28	0.38	D	NA	NA
SVOC	ATRAZINE	UG/L	1912-24-9	353	0	1.9	ND	NA	NA
SVOC	BENZALDEHYDE	UG/L	100-52-7	353	8.5	1	D	0.55	95% KM (t) UCL
SVOC	BIS(2-CHLOROETHOXY)METHANE	UG/L	111-91-1	353	0	1.9	ND	NA	NA
SVOC	BIS(2-CHLOROETHYL)ETHER	UG/L	111-44-4	353	0	0.38	ND	NA	NA
SVOC	BIS(2-CHLOROISOPROPYL)ETHER	UG/L	39638-32-9	353	0	0.38	ND	NA	NA
SVOC	CAPROLACTAM	UG/L	105-60-2	353	0.85	2.1	D	NA	NA
SVOC	HEXACHLOROCYCLOPENTADIENE	UG/L	77-47-4	306	0	1.1	ND	NA	NA
PESTICIDE	CHLORDANE, ALPHA- (CIS-CHLORDANE)	UG/L	5103-71-9	353	0	0.013	ND	NA	NA
PESTICIDE	CHLORDANE, BETA- (TRANS-CHLORDANE)	UG/L	5103-74-2	353	22	0.014	D	0.002	95% KM (% Bootstrap) UCL
PESTICIDE	DIELDRIN	UG/L	60-57-1	353	0	0.013	ND	NA	NA
PESTICIDE	ENDOSULFAN SULFATE	UG/L	1031-07-8	353	2.3	0.00092	D	NA	NA
PESTICIDE	ENDRIN	UG/L	72-20-8	353	0	0.013	ND	NA	NA
PESTICIDE	ENDRIN ALDEHYDE	UG/L	7421-93-4	345	3.2	0.01	D	NA	NA
PESTICIDE	ENDRIN KETONE	UG/L	53494-70-5	352	2.8	0.0052	D	NA	NA
PESTICIDE	HEPTACHLOR	UG/L	76-44-8	353	4.5	0.0076	D	NA	NA
PESTICIDE	HEXACHLOROCYCLOHEXANE, BETA- (BHC)	UG/L	319-85-7	353	5.1	0.011	D	0.001	95% KM (% Bootstrap) UCL
PESTICIDE	MIREX	UG/L	2385-85-5	353	2.8	0.0014	D	NA	NA
PESTICIDE	NONACHLOR, TRANS-	UG/L	39765-80-5	353	2.5	0.0085	D	NA	NA
PESTICIDE	OXYCHLORDANE	UG/L	27304-13-8	353	2.8	0.0018	D	NA	NA
PESTICIDE	TOXAPHENE	UG/L	8001-35-2	353	0.28	0.026	D	NA	NA
HERB	2,2-DICHLOROPROPIONIC ACID (DALAPON)	UG/L	75-99-0	350	0	5.7	ND	NA	NA

Table A-4
Surface Water – Step 1 and Step 2 Uncertain Chemicals

Group	Chemical	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]	Step 1 Result	Step 2 Result
MET	THALLIUM	NA	21	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
METDISS	BERYLLIUM	NA	5.1	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
METDISS	COBALT	NA	3	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
METDISS	LEAD	8	8.1	2	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
METDISS	SILVER	1.9	1.9	6.6	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
VOC	1,2-DIBROMO-3-CHLOROPROPANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	1,3-DICHLOROPROPENE, CIS-	NA	0.055	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
VOC	1,3-DICHLOROPROPENE, TRANS-	NA	0.055	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
VOC	BROMOCHLOROMETHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	CYCLOHEXANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	DICHLORODIFLUOROMETHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	ISOPROPYLBENZENE (CUMENE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	METHYL ACETATE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	METHYL TERT-BUTYL ETHER (MTBE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
VOC	METHYLCYCLOHEXANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	2-NITROANILINE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	3-NITROANILINE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	4-BROMOPHENYL-PHENYL ETHER	NA	1.5	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	4-CHLORO-3-METHYLPHENOL	NA	0.3	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	ATRAZINE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	BENZALDEHYDE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
SVOC	BIS(2-CHLOROETHOXY)METHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	BIS(2-CHLOROETHYL)ETHER	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	BIS(2-CHLOROISOPROPYL)ETHER	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	CAPROLACTAM	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	HEXACHLOROCYCLOPENTADIENE	0.07	0.07	7.9	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	CHLORDANE, ALPHA- (CIS-CHLORDANE)	0.004	0.004	1.6	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	CHLORDANE, BETA- (TRANS-CHLORDANE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTICIDE	DIELDRIN	0.0019	0.0019	3.4	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	ENDOSULFAN SULFATE	NA	0.009	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	ENDRIN	0.0023	0.0023	2.8	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	ENDRIN ALDEHYDE	NA	0.0023	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	ENDRIN KETONE	NA	0.0023	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	HEPTACHLOR	0.0036	0.0036	2.1	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	HEXACHLOROCYCLOHEXANE, BETA- (BHC)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTICIDE	MIREX	0.001	0.001	1.4	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	NONACHLOR, TRANS-	NA	0.004	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	OXYCHLORDANE	NA	0.004	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
PESTICIDE	TOXAPHENE	0.005	0.005	5.2	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
HERB	2,2-DICHLOROPROPIONIC ACID (DALAPON)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5

Table A-4
Surface Water – Step 1 and Step 2 Uncertain Chemicals

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type
HERB	2,4,5-T (2,4,5-TRICHLOROPHENOXYACETIC ACID)	UG/L	93-76-5	351	0	1.1	ND	NA	NA
HERB	2,4,5-TP (SILVEX)	UG/L	93-72-1	351	0.28	0.1	D	NA	NA
HERB	2,4-D (2,4-DICHLOROPHENOXYACETIC ACID)	UG/L	94-75-7	351	0	4.5	ND	NA	NA
HERB	2,4-DB (2,4-D DERIVATIVE)	UG/L	94-82-6	351	0	4.5	ND	NA	NA
HERB	DICAMBA	UG/L	1918-00-9	351	0	2.3	ND	NA	NA
HERB	DICHLORPROP	UG/L	120-36-5	351	0.28	0.72	D	NA	NA
HERB	DINOSEB	UG/L	88-85-7	351	0	1	ND	NA	NA
HERB	MECOPROP (MCPP)	UG/L	93-65-2	351	0	450	ND	NA	NA
HERB	MEPHANAC (MCPA)	UG/L	94-74-6	351	0	450	ND	NA	NA
PCB	AROCLOR 1221	UG/L	11104-28-2	353	0.28	0.072	D	NA	NA
PCB	AROCLOR 1242	UG/L	53469-21-9	353	4	0.029	D	NA	NA
PCB	AROCLOR 1248	UG/L	12672-29-6	353	0.85	0.017	D	NA	NA
PCB	AROCLOR 1260	UG/L	11096-82-5	353	2	0.19	D	NA	NA

Table A-4
Surface Water – Step 1 and Step 2 Uncertain Chemicals

Group	Chemical	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]	Step 1 Result	Step 2 Result
HERB	2,4,5-T (2,4,5-TRICHLOROPHENOXYACETIC ACID)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	2,4,5-TP (SILVEX)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	2,4-D (2,4-DICHLOROPHENOXYACETIC ACID)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	2,4-DB (2,4-D DERIVATIVE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	DICAMBA	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	DICHLORPROP	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	DINOSEB	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	MECOPROP (MCPP)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	MEPHANAC (MCPA)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
PCB	AROCLOR 1221	NA	0.03	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
PCB	AROCLOR 1242	NA	0.03	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
PCB	AROCLOR 1248	NA	0.03	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
PCB	AROCLOR 1260	NA	0.03	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL

Table A-4
Surface Water – Step 1 and Step 2 Uncertain Chemicals

Notes:

1 = These values were rounded to 2 significant figures. Calculations were performed prior to rounding.

µg/L = microgram per liter
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
D = detect
FOD = frequency of detection
HERB = herbicide
HQ = hazard quotient
KM = Kaplan-Meier
MET = metals
METDISS = metals, dissolved
NA = not available or not calculated
ND = non-detect
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PEST = pesticide
RL = reporting limit
RN = registry number
SL = screening level
SVOC = semivolatile organic compound
UCL = upper confidence limit
USEPA = U.S. Environmental Protection Agency
VOC = volatile organic compound

Step 1 Result Definitions:

Prelim-COPEC_Tier1 HQ = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; the maximum overall result exceeds the Tier 1 screening level.
Prelim-COPEC_No Tier1 SL = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; there are no Tier 1 screening levels available.

Step 2 Result Definitions:

Prelim-COPEC_No Tier2 SL = The chemical was identified as a preliminary COPEC; there are no Tier 2 screening levels available, and the frequency of detection is greater than 5 percent.
Prelim-COPEC_Tier2 RL>SL = The chemical was identified as a preliminary COPEC; the frequency of detection is less than 5 percent, but the reporting limit is greater than the screening level.

Data Treatment:

The screening level analyses are based on the Phase 1 RI surface water data (February to October).
PAHs evaluated in the surface water screen were analyzed by Method 8270CSIM; results from Method 8270C were excluded.
Non-detects are reported at the reporting limit (RL).
Non-detect data were screened at half the RL in the Step 1 screen.
95% UCLs were calculated using USEPA's ProUCL (Version 4.1) for all data distributions.
95% UCLs were calculated for chemicals with an FOD of greater than 5 percent and at least four distinct, detected observations.
95% UCLs were calculated with non-detects reported at the RL.
UCLs were selected from the 95% UCL results based on ProUCL's recommendation. If the recommended 95% UCL was greater than the maximum detected result or if there are fewer than four detected observations, the maximum detected concentration was selected.
Chemicals with a FOD of less than 5% are not evaluated in the Tier 2 screen.

APPENDIX B
SURFACE SEDIMENT SCREENING LEVEL ANALYSES

Table B-1 Surface Sediment – Preliminary Step 1 COPECs

Table B-2 Surface Sediment – Preliminary Step 2 COPECs

Table B-3 Surface Sediment – Step 1 and Step 2 Eliminated Chemicals

Table B-4 Surface Sediment – Step 1 and Step 2 Uncertain Chemicals

Table B-1
Surface Sediment – Preliminary Step 1 COPECs

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	Tier 1 Screening Level[1]	Tier 1 Hazard Quotient[1]	Step 1 Result
MET	CADMIUM	mg/kg	7440-43-9	142	100	250	D	1.2	210	Prelim-COPEC_Tier1 HQ
MET	CHROMIUM	mg/kg	7440-47-3	142	100	1,400	D	81	18	Prelim-COPEC_Tier1 HQ
MET	COPPER	mg/kg	7440-50-8	142	100	23,000	D	34	680	Prelim-COPEC_Tier1 HQ
MET	LEAD	mg/kg	7439-92-1	142	100	3,100	D	47	67	Prelim-COPEC_Tier1 HQ
MET	MERCURY	mg/kg	7439-97-6	142	100	13	D	0.15	87	Prelim-COPEC_Tier1 HQ
MET	NICKEL	mg/kg	7440-02-0	142	100	3,300	D	21	160	Prelim-COPEC_Tier1 HQ
MET	SILVER	mg/kg	7440-22-4	142	100	42	D	1	42	Prelim-COPEC_Tier1 HQ
MET	ZINC	mg/kg	7440-66-6	142	100	11,000	D	150	70	Prelim-COPEC_Tier1 HQ
VOC	1,4-DICHLOROBENZENE	mg/kg-OC	106-46-7	142	29	14	D	12	1.1	Prelim-COPEC_Tier1 HQ
SVOC	HEXACHLOROBUTADIENE (HEXACHLORO-1,3-BUTADIENE)	mg/kg-OC	87-68-3	142	0	31	ND	1.6	9.6	Prelim-COPEC_Tier1 HQ
SVOC	HEXACHLOROCYCLOPENTADIENE	mg/kg-OC	77-47-4	138	0	150	ND	0.7	110	Prelim-COPEC_Tier1 HQ
PAH	2-METHYLNAPHTHALENE	µg/kg	91-57-6	142	100	28,000	D	70	400	Prelim-COPEC_Tier1 HQ
PAH	ACENAPHTHENE	µg/kg	83-32-9	142	100	35,000	D	16	2,200	Prelim-COPEC_Tier1 HQ
PAH	ACENAPHTHYLENE	µg/kg	208-96-8	142	100	16,000	D	44	350	Prelim-COPEC_Tier1 HQ
PAH	ANTHRACENE	µg/kg	120-12-7	142	100	46,000	D	85	540	Prelim-COPEC_Tier1 HQ
PAH	BENZO(A)ANTHRACENE	µg/kg	56-55-3	142	100	62,000	D	260	240	Prelim-COPEC_Tier1 HQ
PAH	BENZO(A)PYRENE	µg/kg	50-32-8	142	100	55,000	D	430	130	Prelim-COPEC_Tier1 HQ
PAH	CHRYSENE	µg/kg	218-01-9	142	100	57,000	D	380	150	Prelim-COPEC_Tier1 HQ
PAH	DIBENZO(A,H)ANTHRACENE AND DIBENZO(A,C)ANTHRACENE	µg/kg	215-58-753-70-3	142	100	7,900	D	63	120	Prelim-COPEC_Tier1 HQ
PAH	FLUORANTHENE	µg/kg	206-44-0	142	100	120,000	D	600	200	Prelim-COPEC_Tier1 HQ
PAH	FLUORENE	µg/kg	86-73-7	142	100	14,000	D	19	720	Prelim-COPEC_Tier1 HQ
PAH	NAPHTHALENE	µg/kg	91-20-3	142	100	110,000	D	160	660	Prelim-COPEC_Tier1 HQ
PAH	PHENANTHRENE	µg/kg	85-01-8	142	100	68,000	D	240	280	Prelim-COPEC_Tier1 HQ
PAH	PYRENE	µg/kg	129-00-0	142	100	140,000	D	670	210	Prelim-COPEC_Tier1 HQ
PAH	TOTAL HPAH (9 OF 16) (U = 0)	µg/kg	tPAH_17_HM_0N	142	100	530,000	D	1,700	310	Prelim-COPEC_Tier1 HQ
PAH	TOTAL HPAH (9 OF 16) (U = 1/2)	µg/kg	tPAH_17_HM_N	142	100	530,000	D	1,700	310	Prelim-COPEC_Tier1 HQ
PAH	TOTAL LPAH (7 OF 16) (U = 0)	µg/kg	tPAH_17_LM_0N	142	100	260,000	D	550	470	Prelim-COPEC_Tier1 HQ
PAH	TOTAL LPAH (7 OF 16) (U = 1/2)	µg/kg	tPAH_17_LM_N	142	100	260,000	D	550	470	Prelim-COPEC_Tier1 HQ
PAH	TOTAL PAH (16) (U = 0)	µg/kg	tPAH_17_0N	142	100	780,000	D	4,000	190	Prelim-COPEC_Tier1 HQ
PAH	TOTAL PAH (16) (U = 1/2)	µg/kg	tPAH_17_N	142	100	780,000	D	4,000	190	Prelim-COPEC_Tier1 HQ
PESTH	4,4'-DDE (P,P'-DDE)	µg/kg	72-55-9	36	100	190	D	2.2	86	Prelim-COPEC_Tier1 HQ
PESTH	CHLORDANE, ALPHA- (CIS-CHLORDANE)	mg/kg-OC	5103-71-9	34	100	3	D	0.002	1,600	Prelim-COPEC_Tier1 HQ
PESTH	ENDOSULFAN-ALPHA (I)	mg/kg-OC	959-98-8	34	0	0	ND	0.004	9.5	Prelim-COPEC_Tier1 HQ
PESTH	ENDOSULFAN-BETA (II)	mg/kg-OC	33213-65-9	34	26	0	D	0.004	33	Prelim-COPEC_Tier1 HQ
PESTH	TOTAL CHLORDANE HIGH RESOLUTION (U = 0)	mg/kg-OC	tChlordaneHR_0N	34	100	9	D	0.002	4,600	Prelim-COPEC_Tier1 HQ
PESTH	TOTAL CHLORDANE HIGH RESOLUTION (U = 1/2)	mg/kg-OC	tChlordaneHR_N	34	100	9	D	0.002	4,600	Prelim-COPEC_Tier1 HQ
PESTH	TOTAL DDX HIGH RESOLUTION (U = 0)	µg/kg	tDDTHR_0N	36	100	690	D	1.6	430	Prelim-COPEC_Tier1 HQ
PESTH	TOTAL DDX HIGH RESOLUTION (U = 1/2)	µg/kg	tDDTHR_N	36	100	690	D	1.6	430	Prelim-COPEC_Tier1 HQ
PESTH	TOXAPHENE	mg/kg-OC	8001-35-2	34	0	34	ND	0.01	1,700	Prelim-COPEC_Tier1 HQ
PCB	TOTAL PCB AROCLORS (U = 0)	µg/kg	tPCB_0N	142	100	36,000	D	23	1,600	Prelim-COPEC_Tier1 HQ
PCB	TOTAL PCB AROCLORS (U = 1/2)	µg/kg	tPCB_N	142	100	38,000	D	23	1,700	Prelim-COPEC_Tier1 HQ
PCBCONG	TOTAL PCB CONGENER (U = 0)	ng/kg	tPCBCong_0N	36	100	22,000,000	D	23,000	980	Prelim-COPEC_Tier1 HQ
PCBCONG	TOTAL PCB CONGENER (U = 1/2)	ng/kg	tPCBCong_N	36	100	22,000,000	D	23,000	980	Prelim-COPEC_Tier1 HQ

Table B-1
Surface Sediment – Preliminary Step 1 COPECs

Notes:
1 = These values were rounded to 2 significant figures. Calculations were performed prior to rounding.
µg/kg = milligram per kilogram
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
D = detect
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DDx = 2,4' and 4,4'-DDD, -DDE, -DDT
HPAH = high-molecular-weight polycyclic aromatic hydrocarbon
HQ = hazard quotient
LPAH = low-molecular-weight polycyclic aromatic hydrocarbon
MET = metals
mg/kg = milligram per kilogram
ND = non-detect
ng/kg = nanogram per kilogram
OC = organic carbon
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PCBCONG = polychlorinated biphenyl congener
PESTH = pesticide, high resolution
RL = reporting limit
RN = registry number
SL = screening level
SVOC = semivolatile organic compound
VOC = volatile organic compound

Step 1 Result Definitions:
Prelim-COPEC_Tier1 HQ = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; the maximum overall result exceeds the Tier 1 screening level.

Data Treatment:
Phase 1 sediment data are presented on a dry-weight basis and/or an organic-carbon normalized basis depending on the derivation of the available screening level. Dry weight results are presented if screening levels are not available.
PAHs were analyzed by method 8270CSIM; results from Method 8270C were excluded.
Pesticides were analyzed by the high resolution method, E1699; results from the low resolution method, SW8081A, were excluded.
Non-detects are reported at the reporting limit (RL).
Non-detect data were screened at half the RL in the Step 1 screen.
Chlordane, alpha- (cis-chlordane) has an EqP based Tier 1 screening level and a dry weight Tier 2 screening level.

Table B-2
Surface Sediment – Preliminary Step 2 COPECs

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type
CONV	CYANIDE, TOTAL	mg/kg	57-12-5	142	6.3	7.7	D	1.4	95% KM (Percentile Bootstrap) UCL
MET	ANTIMONY	mg/kg	7440-36-0	142	100	31	D	3.6	95% Chebyshev (Mean, Sd) UCL
MET	ARSENIC	mg/kg	7440-38-2	142	100	400	D	41	95% Chebyshev (Mean, Sd) UCL
MET	BARIUM	mg/kg	7440-39-3	142	100	680	D	180	95% Chebyshev (Mean, Sd) UCL
MET	CADMIUM	mg/kg	7440-43-9	142	100	250	D	28	95% Chebyshev (Mean, Sd) UCL
MET	CHROMIUM	mg/kg	7440-47-3	142	100	1,400	D	230	95% Chebyshev (Mean, Sd) UCL
MET	COPPER	mg/kg	7440-50-8	142	100	23,000	D	1,800	95% Chebyshev (Mean, Sd) UCL
MET	LEAD	mg/kg	7439-92-1	142	100	3,100	D	570	95% Chebyshev (Mean, Sd) UCL
MET	MANGANESE	mg/kg	7439-96-5	142	100	710	D	340	95% Student's-t UCL
MET	MERCURY	mg/kg	7439-97-6	142	100	13	D	2.5	95% Chebyshev (Mean, Sd) UCL
MET	NICKEL	mg/kg	7440-02-0	142	100	3,300	D	280	95% Chebyshev (Mean, Sd) UCL
MET	SELENIUM	mg/kg	7782-49-2	142	100	33	D	5.1	95% Chebyshev (Mean, Sd) UCL
MET	SILVER	mg/kg	7440-22-4	142	100	42	D	9.8	95% Chebyshev (Mean, Sd) UCL
MET	TIN	mg/kg	7440-31-5	142	100	140	D	43	95% Chebyshev (Mean, Sd) UCL
MET	ZINC	mg/kg	7440-66-6	142	100	11,000	D	1,900	95% Chebyshev (Mean, Sd) UCL
SVOC	BIPHENYL (1,1'-BIPHENYL)	µg/kg	92-52-4	142	29	2,400	D	240	95% KM (BCA) UCL
SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	µg/kg	117-81-7	142	100	210,000	D	33,000	95% H-UCL
PAH	1-METHYLNAPHTHALENE	µg/kg	90-12-0	142	100	19,000	D	1,300	95% Chebyshev (Mean, Sd) UCL
PAH	1-METHYLPHENANTHRENE	µg/kg	832-69-9	142	100	35,000	D	3,000	95% Chebyshev (Mean, Sd) UCL
PAH	2,6-DIMETHYLNAPHTHALENE	µg/kg	581-42-0	142	100	46,000	D	2,900	95% Chebyshev (Mean, Sd) UCL
PAH	2-METHYLNAPHTHALENE	µg/kg	91-57-6	142	100	28,000	D	2,400	95% Chebyshev (Mean, Sd) UCL
PAH	ACENAPHTHENE	µg/kg	83-32-9	142	100	35,000	D	3,100	95% Chebyshev (Mean, Sd) UCL
PAH	ACENAPHTHYLENE	µg/kg	208-96-8	142	100	16,000	D	1,500	95% Chebyshev (Mean, Sd) UCL
PAH	ANTHRACENE	µg/kg	120-12-7	142	100	46,000	D	4,600	95% Chebyshev (Mean, Sd) UCL
PAH	BENZO(A)ANTHRACENE	µg/kg	56-55-3	142	100	62,000	D	7,400	95% Chebyshev (Mean, Sd) UCL
PAH	BENZO(A)PYRENE	µg/kg	50-32-8	142	100	55,000	D	5,100	95% H-UCL
PAH	BENZO(B)FLUORANTHENE	µg/kg	205-99-2	142	100	29,000	D	4,900	95% H-UCL
PAH	BENZO(G,H,I)PERYLENE	µg/kg	191-24-2	142	100	26,000	D	4,100	95% Chebyshev (Mean, Sd) UCL
PAH	BENZO(J,K)FLUORANTHENE	µg/kg	BKJFLANTH	142	100	31,000	D	5,000	95% Chebyshev (Mean, Sd) UCL
PAH	CHRYSENE	µg/kg	218-01-9	142	100	57,000	D	7,800	95% Chebyshev (Mean, Sd) UCL
PAH	DIBENZO(A,H)ANTHRACENE AND DIBENZO(A,C)ANTHRACENE	µg/kg	215-58-753-70-3	142	100	7,900	D	1,000	95% H-UCL
PAH	FLUORANTHENE	µg/kg	206-44-0	142	100	120,000	D	15,000	95% Chebyshev (Mean, Sd) UCL
PAH	FLUORENE	µg/kg	86-73-7	142	100	14,000	D	1,200	95% Chebyshev (Mean, Sd) UCL
PAH	INDENO(1,2,3-C,D)PYRENE	µg/kg	193-39-5	142	100	26,000	D	4,100	95% Chebyshev (Mean, Sd) UCL
PAH	NAPHTHALENE	µg/kg	91-20-3	142	100	110,000	D	6,000	95% Chebyshev (Mean, Sd) UCL
PAH	PERYLENE	µg/kg	198-55-0	142	100	8,900	D	1,500	95% Chebyshev (Mean, Sd) UCL
PAH	PHENANTHRENE	µg/kg	85-01-8	142	100	68,000	D	6,800	95% Chebyshev (Mean, Sd) UCL
PAH	PYRENE	µg/kg	129-00-0	142	100	140,000	D	13,000	95% H-UCL
PAH	TOTAL HPAH (9 OF 16) (U = 0)	µg/kg	tPAH_17_HM_0N	142	100	530,000	D	75,000	95% Chebyshev (Mean, Sd) UCL
PAH	TOTAL HPAH (9 OF 16) (U = 1/2)	µg/kg	tPAH_17_HM_N	142	100	530,000	D	75,000	95% Chebyshev (Mean, Sd) UCL
PAH	TOTAL LPAH (7 OF 16) (U = 0)	µg/kg	tPAH_17_LM_0N	142	100	260,000	D	24,000	95% Chebyshev (Mean, Sd) UCL
PAH	TOTAL LPAH (7 OF 16) (U = 1/2)	µg/kg	tPAH_17_LM_N	142	100	260,000	D	24,000	95% Chebyshev (Mean, Sd) UCL
PAH	TOTAL PAH (16) (U = 0)	µg/kg	tPAH_17_0N	142	100	780,000	D	99,000	95% Chebyshev (Mean, Sd) UCL

Table B-2
Surface Sediment – Preliminary Step 2 COPECs

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type
PAH	TOTAL PAH (16) (U = 1/2)	µg/kg	tPAH_17_N	142	100	780,000	D	99,000	95% Chebyshev (Mean, Sd) UCL
PESTH	4,4'-DDD (P,P'-DDD)	µg/kg	72-54-8	36	100	260	D	91	95% Approximate Gamma UCL
PESTH	4,4'-DDE (P,P'-DDE)	µg/kg	72-55-9	36	100	190	D	66	95% Approximate Gamma UCL
PESTH	4,4'-DDT (P,P'-DDT)	µg/kg	50-29-3	36	94	26	D	13	95% KM (Chebyshev) UCL
PESTH	CHLORDANE, ALPHA- (CIS-CHLORDANE)	µg/kg	5103-71-9	36	100	220	D	71	95% Approximate Gamma UCL
PESTH	TOTAL CHLORDANE HIGH RESOLUTION (U = 0)[a]	µg/kg	tChlordaneHR_0N	36	100	650	D	210	95% Approximate Gamma UCL
PESTH	TOTAL CHLORDANE HIGH RESOLUTION (U = 1/2)[a]	µg/kg	tChlordaneHR_N	36	100	650	D	210	95% Approximate Gamma UCL
PESTH	TOTAL DDX HIGH RESOLUTION (U = 0)	µg/kg	tDDTHR_0N	36	100	690	D	230	95% Approximate Gamma UCL
PESTH	TOTAL DDX HIGH RESOLUTION (U = 1/2)	µg/kg	tDDTHR_N	36	100	690	D	230	95% Approximate Gamma UCL
DIOXFUR	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD)	ng/kg	1746-01-6	36	100	26	D	8.3	95% Approximate Gamma UCL
PCB	AROCLOR 1254	mg/kg-OC	11097-69-1	142	95	170	D	24	95% KM (BCA) UCL
PCB	TOTAL PCB AROCLORS (U = 0)	µg/kg	tPCB_0N	142	100	36,000	D	3,900	95% Chebyshev (Mean, Sd) UCL
PCB	TOTAL PCB AROCLORS (U = 1/2)	µg/kg	tPCB_N	142	100	38,000	D	4,100	95% Chebyshev (Mean, Sd) UCL
PCBCONG	TOTAL PCB CONGENER (U = 0)	ng/kg	tPCBCong_0N	36	100	22,000,000	D	5,400,000	95% H-UCL
PCBCONG	TOTAL PCB CONGENER (U = 1/2)	ng/kg	tPCBCong_N	36	100	22,000,000	D	5,400,000	95% H-UCL

Table B-2
Surface Sediment – Preliminary Step 2 COPECs

Group	Chemical	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]	Step 1 Result	Step 2 Result
CONV	CYANIDE, TOTAL	NA	0.1	NA	14	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
MET	ANTIMONY	NA	0.63	NA	5.8	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
MET	ARSENIC	NA	8.2	NA	5	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
MET	BARIUM	NA	130	NA	1.4	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
MET	CADMIUM	1.2	1.2	210	23	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
MET	CHROMIUM	81	81	18	2.8	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
MET	COPPER	34	34	680	54	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
MET	LEAD	47	47	67	12	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
MET	MANGANESE	NA	260	NA	1.3	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
MET	MERCURY	0.15	0.15	87	17	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
MET	NICKEL	21	21	160	14	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
MET	SELENIUM	NA	1	NA	5.1	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
MET	SILVER	1	1	42	9.8	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
MET	TIN	NA	3.4	NA	13	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
MET	ZINC	150	150	70	13	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
SVOC	BIPHENYL (1,1'-BIPHENYL)	NA	17	NA	14	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	NA	180	NA	180	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PAH	1-METHYLNAPHTHALENE	NA	21	NA	63	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PAH	1-METHYLPHENANTHRENE	NA	18	NA	170	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PAH	2,6-DIMETHYLNAPHTHALENE	NA	25	NA	120	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PAH	2-METHYLNAPHTHALENE	70	70	400	35	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	ACENAPHTHENE	16	16	2,200	190	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	ACENAPHTHYLENE	44	44	350	33	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	ANTHRACENE	85	85	540	54	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	BENZO(A)ANTHRACENE	260	260	240	29	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	BENZO(A)PYRENE	430	430	130	12	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	BENZO(B)FLUORANTHENE	NA	130	NA	37	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PAH	BENZO(G,H,I)PERYLENE	NA	67	NA	62	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PAH	BENZO(J,K)FLUORANTHENE	NA	70	NA	71	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PAH	CHRYSENE	380	380	150	20	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	DIBENZO(A,H)ANTHRACENE AND DIBENZO(A,C)ANTHRACENE	63	63	120	16	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	FLUORANTHENE	600	600	200	26	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	FLUORENE	19	19	720	65	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	INDENO(1,2,3-C,D)PYRENE	NA	68	NA	60	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PAH	NAPHTHALENE	160	160	660	38	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	PERYLENE	NA	74	NA	21	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PAH	PHENANTHRENE	240	240	280	28	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	PYRENE	670	670	210	19	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	TOTAL HPAH (9 OF 16) (U = 0)	1,700	1,700	310	44	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	TOTAL HPAH (9 OF 16) (U = 1/2)	1,700	1,700	310	44	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	TOTAL LPAH (7 OF 16) (U = 0)	550	550	470	44	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	TOTAL LPAH (7 OF 16) (U = 1/2)	550	550	470	44	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PAH	TOTAL PAH (16) (U = 0)	4,000	4,000	190	25	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ

Table B-2
Surface Sediment – Preliminary Step 2 COPECs

Group	Chemical	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]	Step 1 Result	Step 2 Result
PAH	TOTAL PAH (16) (U = 1/2)	4,000	4,000	190	25	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PESTH	4,4'-DDD (P,P'-DDD)	NA	1.2	NA	75	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PESTH	4,4'-DDE (P,P'-DDE)	2.2	2.2	86	30	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PESTH	4,4'-DDT (P,P'-DDT)	NA	2	NA	6.3	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PESTH	CHLORDANE, ALPHA- (CIS-CHLORDANE)	NA	2.3	NA	31	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PESTH	TOTAL CHLORDANE HIGH RESOLUTION (U = 0)[a]	NA	2.3	NA	93	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PESTH	TOTAL CHLORDANE HIGH RESOLUTION (U = 1/2)[a]	NA	2.3	NA	93	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PESTH	TOTAL DDX HIGH RESOLUTION (U = 0)	1.6	1.6	430	150	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PESTH	TOTAL DDX HIGH RESOLUTION (U = 1/2)	1.6	1.6	430	150	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
DIOXFUR	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD)	NA	0.85	NA	9.7	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PCB	AROCLOR 1254	NA	6.3	NA	3.8	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 HQ
PCB	TOTAL PCB AROCLORS (U = 0)	23	23	1,600	170	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PCB	TOTAL PCB AROCLORS (U = 1/2)	23	23	1,700	180	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PCBCONG	TOTAL PCB CONGENER (U = 0)	23,000	23,000	980	240	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ
PCBCONG	TOTAL PCB CONGENER (U = 1/2)	23,000	23,000	980	240	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 HQ

Table B-2
Surface Sediment – Preliminary Step 2 COPECs

Notes:

1 = These values were rounded to 2 significant figures. Calculations were performed prior to rounding.

a = Screening level for chlordane, alpha- (cis-chlordane)

µg/kg = milligram per kilogram

BCA = bias corrected accelerated bootstrap method

CAS = Chemical Abstracts Services

COPEC = constituent of potential ecological concern

CONV = conventional

D = detect

DDD = dichlorodiphenyldichloroethane

DDE = dichlorodiphenyldichloroethylene

DDT = dichlorodiphenyltrichloroethane

DDx = 2,4′ and 4,4′-DDD, -DDE, -DDT

DIOXFUR = dioxins and furans

FOD = frequency of detection

HPAH = high-molecular-weight polycyclic aromatic hydrocarbon

HQ = hazard quotient

KM = Kaplan-Meir

LPAH = low-molecular-weight polycyclic aromatic hydrocarbon

MET = metals

NA = not available or not calculated

ND = non-detect

ng/kg = nanogram per kilogram

OC = organic carbon

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

PCBCONG = polychlorinated biphenyl congener

PESTH = pesticide, high resolution

RL = reporting limit

RN = registry number

SL = screening level

SVOC = semivolatile organic compound

UCL = upper confidence limit

USEPA = U.S. Environmental Protection Agency

Step 1 Result Definitions:

Prelim-COPEC_Tier1 HQ = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; the maximum overall result exceeds the Tier 1 screening level.

Prelim-COPEC_No Tier1 SL = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; there are no Tier 1 screening levels available.

Step 2 Result Definitions:

Prelim-COPEC_Tier2 HQ = The chemical was identified as a preliminary COPEC; the EPC (95% UCL or maximum value) exceeds the Tier 2 screening level, and the frequency of detection is greater than 5 percent.

Prelim-COPEC_Tier2 RL>SL = The chemical was identified as a preliminary COPEC; the frequency of detection is less than 5 percent, but the reporting limit is greater than the screening level.

Data Treatment:

Phase 1 sediment data are presented on a dry-weight basis and/or an organic-carbon normalized basis depending on the derivation of the available screening level. Dry weight results are presented if screening levels are not available.

PAHs were analyzed by Method 8270CSIM; results from Method 8270C were excluded.

Pesticides were analyzed by the high resolution method, E1699; results from the low resolution method, SW8081A, were excluded.

Non-detects are reported at the reporting limit (RL).

Non-detect data were screened at half the RL in the Step 1 screen.

95% UCLs were calculated using USEPA's ProUCL (Version 4.1) for all data distributions.

95% UCLs were calculated for chemicals with an FOD of greater than 5 percent and at least four distinct, detected observations.

95% UCLs were calculated with non-detects reported at the RL.

UCLs were selected from the 95% UCL results based on ProUCL's recommendation. If the recommended 95% UCL was greater than the maximum detected result or if there were fewer than four detected observations, the maximum detected concentration was selected.

Chemicals with a FOD of less than 5 percent were not evaluated in the Tier 2 screen.

Chlordane, alpha- (cis-chlordane) has an EqP based Tier 1 screening level and a dry weight Tier 2 screening level.

Table B-3
Surface Sediment – Step 1 and Step 2 Eliminated Chemicals

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]
MET	ALUMINUM	mg/kg	7429-90-5	142	100	19,000	D	13,000	95% Student's-t UCL	NA	18,000	NA	0.73
MET	COBALT	mg/kg	7440-48-4	142	100	69	D	14	95% Modified-t UCL	NA	50	NA	0.28
MET	IRON	mg/kg	7439-89-6	142	100	52,000	D	32,000	95% Student's-t UCL	NA	220,000	NA	0.15
MET	VANADIUM	mg/kg	7440-62-2	142	100	150	D	52	95% Modified-t UCL	NA	57	NA	0.91
METORG	METHYL MERCURY	µg/kg	22967-92-6	35	91	4.3	D	1.7	95% KM (Chebyshev) UCL	NA	100	NA	0.017
VOC	1,1,1-TRICHLOROETHANE	mg/kg-OC	71-55-6	142	0	12	ND	NA	NA	NA	86	NA	NA
VOC	1,1,2,2-TETRACHLOROETHANE	mg/kg-OC	79-34-5	142	0	12	ND	NA	NA	NA	20	NA	NA
VOC	1,1,2-TRICHLOROETHANE	mg/kg-OC	79-00-5	142	0	18	ND	NA	NA	NA	57	NA	NA
VOC	1,1-DICHLOROETHENE	mg/kg-OC	75-35-4	142	0	12	ND	NA	NA	NA	280	NA	NA
VOC	1,2,3-TRICHLOROBENZENE	mg/kg-OC	87-61-6	140	0	60	ND	NA	NA	NA	91	NA	NA
VOC	1,2-DICHLOROBENZENE	mg/kg-OC	95-50-1	142	4.9	1.4	D	NA	NA	12	99	0.12	NA
VOC	1,2-DICHLOROETHANE	mg/kg-OC	107-06-2	142	0	12	ND	NA	NA	NA	26	NA	NA
VOC	1,2-DICHLOROETHENE, CIS-[a]	mg/kg-OC	156-59-2	142	11	0.078	D	0.029	95% KM (% Bootstrap) UCL	NA	65	NA	0.00045
VOC	1,2-DICHLOROETHENE, TRANS-	mg/kg-OC	156-60-5	142	0	18	ND	NA	NA	NA	65	NA	NA
VOC	1,3-DICHLOROBENZENE	mg/kg-OC	541-73-1	142	0	60	ND	NA	NA	NA	84	NA	NA
VOC	1,4-DICHLOROBENZENE	mg/kg-OC	106-46-7	142	29	14	D	0.81	95% KM (Chebyshev) UCL	12	46	1.1	0.018
VOC	2-BUTANONE (MEK)	mg/kg-OC	78-93-3	142	91	8.8	D	2.3	95% KM (BCA) UCL	NA	4.2	NA	0.53
VOC	ACETONE	mg/kg-OC	67-64-1	142	95	41	D	11	95% KM (BCA) UCL	NA	20	NA	0.55
VOC	BENZENE	mg/kg-OC	71-43-2	142	11	1.4	D	0.11	95% KM (Chebyshev) UCL	26	26	0.055	0.0043
VOC	BROMOFORM (TRIBROMOMETHANE)	mg/kg-OC	75-25-2	141	0	48	ND	NA	NA	NA	130	NA	NA
VOC	CARBON DISULFIDE	mg/kg-OC	75-15-0	142	97	7.3	D	1.1	95% KM (BCA) UCL	NA	2.4	NA	0.44
VOC	CARBON TETRACHLORIDE (TETRACHLOROMETHANE)	mg/kg-OC	56-23-5	142	0	12	ND	NA	NA	NA	720	NA	NA
VOC	CHLOROBENZENE	mg/kg-OC	108-90-7	142	18	1.3	D	0.085	95% KM (BCA) UCL	3.5	16	0.38	0.0052
VOC	DICHLOROMETHANE (METHYLENE CHLORIDE)	mg/kg-OC	75-09-2	142	6.3	98	D	4.1	95% KM (Chebyshev) UCL	NA	16	NA	0.26
VOC	ETHYLBENZENE	mg/kg-OC	100-41-4	142	8.5	4.7	D	0.22	95% KM (Chebyshev) UCL	6.4	31	0.73	0.0072
VOC	ISOPROPYLBENZENE (CUMENE)	mg/kg-OC	98-82-8	142	15	2.4	D	0.2	95% KM (Chebyshev) UCL	NA	12	NA	0.016
VOC	STYRENE	mg/kg-OC	100-42-5	142	0	23	ND	NA	NA	NA	710	NA	NA
VOC	TETRACHLOROETHENE (PCE)	mg/kg-OC	127-18-4	142	2.1	0.53	D	NA	NA	NA	19	NA	NA
VOC	TOLUENE	mg/kg-OC	108-88-3	142	9.2	0.25	D	0.043	95% KM (t) UCL	45	110	0.0056	0.0004
VOC	TOTAL XYLENE (U = 0)	mg/kg-OC	tXylene_0N	142	5.6	13	D	0.78	97.5% KM (Chebyshev) UCL	27	43	0.48	0.018
VOC	TOTAL XYLENE (U = 1/2)	mg/kg-OC	tXylene_N	142	5.6	13	D	0.66	95% KM (Chebyshev) UCL	27	43	0.48	0.015
VOC	TRICHLOROETHENE (TCE)	mg/kg-OC	79-01-6	142	1.4	0.083	D	NA	NA	NA	900	NA	NA
VOC	VINYL CHLORIDE	mg/kg-OC	75-01-4	142	0.7	0.05	D	NA	NA	NA	43	NA	NA
SVOC	1,2,4,5-TETRACHLOROBENZENE	mg/kg-OC	95-94-3	142	0	150	ND	NA	NA	NA	4700	NA	NA
SVOC	2,4,6-TRICHLOROPHENOL	mg/kg-OC	88-06-2	142	0	150	ND	NA	NA	NA	270	NA	NA
SVOC	2-CHLORONAPHTHALENE	mg/kg-OC	91-58-7	142	0	31	ND	NA	NA	NA	42	NA	NA
SVOC	3,3'-DICHLOROBENZIDINE	mg/kg-OC	91-94-1	139	0	150	ND	NA	NA	NA	210	NA	NA
SVOC	4-BROMOPHENYL-PHENYL ETHER	mg/kg-OC	101-55-3	142	0	150	ND	NA	NA	NA	160	NA	NA
SVOC	4-CHLOROANILINE	mg/kg-OC	106-47-8	142	69	25	D	6.3	95% KM (BCA) UCL	NA	15	NA	0.43
SVOC	BIS(2-CHLOROETHYL)ETHER	mg/kg-OC	111-44-4	142	0	31	ND	NA	NA	NA	350	NA	NA
SVOC	BUTYLBENZYL PHTHALATE	mg/kg-OC	85-68-7	142	62	54	D	13	95% KM (BCA) UCL	NA	1700	NA	0.0076
SVOC	DI-N-BUTYL PHTHALATE	mg/kg-OC	84-74-2	142	61	76	D	8.2	95% KM (BCA) UCL	NA	120	NA	0.071
SVOC	DI-N-OCTYL PHTHALATE	mg/kg-OC	117-84-0	142	50	39	D	11	95% KM (t) UCL	NA	15	NA	0.74

Table B-3
Surface Sediment – Step 1 and Step 2 Eliminated Chemicals

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]
SVOC	DIBENZOFURAN	mg/kg-OC	132-64-9	142	56	770	D	35	95% KM (Chebyshev) UCL	NA	730	NA	0.048
SVOC	N-NITROSODIPHENYLAMINE	mg/kg-OC	86-30-6	141	0	150	ND	NA	NA	NA	42,000	NA	NA
SVOC	PHENOL	mg/kg-OC	108-95-2	142	27	22	D	2.3	95% KM (BCA) UCL	NA	4.9	NA	0.48
PESTH	ALDRIN	mg/kg-OC	309-00-2	34	35	0.021	D	0.009	95% KM (t) UCL	NA	0.2	NA	0.045
PESTH	DIELDRIN	mg/kg-OC	60-57-1	34	100	1.3	D	0.43	95% Approximate Gamma UCL	17	17	0.076	0.025
PESTH	ENDOSULFAN SULFATE	mg/kg-OC	1031-07-8	34	21	0.008	D	0.0059	95% KM (Percentile Bootstrap) UCL	NA	0.036	NA	0.16
PESTH	ENDOSULFAN-ALPHA (I)	mg/kg-OC	959-98-8	34	0	0.076	ND	NA	NA	0.004	0.33	9.5	NA
PESTH	ENDOSULFAN-BETA (II)	mg/kg-OC	33213-65-9	34	26	0.13	D	0.036	95% KM (Percentile Bootstrap) UCL	0.004	0.19	33	0.18
PESTH	ENDRIN	mg/kg-OC	72-20-8	34	2.9	0.02	D	NA	NA	0.73	0.73	0.027	NA
PESTH	ENDRIN ALDEHYDE	mg/kg-OC	7421-93-4	34	0	0.16	ND	NA	NA	NA	48	NA	NA
PESTH	HEPTACHLOR	mg/kg-OC	76-44-8	34	38	0.012	D	0.0059	95% KM (Percentile Bootstrap) UCL	0.09	0.09	0.13	0.066
PESTH	HEPTACHLOR EPOXIDE	mg/kg-OC	1024-57-3	34	76	0.053	D	0.016	95% KM (BCA) UCL	0.09	0.09	0.59	0.17
PESTH	HEXACHLOROBENZENE	mg/kg-OC	118-74-1	34	97	0.47	D	0.18	95% KM (Chebyshev) UCL	NA	0.38	NA	0.47
PESTH	HEXACHLOROCYCLOHEXANE, ALPHA (BHC)	mg/kg-OC	319-84-6	34	26	0.006	D	0.0036	95% KM (% Bootstrap) UCL	NA	140	NA	0.000026
PESTH	HEXACHLOROCYCLOHEXANE, BETA- (BHC)	mg/kg-OC	319-85-7	34	38	0.005	D	0.0037	95% KM (t) UCL	NA	0.5	NA	0.0073
PESTH	HEXACHLOROCYCLOHEXANE, DELTA (BHC)	mg/kg-OC	319-86-8	34	5.9	0.001	D	0.001	Maximum	NA	7,200	NA	0.00000014
PESTH	HEXACHLOROCYCLOHEXANE, GAMMA- (BHC) (LINDANE)	µg/kg	58-89-9	36	33	0.66	D	0.2	95% KM (t) UCL	NA	0.32	NA	0.62
PESTH	METHOXYCHLOR	mg/kg-OC	72-43-5	34	0	0.16	ND	NA	NA	0.6	3	0.13	NA
PESTH	MIREX	mg/kg-OC	2385-85-5	34	97	0.063	D	0.022	95% KM (BCA) UCL	0.7	0.7	0.09	0.031
HERB	2,4,5-T (2,4,5-TRICHLOROPHENOXYACETIC ACID)	mg/kg-OC	93-76-5	142	4.9	0.42	D	NA	NA	NA	5,900	NA	NA
HERB	2,4,5-TP (SILVEX)	mg/kg-OC	93-72-1	142	2.8	0.21	D	NA	NA	NA	68	NA	NA
HERB	2,4-D (2,4-DICHLOROPHENOXYACETIC ACID)	mg/kg-OC	94-75-7	142	4.9	1.5	D	NA	NA	NA	130	NA	NA

Table B-3
Surface Sediment – Step 1 and Step 2 Eliminated Chemicals

Group	Chemical	Step 1 Result	Step 2 Result
MET	ALUMINUM	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
MET	COBALT	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
MET	IRON	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
MET	VANADIUM	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
METORG	METHYL MERCURY	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	1,1,1-TRICHLOROETHANE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,1,2,2-TETRACHLOROETHANE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,1,2-TRICHLOROETHANE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,1-DICHLOROETHENE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,2,3-TRICHLOROBENZENE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,2-DICHLOROBENZENE	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	1,2-DICHLOROETHANE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,2-DICHLOROETHENE, CIS-[a]	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	1,2-DICHLOROETHENE, TRANS-	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,3-DICHLOROBENZENE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	1,4-DICHLOROBENZENE	Prelim-COPEC_Tier1 HQ	Eliminate_Tier2 HQ
VOC	2-BUTANONE (MEK)	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	ACETONE	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	BENZENE	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	BROMOFORM (TRIBROMOMETHANE)	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	CARBON DISULFIDE	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	CARBON TETRACHLORIDE (TETRACHLOROMETHANE)	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	CHLOROBENZENE	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	DICHLOROMETHANE (METHYLENE CHLORIDE)	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	ETHYLBENZENE	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	ISOPROPYLBENZENE (CUMENE)	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
VOC	STYRENE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	TETRACHLOROETHENE (PCE)	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	TOLUENE	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	TOTAL XYLENE (U = 0)	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	TOTAL XYLENE (U = 1/2)	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
VOC	TRICHLOROETHENE (TCE)	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
VOC	VINYL CHLORIDE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	1,2,4,5-TETRACHLOROBENZENE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2,4,6-TRICHLOROPHENOL	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	2-CHLORONAPHTHALENE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	3,3'-DICHLOROBENZIDINE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	4-BROMOPHENYL-PHENYL ETHER	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	4-CHLOROANILINE	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
SVOC	BIS(2-CHLOROETHYL)ETHER	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	BUTYLBENZYL PHTHALATE	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
SVOC	DI-N-BUTYL PHTHALATE	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
SVOC	DI-N-OCTYL PHTHALATE	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ

Table B-3
Surface Sediment – Step 1 and Step 2 Eliminated Chemicals

Group	Chemical	Step 1 Result	Step 2 Result
SVOC	DIBENZOFURAN	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
SVOC	N-NITROSODIPHENYLAMINE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
SVOC	PHENOL	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTH	ALDRIN	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTH	DIELDRIN	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTH	ENDOSULFAN SULFATE	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTH	ENDOSULFAN-ALPHA (I)	Prelim-COPEC_Tier1 HQ	Eliminate_FOD<5 and RL<SL
PESTH	ENDOSULFAN-BETA (II)	Prelim-COPEC_Tier1 HQ	Eliminate_Tier2 HQ
PESTH	ENDRIN	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTH	ENDRIN ALDEHYDE	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
PESTH	HEPTACHLOR	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTH	HEPTACHLOR EPOXIDE	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTH	HEXACHLOROBENZENE	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTH	HEXACHLOROCYCLOHEXANE, ALPHA (BHC)	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTH	HEXACHLOROCYCLOHEXANE, BETA- (BHC)	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTH	HEXACHLOROCYCLOHEXANE, DELTA (BHC)	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTH	HEXACHLOROCYCLOHEXANE, GAMMA- (BHC) (LINDANE)	Prelim-COPEC_No Tier1 SL	Eliminate_Tier2 HQ
PESTH	METHOXYCHLOR	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
PESTH	MIREX	Eliminate_Tier1 HQ	Eliminate_Tier1 HQ
HERB	2,4,5-T (2,4,5-TRICHLOROPHENOXYACETIC ACID)	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
HERB	2,4,5-TP (SILVEX)	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL
HERB	2,4-D (2,4-DICHLOROPHENOXYACETIC ACID)	Prelim-COPEC_No Tier1 SL	Eliminate_FOD<5 and RL<SL

Table B-3
Surface Sediment – Step 1 and Step 2 Eliminated Chemicals

Notes:

1 = These values were rounded to 2 significant figures. Calculations were performed prior to rounding.

a = Screening level for 1,2-Dichloroethene, trans-

µg/kg = milligram per kilogram

BCA = bias corrected accelerated bootstrap method

CAS = Chemical Abstracts Services

COPEC = constituent of potential ecological concern

D = detect

FOD = frequency of detection

HERB = herbicide

HQ = hazard quotient

KM = Kaplan-Meir

MET = metals

METORG = metals, organic

mg/kg = milligram per kilogram

NA = not available or not calculated

ND = non-detect

OC = organic carbon

PAH = polycyclic aromatic hydrocarbon

PESTH = pesticide, high resolution

RL = reporting limit

RN = registry number

SL = screening level

SVOC = semivolatile organic compound

UCL = upper confidence limit

USEPA = U.S. Environmental Protection Agency

VOC = volatile organic compound

Step 1 Result Definitions:

Eliminate_Tier1 HQ = The chemical can be eliminated from the risk assessment; the hazard quotient is less than Tier 1 screening level.

Prelim-COPEC_Tier1 HQ = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; the maximum overall result exceeds the Tier 1 screening level.

Prelim-COPEC_No Tier1 SL = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; there are no Tier 1 screening levels available.

Step 2 Result Definitions:

Eliminate_FOD<5 and RL<SL = The chemical was eliminated from the risk assessment; the frequency of detection is less than 5 percent, and the reporting limit is less than the screening level.

Eliminate_Tier1 HQ = The chemical was eliminated from the risk assessment based on the results of the Tier 1 screen.

Eliminate_Tier2 HQ = The chemical was eliminated from the risk assessment; the hazard quotient is less than 1.

Data Treatment:

Phase 1 sediment data are presented on a dry-weight basis and/or an organic-carbon normalized basis depending on the derivation of the available screening level. Dry weight results are presented if screening levels are not available.

PAHs were analyzed by method 8270CSIM; results from Method 8270C were excluded.

Pesticides were analyzed by the high resolution method, E1699; results from the low resolution method, SW8081A, were excluded.

Non-detects are reported at the reporting limit (RL).

Non-detect data were screened at half the RL in the Step 1 screen.

95% UCLs were calculated using USEPA's ProUCL (Version 4.1) for all data distributions.

95% UCLs were calculated for chemicals with an FOD of greater than 5 percent and at least four distinct, detected observations.

95% UCLs were calculated with non-detects reported at the RL.

UCLs were selected from the 95% UCL results based on ProUCL's recommendation. If the recommended 95% UCL was greater than the maximum detected result or if there were fewer than four detected observations, the maximum detected concentration was selected.

Chemicals with a FOD of less than 5 percent were not evaluated in the Tier 2 screen.

Chlordane, alpha- (cis-chlordane) has an EqP based Tier 1 screening level and a dry weight Tier 2 screening level.

Table B-4
Surface Sediment – Step 1 and Step 2 Uncertain Chemicals

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type
MET	BERYLLIUM	mg/kg	7440-41-7	142	100	1.4	D	0.81	95% Student's-t UCL
MET	THALLIUM	mg/kg	7440-28-0	142	100	1.6	D	0.42	95% Chebyshev (Mean, Sd) UCL
VOC	1,1,2-TRICHLOROTRIFLUOROETHANE	µg/kg	76-13-1	142	0	14,000	ND	NA	NA
VOC	1,1-DICHLOROETHANE	mg/kg-OC	75-34-3	142	0.7	0.068	D	NA	NA
VOC	1,2,4-TRICHLOROBENZENE	mg/kg-OC	120-82-1	140	0	60	ND	NA	NA
VOC	1,2-DIBROMO-3-CHLOROPROPANE	µg/kg	96-12-8	142	0	3,600	ND	NA	NA
VOC	1,2-DICHLOROPROPANE	mg/kg-OC	78-87-5	142	0	41	ND	NA	NA
VOC	1,3-DICHLOROPROPENE, CIS-	µg/kg	10061-01-5	140	0	720	ND	NA	NA
VOC	1,3-DICHLOROPROPENE, TRANS-	µg/kg	10061-02-6	141	0	720	ND	NA	NA
VOC	2-HEXANONE (METHYL BUTYL KETONE)	mg/kg-OC	591-78-6	142	0	120	ND	NA	NA
VOC	BROMOCHLOROMETHANE	µg/kg	74-97-5	142	0	3,600	ND	NA	NA
VOC	BROMODICHLOROMETHANE	µg/kg	75-27-4	141	0	720	ND	NA	NA
VOC	BROMOMETHANE (METHYL BROMIDE)	mg/kg-OC	74-83-9	142	0	23	ND	NA	NA
VOC	CHLOROETHANE	µg/kg	75-00-3	142	0	1,400	ND	NA	NA
VOC	CHLOROFORM	mg/kg-OC	67-66-3	142	0	18	ND	NA	NA
VOC	CHLOROMETHANE	µg/kg	74-87-3	142	0	3,600	ND	NA	NA
VOC	CYCLOHEXANE	µg/kg	110-82-7	142	0	14,000	ND	NA	NA
VOC	DIBROMOCHLOROMETHANE	µg/kg	124-48-1	141	0	720	ND	NA	NA
VOC	DICHLORODIFLUOROMETHANE	µg/kg	75-71-8	142	0	7,200	ND	NA	NA
VOC	ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE)	µg/kg	106-93-4	142	0	2,900	ND	NA	NA
VOC	METHYL ACETATE	µg/kg	79-20-9	142	0.7	20,000	D	NA	NA
VOC	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE OR (MIBK))	mg/kg-OC	108-10-1	142	2.8	4.3	D	NA	NA
VOC	METHYL TERT-BUTYL ETHER (MTBE)	µg/kg	1634-04-4	142	4.2	65	D	NA	NA
VOC	METHYLCYCLOHEXANE	µg/kg	108-87-2	142	3.5	1,500	D	NA	NA
VOC	TRICHLOROFLUOROMETHANE (FLUOROTRICHLOROMETHANE)	µg/kg	75-69-4	142	0	3,600	ND	NA	NA
VOC	VINYL ACETATE	mg/kg-OC	108-05-4	141	0	120	ND	NA	NA
SVOC	1,4-DIOXANE	mg/kg-OC	123-91-1	142	0	310	ND	NA	NA
SVOC	2,3,4,6-TETRACHLOROPHENOL	mg/kg-OC	58-90-2	142	0	150	ND	NA	NA
SVOC	2,4,5-TRICHLOROPHENOL	mg/kg-OC	95-95-4	142	0	150	ND	NA	NA
SVOC	2,4-DICHLOROPHENOL	mg/kg-OC	120-83-2	142	0	31	ND	NA	NA
SVOC	2,4-DIMETHYLPHENOL	mg/kg-OC	105-67-9	125	0.8	2.2	D	NA	NA
SVOC	2,4-DINITROPHENOL	mg/kg-OC	51-28-5	142	0	780	ND	NA	NA
SVOC	2,4-DINITROTOLUENE	mg/kg-OC	121-14-2	142	0	150	ND	NA	NA
SVOC	2,6-DINITROTOLUENE	mg/kg-OC	606-20-2	142	0	150	ND	NA	NA
SVOC	2-CHLOROPHENOL	mg/kg-OC	95-57-8	142	0	150	ND	NA	NA
SVOC	2-METHYLPHENOL (O-CRESOL)	mg/kg-OC	95-48-7	142	0.7	1.1	D	NA	NA
SVOC	2-NITROANILINE	µg/kg	88-74-4	142	0	37,000	ND	NA	NA
SVOC	2-NITROPHENOL	µg/kg	88-75-5	142	0	7,200	ND	NA	NA
SVOC	3-NITROANILINE	µg/kg	99-09-2	142	0	37,000	ND	NA	NA
SVOC	4-CHLORO-3-METHYLPHENOL	mg/kg-OC	59-50-7	141	0	150	ND	NA	NA
SVOC	4-CHLOROPHENYL PHENYL ETHER	µg/kg	7005-72-3	142	0	7,200	ND	NA	NA
SVOC	4-NITROANILINE	µg/kg	100-01-6	142	0	37,000	ND	NA	NA
SVOC	4-NITROPHENOL	µg/kg	100-02-7	141	0	37,000	ND	NA	NA

Table B-4
Surface Sediment – Step 1 and Step 2 Uncertain Chemicals

Group	Chemical	Units	CAS RN	Sample Size	Frequency of Detection (percent)	Maximum Concentration[1]	Basis for Maximum (D/ND)	95% UCL[1]	UCL Type
SVOC	ACETOPHENONE	µg/kg	98-86-2	142	30	2,700	D	240	95% KM (% Bootstrap) UCL
SVOC	ATRAZINE	µg/kg	1912-24-9	142	0	7,200	ND	NA	NA
SVOC	BENZALDEHYDE	µg/kg	100-52-7	142	67	3,000	D	970	95% KM (Chebyshev) UCL
SVOC	BIS(2-CHLOROETHOXY)METHANE	µg/kg	111-91-1	142	0	7,200	ND	NA	NA
SVOC	BIS(2-CHLOROISOPROPYL)ETHER	µg/kg	39638-32-9	142	0	1,500	ND	NA	NA
SVOC	CAPROLACTAM	µg/kg	105-60-2	142	0	37,000	ND	NA	NA
SVOC	DIETHYL PHTHALATE	mg/kg-OC	84-66-2	142	4.2	14	D	NA	NA
SVOC	DIMETHYL PHTHALATE	µg/kg	131-11-3	142	2.1	190	D	NA	NA
SVOC	DINITRO-O-CRESOL (4,6-DINITRO-2-METHYLPHENOL)	mg/kg-OC	534-52-1	142	0	780	ND	NA	NA
SVOC	HEXACHLOROBUTADIENE (HEXACHLORO-1,3-BUTADIENE)	mg/kg-OC	87-68-3	142	0	31	ND	NA	NA
SVOC	HEXACHLOROCYCLOPENTADIENE	mg/kg-OC	77-47-4	138	0	150	ND	NA	NA
SVOC	HEXACHLOROETHANE	mg/kg-OC	67-72-1	142	0	150	ND	NA	NA
SVOC	ISOPHORONE	mg/kg-OC	78-59-1	142	0	150	ND	NA	NA
SVOC	NITROBENZENE	mg/kg-OC	98-95-3	142	0	310	ND	NA	NA
SVOC	PENTACHLOROPHENOL	µg/kg	87-86-5	141	0	7,200	ND	NA	NA
PAH	1,6,7-TRIMETHYLNAPHTHALENE	µg/kg	2245-38-7	142	100	17,000	D	1,700	95% Chebyshev (Mean, Sd) UCL
PESTH	2,4'-DDD (O,P'-DDD)	µg/kg	53-19-0	36	100	430	D	64	95% Approximate Gamma UCL
PESTH	2,4'-DDE (O,P'-DDE)	µg/kg	3424-82-6	36	86	14	D	5.6	95% KM (Chebyshev) UCL
PESTH	2,4'-DDT (O,P'-DDT)	µg/kg	789-02-6	36	56	5.3	D	1.4	95% KM (t) UCL
PESTH	CHLORDANE, BETA- (TRANS-CHLORDANE)	µg/kg	5103-74-2	36	100	270	D	85	95% Approximate Gamma UCL
PESTH	ENDRIN KETONE	µg/kg	53494-70-5	36	5.6	1.4	D	1.4	Maximum
PESTH	NONACHLOR, CIS-	µg/kg	5103-73-1	36	100	41	D	15	95% Approximate Gamma UCL
PESTH	NONACHLOR, TRANS-	µg/kg	39765-80-5	36	100	120	D	40	95% Approximate Gamma UCL
PESTH	OXYCHLORDANE	µg/kg	27304-13-8	36	42	1.5	D	0.38	95% KM (BCA) UCL
PESTH	TOXAPHENE	mg/kg-OC	8001-35-2	34	0	34	ND	NA	NA
HERB	2,2-DICHLOROPROPIONIC ACID (DALAPON)	µg/kg	75-99-0	142	0	3,000	ND	NA	NA
HERB	2,4-DB (2,4-D DERIVATIVE)	µg/kg	94-82-6	142	1.4	120	D	NA	NA
HERB	DICAMBA	µg/kg	1918-00-9	142	1.4	40	D	NA	NA
HERB	DICHLORPROP	µg/kg	120-36-5	142	31	440	D	98	95% KM (% Bootstrap) UCL
HERB	DINOSEB	mg/kg-OC	88-85-7	141	0.71	0.3	D	NA	NA
HERB	MECOPROP (MCPP)	µg/kg	93-65-2	142	0.7	28,000	D	NA	NA
HERB	MEPHANAC (MCPA)	µg/kg	94-74-6	142	1.4	9,300	D	NA	NA
PCB	AROCLOR 1016	µg/kg	12674-11-2	142	0.7	1,800	D	NA	NA

Table B-4
Surface Sediment – Step 1 and Step 2 Uncertain Chemicals

Group	Chemical	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]	Step 1 Result	Step 2 Result
MET	BERYLLIUM	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
MET	THALLIUM	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
VOC	1,1,2-TRICHLOROTRIFLUOROETHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	1,1-DICHLOROETHANE	NA	0.058	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
VOC	1,2,4-TRICHLOROBENZENE	NA	47	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
VOC	1,2-DIBROMO-3-CHLOROPROPANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	1,2-DICHLOROPROPANE	NA	33	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
VOC	1,3-DICHLOROPROPENE, CIS-	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	1,3-DICHLOROPROPENE, TRANS-	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	2-HEXANONE (METHYL BUTYL KETONE)	NA	5.8	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
VOC	BROMOCHLOROMETHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	BROMODICHLOROMETHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	BROMOMETHANE (METHYL BROMIDE)	NA	0.14	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
VOC	CHLOROETHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	CHLOROFORM	NA	9.5	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
VOC	CHLOROMETHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	CYCLOHEXANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	DIBROMOCHLOROMETHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	DICHLORODIFLUOROMETHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	METHYL ACETATE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE OR (MIBK))	NA	2.5	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
VOC	METHYL TERT-BUTYL ETHER (MTBE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	METHYLCYCLOHEXANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	TRICHLOROFLUOROMETHANE (FLUOROTRICHLOROMETHANE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
VOC	VINYL ACETATE	NA	1.3	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	1,4-DIOXANE	NA	59	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	2,3,4,6-TETRACHLOROPHENOL	NA	13	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	2,4,5-TRICHLOROPHENOL	NA	82	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	2,4-DICHLOROPHENOL	NA	8.2	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	2,4-DIMETHYLPHENOL	NA	30	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	2,4-DINITROPHENOL	NA	0.62	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	2,4-DINITROTOLUENE	NA	19	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	2,6-DINITROTOLUENE	NA	16	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	2-CHLOROPHENOL	NA	34	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	2-METHYLPHENOL (O-CRESOL)	NA	5.5	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	2-NITROANILINE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	2-NITROPHENOL	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	3-NITROANILINE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	4-CHLORO-3-METHYLPHENOL	NA	39	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	4-CHLOROPHENYL PHENYL ETHER	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	4-NITROANILINE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	4-NITROPHENOL	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5

Table B-4
Surface Sediment – Step 1 and Step 2 Uncertain Chemicals

Group	Chemical	Tier 1 Screening Level[1]	Tier 2 Screening Level[1]	Tier 1 Hazard Quotient[1]	Tier 2 Hazard Quotient[1]	Step 1 Result	Step 2 Result
SVOC	ACETOPHENONE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
SVOC	ATRAZINE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	BENZALDEHYDE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
SVOC	BIS(2-CHLOROETHOXY)METHANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	BIS(2-CHLOROISOPROPYL)ETHER	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	CAPROLACTAM	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
SVOC	DIETHYL PHTHALATE	NA	22	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	DIMETHYL PHTHALATE	NA	6	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	DINITRO-O-CRESOL (4,6-DINITRO-2-METHYLPHENOL)	NA	10	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	HEXACHLOROBUTADIENE (HEXACHLORO-1,3-BUTADIENE)	1.6	3.9	9.6	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
SVOC	HEXACHLOROCYCLOPENTADIENE	0.7	14	110	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
SVOC	HEXACHLOROETHANE	NA	80	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	ISOPHORONE	NA	43	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	NITROBENZENE	NA	8	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
SVOC	PENTACHLOROPHENOL	NA	360	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
PAH	1,6,7-TRIMETHYLNAPHTHALENE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTH	2,4'-DDD (O,P'-DDD)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTH	2,4'-DDE (O,P'-DDE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTH	2,4'-DDT (O,P'-DDT)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTH	CHLORDANE, BETA- (TRANS-CHLORDANE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTH	ENDRIN KETONE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTH	NONACHLOR, CIS-	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTH	NONACHLOR, TRANS-	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTH	OXYCHLORDANE	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
PESTH	TOXAPHENE	0.01	0.01	1,700	NA	Prelim-COPEC_Tier1 HQ	Prelim-COPEC_Tier2 RL>SL
HERB	2,2-DICHLOROPROPIONIC ACID (DALAPON)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	2,4-DB (2,4-D DERIVATIVE)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	DICAMBA	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	DICHLORPROP	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_No Tier2 SL
HERB	DINOSEB	NA	1.5	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL
HERB	MECOPROP (MCPP)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
HERB	MEPHANAC (MCPA)	NA	NA	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim_COPEC_No Tier2 SL FOD<5
PCB	AROCLOR 1016	NA	23	NA	NA	Prelim-COPEC_No Tier1 SL	Prelim-COPEC_Tier2 RL>SL

Table B-4
Surface Sediment – Step 1 and Step 2 Uncertain Chemicals

Notes:

1 = These values were rounded to 2 significant figures. Calculations were performed prior to rounding.

µg/kg = milligram per kilogram
BCA = bias corrected accelerated bootstrap method
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
D = detect
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DDx = 2,4′ and 4,4′-DDD, -DDE, -DDT
FOD = frequency of detection
HERB = herbicide
HQ = hazard quotient
KM = Kaplan-Meir
MET = metals
mg/kg = milligram per kilogram
NA = not available or not calculated
ND = non-detect
ng/kg = nanogram per kilogram
OC = organic carbon
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PESTH = pesticide, high resolution
RL = reporting limit
RN = registry number
SL = screening level
SVOC = semivolatile organic compound
UCL = upper confidence limit
USEPA = U.S. Environmental Protection Agency
VOC = volatile organic compound

Step 1 Result Definitions:

Prelim-COPEC_Tier1 HQ = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; the maximum overall result exceeds the Tier 1 screening level.
Prelim-COPEC_No Tier1 SL = The chemical is identified as a preliminary COPEC and will be evaluated in the Tier 2 screen; there are no Tier 1 screening levels available.

Step 2 Result Definitions:

Prelim-COPEC_No Tier2 SL FOD<5 = The chemical was identified as a preliminary COPEC; there are no Tier 2 screening levels available, and the frequency of detection is less than 5 percent.
Prelim-COPEC_No Tier2 SL= The chemical was identified as a preliminary COPEC; there are no Tier 2 screening levels available, and the frequency of detection is greater than 5 percent.
Prelim-COPEC_Tier2 RL>SL = The chemical was identified as a preliminary COPEC; the frequency of detection is less than 5 percent, but the reporting limit is greater than the screening level.

Data Treatment:

Phase 1 sediment data are presented on a dry-weight basis and/or an organic-carbon normalized basis depending on the derivation of the available screening level. Dry weight results are presented if screening levels are not available.
PAHs were analyzed by method 8270CSIM; results from Method 8270C were excluded.
Pesticides were analyzed by the high resolution method, E1699; results from the low resolution method, SW8081A, were excluded.
Non-detects are reported at the reporting limit (RL).
Non-detect data were screened at half the RL in the Step 1 screen.
95% UCLs were calculated using USEPA's ProUCL (Version 4.1) for all data distributions.
95% UCLs were calculated for chemicals with an FOD of greater than 5 percent and at least four distinct, detected observations.
95% UCLs were calculated with non-detects reported at the RL.
UCLs were selected from the 95% UCL results based on ProUCL's recommendation. If the recommended 95% UCL was greater than the maximum detected result or if there were fewer than four detected observations, the maximum detected concentration was selected.

Chemicals with a FOD of less than 5 percent were not evaluated in the Tier 2 screen.
Chlordane, alpha- (cis-chlordane) has an EqP based Tier 1 screening level and a dry weight Tier 2 screening level.

APPENDIX C
WILDLIFE SCREENING LEVEL ANALYSES – MAXIMUM EXPOSURE ASSUMPTIONS

Table C-1 Wildlife – Preliminary COPECs Maximum Exposure Assumptions
Table C-2 Wildlife – Eliminated Chemicals Maximum Exposure Assumptions
Table C-3 Wildlife – Uncertain Chemicals Maximum Exposure Assumptions

Table C-1
Wildlife – Preliminary COPECs Maximum Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Sandpiper[1]					Heron[1]					Cormorant[1]				
				TDI[2]	TRV[2]	HQ	B(S)AF[3]		TDI[2]	TRV[2]	HQ	B(S)AF[3]		TDI[2]	TRV[2]	HQ	B(S)AF[3]	
MET	Arsenic	7440-38-2	100	94	2.2	42	1.00	BAF	43	2.2	19	1.08	BAF	49	2.2	22	2.41	BAF
MET	Cadmium	7440-43-9	100	960	1.5	650	21.14	BAF	300	1.5	200	12.37	BAF	41	1.5	28	3.21	BAF
MET	Chromium	7440-47-3	100	110	2.7	40	0.12	BAF	25	2.7	9.2	0.15	BAF	7.6	2.7	2.9	0.10	BAF
MET	Copper	7440-50-8	100	13,000	4.1	3,200	2.89	BAF	8,000	4.1	2,000	3.54	BAF	1,000	4.1	250	0.87	BAF
MET	Lead	7439-92-1	100	220	1.6	130	0.09	BAF	40	1.6	25	0.10	BAF	32	1.6	19	0.19	BAF
MET	Nickel	7440-02-0	100	970	6.7	140	1.37	BAF	290	6.7	43	0.88	BAF	78	6.7	12	0.46	BAF
MET	Selenium	7782-49-2	100	34	0.29	120	5.53	BAF	21	0.29	73	6.66	BAF	20	0.29	67	11.74	BAF
MET	Silver	7440-22-4	100	8	2	4	1.00	BSAF	3	2	1.5	1.00	BSAF	1.4	2	0.69	1.00	BSAF
MET	Zinc	7440-66-6	100	2,600	66	40	1.11	BAF	1,500	66	23	1.48	BAF	920	66	14	1.73	BAF
METORG	Methyl mercury[a]	22967-92-6	91	0.16	0.0064	24	97.40	BSAF	0.084	0.0064	13	108.11	BSAF	0.044	0.0064	6.9	118.11	BSAF
PAH	Anthracene	120-12-7	100	190	33	5.7	23.70	BSAF	24	33	0.74	6.31	BSAF	11	33	0.35	6.31	BSAF
PAH	Benzo(a)anthracene	56-55-3	100	80	0.65	120	11.78	BSAF	27	0.65	42	8.43	BSAF	13	0.65	20	8.43	BSAF
PAH	Benzo(a)pyrene[b]	50-32-8	100	37	33	1.1	9.51	BSAF	13	33	0.4	7.11	BSAF	6.2	33	0.19	7.11	BSAF
PAH	Benzo(b)fluoranthene[b]	205-99-2	100	27	33	0.82	8.03	BSAF	7.9	33	0.24	4.95	BSAF	3.8	33	0.11	4.95	BSAF
PAH	Benzo(g,h,i)perylene[b]	191-24-2	100	33	33	1	16.76	BSAF	11	33	0.33	11.51	BSAF	5.2	33	0.16	11.51	BSAF
PAH	Benzo(j,k)fluoranthene[b]	BKJFLANTH	100	49	33	1.5	15.00	BSAF	12	33	0.36	7.69	BSAF	5.7	33	0.17	7.69	BSAF
PAH	Chrysene[b]	218-01-9	100	50	33	1.5	7.30	BSAF	17	33	0.52	5.35	BSAF	8.1	33	0.25	5.35	BSAF
PAH	Dibenzo(a,h)anthracene and dibenzo(a,c)anthracene[b]	215-58-753-70-3	100	26	33	0.79	37.07	BSAF	8.8	33	0.27	25.66	BSAF	4.2	33	0.13	25.66	BSAF
PAH	Fluoranthene[b]	206-44-0	100	850	33	26	42.20	BSAF	150	33	4.4	14.99	BSAF	70	33	2.1	14.99	BSAF
PAH	Indeno(1,2,3-c,d)pyrene[b]	193-39-5	100	37	33	1.1	19.55	BSAF	14	33	0.42	15.48	BSAF	6.7	33	0.2	15.48	BSAF
PAH	Phenanthrene	85-01-8	100	66	33	2	8.86	BSAF	11	33	0.35	3.21	BSAF	5.4	33	0.16	3.21	BSAF
PAH	Pyrene[b]	129-00-0	100	71	33	2.1	3.73	BSAF	13	33	0.41	1.55	BSAF	6.3	33	0.19	1.55	BSAF
PAH	Total HPAH (9 of 16) (U = 0)[b]	tPAH_17_HM_0N	100	630	33	19	9.51	BSAF	220	33	6.7	7.11	BSAF	110	33	3.2	7.11	BSAF
PAH	Total HPAH (9 of 16) (U = 1/2)[b]	tPAH_17_HM_N	100	630	33	19	9.51	BSAF	220	33	6.7	7.11	BSAF	110	33	3.2	7.11	BSAF
PAH	Total LPAH (7 of 16) (U = 0)	tPAH_17_LM_0N	100	370	33	11	10.73	BSAF	63	33	1.9	3.82	BSAF	30	33	0.92	3.82	BSAF
PAH	Total LPAH (7 of 16) (U = 1/2)	tPAH_17_LM_N	100	370	33	11	10.73	BSAF	63	33	1.9	3.82	BSAF	30	33	0.92	3.82	BSAF
PAH	Total PAH (16) (U = 0)	tPAH_17_0N	100	960	33	29	9.51	BSAF	340	33	10	7.11	BSAF	160	33	5	7.11	BSAF
PAH	Total PAH (16) (U = 1/2)	tPAH_17_N	100	960	33	29	9.51	BSAF	340	33	10	7.11	BSAF	160	33	5	7.11	BSAF
PESTH	4,4'-DDD (p,p'-DDD)	72-54-8	100	0.51	0.23	2.2	11.22	BSAF	0.11	0.23	0.5	5.15	BSAF	0.054	0.23	0.24	5.15	BSAF
PESTH	4,4'-DDE (p,p'-DDE)	72-55-9	100	1.5	0.23	6.5	48.47	BSAF	0.58	0.23	2.6	39.18	BSAF	0.28	0.23	1.2	39.18	BSAF
PESTH	Dieldrin	60-57-1	100	0.14	0.071	2	9.57	BSAF	0.12	0.071	1.7	17.57	BSAF	0.058	0.071	0.82	17.57	BSAF
DIOXFUR	TCDD Congeners TEQ (U = 0)	TCDDCong_TEQU0	NA	0.0012	0.000014	82	NA	NA	0.00022	0.000014	16	NA	NA	0.00011	0.000014	7.5	NA	NA
DIOXFUR	TCDD Congeners TEQ (U = 1/2)	TCDDCong_TEQU1/2	NA	0.0012	0.000014	82	NA	NA	0.00022	0.000014	16	NA	NA	0.00011	0.000014	7.5	NA	NA
PCB	Aroclor 1242	53469-21-9	100	8.1	0.18	45	4.79	BSAF	3.7	0.18	21	4.79	BSAF	1.8	0.18	9.8	4.79	BSAF
PCB	Aroclor 1254	11097-69-1	95	9.9	0.18	55	4.79	BSAF	4.4	0.18	24	4.79	BSAF	2.1	0.18	11	4.79	BSAF
PCB	Total PCB Aroclors (U = 0)	tPCB_0N	100	90	0.18	500	27.85	BSAF	37	0.18	210	23.98	BSAF	18	0.18	98	23.98	BSAF
PCB	Total PCB Aroclors (U = 1/2)	tPCB_N	100	95	0.18	530	27.85	BSAF	39	0.18	220	23.98	BSAF	19	0.18	100	23.98	BSAF
PCBCONG	PCB Congeners TEQ (U = 0)	PCBCong_TEQU0	NA	0.0062	0.000014	440	NA	NA	0.0055	0.000014	390	NA	NA	0.0026	0.000014	190	NA	NA
PCBCONG	PCB Congeners TEQ (U = 1/2)	PCBCong_TEQU1/2	NA	0.0062	0.000014	440	NA	NA	0.0055	0.000014	390	NA	NA	0.0026	0.000014	190	NA	NA
PCBCONG	Total PCB Congener (U = 0)	tPCBCong_0N	100	81	0.41	200	27.85	BSAF	34	0.41	82	23.98	BSAF	16	0.41	39	23.98	BSAF
PCBCONG	Total PCB Congener (U = 1/2)	tPCBCong_N	100	81	0.41	200	27.85	BSAF	34	0.41	82	23.98	BSAF	16	0.41	39	23.98	BSAF

Table C-1
Wildlife – Preliminary COPECs Maximum Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Raccoon[1]					Basis for Wildlife COPEC
				TDI[2]	TRV[2]	HQ	B(S)AF[3]		
MET	Arsenic	7440-38-2	100	24	1.2	20	1.08	BAF	SHCR
MET	Cadmium	7440-43-9	100	160	0.41	390	12.37	BAF	SHCR
MET	Chromium	7440-47-3	100	18	2.4	7.3	0.15	BAF	SHCR
MET	Copper	7440-50-8	100	4,300	12	370	3.54	BAF	SHCR
MET	Lead	7439-92-1	100	31	2.3	14	0.10	BAF	SHCR
MET	Nickel	7440-02-0	100	160	0.46	350	0.88	BAF	SHCR
MET	Selenium	7782-49-2	100	11	0.19	59	6.66	BAF	SHCR
MET	Silver	7440-22-4	100	1.7	6.8	0.25	1.00	BSAF	SH
MET	Zinc	7440-66-6	100	840	75	11	1.48	BAF	SHCR
METORG	Methyl mercury[a]	22967-92-6	91	0.044	0.0098	4.5	108.11	BSAF	SHCR
PAH	Anthracene	120-12-7	100	13	30	0.42	6.31	BSAF	S
PAH	Benzo(a)anthracene	56-55-3	100	14	0.18	81	8.43	BSAF	SHCR
PAH	Benzo(a)pyrene[b]	50-32-8	100	7	0.18	39	7.11	BSAF	SR
PAH	Benzo(b)fluoranthene[b]	205-99-2	100	4.2	0.18	24	4.95	BSAF	R
PAH	Benzo(g,h,i)perylene[b]	191-24-2	100	5.8	0.18	33	11.51	BSAF	SR
PAH	Benzo(j,k)fluoranthene[b]	BKJFLANTH	100	6.4	0.18	36	7.69	BSAF	SR
PAH	Chrysene[b]	218-01-9	100	9.2	0.18	52	5.35	BSAF	SR
PAH	Dibenzo(a,h)anthracene and dibenzo(a,c)anthracene[b]	215-58-753-70-3	100	4.7	0.18	26	25.66	BSAF	R
PAH	Fluoranthene[b]	206-44-0	100	78	0.18	440	14.99	BSAF	SHCR
PAH	Indeno(1,2,3-c,d)pyrene[b]	193-39-5	100	7.4	0.18	42	15.48	BSAF	SR
PAH	Phenanthrene	85-01-8	100	6.2	30	0.2	3.21	BSAF	S
PAH	Pyrene[b]	129-00-0	100	7.5	0.18	42	1.55	BSAF	SR
PAH	Total HPAH (9 of 16) (U = 0)[b]	tPAH_17_HM_0N	100	120	0.18	670	7.11	BSAF	SHCR
PAH	Total HPAH (9 of 16) (U = 1/2)[b]	tPAH_17_HM_N	100	120	0.18	670	7.11	BSAF	SHCR
PAH	Total LPAH (7 of 16) (U = 0)	tPAH_17_LM_0N	100	34	30	1.1	3.82	BSAF	SHR
PAH	Total LPAH (7 of 16) (U = 1/2)	tPAH_17_LM_N	100	34	30	1.1	3.82	BSAF	SHR
PAH	Total PAH (16) (U = 0)	tPAH_17_0N	100	180	0.18	1,000	7.11	BSAF	SHCR
PAH	Total PAH (16) (U = 1/2)	tPAH_17_N	100	180	0.18	1,000	7.11	BSAF	SHCR
PESTH	4,4'-DDD (p,p'-DDD)	72-54-8	100	0.06	0.05	1.2	5.15	BSAF	SR
PESTH	4,4'-DDE (p,p'-DDE)	72-55-9	100	0.31	0.05	6.1	39.18	BSAF	SHCR
PESTH	Dieldrin	60-57-1	100	0.065	0.007	9.2	17.57	BSAF	SHR
DIOXFUR	TCDD Congeners TEQ (U = 0)	TCDDCong_TEQU0	NA	0.000057	0.0000005	110	NA	NA	SHCR
DIOXFUR	TCDD Congeners TEQ (U = 1/2)	TCDDCong_TEQU1/2	NA	0.000057	0.0000005	110	NA	NA	SHCR
PCB	Aroclor 1242	53469-21-9	100	2	0.045	44	4.79	BSAF	SHCR
PCB	Aroclor 1254	11097-69-1	95	2.4	0.015	160	4.79	BSAF	SHCR
PCB	Total PCB Aroclors (U = 0)	tPCB_0N	100	20	0.015	1,300	23.98	BSAF	SHCR
PCB	Total PCB Aroclors (U = 1/2)	tPCB_N	100	21	0.015	1,400	23.98	BSAF	SHCR
PCBCONG	PCB Congeners TEQ (U = 0)	PCBCong_TEQU0	NA	0.0012	0.0000005	2,400	NA	NA	SHCR
PCBCONG	PCB Congeners TEQ (U = 1/2)	PCBCong_TEQU1/2	NA	0.0012	0.0000005	2,400	NA	NA	SHCR
PCBCONG	Total PCB Congener (U = 0)	tPCBCong_0N	100	18	0.0098	1,800	23.98	BSAF	SHCR
PCBCONG	Total PCB Congener (U = 1/2)	tPCBCong_N	100	18	0.0098	1,800	23.98	BSAF	SHCR

Table C-1
Wildlife – Preliminary COPECs Maximum Exposure Assumptions

Notes:

1 = The maximum TDI, 95 UCL TDI, TRV, and HQ were rounded to two significant figures. The B(S)AFs were rounded to two decimal places. Calculations were performed prior to rounding.

2 = TDIs and TRVs were reported in milligrams per kilogram body weight-day.

3 = BAF values are presented on a dry weight basis (kilogram dry weight/kilogram dry weight), and BSAF values are presented on an organic carbon/lipid basis (kilogram organic carbon/kilogram lipid).

a = The BSAFs for methyl mercury for all four receptors were based on all prey items from data presented in Lawrence and Mason (2001), Parametrix (1998), and Taylor et al. (2012).

b = The TRV for avian receptors was updated from 280 to 33 (milligrams per kilogram body weight-day).

BAF = bioaccumulation factor

B(S)AF = bioaccumulation factor or biota-sediment accumulation factor

CAS = Chemical Abstracts Services

COPEC = constituent of potential ecological concern

DDD = dichlorodiphenyldichloroethane

DDE = dichlorodiphenyldichloroethylene

DDT = dichlorodiphenyltrichloroethane

DIOXFUR = dioxins and furans

FOD = frequency of detection

HPAH = high-molecular-weight polycyclic aromatic hydrocarbon

HQ = hazard quotient

LPAH = low-molecular-weight polycyclic aromatic hydrocarbon

MET = metals

METORG = metals, organic

NA = not available or not calculated

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

PCBCONG = polychlorinated biphenyl congener

PESTH = pesticide, high resolution

RN = registry number

TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin

TDI = total daily intake

TEQ = toxic equivalent

TRV = toxicity reference value

U = compound analyzed but not detected above detection limit

Basis for Wildlife COPEC:

S = Sandpiper H = Heron C = Cormorant R = Raccoon

Data Treatment:

Screening was conducted using the Phase 1 surface sediment data.

PAHs evaluated in the screen were analyzed by Method 8270CSIM; results from Method 8270C were excluded.

Pesticides evaluated in the screen were analyzed by the high resolution method, E1699; results from the low resolution method, SW8081A, were excluded.

For chemical summations, non-detects were treated as zero (U = 0) or at one-half the detection limit (U = 1/2).

Only the bioaccumulative compounds listed in Appendix C of the SLERA Technical Memorandum No. 1 were evaluated in the wildlife toxicity screen.

Frequency of detection (FOD) was based on the samples included in the TDI calculation. Samples that did not have a TOC result were not included in the TDI calculation unless a BAF was available. Due to this distinction, the FOD calculated for the Wildlife Screen may differ from the FOD calculated for the sediment screen.

Table C-2
Wildlife – Eliminated Chemicals Maximum Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Sandpiper[1]					Heron[1]					Cormorant[1]				
				TDI[2]	TRV[2]	HQ	B(S)AF[3]		TDI[2]	TRV[2]	HQ	B(S)AF[3]		TDI[2]	TRV[2]	HQ	B(S)AF[3]	
PAH	Acenaphthene	83-32-9	100	11	33	0.35	2.04	BSAF	4.9	33	0.15	2.04	BSAF	2.3	33	0.072	2.04	BSAF
PAH	Acenaphthylene	208-96-8	100	6.5	33	0.2	5.07	BSAF	2.9	33	0.09	5.07	BSAF	1.4	33	0.043	5.07	BSAF
PAH	Fluorene	86-73-7	100	25	33	0.78	10.73	BSAF	4.3	33	0.13	3.82	BSAF	2.1	33	0.063	3.82	BSAF
PESTH	4,4'-DDT (p,p'-DDT)	50-29-3	94	0.011	0.23	0.05	1.50	BSAF	0.0092	0.23	0.041	2.76	BSAF	0.0044	0.23	0.019	2.76	BSAF
PESTH	Aldrin	309-00-2	35	0.00039	0.007	0.055	0.42	BSAF	0.00009	0.007	0.013	0.42	BSAF	0.000041	0.007	0.0059	0.42	BSAF
PESTH	Chlordane, alpha- (cis-Chlordane)	5103-71-9	100	0.25	2.1	0.12	7.16	BSAF	0.12	2.1	0.055	7.16	BSAF	0.057	2.1	0.026	7.16	BSAF
PESTH	Chlordane, beta- (trans-Chlordane)	5103-74-2	100	0.3	2.1	0.14	7.16	BSAF	0.1	2.1	0.049	5.42	BSAF	0.05	2.1	0.023	5.42	BSAF
PESTH	Endosulfan-alpha (I)	959-98-8	0	0.052	10	0.0052	60.65	BAF	0.027	10	0.0027	58.26	BAF	0.0019	10	0.00019	7.95	BAF
PESTH	Endosulfan-beta (II)	33213-65-9	25	0.014	10	0.0014	7.54	BAF	0.021	10	0.0021	22.29	BAF	0.0039	10	0.00039	7.77	BAF
PESTH	Heptachlor	76-44-8	38	0.0043	0.28	0.015	10.07	BSAF	0.002	0.28	0.0073	10.07	BSAF	0.00097	0.28	0.0035	10.07	BSAF
PESTH	Heptachlor epoxide	1024-57-3	76	0.00039	0.28	0.0014	0.30	BSAF	0.00021	0.28	0.00075	0.71	BSAF	0.000097	0.28	0.00035	0.71	BSAF
PESTH	Hexachlorobenzene	118-74-1	97	0.064	0.67	0.096	12.23	BSAF	0.022	0.67	0.032	8.62	BSAF	0.01	0.67	0.015	8.62	BSAF
PESTH	Hexachlorocyclohexane, alpha (BHC)	319-84-6	26	0.00049	0.57	0.00086	0.74	BSAF	0.00018	0.57	0.00032	0.87	BSAF	0.000085	0.57	0.00015	0.87	BSAF
PESTH	Hexachlorocyclohexane, beta- (BHC)	319-85-7	38	0.0005	0.57	0.00088	0.77	BSAF	0.00018	0.57	0.00032	0.89	BSAF	0.000086	0.57	0.00015	0.89	BSAF
PESTH	Hexachlorocyclohexane, delta (BHC)	319-86-8	6	0.00028	0.57	0.00048	0.07	BSAF	0.00021	0.57	0.00037	1.03	BSAF	0.0001	0.57	0.00018	1.03	BSAF
PESTH	Hexachlorocyclohexane, gamma- (BHC) (Lindane)	58-89-9	32	0.0005	0.57	0.00088	0.77	BSAF	0.00018	0.57	0.00032	0.89	BSAF	0.000086	0.57	0.00015	0.89	BSAF
PESTH	Methoxychlor	72-43-5	0	0.051	80	0.00063	47.16	BAF	0.00086	80	0.000011	2.00	BSAF	0.00041	80	0.0000051	2.00	BSAF
PESTH	Mirex	2385-85-5	97	0	3.3	0.0034	16.00	BSAF	0.0054	3.3	0.0016	16.00	BSAF	0.0026	3.3	0.00078	16.00	BSAF
PESTH	Total Chlordane High Resolution (U = 0)	tChlordaneHR_0N	100	1	2.1	0.34	7.16	BSAF	0.35	2.1	0.16	7.16	BSAF	0.17	2.1	0.078	7.16	BSAF
PESTH	Total Chlordane High Resolution (U = 1/2)	tChlordaneHR_N	100	1	2.1	0.34	7.16	BSAF	0.35	2.1	0.16	7.16	BSAF	0.17	2.1	0.078	7.16	BSAF
PESTH	Toxaphene	8001-35-2	0	0	0.4	0.59	1.00	BSAF	0.092	0.4	0.23	1.00	BSAF	0.043	0.4	0.11	1.00	BSAF

Table C-2
Wildlife – Eliminated Chemicals Maximum Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Raccoon[1]					Basis for Uncertain COPEC
				TDI[2]	TRV[2]	HQ	B(S)AF[3]		
PAH	Acenaphthene	83-32-9	100	2.7	30	0.089	2.04	BSAF	Eliminate_HQ
PAH	Acenaphthylene	208-96-8	100	1.6	30	0.052	5.07	BSAF	Eliminate_HQ
PAH	Fluorene	86-73-7	100	2.3	30	0.077	3.82	BSAF	Eliminate_HQ
PESTH	4,4'-DDT (p,p'-DDT)	50-29-3	94	0.0049	0.05	0.099	2.76	BSAF	Eliminate_HQ
PESTH	Aldrin	309-00-2	35	0.000057	0.1	0.00057	0.42	BSAF	Eliminate_HQ
PESTH	Chlordane, alpha- (cis-Chlordane)	5103-71-9	100	0.063	1.1	0.057	7.16	BSAF	Eliminate_HQ
PESTH	Chlordane, beta- (trans-Chlordane)	5103-74-2	100	0.056	1.1	0.051	5.42	BSAF	Eliminate_HQ
PESTH	Endosulfan-alpha (I)	959-98-8	0	0.014	0.08	0.18	58.26	BAF	Eliminate_HQ_FOD<5
PESTH	Endosulfan-beta (II)	33213-65-9	25	0.011	0.08	0.14	22.29	BAF	Eliminate_HQ
PESTH	Heptachlor	76-44-8	38	0.0011	0.2	0.0054	10.07	BSAF	Eliminate_HQ
PESTH	Heptachlor epoxide	1024-57-3	76	NA	NA	NA	NA	NA	Eliminate_HQ
PESTH	Hexachlorobenzene	118-74-1	97	0.011	1.5	0.0079	8.62	BSAF	Eliminate_HQ
PESTH	Hexachlorocyclohexane, alpha (BHC)	319-84-6	26	0.0001	4	0.000026	0.87	BSAF	Eliminate_HQ
PESTH	Hexachlorocyclohexane, beta- (BHC)	319-85-7	38	0.0001	0.2	0.00052	0.89	BSAF	Eliminate_HQ
PESTH	Hexachlorocyclohexane, delta (BHC)	319-86-8	6	0.00012	4	0.00003	1.03	BSAF	Eliminate_HQ
PESTH	Hexachlorocyclohexane, gamma- (BHC) (Lindane)	58-89-9	32	0.0001	4	0.000026	0.89	BSAF	Eliminate_HQ
PESTH	Methoxychlor	72-43-5	0	0.00047	2	0.00024	2.00	BSAF	Eliminate_HQ_FOD<5
PESTH	Mirex	2385-85-5	97	0.0028	0.4	0.0071	16.00	BSAF	Eliminate_HQ
PESTH	Total Chlordane High Resolution (U = 0)	tChlordaneHR_0N	100	0.19	1.1	0.17	7.16	BSAF	Eliminate_HQ
PESTH	Total Chlordane High Resolution (U = 1/2)	tChlordaneHR_N	100	0.19	1.1	0.17	7.16	BSAF	Eliminate_HQ
PESTH	Toxaphene	8001-35-2	0	0.052	4	0.013	1.00	BSAF	Eliminate_HQ_FOD<5

Table C-2
Wildlife – Eliminated Chemicals Maximum Exposure Assumptions

Notes:
1 = The maximum TDI, 95 UCL TDI, TRV, and HQ were rounded to two significant figures. The B(S)AFs were rounded to two decimal places. Calculations were performed prior to rounding.
2 = TDIs and TRVs were reported in milligrams per kilogram body weight-day.
3 = BAF values are presented on a dry weight basis (kilogram dry weight/kilogram dry weight), and BSAF values are presented on an organic carbon/lipid basis (kilogram organic carbon/kilogram lipid).
BAF = bioaccumulation factor
B(S)AF = bioaccumulation factor or biota-sediment accumulation factor
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
DDT = dichlorodiphenyltrichloroethane
FOD = frequency of detection
HQ = hazard quotient
NA = not available or not calculated
PAH = polycyclic aromatic hydrocarbon
PESTH = pesticide, high resolution
RN = registry number
TDI = total daily intake
TRV = toxicity reference value
U = compound analyzed but not detected above detection limit

Data Treatment:
Screening was conducted using the Phase 1 surface sediment data.
PAHs evaluated in the screen were analyzed by Method 8270CSIM; results from Method 8270C were excluded.
Pesticides evaluated in the screen were analyzed by the high resolution method, E1699; results from the low resolution method, SW8081A, were excluded.
For chemical summations, non-detects were treated as zero (U = 0) or at one-half the detection limit (U = 1/2).
Only the bioaccumulative compounds listed in Appendix C of the SLERA Technical Memorandum No. 1 were evaluated in the wildlife toxicity screen.
Frequency of detection (FOD) was based on the samples included in the TDI calculation. Samples that did not have a TOC result were not included in the TDI calculation unless a BAF was available. Due to this distinction, the FOD calculated for the Wildlife Screen may differ from the FOD calculated for the sediment screen.

Table C-3
Wildlife – Uncertain Chemicals Maximum Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Sandpiper[1]					Heron[1]					Cormorant[1]				
				TDI[2]	TRV[2]	HQ	B(S)AF[3]		TDI[2]	TRV[2]	HQ	B(S)AF[3]		TDI[2]	TRV[2]	HQ	B(S)AF[3]	
VOC	1,2,4-Trichlorobenzene	120-82-1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VOC	1,2-Dichlorobenzene	95-50-1	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VOC	1,3-Dichlorobenzene	541-73-1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VOC	1,4-Dichlorobenzene	106-46-7	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	1,2,4,5-Tetrachlorobenzene	95-94-3	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	4-Bromophenyl-phenyl ether	101-55-3	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	4-Chlorophenyl phenyl ether	7005-72-3	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	Hexachlorobutadiene (Hexachloro-1,3-butadiene)	87-68-3	0	5.8	4	1.4	42.87	BAF	1.9	4	0.47	26.30	BAF	0.33	4	0.081	8.63	BAF
SVOC	Hexachlorocyclopentadiene	77-47-4	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	Hexachloroethane	67-72-1	0	33	17	1.9	51.67	BAF	11	17	0.62	30.71	BAF	1.6	17	0.093	8.80	BAF
SVOC	Pentachlorophenol	87-86-5	0	39	7.6	5.1	60.25	BAF	21	7.6	2.7	60.25	BAF	2.6	7.6	0.34	14.30	BAF
PESTH	Endrin	72-20-8	3	0.0067	0.01	0.67	7.54	BAF	0.01	0.01	1	22.26	BAF	0.0015	0.01	0.15	6.32	BAF
PCB	Aroclor 1016	12674-11-2	1	1.5	0.18	8.5	4.79	BSAF	0.71	0.18	3.9	4.79	BSAF	0.34	0.18	1.9	4.79	BSAF
PCB	Aroclor 1221	11104-28-2	1	0.13	0.18	0.75	4.79	BSAF	0.059	0.18	0.33	4.79	BSAF	0.028	0.18	0.16	4.79	BSAF
PCB	Aroclor 1232	11141-16-5	1	0.4	0.18	2.2	4.79	BSAF	0.19	0.18	1	4.79	BSAF	0.089	0.18	0.49	4.79	BSAF
PCB	Aroclor 1248	12672-29-6	0	0.045	0.18	0.25	1.20	BSAF	0.015	0.18	0.086	1.20	BSAF	0.0071	0.18	0.04	1.20	BSAF
PCB	Aroclor 1260	11096-82-5	5	0.58	0.18	3.2	0.57	BSAF	0.21	0.18	1.1	0.57	BSAF	0.095	0.18	0.53	0.57	BSAF
PCB	Aroclor 1268	11100-14-4	0	0	0.18	0.75	4.79	BSAF	0.059	0.18	0.33	4.79	BSAF	0.028	0.18	0.16	4.79	BSAF

Table C-3
Wildlife – Uncertain Chemicals Maximum Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Raccoon[1]					Basis for Uncertain COPEC
				TDI[2]	TRV[2]	HQ	B(S)AF[3]		
VOC	1,2,4-Trichlorobenzene	120-82-1	0	NA	NA	NA	NA	NA	Prelim-COPEC_No TRV_FOD<5
VOC	1,2-Dichlorobenzene	95-50-1	5	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF_FOD<5
VOC	1,3-Dichlorobenzene	541-73-1	0	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF_FOD<5
VOC	1,4-Dichlorobenzene	106-46-7	29	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF
SVOC	1,2,4,5-Tetrachlorobenzene	95-94-3	0	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF_FOD<5
SVOC	4-Bromophenyl-phenyl ether	101-55-3	0	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF_FOD<5
SVOC	4-Chlorophenyl phenyl ether	7005-72-3	0	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF_FOD<5
SVOC	Hexachlorobutadiene (Hexachloro-1,3-butadiene)	87-68-3	0	1	1	1	26.30	BAF	Prelim-COPEC_HQ_SR_FOD<5
SVOC	Hexachlorocyclopentadiene	77-47-4	0	NA	NA	NA	NA	NA	Prelim-COPEC_No TRV_FOD<5
SVOC	Hexachloroethane	67-72-1	0	5.6	11	0.53	30.71	BAF	Prelim-COPEC_HQ_S_FOD<5
SVOC	Pentachlorophenol	87-86-5	0	11	0.12	92	60.25	BAF	Prelim-COPEC_HQ_SHR_FOD<5
PESTH	Endrin	72-20-8	3	0.0055	0.025	0.22	22.26	BAF	Prelim-COPEC_HQ_H_FOD<5
PCB	Aroclor 1016	12674-11-2	1	0.38	0.9	0.42	4.79	BSAF	Prelim-COPEC_HQ_SHC_FOD<5
PCB	Aroclor 1221	11104-28-2	1	0.032	0.015	2.1	4.79	BSAF	Prelim-COPEC_HQ_R_FOD<5
PCB	Aroclor 1232	11141-16-5	1	0.099	0.015	6.6	4.79	BSAF	Prelim-COPEC_HQ_SHR_FOD<5
PCB	Aroclor 1248	12672-29-6	0	0.0091	0.0085	1.1	1.20	BSAF	Prelim-COPEC_HQ_R_FOD<5
PCB	Aroclor 1260	11096-82-5	5	0.12	0.015	8	0.57	BSAF	Prelim-COPEC_HQ_SHR_FOD<5
PCB	Aroclor 1268	11100-14-4	0	0.032	0.015	2.1	4.79	BSAF	Prelim-COPEC_HQ_R_FOD<5

Table C-3
Wildlife – Uncertain Chemicals Maximum Exposure Assumptions

Notes:
1 = The maximum TDI, 95 UCL TDI, TRV, and HQ were rounded to two significant figures. The B(S)AFs were rounded to two decimal places. Calculations were performed prior to rounding.
2 = TDIs and TRVs were reported in milligrams per kilogram body weight-day.
3 = BAF values are presented on a dry weight basis (kilogram dry weight/kilogram dry weight), and BSAF values are presented on an organic carbon/lipid basis (kilogram organic carbon/kilogram lipid).
BAF = bioaccumulation factor
B(S)AF = bioaccumulation factor or biota-sediment accumulation factor
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
FOD = frequency of detection
HQ = hazard quotient
NA = not available or not calculated
PCB = polychlorinated biphenyl
PESTH = pesticide, high resolution
RN = registry number
SVOC = semivolatile organic compound
TDI = total daily intake
TRV = toxicity reference value
VOC = volatile organic compound

Data Treatment:
Screening was conducted using the Phase 1 surface sediment data.
PAHs evaluated in the screen were analyzed by Method 8270CSIM; results from Method 8270C were excluded.
Pesticides evaluated in the screen were analyzed by the high resolution method, E1699; results from the low resolution method, SW8081A, were excluded.
For chemical summations, non-detects were treated as zero (U = 0) or at one-half the detection limit (U = 1/2).
Only the bioaccumulative compounds listed in Appendix C of the SLERA Technical Memorandum No. 1 were evaluated in the wildlife toxicity screen.
Frequency of detection (FOD) was based on the samples included in the TDI calculation. Samples that did not have a TOC result were not included in the TDI calculation unless a BAF was available. Due to this distinction, the FOD calculated for the Wildlife Screen may differ from the FOD calculated for the sediment screen.

APPENDIX D
WILDLIFE SCREENING LEVEL ANALYSES – 95% UCL EXPOSURE ASSUMPTIONS

Table D-1 Wildlife – Preliminary COPECs 95% UCL Exposure Assumptions
Table D-2 Wildlife – Eliminated Chemicals 95% UCL Exposure Assumptions
Table D-3 Wildlife – Uncertain Chemicals 95% UCL Exposure Assumptions

Table D-1
Wildlife – Preliminary COPECs 95% UCL Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Count	Sandpiper[1]							Heron[1]						
					Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]		Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]	
MET	Arsenic	7440-38-2	100	142	82	D	8.3	2.2	3.7	0.84	BAF	26	D	2.7	2.2	1.2	0.65	BAF
MET	Cadmium	7440-43-9	100	142	630	D	70	1.5	47	13.87	BAF	110	D	13	1.5	8.6	4.71	BAF
MET	Chromium	7440-47-3	100	142	93	D	15	2.7	5.6	0.07	BAF	12	D	1.9	2.7	0.71	0.06	BAF
MET	Copper	7440-50-8	100	142	7,700	D	610	4.1	150	1.58	BAF	4,100	D	320	4.1	80	1.81	BAF
MET	Lead	7439-92-1	100	142	230	D	42	1.6	26	0.12	BAF	22	D	4.1	1.6	2.5	0.04	BAF
MET	Nickel	7440-02-0	100	142	740	D	64	6.7	9.5	0.96	BAF	100	D	8.9	6.7	1.3	0.29	BAF
MET	Selenium	7782-49-2	100	142	29	D	4.5	0.29	15	4.59	BAF	13	D	2	0.29	6.8	4.00	BAF
MET	Silver	7440-22-4	100	142	8	D	2.4	2	1.2	1.00	BSAF	3	D	0.94	2	0.46	1.00	BSAF
MET	Zinc	7440-66-6	100	142	2,100	D	380	66	5.7	0.80	BAF	960	D	180	66	2.7	0.93	BAF
METORG	Methyl mercury[a]	22967-92-6	91	34	0.078	D	0.039	0.0064	6.1	48.70	BSAF	0.042	D	0.021	0.0064	3.3	54.05	BSAF
PAH	Benzo(a)anthracene	56-55-3	100	142	5.8	D	1.1	0.65	1.6	0.57	BSAF	3.6	D	0.65	0.65	1	1.09	BSAF
PAH	Benzo(a)pyrene[b]	50-32-8	100	142	5.1	D	1	33	0.032	0.61	BSAF	1.6	D	0.48	33	0.015	0.84	BSAF
PAH	Benzo(b)fluoranthene[b]	205-99-2	100	142	10	D	2.9	33	0.088	2.87	BSAF	4.3	D	1.2	33	0.036	2.65	BSAF
PAH	Benzo(j,k)fluoranthene[b]	BKJFLANTH	100	142	17	D	4	33	0.12	4.92	BSAF	7.1	D	1.7	33	0.051	4.51	BSAF
PAH	Chrysene[b]	218-01-9	100	142	7.9	D	1.5	33	0.047	0.90	BSAF	3.2	D	0.62	33	0.019	0.97	BSAF
PAH	Dibenzo(a,h)anthracene and dibenzo(a,c)anthracene[b]	215-58-753-70-3	100	142	5.6	D	1.6	33	0.047	7.75	BSAF	2.9	D	0.79	33	0.024	8.32	BSAF
PAH	Fluoranthene[b]	206-44-0	100	142	61	D	7.9	33	0.24	2.75	BSAF	26	D	3.4	33	0.1	2.67	BSAF
PAH	Indeno(1,2,3-c,d)pyrene[b]	193-39-5	100	142	4.3	D	1.4	33	0.043	1.70	BSAF	1.7	D	0.56	33	0.017	1.79	BSAF
PAH	Pyrene[b]	129-00-0	100	142	13	D	2.2	33	0.067	0.44	BSAF	4.2	D	0.69	33	0.021	0.46	BSAF
PAH	Total HPAH (9 of 16) (U = 0)[b]	tPAH_17_HM_0N	100	142	59	D	11	33	0.35	0.61	BSAF	27	D	5.3	33	0.16	0.84	BSAF
PAH	Total HPAH (9 of 16) (U = 1/2)[b]	tPAH_17_HM_N	100	142	59	D	11	33	0.35	0.61	BSAF	27	D	5.3	33	0.16	0.84	BSAF
PAH	Total PAH (16) (U = 0)	tPAH_17_0N	100	142	90	D	15	33	0.45	0.61	BSAF	41	D	6.7	33	0.21	0.84	BSAF
PAH	Total PAH (16) (U = 1/2)	tPAH_17_N	100	142	90	D	15	33	0.45	0.61	BSAF	41	D	6.7	33	0.21	0.84	BSAF
PESTH	Dieldrin	60-57-1	100	34	0.07	D	0.023	0.071	0.32	4.61	BSAF	0.07	D	0.023	0.071	0.33	10.12	BSAF
DIOXFUR	TCDD Congeners TEQ (U = 0)	TCDDCong_TEQU0	100	34	0.00012	D	4E-05	0.000014	2.8	NA	NA	0.00015	D	5E-05	0.000014	3.9	NA	NA
DIOXFUR	TCDD Congeners TEQ (U = 1/2)	TCDDCong_TEQU1/2	100	34	0.00012	D	4E-05	0.000014	2.8	NA	NA	0.00015	D	5E-05	0.000014	3.9	NA	NA
PCB	Aroclor 1242	53469-21-9	100	142	4.2	D	0.71	0.18	3.9	2.33	BSAF	1.8	D	0.31	0.18	1.7	2.33	BSAF
PCB	Aroclor 1254	11097-69-1	95	142	5.4	D	0.71	0.18	3.9	2.33	BSAF	2.1	D	0.3	0.18	1.7	2.33	BSAF
PCB	Total PCB Aroclors (U = 0)	tPCB_0N	100	142	23	D	4.2	0.18	23	6.56	BSAF	11	D	2.1	0.18	12	7.04	BSAF
PCB	Total PCB Aroclors (U = 1/2)	tPCB_N	100	142	24	D	4.4	0.18	24	6.56	BSAF	12	D	2.2	0.18	12	7.04	BSAF
PCBCONG	PCB Congeners TEQ (U = 0)	PCBCong_TEQU0	100	34	0.0062	D	0.0014	0.000014	100	NA	NA	0.002	D	0.0004	0.000014	31	NA	NA
PCBCONG	PCB Congeners TEQ (U = 1/2)	PCBCong_TEQU1/2	100	34	0.0062	D	0.0014	0.000014	100	NA	NA	0.002	D	0.0004	0.000014	31	NA	NA
PCBCONG	Total PCB Congener (U = 0)	tPCBCong_0N	100	34	20	D	6.4	0.41	16	6.56	BSAF	9.9	D	3.2	0.41	7.9	7.04	BSAF
PCBCONG	Total PCB Congener (U = 1/2)	tPCBCong_N	100	34	20	D	6.4	0.41	16	6.56	BSAF	9.9	D	3.2	0.41	7.9	7.04	BSAF

Table D-1
Wildlife – Preliminary COPECs 95% UCL Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Count	Cormorant[1]							Raccoon[1]							Basis for Wildlife COPEC
					Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]		Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]		
MET	Arsenic	7440-38-2	100	142	9.9	D	1	2.2	0.45	0.48	BAF	15	D	1.5	1.2	1.3	0.65	BAF	SHR
MET	Cadmium	7440-43-9	100	142	8.1	D	0.89	1.5	0.6	0.63	BAF	62	D	6.8	0.41	17	4.71	BAF	SHR
MET	Chromium	7440-47-3	100	142	3.6	D	0.58	2.7	0.22	0.04	BAF	11	D	1.7	2.4	0.72	0.06	BAF	S
MET	Copper	7440-50-8	100	142	250	D	19	4.1	4.8	0.20	BAF	2,200	D	180	12	15	1.81	BAF	SHCR
MET	Lead	7439-92-1	100	142	6.2	D	1.1	1.6	0.69	0.03	BAF	22	D	4	2.3	1.7	0.04	BAF	SHR
MET	Nickel	7440-02-0	100	142	19	D	1.7	6.7	0.25	0.11	BAF	65	D	5.6	0.46	12	0.29	BAF	SHR
MET	Selenium	7782-49-2	100	142	5.5	D	0.86	0.29	3	3.33	BAF	6.9	D	1.1	0.19	5.6	4.00	BAF	SHCR
MET	Silver	7440-22-4	100	142	1.4	D	0.44	2	0.22	1.00	BSAF	1.7	D	0.53	6.8	0.078	1.00	BSAF	S
MET	Zinc	7440-66-6	100	142	350	D	65	66	0.98	0.66	BAF	540	D	100	75	1.3	0.93	BAF	SHR
METORG	Methyl mercury[a]	22967-92-6	91	34	0.022	D	0.011	0.0064	1.7	59.06	BSAF	0.022	D	0.011	0.0098	1.1	54.05	BSAF	SHCR
PAH	Benzo(a)anthracene	56-55-3	100	142	1.7	D	0.3	0.65	0.47	1.09	BSAF	2	D	0.37	0.18	2.1	1.09	BSAF	SR
PAH	Benzo(a)pyrene[b]	50-32-8	100	142	0.74	D	0.22	33	0.0068	0.84	BSAF	1	D	0.28	0.18	1.6	0.84	BSAF	R
PAH	Benzo(b)fluoranthene[b]	205-99-2	100	142	2	D	0.57	33	0.017	2.65	BSAF	2.3	D	0.65	0.18	3.7	2.65	BSAF	R
PAH	Benzo(j,k)fluoranthene[b]	BKJFLANTH	100	142	3.4	D	0.81	33	0.025	4.51	BSAF	3.8	D	0.91	0.18	5.1	4.51	BSAF	R
PAH	Chrysene[b]	218-01-9	100	142	1.5	D	0.29	33	0.0088	0.97	BSAF	1.8	D	0.35	0.18	2	0.97	BSAF	R
PAH	Dibenzo(a,h)anthracene and dibenzo(a,c)anthracene[b]	215-58-753-70-3	100	142	1.4	D	0.38	33	0.011	8.32	BSAF	1.5	D	0.42	0.18	2.4	8.32	BSAF	R
PAH	Fluoranthene[b]	206-44-0	100	142	12	D	1.6	33	0.049	2.67	BSAF	14	D	1.8	0.18	10	2.67	BSAF	R
PAH	Indeno(1,2,3-c,d)pyrene[b]	193-39-5	100	142	0.78	D	0.26	33	0.008	1.79	BSAF	0.92	D	0.3	0.18	1.7	1.79	BSAF	R
PAH	Pyrene[b]	129-00-0	100	142	1.9	D	0.31	33	0.0095	0.46	BSAF	2.5	D	0.42	0.18	2.4	0.46	BSAF	R
PAH	Total HPAH (9 of 16) (U = 0)[b]	tPAH_17_HM_0N	100	142	13	D	2.5	33	0.074	0.84	BSAF	16	D	3	0.18	17	0.84	BSAF	R
PAH	Total HPAH (9 of 16) (U = 1/2)[b]	tPAH_17_HM_N	100	142	13	D	2.5	33	0.074	0.84	BSAF	16	D	3	0.18	17	0.84	BSAF	R
PAH	Total PAH (16) (U = 0)	tPAH_17_0N	100	142	19	D	3.1	33	0.096	0.84	BSAF	24	D	3.8	0.18	22	0.84	BSAF	R
PAH	Total PAH (16) (U = 1/2)	tPAH_17_N	100	142	19	D	3.1	33	0.096	0.84	BSAF	24	D	3.8	0.18	22	0.84	BSAF	R
PESTH	Dieldrin	60-57-1	100	34	0.034	D	0.011	0.071	0.16	10.12	BSAF	0.037	D	0.012	0.007	1.8	10.12	BSAF	R
DIOXFUR	TCDD Congeners TEQ (U = 0)	TCDDCong_TEQU0	100	34	0.000073	D	3E-05	0.000014	1.8	NA	NA	0.000048	D	2E-05	0.0000005	32	NA	NA	SHCR
DIOXFUR	TCDD Congeners TEQ (U = 1/2)	TCDDCong_TEQU1/2	100	34	0.000073	D	3E-05	0.000014	1.8	NA	NA	0.000048	D	2E-05	0.0000005	32	NA	NA	SHCR
PCB	Aroclor 1242	53469-21-9	100	142	0.86	D	0.14	0.18	0.81	2.33	BSAF	0.99	D	0.17	0.045	3.7	2.33	BSAF	SHR
PCB	Aroclor 1254	11097-69-1	95	142	1	D	0.14	0.18	0.79	2.33	BSAF	1.2	D	0.17	0.015	11	2.33	BSAF	SHR
PCB	Total PCB Aroclors (U = 0)	tPCB_0N	100	142	5.2	D	1	0.18	5.5	7.04	BSAF	5.9	D	1.1	0.015	75	7.04	BSAF	SHCR
PCB	Total PCB Aroclors (U = 1/2)	tPCB_N	100	142	5.5	D	1	0.18	5.8	7.04	BSAF	6.2	D	1.2	0.015	78	7.04	BSAF	SHCR
PCBCONG	PCB Congeners TEQ (U = 0)	PCBCong_TEQU0	100	34	0.00094	D	0.0002	0.000014	15	NA	NA	0.00036	D	8E-05	0.0000005	150	NA	NA	SHCR
PCBCONG	PCB Congeners TEQ (U = 1/2)	PCBCong_TEQU1/2	100	34	0.00094	D	0.0002	0.000014	15	NA	NA	0.00036	D	7E-05	0.0000005	150	NA	NA	SHCR
PCBCONG	Total PCB Congener (U = 0)	tPCBCong_0N	100	34	4.7	D	1.5	0.41	3.7	7.04	BSAF	5.3	D	1.7	0.0098	180	7.04	BSAF	SHCR
PCBCONG	Total PCB Congener (U = 1/2)	tPCBCong_N	100	34	4.7	D	1.5	0.41	3.7	7.04	BSAF	5.3	D	1.7	0.0098	180	7.04	BSAF	SHCR

Table D-1
Wildlife – Preliminary COPECs 95% UCL Exposure Assumptions

Notes:
1 = The maximum TDI, 95 UCL TDI, TRV, and HQ were rounded to two significant figures. The B(S)AFs were rounded to two decimal places. Calculations were performed prior to rounding.
2 = TDIs and TRVs were reported in milligrams per kilogram body weight-day.
3 = BAF values are presented on a dry weight basis (kilogram dry weight/kilogram dry weight), and BSAF values are presented on an organic carbon/lipid basis (kilogram organic carbon/kilogram lipid).
a = The BSAFs for methyl mercury for all four receptors were based on all prey items from data presented in Lawrence and Mason (2001), Parametrix (1998), and Taylor et al. (2012).
b = The TRV for avian receptors was updated from 280 to 33 (milligrams per kilogram body weight-day).
BAF = bioaccumulation factor
B(S)AF = bioaccumulation factor or biota-sediment accumulation factor
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
D = detect
DIOXFUR = dioxins and furans
FOD = frequency of detection
HPAH = high-molecular-weight polycyclic aromatic hydrocarbon
HQ = hazard quotient
MET = metals
METORG = metals, organic
NA = not available or not calculated
ND = non-detect
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PCBCONG = polychlorinated biphenyl congener
PESTH = pesticide, high resolution
RN = registry number
TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
TDI = total daily intake
TEQ = toxic equivalent
TRV = toxicity reference value
U = compound analyzed but not detected above detection limit
UCL = upper confidence limit

Basis for Wildlife COPEC:
S = Sandpiper H = Heron C = Cormorant R = Raccoon

Data Treatment:
Screening was conducted using the Phase 1 surface sediment data.
PAHs evaluated in the screen were analyzed by Method 8270CSIM; results from Method 8270C were excluded.
Pesticides evaluated in the screen were analyzed by the high resolution method, E1699; results from the low resolution method, SW8081A, were excluded.
For chemical summations, non-detects were treated as zero (U = 0) or at one-half the detection limit (U = 1/2).
Only the bioaccumulative compounds listed in Appendix C of the SLERA Technical Memorandum No. 1 were evaluated in the wildlife toxicity screen.
Frequency of detection (FOD) was based on the samples included in the TDI calculation. Samples that did not have a TOC result were not included in the TDI calculation unless a BAF was available. Due to this distinction, the FOD calculated for the Wildlife Screen may differ from the FOD calculated for the sediment screen.

Table D-2
Wildlife – Eliminated Chemicals 95% UCL Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Count	Sandpiper[1]							Heron[1]						
					Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]		Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]	
PAH	Acenaphthene	83-32-9	100	142	4.6	D	0.41	33	0.013	0.64	BSAF	1.6	D	0.13	33	0.0041	0.64	BSAF
PAH	Acenaphthylene	208-96-8	100	142	2.1	D	0.33	33	0.01	1.23	BSAF	0.73	D	0.13	33	0.0039	1.23	BSAF
PAH	Anthracene	120-12-7	100	142	17	D	1.5	33	0.047	1.87	BSAF	7.3	D	0.65	33	0.02	1.91	BSAF
PAH	Benzo(g,h,i)perylene[a]	191-24-2	100	142	2.2	D	0.46	33	0.014	0.46	BSAF	0.91	D	0.29	33	0.0089	0.92	BSAF
PAH	Fluorene	86-73-7	100	142	4.6	D	0.39	33	0.012	1.67	BSAF	1.9	D	0.16	33	0.0049	1.62	BSAF
PAH	Phenanthrene	85-01-8	100	142	9.9	D	1.3	33	0.041	0.89	BSAF	3.5	D	0.53	33	0.016	0.96	BSAF
PAH	Total LPAH (7 of 16) (U = 0)	tPAH_17_LM_0N	100	142	66	D	7	33	0.22	1.67	BSAF	27	D	2.8	33	0.086	1.62	BSAF
PAH	Total LPAH (7 of 16) (U = 1/2)	tPAH_17_LM_N	100	142	66	D	7	33	0.22	1.67	BSAF	27	D	2.8	33	0.086	1.62	BSAF
PESTH	4,4'-DDD (p,p'-DDD)	72-54-8	100	34	0.21	D	0.088	0.23	0.39	4.60	BSAF	0.1	D	0.042	0.23	0.18	4.70	BSAF
PESTH	4,4'-DDE (p,p'-DDE)	72-55-9	100	34	0.29	D	0.15	0.23	0.66	9.30	BSAF	0.16	D	0.08	0.23	0.35	10.52	BSAF
PESTH	4,4'-DDT (p,p'-DDT)	50-29-3	94	34	0.0049	D	0.0017	0.23	0.0077	0.56	BSAF	0.0037	D	0.0012	0.23	0.0054	1.10	BSAF
PESTH	Aldrin	309-00-2	35	34	0.00013	D	6E-05	0.007	0.0089	0.42	BSAF	0.000048	D	2E-05	0.007	0.003	0.42	BSAF
PESTH	Chlordane, alpha- (cis-Chlordane)	5103-71-9	100	34	0.14	D	0.054	2.1	0.025	3.86	BSAF	0.064	D	0.025	2.1	0.011	3.86	BSAF
PESTH	Chlordane, beta- (trans-Chlordane)	5103-74-2	100	34	0.3	D	0.12	2.1	0.054	7.16	BSAF	0.1	D	0.041	2.1	0.019	5.42	BSAF
PESTH	Endosulfan-alpha (I)	959-98-8	0	36	0.17	ND	NA	10	0.0085	98.88	BAF	0.021	ND	NA	10	0.001	22.35	BAF
PESTH	Endosulfan-beta (II)	33213-65-9	25	36	0.0086	D	0.0016	10	0.00016	4.52	BAF	0.012	D	0.0023	10	0.00023	12.85	BAF
PESTH	Endrin	72-20-8	3	36	0.00053	D	NA	0.01	0.053	4.53	BAF	0.00079	D	NA	0.01	0.079	13.32	BAF
PESTH	Heptachlor	76-44-8	38	34	0.0014	D	0.0007	0.28	0.0024	10.07	BSAF	0.00066	D	0.0003	0.28	0.0011	10.07	BSAF
PESTH	Heptachlor epoxide	1024-57-3	76	34	0.00039	D	0.0001	0.28	0.00036	0.30	BSAF	0.00021	D	6E-05	0.28	0.00021	0.71	BSAF
PESTH	Hexachlorobenzene	118-74-1	97	34	0.021	D	0.0078	0.67	0.012	3.69	BSAF	0.0097	D	0.0037	0.67	0.0056	3.87	BSAF
PESTH	Hexachlorocyclohexane, alpha (BHC)	319-84-6	26	34	0.000053	D	3E-05	0.57	0.00006	0.74	BSAF	0.000027	D	2E-05	0.57	0.000029	0.87	BSAF
PESTH	Hexachlorocyclohexane, beta- (BHC)	319-85-7	38	34	0.000066	D	4E-05	0.57	0.000073	0.77	BSAF	0.000024	D	2E-05	0.57	0.000029	0.80	BSAF
PESTH	Hexachlorocyclohexane, delta (BHC)	319-86-8	6	34	0.0000029	D	NA	0.57	0.0000051	0.07	BSAF	0.0000056	D	NA	0.57	0.0000097	1.03	BSAF
PESTH	Hexachlorocyclohexane, gamma- (BHC) (Lindane)	58-89-9	32	34	0.00011	D	5E-05	0.57	0.000088	0.77	BSAF	0.000039	D	2E-05	0.57	0.000034	0.80	BSAF
PESTH	Methoxychlor	72-43-5	0	34	0.004	ND	NA	80	0.000025	2.00	BSAF	0.0017	ND	NA	80	0.000011	2.00	BSAF
PESTH	Mirex	2385-85-5	97	34	0.0034	D	0.0012	3.3	0.00035	4.65	BSAF	0.0016	D	0.0005	3.3	0.00016	4.65	BSAF
PESTH	Total Chlordane High Resolution (U = 0)	tChlordaneHR_0N	100	34	0.4	D	0.16	2.1	0.075	3.86	BSAF	0.19	D	0.073	2.1	0.034	3.86	BSAF
PESTH	Total Chlordane High Resolution (U = 1/2)	tChlordaneHR_N	100	34	0.4	D	0.16	2.1	0.075	3.86	BSAF	0.19	D	0.073	2.1	0.034	3.86	BSAF
PESTH	Toxaphene	8001-35-2	0	34	0.47	ND	NA	0.4	0.59	1.00	BSAF	0.18	ND	NA	0.4	0.23	1.00	BSAF
PCB	Aroclor 1221	11104-28-2	1	142	0.043	D	NA	0.18	0.24	2.33	BSAF	0.02	D	NA	0.18	0.11	2.33	BSAF
PCB	Aroclor 1248	12672-29-6	0	142	0.074	ND	NA	0.18	0.2	0.87	BSAF	0.023	ND	NA	0.18	0.063	0.87	BSAF

Table D-2
Wildlife – Eliminated Chemicals 95% UCL Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Count	Cormorant[1]							Raccoon[1]							Basis for Wildlife COPEC
					Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]		Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]		
PAH	Acenaphthene	83-32-9	100	142	0.74	D	0.061	33	0.0019	0.64	BSAF	0.94	D	0.08	30	0.0026	0.64	BSAF	Eliminate_HQ
PAH	Acenaphthylene	208-96-8	100	142	0.34	D	0.06	33	0.0018	1.23	BSAF	0.42	D	0.072	30	0.0024	1.23	BSAF	Eliminate_HQ
PAH	Anthracene	120-12-7	100	142	3.5	D	0.31	33	0.0095	1.91	BSAF	4	D	0.36	30	0.012	1.91	BSAF	Eliminate_HQ
PAH	Benzo(g,h,i)perylene[a]	191-24-2	100	142	0.42	D	0.14	33	0.0042	0.92	BSAF	0.53	D	0.17	0.18	0.93	0.92	BSAF	Eliminate_HQ
PAH	Fluorene	86-73-7	100	142	0.88	D	0.075	33	0.0023	1.62	BSAF	1	D	0.088	30	0.0029	1.62	BSAF	Eliminate_HQ
PAH	Phenanthrene	85-01-8	100	142	1.6	D	0.25	33	0.0077	0.96	BSAF	2.1	D	0.3	30	0.01	0.96	BSAF	Eliminate_HQ
PAH	Total LPAH (7 of 16) (U = 0)	tPAH_17_LM_0N	100	142	13	D	1.3	33	0.041	1.62	BSAF	15	D	1.6	30	0.051	1.62	BSAF	Eliminate_HQ
PAH	Total LPAH (7 of 16) (U = 1/2)	tPAH_17_LM_N	100	142	13	D	1.3	33	0.041	1.62	BSAF	15	D	1.6	30	0.051	1.62	BSAF	Eliminate_HQ
PESTH	4,4'-DDD (p,p'-DDD)	72-54-8	100	34	0.049	D	0.02	0.23	0.088	4.70	BSAF	0.055	D	0.022	0.05	0.45	4.70	BSAF	Eliminate_HQ
PESTH	4,4'-DDE (p,p'-DDE)	72-55-9	100	34	0.074	D	0.038	0.23	0.17	10.52	BSAF	0.083	D	0.043	0.05	0.85	10.52	BSAF	Eliminate_HQ
PESTH	4,4'-DDT (p,p'-DDT)	50-29-3	94	34	0.0018	D	0.0006	0.23	0.0025	1.10	BSAF	0.002	D	0.0007	0.05	0.014	1.10	BSAF	Eliminate_HQ
PESTH	Aldrin	309-00-2	35	34	0.000022	D	1E-05	0.007	0.0014	0.42	BSAF	0.000028	D	1E-05	0.1	0.00013	0.42	BSAF	Eliminate_HQ
PESTH	Chlordane, alpha- (cis-Chlordane)	5103-71-9	100	34	0.031	D	0.012	2.1	0.0054	3.86	BSAF	0.034	D	0.013	1.1	0.012	3.86	BSAF	Eliminate_HQ
PESTH	Chlordane, beta- (trans-Chlordane)	5103-74-2	100	34	0.05	D	0.02	2.1	0.0091	5.42	BSAF	0.056	D	0.022	1.1	0.02	5.42	BSAF	Eliminate_HQ
PESTH	Endosulfan-alpha (I)	959-98-8	0	36	0.0021	ND	NA	10	0.0001	4.32	BAF	0.011	ND	NA	0.08	0.068	22.35	BAF	Eliminate_HQ_FOD<5
PESTH	Endosulfan-beta (II)	33213-65-9	25	36	0.0017	D	0.0003	10	0.000031	3.32	BAF	0.0066	D	0.0012	0.08	0.015	12.85	BAF	Eliminate_HQ
PESTH	Endrin	72-20-8	3	36	0.00009	D	NA	0.01	0.009	2.89	BAF	0.00042	D	NA	0.025	0.017	13.32	BAF	Eliminate_HQ_FOD<5
PESTH	Heptachlor	76-44-8	38	34	0.00031	D	0.0002	0.28	0.00054	10.07	BSAF	0.00035	D	0.0002	0.2	0.00084	10.07	BSAF	Eliminate_HQ
PESTH	Heptachlor epoxide	1024-57-3	76	34	0.000097	D	3E-05	0.28	0.000099	0.71	BSAF	NA	NA	NA	NA	NA	0.71	BSAF	Eliminate_HQ
PESTH	Hexachlorobenzene	118-74-1	97	34	0.0046	D	0.0018	0.67	0.0026	3.87	BSAF	0.0052	D	0.002	1.5	0.0014	3.87	BSAF	Eliminate_HQ
PESTH	Hexachlorocyclohexane, alpha (BHC)	319-84-6	26	34	0.000013	D	8E-06	0.57	0.000014	0.87	BSAF	0.000015	D	9E-06	4	0.0000023	0.87	BSAF	Eliminate_HQ
PESTH	Hexachlorocyclohexane, beta- (BHC)	319-85-7	38	34	0.000011	D	8E-06	0.57	0.000013	0.80	BSAF	0.000014	D	9E-06	0.2	0.000046	0.80	BSAF	Eliminate_HQ
PESTH	Hexachlorocyclohexane, delta (BHC)	319-86-8	6	34	0.0000026	D	NA	0.57	0.0000046	1.03	BSAF	0.0000031	D	NA	4	0.00000077	1.03	BSAF	Eliminate_HQ
PESTH	Hexachlorocyclohexane, gamma- (BHC) (Lindane)	58-89-9	32	34	0.000018	D	9E-06	0.57	0.000016	0.80	BSAF	0.000023	D	1E-05	4	0.0000028	0.80	BSAF	Eliminate_HQ
PESTH	Methoxychlor	72-43-5	0	34	0.00081	ND	NA	80	0.0000051	2.00	BSAF	0.00094	ND	NA	2	0.00024	2.00	BSAF	Eliminate_HQ_FOD<5
PESTH	Mirex	2385-85-5	97	34	0.00074	D	0.0003	3.3	0.000076	4.65	BSAF	0.00084	D	0.0003	0.4	0.00072	4.65	BSAF	Eliminate_HQ
PESTH	Total Chlordane High Resolution (U = 0)	tChlordaneHR_0N	100	34	0.09	D	0.035	2.1	0.016	3.86	BSAF	0.1	D	0.039	1.1	0.036	3.86	BSAF	Eliminate_HQ
PESTH	Total Chlordane High Resolution (U = 1/2)	tChlordaneHR_N	100	34	0.09	D	0.035	2.1	0.016	3.86	BSAF	0.1	D	0.039	1.1	0.036	3.86	BSAF	Eliminate_HQ
PESTH	Toxaphene	8001-35-2	0	34	0.087	ND	NA	0.4	0.11	1.00	BSAF	0.1	ND	NA	4	0.013	1.00	BSAF	Eliminate_HQ_FOD<5
PCB	Aroclor 1221	11104-28-2	1	142	0.0095	D	NA	0.18	0.053	2.33	BSAF	0.011	D	NA	0.015	0.71	2.33	BSAF	Eliminate_HQ_FOD<5
PCB	Aroclor 1248	12672-29-6	0	142	0.01	ND	NA	0.18	0.029	0.87	BSAF	0.014	ND	NA	0.0085	0.81	0.87	BSAF	Eliminate_HQ_FOD<5

Table D-2
Wildlife – Eliminated Chemicals 95% UCL Exposure Assumptions

Notes:
1 = The maximum TDI, 95 UCL TDI, TRV, and HQ were rounded to two significant figures. The B(S)AFs were rounded to two decimal places. Calculations were performed prior to rounding.
2 = TDIs and TRVs were reported in milligrams per kilogram body weight-day.
3 = BAF values are presented on a dry weight basis (kilogram dry weight/kilogram dry weight), and BSAF values are presented on an organic carbon/lipid basis (kilogram organic carbon/kilogram lipid).
a = The TRV for avian receptors was updated from 280 to 33 (milligrams per kilogram body weight-day).
BAF = bioaccumulation factor
B(S)AF = bioaccumulation factor or biota-sediment accumulation factor
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
D = detect
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
FOD = frequency of detection
HQ = hazard quotient
LPAH = low-molecular-weight polycyclic aromatic hydrocarbon
NA = not available or not calculated
ND = non-detect
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PESTH = pesticide, high resolution
RN = registry number
TDI = total daily intake
TRV = toxicity reference value
U = compound analyzed but not detected above detection limit
UCL = upper confidence limit

Data Treatment:
Screening was conducted using the Phase 1 surface sediment data.
PAHs evaluated in the screen were analyzed by Method 8270CSIM; results from Method 8270C were excluded.
Pesticides evaluated in the screen were analyzed by the high resolution method, E1699; results from the low resolution method, SW8081A, were excluded.
For chemical summations, non-detects were treated as zero (U = 0) or at one-half the detection limit (U = 1/2).
Only the bioaccumulative compounds listed in Appendix C of the SLERA Technical Memorandum No. 1 were evaluated in the wildlife toxicity screen.
Frequency of detection (FOD) was based on the samples included in the TDI calculation. Samples that did not have a TOC result were not included in the TDI calculation unless a BAF was available. Due to this distinction, the FOD calculated for the Wildlife Screen may differ from the FOD calculated for the sediment screen.

Table D-3
Wildlife – Uncertain Chemicals 95% UCL Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Count	Sandpiper[1]							Heron[1]						
					Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]		Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]	
VOC	1,2,4-Trichlorobenzene	120-82-1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VOC	1,2-Dichlorobenzene	95-50-1	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VOC	1,3-Dichlorobenzene	541-73-1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VOC	1,4-Dichlorobenzene	106-46-7	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	1,2,4,5-Tetrachlorobenzene	95-94-3	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	4-Bromophenyl-phenyl ether	101-55-3	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	4-Chlorophenyl phenyl ether	7005-72-3	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	Hexachlorobutadiene (Hexachloro-1,3-butadiene)	87-68-3	0	142	14	ND	NA	4	1.7	51.26	BAF	1.3	ND	NA	4	0.16	8.77	BAF
SVOC	Hexachlorocyclopentadiene	77-47-4	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	Hexachloroethane	67-72-1	0	142	84	ND	NA	17	2.5	65.67	BAF	7.1	ND	NA	17	0.21	10.29	BAF
SVOC	Pentachlorophenol	87-86-5	0	141	33	ND	NA	7.6	2.2	25.74	BAF	18	ND	NA	7.6	1.2	25.74	BAF
PCB	Aroclor 1016	12674-11-2	1	142	0.79	D	NA	0.18	4.4	2.33	BSAF	0.35	D	NA	0.18	1.9	2.33	BSAF
PCB	Aroclor 1232	11141-16-5	1	142	0.2	D	NA	0.18	1.1	2.33	BSAF	0.091	D	NA	0.18	0.5	2.33	BSAF
PCB	Aroclor 1260	11096-82-5	5	142	0.58	D	NA	0.18	3.2	0.57	BSAF	0.21	D	NA	0.18	1.1	0.57	BSAF
PCB	Aroclor 1268	11100-14-4	0	142	0.15	ND	NA	0.18	0.41	2.33	BSAF	0.058	ND	NA	0.18	0.16	2.33	BSAF

Table D-3
Wildlife – Uncertain Chemicals 95% UCL Exposure Assumptions

Group	Chemical Name	CAS RN	FOD	Count	Cormorant[1]							Raccoon[1]							Basis for Wildlife_COPEC
					Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]		Maximum TDI[2]	Basis for Maximum (D/ND)	95% UCL TDI[2]	TRV[2]	HQ	B(S)AF[3]		
VOC	1,2,4-Trichlorobenzene	120-82-1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Prelim-COPEC_No TRV_FOD<5
VOC	1,2-Dichlorobenzene	95-50-1	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF_FOD<5
VOC	1,3-Dichlorobenzene	541-73-1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF_FOD<5
VOC	1,4-Dichlorobenzene	106-46-7	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF
SVOC	1,2,4,5-Tetrachlorobenzene	95-94-3	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF_FOD<5
SVOC	4-Bromophenyl-phenyl ether	101-55-3	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF_FOD<5
SVOC	4-Chlorophenyl phenyl ether	7005-72-3	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Prelim-COPEC_No BSAF or BAF_FOD<5
SVOC	Hexachlorobutadiene (Hexachloro-1,3-butadiene)	87-68-3	0	142	0.11	ND	NA	4	0.014	1.45	BAF	0.68	ND	NA	1	0.34	8.77	BAF	Prelim-COPEC_HQ_S_FOD<5
SVOC	Hexachlorocyclopentadiene	77-47-4	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Prelim-COPEC_No TRV_FOD<5
SVOC	Hexachloroethane	67-72-1	0	142	0.47	ND	NA	17	0.014	1.30	BAF	3.8	ND	NA	11	0.18	10.29	BAF	Prelim-COPEC_HQ_S_FOD<5
SVOC	Pentachlorophenol	87-86-5	0	141	1.5	ND	NA	7.6	0.095	4.01	BAF	9.4	ND	NA	0.12	39	25.74	BAF	Prelim-COPEC_HQ_SHR_FOD<5
PCB	Aroclor 1016	12674-11-2	1	142	0.16	D	NA	0.18	0.91	2.33	BSAF	0.19	D	NA	0.9	0.21	2.33	BSAF	Prelim-COPEC_HQ_SH_FOD<5
PCB	Aroclor 1232	11141-16-5	1	142	0.043	D	NA	0.18	0.24	2.33	BSAF	0.049	D	NA	0.015	3.3	2.33	BSAF	Prelim-COPEC_HQ_SR_FOD<5
PCB	Aroclor 1260	11096-82-5	5	142	0.095	D	NA	0.18	0.53	0.57	BSAF	0.12	D	NA	0.015	8	0.57	BSAF	Prelim-COPEC_HQ_SHR_FOD<5
PCB	Aroclor 1268	11100-14-4	0	142	0.027	ND	NA	0.18	0.076	2.33	BSAF	0.033	ND	NA	0.015	1.1	2.33	BSAF	Prelim-COPEC_HQ_R_FOD<5

Table D-3
Wildlife – Uncertain Chemicals 95% UCL Exposure Assumptions

Notes:
1 = The maximum TDI, 95 UCL TDI, TRV, and HQ were rounded to two significant figures. The B(S)AFs were rounded to two decimal places. Calculations were performed prior to rounding.
2 = TDIs and TRVs were reported in milligrams per kilogram body weight-day.
3 = BAF values are presented on a dry weight basis (kilogram dry weight/kilogram dry weight), and BSAF values are presented on an organic carbon/lipid basis (kilogram organic carbon/kilogram lipid).
BAF = bioaccumulation factor
B(S)AF = bioaccumulation factor or biota-sediment accumulation factor
CAS = Chemical Abstracts Services
COPEC = constituent of potential ecological concern
D = detect
FOD = frequency of detection
HQ = hazard quotient
NA = not available or not calculated
ND = non-detect
PCB = polychlorinated biphenyl
RN = registry number
SVOC = semivolatile organic compound
TDI = total daily intake
TRV = toxicity reference value
UCL = upper confidence limit
VOC = volatile organic compound

Data Treatment:
Screening was conducted using the Phase 1 surface sediment data.
PAHs evaluated in the screen were analyzed by Method 8270CSIM; results from Method 8270C were excluded.
Pesticides evaluated in the screen were analyzed by the high resolution method, E1699; results from the low resolution method, SW8081A, were excluded.
For chemical summations, non-detects were treated as zero (U = 0) or at one-half the detection limit (U = 1/2).
Only the bioaccumulative compounds listed in Appendix C of the SLERA Technical Memorandum No. 1 were evaluated in the wildlife toxicity screen.
Frequency of detection (FOD) was based on the samples included in the TDI calculation. Samples that did not have a TOC result were not included in the TDI calculation unless a BAF was available. Due to this distinction, the FOD calculated for the Wildlife Screen may differ from the FOD calculated for the sediment screen.

ATTACHMENT 1
SLERA TECHNICAL MEMORANDUM NO. 1

FINAL
SCREENING LEVEL RISK ASSESSMENT: TECHNICAL MEMORANDUM NO. 1

REMEDIAL INVESTIGATION/FEASIBILITY STUDY, NEWTOWN CREEK

Prepared by

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February 2012

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LIST OF ACRONYMS AND ABBREVIATIONS

µg	microgram
95% UCL	95 percent upper confidence limit of the arithmetic mean
AET	Apparent Effects Threshold
ATSDR	Agency for Toxic Substances and Disease Registry
BAF	biota-sediment accumulation factor (kg dry weight/kg dry weight)
BAZ	biologically active zone
BERA	Baseline Ecological Risk Assessment
BSAF	biota-sediment accumulation factor (kg lipid/kg organic carbon)
BTAG	Biological Technical Assistance Group
BW	receptor body weight (kg)
ccc	criteria continuous concentration
CCME	Canadian Council of Environment Ministers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
COPEC	constituents of potential ecological concern
$C_{f,i}$	chemical concentration in each item of food (mg/kg)
C_s	chemical concentration in sediment (mg/kg)
CSM	conceptual site model
DMP	Data Management Plan
CSO	combined sewer outfall
DO	dissolved oxygen
Eco-SSL	ecological soil screening level
EMF_s	exposure modifying factor for incidental sediment ingestion
$EMF_{f,i}$	exposure modifying factor for food item *i*
EqP	equilibrium partitioning
ER-L	Effects Range-Low
ER-M	Effects Range-Medium
ERA	Ecological Risk Assessment
ESA	U.S. Endangered Species Act of 1973
ESI	expanded site investigation

g	gram
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
IR_f	food ingestion rate (kg/day)
kg	kilogram
L	liter
mg	milligram
LOAEL	lowest observed adverse effect level
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observed adverse effect level
NRWQC	National Recommended Water Quality Criteria
NYCDEP	New York City Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
ODEQ	Oregon Department of Environmental Quality
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyls
PDRC	Phelps Dodge Refining Corporation
PEL	Probable Effect Level
P_s	proportion of sediment in the diet (as a fraction)
RI/FS	Remedial Investigation/Feasibility Study
Study Area	Newtown Creek
SL	screening level
SL_{sed}	wildlife-based sediment screening level (mg/kg)
SLERA	Screening Level Ecological Risk Assessment
SMDP	Scientific Management Decision Point
SMIA	Significant Maritime Industrial Area
SQuiRT	Screening Quick Reference Tables
SVOCs	semivolatile organic compounds
TCEQ	Texas Commission of Environmental Quality
TDI	total daily intake
TDI_{all}	total daily intake of chemical from all sources (e.g., mg chemical/kg body weight/day)
TDI_{food}	total daily intake of chemical from ingestion of food items

TDI_{sed}	total daily intake of chemical from incidental sediment ingestion
TDI_{water}	total daily intake of chemical from incidental and/or drinking water ingestion
TELs	Threshold Effect Levels
TOC	total organic carbon
TOGS	Technical and Operational Guidance Series
TRV	toxicity reference value
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds

1 INTRODUCTION

The first step in the ecological risk assessment (ERA) process for the Newtown Creek Remedial Investigation/Feasibility Study (RI/FS) involves the development of a Screening Level Ecological Risk Assessment (SLERA). The goal of the SLERA is to employ a conservative approach to identify constituents of potential ecological concern (COPECs) for further evaluation in a baseline ecological risk assessment (BERA). For the Newtown Creek Study Area ("the Study Area"), the SLERA is being completed in four steps:

- **Technical Memorandum No. 1 (this document).** This technical memorandum presents the surface water and sediment screening levels (SLs) that will be used to complete the SLERA. SLs are concentrations of chemicals in sediments (milligrams per kilogram [mg/kg]) and water (micrograms per liter [µg /L]) that represent the toxicological benchmarks against which sediment and surface water data from the Study Area will be compared. While historical data are available for the Study Area, their use in the SLERA is compromised either by limited spatial extent, concerns over quality, or relevance (see Section 2.1). As discussed with the USEPA Region 2 in August 2011, a preferable approach is to use data collected during the upcoming Phase 1 RI field program (planned for Spring/Summer 2012), as well as any of the historical data, where deemed usable. Because the Phase 1 data are not yet available, this memorandum does not include a comparison with SLs, nor does it include an identification of the COPECs. Furthermore, this memorandum does not include an extensive evaluation of chemical fate and transport as is typical of a SLERA. As described below, these SLERA components will be presented in subsequent documents.
- **Technical Memorandum No. 2 (Fall 2012).** In Technical Memorandum No. 2, the SLERA analyses will be presented. This will involve comparing the Phase 1 surface water and sediment data, along with any useable historical data, to the SLs presented in Technical Memorandum No. 1. Any modifications to the SLs presented in Technical Memorandum No. 1 that result from agency discussions will be incorporated.
- **SLERA/Problem Formulation Workshop (Fall/Winter 2012/2013).** The results of the SLERA and planning of the BERA will be discussed in a workshop with agency and project stakeholders in the fall or winter of 2012/2013.

- **Final SLERA Report (May 2013).** This report will be submitted as part of a BERA Problem Formulation document, which represents a Scientific Management Decision Point (SMDP) for agency approval.

1.1 Approach

The SLERA will be conducted following the approach described in the RI/FS Work Plan (AECOM 2011). This approach reflects U.S. Environmental Protection Agency (USEPA) guidance for ecological risk assessment under Superfund (USEPA 1997, 2001a), as well as a tiered approach for selecting screening levels developed from discussions and meetings with USEPA Region 2 in 2010 and December 2011.

USEPA (1997) presents an eight-step process for conducting an ERA: the SLERA comprises steps 1 and 2; the baseline problem formulation is step 3; field study design and Study Area investigation represent steps 4 through 6; risk characterization is step 7; and risk management is step 8 (Figure 1-1). USEPA (2001a) discusses the use of a refined screening step that takes into account the frequency of detection, the nutritional status of the chemicals, and a consideration of background concentrations in an effort to reduce the number of COPECs for consideration in the BERA (although it is acknowledged that background concentrations cannot be used to eliminate COPECs in the SLERA). The SLERA approach developed for the Newtown Creek RI/FS includes the following:

- Step 1: This will be the most conservative screen, in which maximum chemical concentrations will be compared with Tier 1 SLs provided by USEPA Region 2. Chemicals without a Tier 1 screening level will be carried through to Step 2. This step will not include a screening for wildlife.
- Step 2: This will be a more refined screen, in which less conservative chemical concentrations (95 percent upper confidence limit of the arithmetic mean [95% UCL]) will be compared with Tier 2 SLs from a variety of sources. This step will also take into account the frequency of detection and include a screening based on potential risks to wildlife. The species and exposure pathways selected for the wildlife screening will depend upon the results of the RI/FS Phase 1 habitat and shoreline surveys.

1.2 Document Organization

Section 2 of this technical memorandum presents a preliminary conceptual site model (CSM) based on current understanding of the project Study Area. The selection of Tier 1 and Tier 2 SLs for assessing direct exposure from surface water and sediment are presented in Section 3. Section 4 describes an approach for developing wildlife based SLs to assess potentially bioaccumulative chemicals. The next steps for the SLERA are summarized in Section 5 and all citations are presented in Section 6.

2 PRELIMINARY ECOLOGICAL CONCEPTUAL SITE MODEL

A CSM describes the relationships between the receptors (i.e., aquatic life and wildlife) that are potentially at risk and the stressors (in this case, the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]-related chemicals[1]) to which they may be exposed. While it is recognized that physical and biological stressors, including the impacts of nutrients and dissolved oxygen, have been discussed in the RI/FS Work Plan for the Study Area, the scope of the SLERA is confined to the CERCLA chemicals. The physical and biological stressors will be considered during the BERA problem formulation.

The CSM is based on information about the sources of the chemicals, the existing habitat, and the significance of the exposure pathways from the sources to the receptors. The CSM also provides the basis for identifying assessment endpoints and measurement endpoints for representative receptors.

Based on current understanding of the Study Area, Figure 2-1 presents the preliminary ecological CSM. As the RI/FS progresses and the ERA analyses are performed, the model will be updated accordingly.

The following subsections describe the components of the preliminary ecological CSM.

2.1 Sources

The Study Area extends from the confluence of Newtown Creek with the lower East River at the westernmost neighborhoods of Greenpoint and Hunters Point to the upstream end of the East Branch and English Kills. The Study Area also includes Dutch Kills, Whale Creek, and Maspeth Creek, as tributaries to Newtown Creek. The entire waterbody is classified as a saline tributary to the Lower East River according to Title 6 of the NYCRR, Chapter X, Part 890. The only significant freshwater inflows to the waterbody are wet-weather discharges from combined sewer outfalls (CSOs) and stormwater (NYCDEP 2007).

[1] CERCLA-related chemicals are Study Area-related releases of chemicals considered to be hazardous substances as defined under CERCLA that are present in the sediments, surface water, and biota of Newtown Creek.

The Study Area has a long history of industrial activity and urbanization. As a result, there are many potential sources of stressors to Newtown Creek and its tributaries, including a variety of point and non-point source discharges or releases. As these have been described thoroughly in the RI/FS Work Plan (AECOM 2011), they are only summarized here.

Primary sources for the chemicals of interest include discharges and releases from the facilities or activities generating the chemicals. For the Study Area, these include:

- Historical and current discharges of wastewater from industries at the Study Area
- Accidental spills
- Historical and ongoing releases of stormwater
- Combined storm and sanitary discharges through the CSO system
- Historical and ongoing aerial deposition
- Releases from present day navigational shipping and commercial boat traffic

From these primary sources, secondary sources include the surface water and sediments of the Study Area. The secondary sources constitute the media to which the receptors are exposed. For sediment, this is the biologically active zone (BAZ), which is typically the top 10 to 15 centimeters and includes the interstitial porewater. Physical/chemical processes such as sorption, desorption, diffusion, precipitation, and advection will affect the partitioning of chemicals between the solid and aqueous phases and could mobilize chemicals from the deeper sediments to the BAZ and the surface water. Deeper sediments could also become a source if exposed via dredging operations. Groundwater constitutes a potential secondary source for the discharge of chemicals from the surrounding properties.

Previous investigations in the Study Area have documented the presence of anthropogenic chemicals in the sediments and the surface water. These investigations include work performed by the Phelps Dodge Refining Corporation (PDRC) in the Laurel Hill/Maspeth Creek portion of Newtown Creek (referred to as the OU6 RI) (Anchor 2007), work performed by the New York City Department of Environmental Protection (NYCDEP) in preparation for the NYCDEP proposed maintenance dredging (NYCDEP 2009), and work performed by USEPA in the main portion of Newtown Creek, but not in the headwaters of the tributaries (Weston Solutions 2009).

Anchor (2007) documented the presence of a wide range of metals, hydrocarbons (including polycyclic aromatic hydrocarbons [PAHs]), polychlorinated biphenyls (PCBs), pesticides, plasticizers (e.g., phthalates), and other constituents in the surficial sediments of OU6. In contrast, very few chemicals were detected in the surface water, and, for those that were detected, maximum concentrations for most were below applicable water quality criteria. Pesticides (aldrin, dieldrin, 4,4′-DDD, 4,4′-DDT, heptachlor, and heptachlor epoxide) and tetrachloroethene were the only chemicals that exceeded their respective water quality criteria. The use of these data in the SLERA analyses will be evaluated during preparation of SLERA Technical Memorandum No. 2.

NYCDEP conducted sediment core and surface water sampling at the mouth of Newtown Creek and at Whale Creek in preparation for maintenance dredging at these locations (NYCDEP 2009). Concentrations of chemicals in many of the sediment samples exceeded state sediment quality guidelines (NYSDEC 1999) for metals, PAHs, PCBs, and dioxins. Some samples exhibited exceedances for a few pesticides, and volatile organic compounds (VOCs). Furthermore, chemical concentrations in many of the surface water and elutriate samples exceeded state ambient water quality standards (NYSDEC 1998) for PCBs, and some samples exceeded state ambient water quality standards for total cyanide and dioxin. These data were collected for dredging purposes (i.e., sediment cores and elutriate samples). They are not suitable for a SLERA analysis of surface sediment and surface water because the cores are much deeper than the BAZ (the top 10 to 15 centimeters): the resulting sediment and elutriate chemistry data are not applicable for evaluating potential risks to organisms in the BAZ.

USEPA conducted an expanded site investigation (ESI) of Newtown Creek in 2009 (Weston Solutions 2009). Only sediment samples were collected (no surface water) and the results were compared to a background location within the nearby Atlantic Basin. The study found that metals, VOCs, semivolatile organic compounds (SVOCs) including PAHs, and PCBs were present in Study Area sediments at concentrations above those in the Atlantic Basin sediments. Given the variety and distribution of the detected constituents throughout Newtown Creek, the ESI report concluded there were a variety of sources influencing the sediment quality in Newtown Creek. While the spatial extent of the samples from this study covered much of the creek and extended into some of the tributaries, subsequent evaluation

of the data has revealed some concern with the quality of the data for some of the chemicals (notably the PCBs and PAHs). This concern includes questions over the true sampling depth, as well as questions regarding the analytical detection limits that were achieved. Thus, while historical data will be considered for the SLERA, only those data deemed usable according to the criteria outlined in the RI/FS Work Plan and described in the project Data Management Plan (DMP) will be included.

2.2 Habitat Characteristics

Given the highly urban and industrial land use and activities of the Study Area, the habitat available for aquatic life and wildlife is limited. Most of the shoreline consists of bulkheads (wood, steel) and armored concrete or riprap with sparse vegetation in eroded sections and on sediment mounds. There are a few localized areas of intertidal mudflats with and without vegetation and possibly some areas of high marsh in the main stem of Newtown Creek. The few riparian areas adjacent to Newtown Creek are dominated by impervious surfaces and riprap. Given the Study Area's designation as a Significant Maritime Industrial Area (SMIA), as well as continued discharges to the creek from municipal and industrial outfalls, it is likely that this limited habitat condition will exist into the foreseeable future. The habitat characteristics of Newtown Creek and its tributaries will be further developed in the SLERA report following completion of the habitat and shoreline surveys as part of the Phase 1 RI Field Program.

2.3 Ecological Receptors

This section describes the receptors considered in the preliminary ecological CSM (Figure 2-1). It should be noted that these receptors will be re-evaluated following completion of the habitat and shoreline surveys as part of the RI Phase 1 Field Program, with possible modifications in SLERA Technical Memorandum No. 2 and/or in the Final SLERA Report and BERA Problem Formulation.

2.3.1 Water Column Organisms

This general receptor class typically includes phytoplankton, zooplankton, ichthyoplankton, and fish that live and reproduce in the water column. Maintaining the balance of this community is important, as it is the foundation of the aquatic food web. These organisms are

directly exposed to dissolved chemicals either through passive diffusion or as they ventilate surface water. Fish are also indirectly exposed to bioaccumulative chemicals through the ingestion of food.

NYCDEP (2007) found diatoms to be the dominant class of phytoplankton, followed by dinoflagellates and green algae. Zooplankton, protozoan, and copepods were the species most frequently collected. Ichthyoplankton exhibited the lowest diversity and abundance in the upper reaches of Newtown Creek, with numbers and species increasing downstream. Species found included the sculpin, goby, and sand lance. By contrast, in the East River near the mouth of the Creek, ichthyoplankton species included the cunner, wrasse, tautog, fourbeard rockling, and menhaden (NYCDEP 2007).

The fish community of Newtown Creek has been described as sparse, especially during the summer months, when dissolved oxygen (DO) concentrations are typically at their lowest (NYCDEP 2007). Species observed in the middle of the creek include weakfish and striped bass. Weakfish are usually found in shallow waters along shores and in estuaries, favoring sandy and sometimes grassy bottoms. They are omnivorous and feed on crabs, shrimp, and mollusks, as well as small fish, such as menhaden and killifish. Because of their varied diet, weakfish forage at different levels and are very adaptable to local food conditions, feeding at the surface or deeper as conditions dictate. Striped bass are often found around piers, jetties, and rocks. They are carnivorous and opportunistic predators feeding on small fish, such as herring, menhaden, and flounder, as well as invertebrates, such as worms, squid, and crabs.

For this technical memorandum, fish are not included as a separate receptor group. For initial screening, it is believed that the conservatism of SLs for water column organisms will protect the sensitive life stages of pelagic fish. Similarly, the conservatism built into the SLs developed for the wildlife screen in Step 2 will ensure that none of the bioaccumulative chemicals that might be present in prey items will be erroneously screened out. Risks to fish as a separate receptor group will be reserved for the BERA following identification of the COPECs.

2.3.2 Sediment Organisms

Organisms that live in close association with the sediment include benthic and epibenthic invertebrates, as well as demersal fish. These species are exposed to sediment-associated chemicals by direct contact, by ventilating sediment porewater for breathing, through the incidental ingestion of sediment, or indirectly exposed through the ingestion of prey items. Some species may also be exposed to chemicals in surface water as a result of their breathing or feeding strategies.

The benthic environment of the Study Area, which is composed of surficial sediments and associated surface water and porewater, is expected to be characterized by low DO levels and also dominated by unconsolidated silts. These conditions, along with physical disturbance and sediment smothering, are likely to severely limit the benthic community that can persist at the Study Area (NYCDEP 2007).

The benthic community of the Study Area has been described as pollution-tolerant, exhibiting low species diversity and abundance, especially in the upper reaches (NYCDEP 2007). Dominant species include worms (phylum *Annelida),* especially *Oligochaeta* (a subclass within phylum *Annelida*), which are important indicators of pollution because of their tolerance to organic enrichment (Gosner 1978; Weiss 1995). One species of mollusk, *Nassarius trivittatus*, has been found on occasion. Like the polychaetes, this mollusk is also considered to be pollution-tolerant.

Epibenthic macrofauna, such as blue crabs, shrimp, sea squirts, and tunicates, have been observed at the Study Area (NYCDEP 2007). Epibenthos are directly exposed to both chemicals dissolved in the water column and chemicals sorbed to sediments because they ventilate surface water over gills and because they ingest benthic invertebrates, zooplankton, benthic and epiphytic microflora (both algae and bacteria), detritus, and scavenged tissue (e.g., dead fish). Incidental ingestion of sediment during foraging activities can also lead to exposure to sediment-sorbed constituents. Epibenthic invertebrates, such as filter feeding barnacles, have also been observed growing on structures such as piers and bulkheads. The epibenthic community of Newtown Creek exhibits low diversity and abundance (similar to the benthic community) in the creek, especially at upstream locations and during the summer months in the middle of the creek (NYCDEP 2007).

Observations of demersal fish include the winter flounder and the weakfish (NYCDEP 2007). The winter flounder has a much more limited diet than either the striped bass or the weakfish, feeding primarily on small invertebrates, shrimp, clams, and worms. As described above, the weakfish is adaptable and can feed in the water column or demersally, depending upon the conditions.

As for pelagic fish, demersal fish are not included as a separate receptor group for this technical memorandum. For initial screening, it is believed that the conservatism of SLs for sediment organisms will protect the sensitive life stages of demersal fish. Similarly, the conservatism built into the SLs developed for the wildlife screen in Step 2 will ensure that none of the bioaccumulative chemicals that might be present in prey items will be erroneously screened out. Risks to fish as a separate receptor group will be reserved for the BERA following identification of the COPECs.

2.3.3 Reptiles and Amphibians

While reptiles and amphibians have not been observed in the Study Area, these receptor groups are also included in the preliminary CSM. However, given the lack of freshwater in the Study Area, the presence of amphibians in the Study Area and/or exposure of amphibians to chemicals in the surface water, sediments, and biota of Newtown Creek is unlikely. Furthermore, due to a lack of readily available effects data for these receptors, the significance of exposure to Study Area chemicals is unknown. Because of these uncertainties, SLs have not been developed for this receptor group as part of this technical memorandum.

2.3.4 Semi-aquatic Birds

Birds are the principal aquatic-dependent wildlife species that occur in the Study Area. Because the diets of semi-aquatic birds vary, they are typically evaluated based on their feeding guilds. These can be divided into the following categories: piscivores (fish-eating), carnivores (consumers of small fish and benthic invertebrates), benthivores (which probe sediments for benthic invertebrates), and herbivores (which feed on plant material). Based

on anecdotal observations in the Study Area, the following describes the selection of representative receptors for the development of SLs.

2.3.4.1 Piscivores

Fish-eating cormorants have been observed in the Study Area and are, therefore, selected as the representative species for this feeding guild. Cormorants can be found in diverse aquatic habitats including rivers, lakes, lagoons, estuaries, and open coastlines. They typically dive for fish and invertebrates from the water's surface. They could be exposed to chemicals through the ingestion of fish and epibenthic invertebrates and through the incidental ingestion of sediment from the Study Area.

2.3.4.2 Carnivores

The term "carnivores" is used here to represent birds that consume a mixture of animal food, including fish, as well as invertebrates. The egret and green heron are examples of carnivorous birds that have been observed in the Study Area and, therefore, are selected as the representative receptor for this feeding guild. The egret runs after its food, which includes small fish, shrimp, and crustaceans. The green heron similarly feeds at the edge of the water on small fish, crustaceans, and mollusks. Both birds could be exposed to Study Area chemicals through the ingestion of small fish and benthic invertebrates and through the incidental ingestion of sediment.

2.3.4.3 Benthivores

Benthivorous birds depend on the presence of shallow-sloping shorelines, beaches, or tidal/mud flats for feeding. Because of their sediment probing habits, they could be exposed to Study Area chemicals through the ingestion of benthic invertebrates and through the incidental ingestion of sediment. Because sandpipers have been observed in the Study Area, they are selected as a representative receptor for this group.

2.3.4.4 Herbivores

Examples of herbivorous birds include ducks and geese commonly found in urban environments (e.g., mallard, Canada goose). While these birds have been observed in the

Study Area, the scarcity of floating emergent or submergent plant material observed to date suggests that this exposure pathway will be relatively insignificant. Furthermore, as it is likely that either the fish/invertebrate-eating or sediment-probing birds will be more exposed to Study Area chemicals than herbivorous birds, they can be considered as surrogates for this feeding guild. Thus, SLs were not developed for this feeding guild for this technical memorandum. If a separate evaluation of herbivorous birds is deemed necessary based upon the habitat survey, SLs will be developed.

2.3.5 Semi-aquatic Mammals

Due to the industrialized and urbanized nature of the Study Area, habitat to support semi-aquatic mammals is limited. Species that may be found within the Study Area would most likely include those with limited ranges and urban-adapted species. Although it has not been observed in the Study Area, the raccoon was chosen as the representative receptor for this feeding guild because it is highly adaptable and often found in urban environments. While raccoons typically make their dens in trees or burrows, they have been known to use barns, sewers, or the crawl spaces beneath buildings. Raccoons are mostly nocturnal and solitary. They are opportunistic feeders, with common foods including berries, nuts, insects, rodents, frogs, and crayfish. In suburban and urban areas, raccoons often forage through trash cans for food. The raccoon could be exposed to Study Area chemicals through the ingestion of crabs and crayfish, as well as through the incidental ingestion of sediment.

Muskrats are another potential receptor; at least one individual has been observed in the Study Area (USEPA 2011d, personal communication November 30, 2011). Finally, there is a possibility of a pathway involving Norway rats scavenging material from the creek and then becoming prey for raptors. SLs were not developed for these groups as part of this technical memorandum. If these pathways are deemed complete and significant on the basis of the habitat surveys, SLs will be developed for this receptor group.

2.3.6 Riparian Birds

Because seed and berry eating riparian birds such as sparrows and starlings have been observed in the Study Area, this receptor group is included in the preliminary CSM. While it is possible that some riparian birds (e.g., swifts or swallows) could be exposed to Study

Area-related bioaccumulative chemicals through the ingestion of emergent insects from the Study Area, the general lack of freshwater reduces the significance of this exposure pathway. For seed- and berry-eating riparian birds, the exposure pathway is considered incomplete. Thus, SLs were not developed for riparian birds as part of this technical memorandum. If these pathways are deemed complete and significant on the basis of the habitat surveys, SLs will be developed for this receptor group.

2.3.7 Threatened and Endangered Species

Threatened and endangered species are receptors that require special consideration in ecological risk evaluations (USEPA 1997). If present, these species need to be considered carefully when designing and conducting a remedial action. The U.S. Endangered Species Act of 1973 (ESA) provides Federal authority to list species as threatened or endangered. The State of New York has also enacted endangered species legislation.

A review of federal- and state-listed species of special concern has been previously conducted by others for the nearby Gowanus Canal (USEPA 2011a). The authors conducted a comprehensive search of online databases and resources available from New York State Department of Environmental Conservation (NYSDEC), the New York Natural Heritage Program, and the U.S. Fish and Wildlife Service. It was concluded that few, if any, of the species listed for Kings and Queens Counties would be expected to occur in the Gowanus Canal study area due to the lack of preferred habitat. The only species with the potential to occur in the Gowanus Canal is the federal- and state-listed endangered shortnose sturgeon (Acipenser brevirostrum). However, as further concluded, although the shortnose sturgeon can be found throughout the Hudson River system, it would only occur for a brief period at the mouth of the Gowanus Canal, if at all, while migrating.

Lastly, in conducting a review for areas of special concern for future CSO planning, the City of New York concluded that "there are no threatened or endangered species or their designated critical habitat within the Newtown Creek waterbody" (NYCDEP 2007).

Based on these findings, threatened and endangered species will not be evaluated in the SLERA for Newtown Creek.

2.4 Exposure Pathways

For there to be a potential ecological risk, there must be a complete exposure pathway from the source(s) to the receptor(s), as well as a route of uptake by the receptor, and the chemicals associated with the source must have adverse effects at the levels present (USEPA 1998). While many exposure pathways may exist in an ecosystem, not all are complete. For complete exposure pathways, some may be of greater relevance for potential risk than others (USEPA 1997). Exposure pathways are typically described in the following ways: complete and significant, complete and insignificant or significance unknown, or incomplete. Each of these is defined below:

Complete and significant: There is a link between the source and the receptor, and the pathway is considered a potentially important driver for risk. This pathway will be evaluated quantitatively.

Complete and insignificant or significance unknown: There is a link between the source and the receptor; however, the significance of this pathway in terms of overall exposure is either minor relative to other exposure pathways or is unknown. These pathways will only be evaluated qualitatively in the SLERA. If the uncertainty is due to a Study Area-specific data gap, collection of appropriate information to permit a quantitative evaluation of these pathways will be considered and discussed in the BERA problem formulation.

Incomplete: There is no link between the source and the receptor. Further assessment of these pathways will not be performed.

Based on existing information and current understanding of the Study Area, Figure 2-1 shows the preliminary receptor groups and exposure pathways for evaluation in the SLERA. These receptor groups and exposure pathways are described in the following sections.

2.4.1 Water Column Organisms

Water column organisms, including pelagic fish, may be directly exposed to Study Area chemicals in the surface water or indirectly exposed to bioaccumulative chemicals through

the ingestion of prey items. Thus, for water column organisms, these represent complete and significant exposure pathways. While water column organisms can come into contact with sediment, this exposure pathway is considered insignificant.

2.4.2 Sediment Organisms

Benthic and epibenthic organisms, including demersal fish, may be directly exposed to Study Area chemicals in the sediment and surface water or indirectly exposed to bioaccumulative chemicals from the ingestion of prey items. Thus, these pathways are considered complete and significant.

For sediment-associated organisms, exposures are only considered complete for the BAZ, which is typically the top 10 to 15 centimeters of the sediment. Deeper sediment will not be ecologically relevant, unless large-scale surface sediment removal or scouring and subsequent redeposition was to occur, or if dredging exposes the deeper sediment. The migration of chemicals from deep to shallow sediment is a potentially complete indirect pathway to sediment biota, as is the transport of chemicals via rooted aquatic plants. The significance of these pathways will be evaluated in the BERA problem formulation following completion of the Phase 1 surveys and/or the collection of additional data as an addendum to the Phase 1 Work Plan.

2.4.3 Reptiles and Amphibians

While all exposure pathways are potentially complete for reptiles and amphibians, their significance is unknown at this time.

2.4.4 Semi-aquatic Birds

Semi-aquatic birds may be exposed to Study Area chemicals through their diet, as well as through direct contact with sediment and surface water. Because of the potential for Study Area chemicals to bioaccumulate in prey items, the dietary ingestion of biota is considered to be the primary route of exposure for all the semi-aquatic birds. Thus, the ingestion of prey is considered a complete and significant exposure pathway.

While the incidental ingestion of sediment is considered a complete pathway for quantitative evaluation, the different feeding strategies of the semi-aquatic birds mean that the significance of this pathway will be species-dependent. For example, the sandpiper is known to ingest quantities of sediment during foraging and probing for benthic invertebrates. For the egret, incidental sediment ingestion while feeding may also occur during foraging, but at a lower rate when compared to the sandpiper. For the cormorant, sediment ingestion is also considered a complete pathway; but because the cormorant dives for its prey through the water column, this pathway is of much lower significance. These different ingestion rates are reflected in the development of the wildlife-based SLs in Section 4.

Because there is currently no information on rooted aquatic plants in the Study Area, this exposure pathway is considered complete, but its significance is unknown at this time.

For all semi-aquatic birds, incidental ingestion of surface water during foraging or other activities may occur, but its significance is not known. Furthermore, exposure to surface water chemicals through drinking is considered complete but of unknown significance, as the salinity of the water will prohibit its use as a source of drinking water. The potential significance of this pathway will be re-evaluated following completion of the Phase 1 field surveys. If necessary, the wildlife exposure models will be updated appropriately.

2.4.5 Semi-aquatic Mammals

Semi-aquatic mammals may be exposed to Study Area chemicals through their diet, as well as through direct contact with sediment and surface water. As with semi-aquatic birds, the dietary ingestion of biota is considered to be the primary route of exposure. Thus, the ingestion of prey is considered a complete and significant exposure pathway. For the raccoon, incidental ingestion of sediment is also considered a complete exposure pathway although it is of lesser significance than the ingestion of biota. As with semi-aquatic birds, the ingestion of surface water is considered complete but insignificant. Because it is unlikely that semi-aquatic mammals will come into contact with rooted aquatic plants, this exposure pathway is considered incomplete.

2.4.6 Riparian Birds

While riparian birds could be exposed to Study Area chemicals in surface water or through their diet, the significance of these pathways in unknown at this time. Because it is not likely that riparian birds will be in contact with sediment, emergent insects, or rooted aquatic plants in Newtown Creek, these pathways are considered incomplete.

2.5 Preliminary Assessment Endpoints and Measures of Effect

Based on the above, the following provides a set of preliminary assessment endpoints and measures of effect for water column organisms, sediment organisms, semi-aquatic birds, and semi-aquatic mammals. Given the uncertainties regarding the significance of exposure for reptiles and amphibians, as well as riparian birds, assessment endpoints and measures of effect were not developed for these receptor groups for this memorandum. If an evaluation is deemed necessary based upon the Phase 1 habitat survey, SLs will be developed.

Assessment endpoints are "an explicit expression of the environmental value to be protected, operationally defined as an ecological entity and its attributes" (USEPA 1998). The selection criteria for assessment endpoints include: ecological relevance, susceptibility (exposure plus sensitivity), and relevance to management goals (USEPA 2003a).

Measures of effect are used to evaluate whether the assessment endpoint is protected. For the SLERA, aquatic and sediment SLs will be used as the measures of effect. However, for the BERA, it is anticipated that additional lines of evidence such as the structure of the ecological community, toxicity tests, and acceptable tissue residues might be included. If warranted, the use of these will be discussed in the BERA Problem Formulation. Based on the preliminary CSM, the following sections present the preliminary assessment endpoints and measures of effect that will be used in the SLERA.

2.5.1 Water Column Organisms

For water column organisms including pelagic fish, the assessment endpoint is protection of the aquatic community from adverse effects on survival, growth, or reproduction associated with direct exposure to Study Area chemicals in surface water. For SL purposes, this assessment endpoint will be evaluated by comparing chemical concentrations in surface

water to state and federal water quality standards and guidelines, as well as water quality guidelines from the scientific literature, if necessary. Potential risks to pelagic fish from exposure to bioaccumulative chemicals via the food chain will be reserved for the BERA.

2.5.2 Sediment Organisms

For sediment organisms including demersal fish, the assessment endpoint is protection of the sediment-associated community from adverse effects on survival, growth, or reproduction associated with direct exposure to Study Area chemicals in sediment and porewater. This endpoint will be evaluated in the SLERA by comparison of contaminant concentrations in sediment to state sediment quality guidelines as well as SL benchmark values from the scientific literature. As for pelagic fish, potential risks to demersal fish from exposure to bioaccumulative chemicals via the food chain will be reserved for the BERA.

2.5.3 Semi-aquatic Birds

For semi-aquatic birds, the assessment endpoint is protection of semi-aquatic bird populations from adverse effects on survival, growth, or reproduction associated with indirect exposure to Study Area chemicals in sediment via the food chain. This endpoint will be assessed by comparison of contaminant concentrations in sediment to SLs based on ingested doses from prey items and incidental ingestion of sediment. As discussed above, because there is currently no information on rooted aquatic plants in the Study Area, SLs were not developed for semi-aquatic birds for this exposure pathway for this memorandum.

2.5.4 Semi-aquatic Mammals

For semi-aquatic mammals, the assessment endpoint is protection of semi-aquatic mammalian populations from adverse effects on survival, growth, or reproduction associated with indirect exposure to Study Area chemicals in sediment via the food chain. This endpoint will be assessed by comparison of contaminant concentrations in sediment to SLs based on ingested doses from biota and incidental ingestion of sediment. SLs are presented in this memorandum for the raccoon. Based on the habitat survey, models will be considered for muskrat and Norway rat.

3 SCREENING LEVELS FOR ASSESSING DIRECT EXPOSURE

This section presents the SLs selected to assess the potential for adverse effects to populations of water column- and sediment-associated organisms from direct exposure.

As discussed with the USEPA Region 2 (for example, at a meeting in March 2010 and in a conference call in December 2011), the SLs are to be selected using a tiered approach. For the SLERA, this includes tier 1 SLs to be used in Step 1 of the SLERA and tier 2 SLs to be used in Step 2 (see Figure 3-1).

Tier 1 SLs are New York Marine Screening Benchmarks recommended by USEPA Region 2 (USEPA 2010). For surface water, these are either New York State water quality standards and guidance values (NYSDEC 1998) or USEPA chronic water quality criteria (USEPA 2009). For sediment, these are the New York State guidance values for screening contaminated sediments (NYSDEC 1999).

In Step 1, any chemical with at least 20 samples in a data set and with a maximum concentration below the tier 1 SL will be eliminated. Chemicals with a data set of less than 20 samples will be carried through to the BERA problem formulation. Any chemical with at least 20 samples in a data set and a maximum value exceeding the tier 1 SL, and any chemical without a tier 1 SL, will pass through to Step 2. Furthermore, any chemicals without a tier 1 or tier 2 SL will be carried through to the BERA problem formulation.

As described below, the tier 2 SLs are from a variety of sources. For surface water, the tier 2 SLs reflect chronic guidelines or standards. For sediment, the tier 2 SLs are either threshold levels below which adverse effects are unlikely or are EqP values using a more Study Area-specific organic carbon content. The tier 2 screening will include an evaluation for the frequency of detection and will use the upper 95% UCL as the exposure point concentration:

- For a data set of 20 samples or more, chemicals with a frequency of detection of less than 5 percent will be eliminated from further consideration, if the quantitation limit is lower than the SL. Otherwise, these chemicals will be retained for further consideration in the BERA problem formulation.

- Chemicals with a frequency of detection of greater than 5 percent but with a 95% UCL concentration below the tier 2 SL will be eliminated.
- Chemicals with a frequency of detection of greater than 5 percent and with a 95% UCL concentration exceeding the tier 2 SL will be identified as COPECs and retained for further evaluation in the BERA problem formulation.

As the ecological risk assessment progresses, it should be noted that in keeping with USEPA guidance (USEPA 2001a), background concentrations will also be taken into consideration. While it is recognized that they cannot be used to eliminate COPECs from further evaluation, background concentrations from reference areas with urban characteristics similar to those of the Study Area will be taken into consideration during the BERA risk characterization.

3.1 Surface Water Screening Levels

The sources and hierarchy for the selection of surface water SLs are presented in Appendix A. Because the water bodies of the Study Area are classified as saltwater, marine/estuarine SLs are selected in preference to freshwater values.

3.1.1 Tier 1 Surface Water Screening Levels

The tier 1 SLs are values recommended by USEPA Region 2 for use in New York waters (USEPA 2010). These are primarily based on New York State Technical & Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC 1998 and updates) and the National Recommended Water Quality Criteria (NRWQC) (USEPA 2009). The hierarchy used by Region 2 was to first select a New York State marine chronic value, then a NRWQC marine chronic value. In some instances, a marine acute value was selected in lieu of a chronic value.

3.1.2 Tier 2 Surface Water Screening Levels

The tier 2 SLs are, for the most part, marine chronic water quality standards or guidelines for the protection of aquatic life from adverse effects on survival, growth, and reproduction due

to a continuous exposure or exposure over a relatively long period of time, often one-tenth of an organism's life span or more.

These were selected from several sources using the following hierarchy (in order of decreasing preference):

- USEPA (NRWQC) saltwater criteria continuous concentration (ccc) (USEPA 2009). (These were included again because, for a few chemicals, EPA Region 2 did not select the available NRWQC.)
- USEPA Region 4 Waste Management Division Saltwater Surface Water Screening Values for Hazardous Waste Sites (USEPA 2001b). This source is a compilation of various sources, and includes references to several state, federal, and Canadian guidance documents.
- USEPA Region 3 Biological Technical Assistance Group (BTAG) Marine Benchmarks (USEPA 2006). This source is also a compilation of various sources, and includes references to several state, federal, and Canadian guidance documents.
- Screening Quick Reference Tables (SQuiRT) compiled by the National Oceanic and Atmospheric Administration (NOAA); this was the source for marine chronic values (Buchman 2008).

If values could not be found in any of the above, additional sources included:

- Oregon Department of Environmental Quality marine screening values (ODEQ 2001)
- Texas Commission of Environmental Quality saltwater SLs (TCEQ 2006)
- Tier 2 freshwater toxicological benchmarks for aquatic life developed for the Oak Ridge National Laboratory (Suter and Tsao 1996)

3.2 Sediment Screening Levels

The sources and selection of the sediment SLs are presented in Appendix B.

3.2.1 Tier 1 Sediment Screening Levels

The tier 1 SLs are values recommended by USEPA Region 2 for use in New York waters (USEPA 2010). These are based on NYSDEC Technical Guidance for Screening Contaminated Sediments (NYSDEC 1999) and, depending on the chemical, are either toxicity-based effects range-low values (ER-Ls) from Long et al. (1995) or are calculated

using EqP theory from water quality criteria. The EqP-based values were conservatively adjusted for a sediment organic carbon content of 1 percent (USEPA 2010). Note that this level is lower than the organic carbon content of Newtown Creek sediments (see below) and, thus, produces a more conservative dry-weight-based SL.

3.2.2 Tier 2 Sediment Screening Levels

As with the tier 1 SLs, the tier 2 sediment SLs are either toxicity-based or derived using EqP. The EqP-derived values are carbon-normalized. An organic carbon content of 8.7 percent was selected for presentation of the EqP-based SLs in this technical memorandum. This value is equal to the average organic carbon content calculated using the data collected as part of the OU6 investigation (Anchor 2007) and the Expanded Site Investigation (Weston Solutions 2009). The carbon-normalized EqP values are translated to dry weight-based values in this technical memorandum solely for presentation purposes, to provide values in the screening level tables all of which are in the same units (mg/kg dry weight). When performing the SLERA, organic-carbon-normalized EqP-based SLs will be compared with sample-specific TOC-normalized data.

The tier 2 sediment SLs were selected using the following sources and hierarchy as described in the RI/FS Work Plan (AECOM 2011), and an April 2010 project technical memorandum (in order of decreasing preference):

- ER-Ls (Long et al. 1995)
- Threshold Effect Levels (TELs) (McDonald et al. 1996)
- Amphipod logistic regression T-20 levels (Field et al. 2002) (T-20 is the 20th percentile of incidence for toxic effects)
- Canadian Council of Environment Ministers (CCME 2002)
- USEPA Region 3 BTAG marine sediment benchmarks based on EqP (USEPA 2006), adjusted for a sediment total organic carbon (TOC) content of 8.7 percent
- USEPA Region 6 sediment SLs based on EqP (USEPA 1999), also adjusted for a TOC of 8.7 percent
- USEPA Region 5 freshwater sediment SLs based on EqP (USEPA 2003b), adjusted for a TOC of 8.7 percent
- NYSDEC sediment guideline values based on EqP and chronic benthic sediment criteria (NYSDEC 1999) and adjusted for a TOC of 8.7 percent

- Apparent Effects Thresholds (AETs) developed by the Washington State Department of Ecology as cited in Buchman (2008). While these are toxicity-based values, they are given lower priority because they were developed from in situ testing in Puget Sound.

4 SCREENING LEVELS FOR ASSESSING INDIRECT EXPOSURE

Because of the nuances associated with the exposure of wildlife to stressors in general (e.g., selection of representative species, availability of prey items, home range, migratory patterns, bioaccumulation characteristics), there are fewer sources for standard wildlife SLs. Those that are available may be based on species that are not applicable to an urban environment, such as this Study Area, or they have not been developed for the bioaccumulative chemicals pertinent to the Study Area. Because of this, SLs protective of higher trophic level organisms from bioaccumulative chemicals are typically developed on a project-by-project basis. This section, therefore, presents sediment SLs along with the equations and parameters used to calculate these SLs for candidate receptors in the Study Area.

4.1 Candidate Wildlife Receptors

As discussed in earlier sections of this memorandum, and consistent with the preliminary ecological CSM, the following species have been selected as candidate receptors for the development of wildlife-based SLs for the Study Area. These receptors have been selected because they have been observed in the Study Area and represent specific feeding guilds. As previously noted, the use of these receptors for future analyses will be re-evaluated following completion of the Phase 1 field program surveys:

- Piscivorous bird – cormorant (observed)
- Insectivorous bird – sandpiper (observed)
- Carnivorous bird – heron (observed)
- Omnivorous mammal – raccoon (not observed, but opportunistic and possible in urban environments)

4.2 Wildlife-Based Screening Levels

Sediment SLs were developed for each of the candidate wildlife receptors based on their dietary intake. Only those chemicals that are identified as bioaccumulative by USEPA (2000) and that are on the Study Area RI Phase 1 analyte list were targeted for SL development. Those chemicals are listed in Appendix C.

The foundation for development of the SLs is the total daily intake for a particular chemical via the ingestion of water, food, and sediment as described in Equation 1:

$$TDI_{All} = TDI_{water} + TDI_{sed} + TDI_{food} \quad \text{(Equation 1)}$$

Where:

TDI_{all} = total daily intake of chemical from all sources (mg chemical/kg body weight-day)

TDI_{water} = total daily intake of chemical from incidental and/or drinking water ingestion

TDI_{sed} = total daily intake of chemical from incidental sediment ingestion

TDI_{food} = total daily intake of chemical from ingestion of food items

As discussed in Section 2.4, because the significance of the incidental and/or drinking water ingestion pathway is unknown, the primary exposure pathways used to develop the wildlife SLs in this technical memorandum are the ingestion of sediment and/or biota.

Dose is related to risk as described in Equation (2):

$$HQ = \frac{TDI_{all}}{TRV} \quad \text{(Equation 2)}$$

Where:

HQ = Hazard Quotient (set equal to 1.0)

TRV = Toxicity Reference Value (mg chemical/kg body weight-day)

The intake via sediment and biota can be further defined by:

$$TDI_{all} \approx TDI_{sed} + TDI_{food} = \frac{IR_f}{BW} \times \left(C_s \times P_s \times EMF_s + \sum_i \left(C_{f,i} EMF_{f,i} \right) \right) \quad \text{(Equation 3)}$$

Where:

IR_f = Food ingestion rate (kg/day)

BW = Receptor body weight (kg)

C_s = Chemical concentration in sediment (mg/kg)

P_s = Proportion of sediment in the diet (as a fraction of food intake)

EMF_s = Exposure modifying factor for incidental sediment ingestion (e.g., area use factor, bioavailability)

$C_{f,i}$ = Chemical concentration in each item of food (mg/kg)

$EMF_{f,i}$ = Exposure modifying factor for food item *i* (e.g., area use factor, bioavailability)

The chemical concentration in each item of food ($C_{f,i}$) can either be measured or estimated. In the absence of measured concentrations[2], the chemical concentration in each food item can be estimated using literature-based biota-sediment accumulation factors (BAFs):

$$C_{f,i} = C_s \times \text{BAF} \qquad \text{(Equation 4)}$$

Where:

BAF = Biota-Sediment Accumulation Factor on a dry weight basis (kg dry weight sediment/kg dry weight organism)

Based on the above daily intake models, sediment SLs can be calculated by incorporating information on the toxicity of a chemical and an acceptable level of risk (i.e., a hazard quotient), using the following relationships. Combining Equations 1 through 4, rearranging, and assuming only one type of biota in the diet:

$$C_s = \frac{TRV \times HQ}{\frac{IR_f}{BW} \times \left(P_s \times EMF_s + BAF \times EMF_f\right)} \qquad \text{(Equation 5)}$$

And:

$$SL_{sed} = C_s \ \ for\ HQ = 1 \qquad \text{(Equation 6)}$$

Where:

SL_{sed} = Wildlife-based sediment screening level (mg/kg dry weight)

[2] The resources associated with collecting and analyzing tissue samples are usually reserved for the BERA.

It can be informative to separate out the sediment levels that result from food ingestion and incidental sediment ingestion. The sediment screening level based on the incidental sediment ingestion is (from Equations 5 and 6):

$$SL_{sed-ingestion} = \frac{TRV \times HQ}{\frac{IR_f}{BW} \times \left(P_s \times EMF_s\right)} \quad \text{(Equation 7)}$$

The sediment screening level based on the ingestion of food is:

$$SL_{food-ingestion} = \frac{TRV \times HQ}{\frac{IR_f}{BW} \times \left(BAF \times EMF_f\right)} \quad \text{(Equation 8)}$$

Equations 7 and 8 are combined to give the sediment screening level:

$$SL_{sed} = \frac{1}{\left(\frac{1}{SL_{sed-ingestion}} + \frac{1}{SL_{food-ingestion}}\right)} \quad \text{(Equation 9)}$$

The toxicity reference values (TRVs) used for initial screening are no-observed adverse effect levels (NOAELs) reported in the scientific literature for avian test species such as quail, mallard, and chicken; and for mammalian test species such as rats, mice, and dogs. TRVs were selected from several sources, including USEPA's ecological soil SL (Eco-SSL) documents (e.g., USEPA 2005), Sample et al. (1996), Agency for Toxic Substances and Disease Registry (ATSDR; e.g., ATSDR 1997), and Integrated Risk Information System (IRIS; USEPA 2011b), as well as other sources from the scientific literature. The Eco-SSL documents were the primary source for TRV selection. The Eco-SSL TRV compilation, screening, and selection process uses a standardized and comprehensive approach to identify TRVs for birds and mammals (USEPA 2003a). For those chemicals without a reported NOAEL, the lowest observed adverse effect level (LOAEL), if available, will be adjusted down by a safety factor of 10 and used.

For mammals, it is standard practice to correct the TRVs for the difference between the body weight of the test species and the receptor being evaluated. Thus, for the raccoon, the test species TRVs were corrected using the following relationship:

$$NOAEL_{Raccoon} = NOAEL_{Test\ species} \times \left(\frac{BW_{Test\ species}}{BW_{Raccoon}} \right)^{0.25} \qquad \text{(Equation 10)}$$

Where:

$NOAEL_{Raccoon}$	=	TRV for use in the SLERA (mg/kg-day)
$NOAEL_{Test\ species}$	=	no-observed-adverse-effect-level from literature (mg/kg-day)
$BW_{Raccoon}$	=	5.45 kg

The TRVs that were identified for the bioaccumulatives on the Phase 1 analyte list are presented in Appendix D-1 for avian receptors and D-2 for mammalian receptors. Lipid/carbon-based (normalized) biota-sediment accumulation factors (BAFs) were selected primarily from two sources: the USEPA BSAF data set (USEPA 2011c) and the U.S. Army Corps of Engineers (USACE) BSAF database (USACE 2011). These databases contain BSAFs for many different species, with sometimes up to ten values for each. For the species within each of the receptor groups—fish, benthic invertebrates, and epibenthic invertebrates—both maximum and average BSAFs were calculated. From these, the maximum and average BSAFs for the receptor group were calculated. In the absence of BSAFs from either of these two sources, BAFs from the Calcasieu Estuary baseline ecological risk assessment (CDM 2002)[3] were selected in a similar manner.

The BSAF and BAF data for the Phase 1 bioaccumulatives are presented in Appendix E-1 and E-2, respectively. In selecting BSAFs for calculating receptor specific screening levels, it was sometimes necessary to use "all prey item" values when there were either no, or few, prey item specific values. Under similar circumstances when selecting BAFs, either "all invertebrates" or "all fish" values were used.

[3] The BAFs from the Calcasieu risk assessment are in fact biota-sediment accumulation factors; but since they are not normalized for sediment organic carbon or tissue lipid content, they are referred to as BAFs.

Because the BSAFs in the two databases are based on a sediment organic carbon and prey item lipid content basis, they were normalized for use in calculating dry-weight based sediment SLs using a Study Area-specific sediment organic carbon content of 8.7 percent and a prey-item specific lipid content (USEPA 2011c; USACE 2011)[4], using the following relationship:

$$BAF = \frac{BSAF \times FL}{TOC} \qquad \text{(Equation 11)}$$

Where:

BSAF = biota-sediment accumulation factor on a lipid/carbon basis (kg organic carbon/kg lipid)

FL = fraction lipid of the organism (kg lipid/kg dry weight)

For SL purposes, conservative assumptions were used for those factors that can modify exposure (EMFs). Thus, it is assumed that the chemicals are 100 percent bioavailable, that the receptors feed exclusively within the Study Area, and that they are there year-round (i.e., no migration). These assumptions will be refined during the BERA problem formulation phase to reflect Study-Area-specific and species-specific values.

Tables 4-1 and 4-2 present the exposure parameters used to develop the wildlife SLs for the semi-aquatic birds and mammals. This information is briefly described below for each of the receptors.

Sandpiper

For spotted sandpipers, females are up to 20 to 25 percent larger than males. During breeding season, the mean body mass of females at 47.76 grams (g) is significantly higher than that of males at 39.44 g (Oring et al. 1997). Thus, for the SLERA, the male body weight of 39.44 g was selected. A sandpiper is typically a shorebird that obtains much of its diet by probing or "mining" soft sediments along shorelines and exposed mud flats in search of

[4] A mean lipid content by receptor group was calculated in a similar manner to that described for the BSAFs, using data from the USEPA and USACE databases.

benthic invertebrates such as polychaetes and aquatic insects. Thus, its diet is assumed to be 100 percent benthic invertebrates. Because of the sandpiper's feeding strategy, the proportion of sediment ingested relative to food intake is set relatively high at 30 percent based on a reported value for a semi-palmated sandpiper (USEPA 1993).

Heron

While both egrets and green herons have been observed in the Study Area, to be conservative, the carnivorous bird feeding guild is represented by the smaller of the two, the green heron An average body weight of 241 g was reported for 16 green herons in northeastern Louisiana (sex unknown) by Davis and Kushlan (1994). In an earlier study, the body weight of one female green heron from Georgia was reported to be 229 g (Norris and Johnston 1958). Thus, for the SLERA, a body weight of 229 g was selected. The dietary habits of species within this guild are quite diverse; they consume a variety of benthic invertebrates, such as polychaetes, aquatic insects, and bivalves, as well as epibenthic invertebrates, such as blue crabs and shrimp. There are no known studies on the incidental sediment ingestion rate for egrets or herons. Those that are perch and strike surface feeders would likely have little sediment exposure, but others that feed on benthic invertebrates may have some sediment exposure during feeding. In a study that included willets (long bills for probing), Huis and Beyer (1998) reported willet digestia with an estimated 3 percent sediment content. The digestia of 47 waterfowl shot by hunters at Prime Hook National Wildlife Refuge in Delaware contained an average of 2.4 percent sediment (Beyer et al. 1999). Based on these studies, it seems reasonable to assume a 3 percent incidental sediment ingestion for heron species.

Cormorant

The body weight of cormorants is variable, depending on location and gender. As cited by Hatch and Westeloh (1999), cormorants from Quebec were bigger than those from Florida, with average body weights for males of 2,089 g and 1,758 g, respectively, and for females 1,831 g and 1,535 g, respectively. The average body weight of the Florida females was selected for the SLERA. Cormorants feed mainly on small fish by diving and pursuing prey. Because of their feeding strategy, cormorants have little exposure to sediments. Therefore, the rate of incidental sediment ingestion for this receptor is set at 1 percent.

Raccoon

Male raccoons are generally larger than females, and their weights vary depending on location (USEPA 1993). As cited by USEPA (1993), the average body weight for male raccoons is reported to be 6,223 g, while for females it is reported to be 5,453 g. The lower body weight of the females was selected for the SLERA. Raccoons are highly opportunistic and will vary their diet according to food availability (USEPA 1993). Quantitative analysis of dietary composition is generally lacking, and given their opportunistic foraging, there would be a high degree of uncertainty associated with such an analysis. However, raccoons will consume virtually any animal and vegetable matter (USEPA 1993). For this memorandum, the raccoon's diet is conservatively assumed to consist of 100 percent epibenthic invertebrates, such as blue crabs. Based on empirical measurements by Beyer et al. (1994), incidental sediment ingestion for the raccoon is set at 9.4 percent.

Calculation of the wildlife SLs is presented in Appendix F using the maximum BSAF and in Appendix G using the average BSAF. Appendix F-1 and G-1 present a summary of the resulting SLs for each of the receptors, while details of the calculations are presented in Appendices F-2 and G-2 for the sandpiper, Appendices F-3 and G-3 for the heron, Appendices F-4 and G-4 for the cormorant, and Appendices F-5 and G-5 for the raccoon.

It is noted that SLs could not be developed for all of the bioaccumulative chemicals. This was most often due to the lack of a BSAF for a chemical. Chemicals for which no SL could be developed will be carried through to the BERA problem formulation.

5 NEXT STEPS

The next steps for the SLERA include evaluating the information collected during the Phase 1 field program. This will involve interpreting data and observations made during the field surveys to verify inclusion/exclusion of the preliminary ecological receptors and exposure pathways. Additional receptors and exposure pathways will be considered as appropriate. Furthermore, Phase 1 sediment and water chemistry data, along with any usable historical data, will be used to conduct the SLERA risk analyses. The results of these analyses will be presented in SLERA Technical Memorandum No. 2 in the fall of 2012.

It is anticipated that a workshop with the agency and project respondents will be held in the fall/winter of 2012/2013 to discuss the results of the SLERA and propose a BERA problem formulation.

The Final SLERA Report will be submitted as part of a BERA Problem Formulation document in the spring of 2013, which represents an SMDP for agency approval.

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TABLES

Table 4-1

Newtown Creek SLERA: Exposure Parameters Used to Develop Wildlife Screening Levels for Semi-aquatic Birds and Mammals

Common Name	Scientific Name	Feeding Behavior and Trophic Guild Representation	Body Weight (kg)[a]	Food Ingestion Rate (kg food dw/day)	Sediment Ingestion (% of Diet)	Dietary Proportions (%)
Birds						
Sandpiper	*Actitis macularius*	Sediment-probing. Benthivore.	0.0394[b]	0.007[c]	30[d]	100% Benthic Invertebrates
Heron	*Butorides virescens*	Littoral zone ambushing/stalking. Carnivore	0.229[e]	0.022[c]	3[f]	100% Benthic/ Epibenthic Invertebrates
Cormorant	*Phalacrocorax auritus*	Forage during flight. Piscivore.	1.535[g]	0.077[c]	1[f]	100% Fish
Mammals						
Raccoon	*Procyon lotor*	Littoral zone gleaning. Omnivore.	5.453[h]	0.277[i]	9.4[j]	100% Epibenthic Invertebrates

Notes:
dw – dry weight
kg food dw/day – kilogram of food dry weight per day
[a] Lowest gender body weights selected.
[b] Male spotted sandpiper (Oring et al. 1997)
[c] Based on allometric equation for all birds: Ingestion kg/day = 0.0582 * $BW^{0.651}$ (kg) (Equation 3-3 in USEPA 1993)
[d] Semi-palmated sandpiper (USEPA 1993)
[e] Female green heron (Norris and Johnston 1958)
[f] Conservative assumption based on professional judgment considering values for birds with similar diets and feeding behavior (Huis and Beyer 1998)
[g] Florida females (Hatch and Westeloh 1999)
[h] Female raccoons (USEPA 1993)
[i] Based on allometric equation for all mammals: Ingestion kg/day = 0.0687 * $BW^{0.822}$ (kg) (Equation 3-7 in USEPA 1993)
[j] Based on empirical data (Beyer et al. 1994)

Table 4-2

Newtown Creek SLERA: Prey Item Exposure Parameters Used to Develop Wildlife Screening Levels for Semi-aquatic Birds and Mammals

Prey Item	Lipid Content[a] (%)	Moisture Content[b] (%)
Benthic Invertebrates	6.16	78.5
Epibenthic Invertebrates	5.55	78.5
Fish	5.08	71.5

Notes:
[a] USACE 2011, USEPA 2011c.
[b] USEPA 1993.

FIGURES

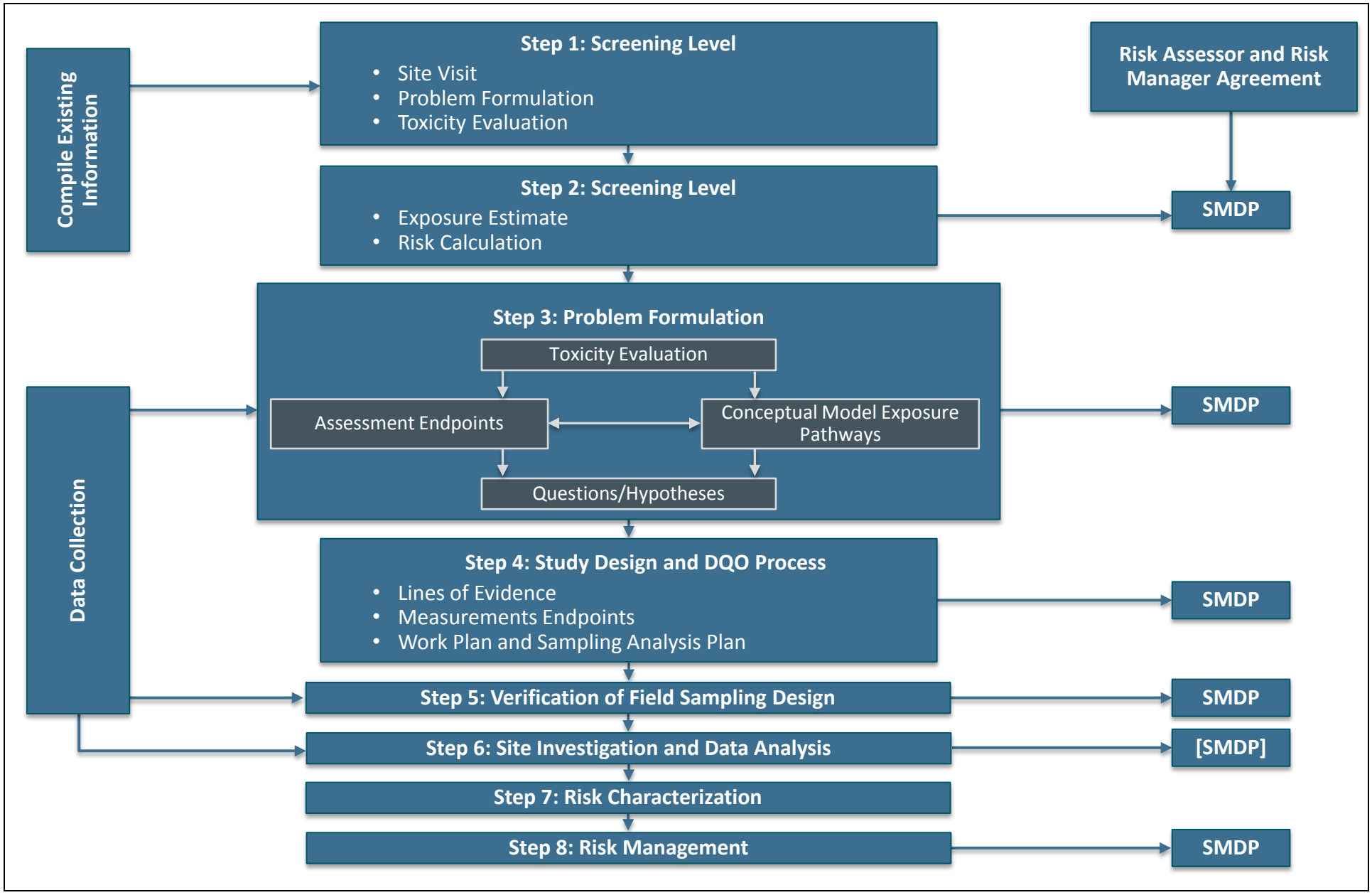
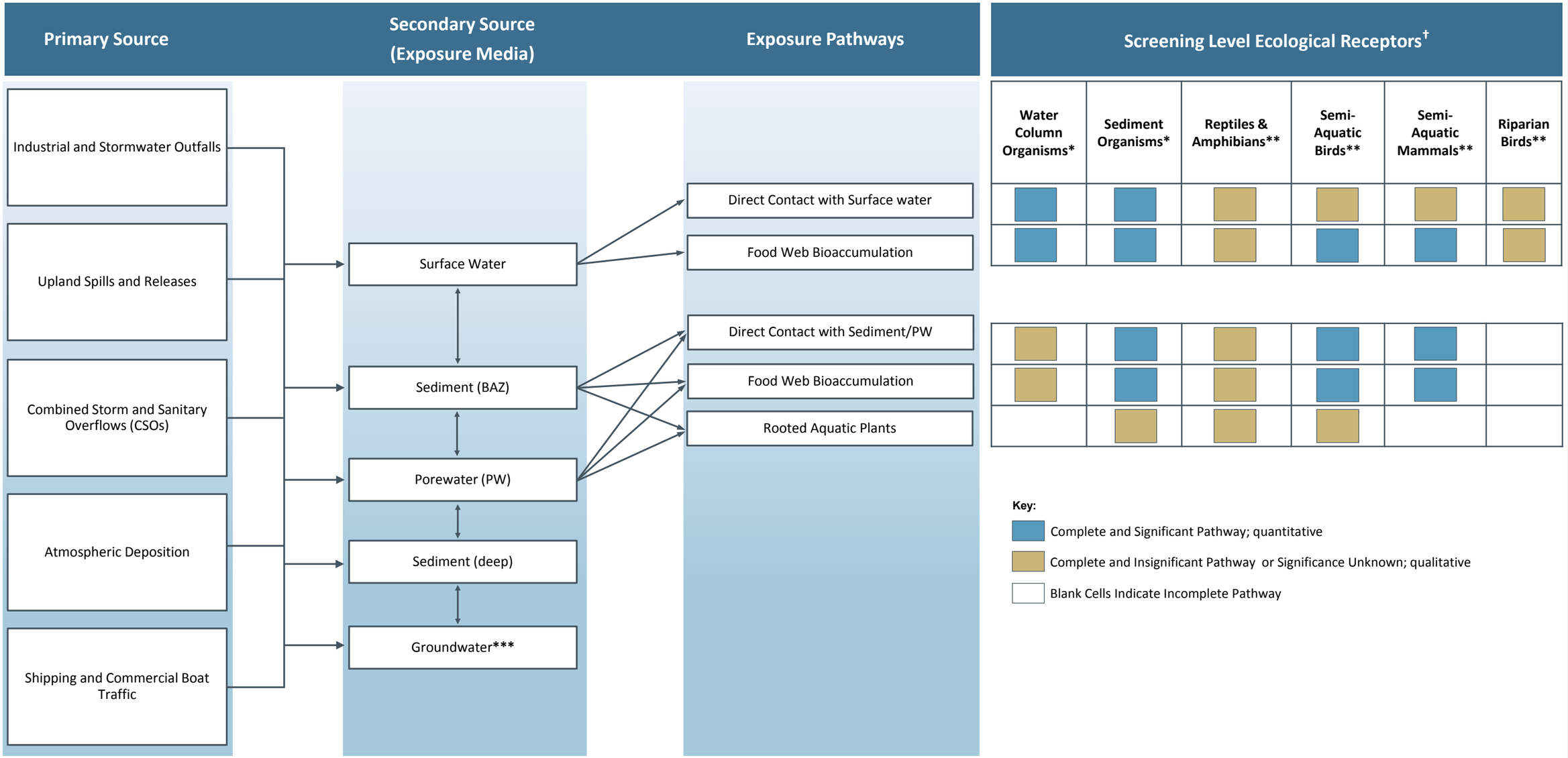


Figure 1-1
Superfund Ecological Risk Assessment (ERA) Process (USEPA 1997)
SLERA Technical Memorandum No. 1
Newtown Creek RI/FS



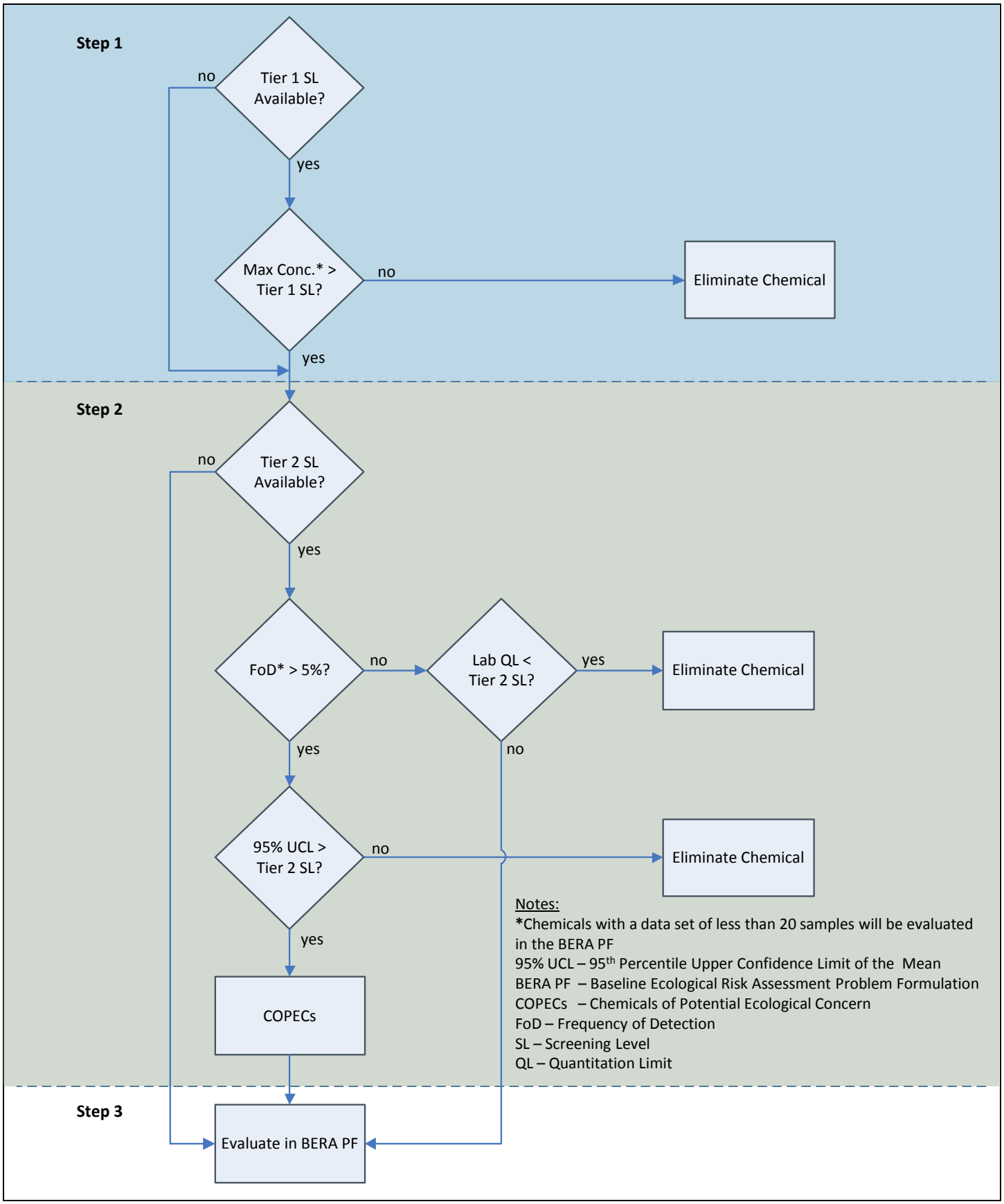
† *Receptors will be refined during the baseline ecological risk assessment problem formulation (BERA PF).*

* *For the Screening Level Ecological Risk Assessment (SLERA), these receptor groups include fish.*

** *Selection of these receptors will depend on results of habitat and shoreline surveys and whether presence and/or exposure pathways considered likely.*

*** *Significance of source to be determined after collection and evaluation of data.*

Figure 2-1
Newtown Creek Preliminary Conceptual Site Model
SLERA Technical Memorandum No. 1
Newtown Creek RI/FS


Step 1
Tier 1 SL Available?
no
yes
Max Conc.* > Tier 1 SL?
no
Eliminate Chemical
yes
Step 2
Tier 2 SL Available?
no
yes
FoD* > 5%?
no
Lab QL < Tier 2 SL?
yes
Eliminate Chemical
yes
no
95% UCL > Tier 2 SL?
no
Eliminate Chemical
yes
COPECs
Step 3
Evaluate in BERA PF
Notes:
*Chemicals with a data set of less than 20 samples will be evaluated in the BERA PF
95% UCL – 95th Percentile Upper Confidence Limit of the Mean
BERA PF – Baseline Ecological Risk Assessment Problem Formulation
COPECs – Chemicals of Potential Ecological Concern
FoD – Frequency of Detection
SL – Screening Level
QL – Quantitation Limit

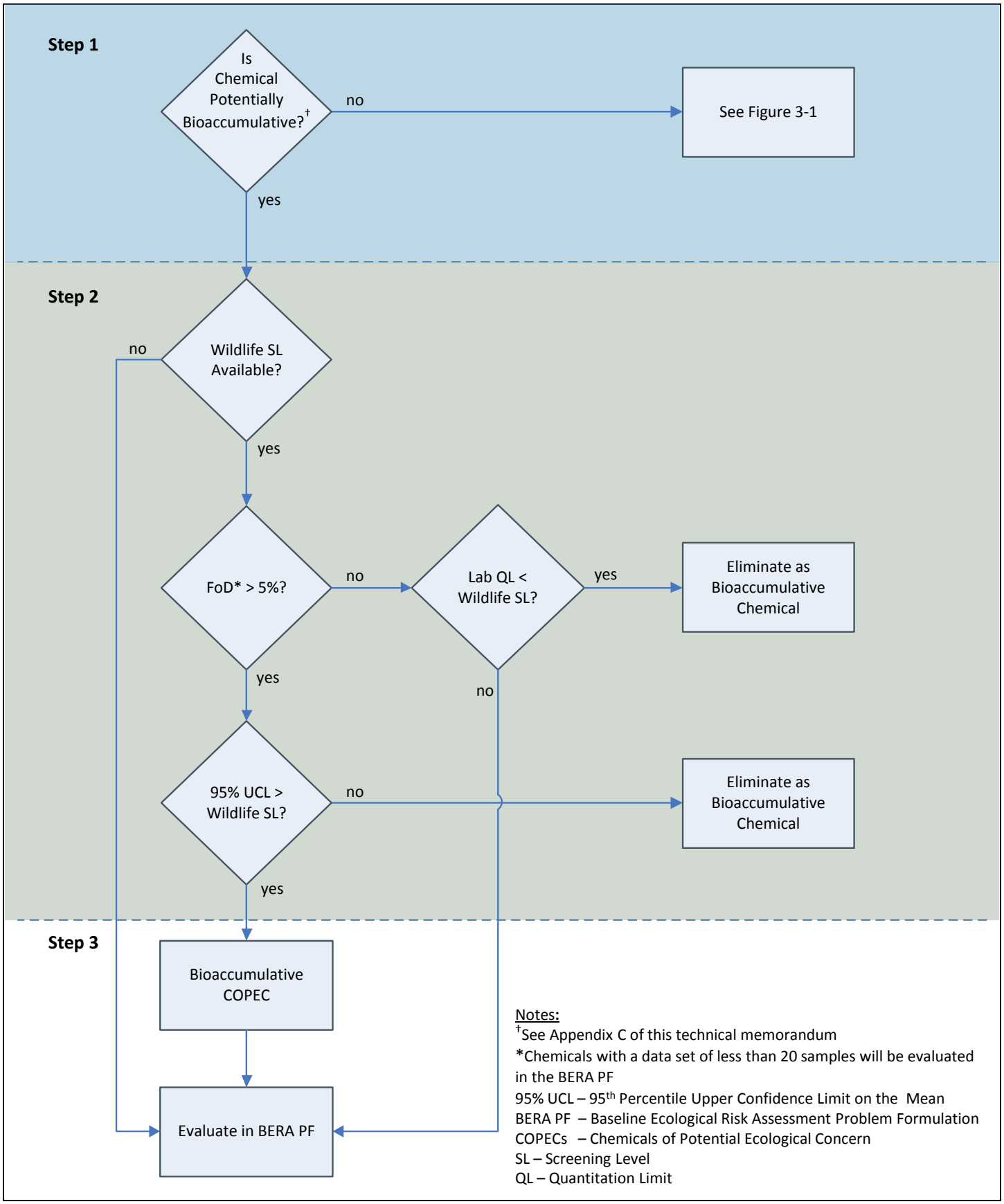


Figure 3-2
Newtown Creek Screening Approach (Bioaccumulative)
SLERA Technical Memorandum No. 1
Newtown Creek RI/FS

APPENDIX A
NEWTOWN CREEK SLERA:
SURFACE WATER SCREENING LEVELS

Appendix A Newtown Creek SLERA: Surface Water Screening Levels

Parameters	CAS	Tier 1 Screening Levels (µg/L)	Tier 2 Screening Values (µg/L)						
		USEPA Region 2 Marine Screening Benchmarks (USEPA 2010)[a]	USEPA (2009) Saltwater CCC		Alternative Tier 2 Screening Values			Selected Tier 2 SL[b]	
		Benchmark	Value	Note	Value	Note	Reference	Final Value	Tier 2 Reference
TCL Volatiles									
1,1,1-Trichloroethane	71-55-6				3120		Buchman, 2008	3120	Buchman, 2008
1,1,2,2-Tetrachloroethane	79-34-5				902		Buchman, 2008	902	Buchman, 2008
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1				9400	FW	DEQ, 1998	9400	DEQ, 1998
1,1,2-Trichloroethane	79-00-5				550		USEPA Region 3, 2006	550	USEPA Region 3, 2006
1,1,-Dichloroethylene	75-35-4				2240		USEPA Region 4, 2001	2240	USEPA Region 4, 2001
1,1-Dichloroethane	75-34-3				47		Suter and Tsao, 1996	47	Suter and Tsao, 1996
1,2,3-Trichlorobenzene	87-61-6	5						5	Tier 1 SL
1,2,4-Trichlorobenzene	120-82-1	5			5.4		USEPA Region 3, 2006	5.4	USEPA Region 3, 2006
1,2-Dibromoethane	106-93-4								
1,2-Dibromo-3-chloropropane	96-12-8								
1,2-Dichlorobenzene	95-50-1	5			42		USEPA Region 3, 2006	42	USEPA Region 3, 2006
1,2-Dichloroethane	107-06-2				1130		USEPA Region 4, 2001	1130	USEPA Region 4, 2001
1,2-Dichloropropane	78-87-5				2400		USEPA Region 4, 2001	2400	USEPA Region 4, 2001
1,3-Dichlorobenzene	541-73-1	5			28.5		USEPA Region 4, 2001	28.5	USEPA Region 4, 2001
1,4-Dichlorobenzene	106-46-7	5			19.9		USEPA Region 4, 2001	19.9	USEPA Region 4, 2001
2-Butanone	78-93-3				14000		Suter and Tsao, 1996	14000	Suter and Tsao, 1996
2-Hexanone	591-78-6				99		Suter and Tsao, 1996	99	Suter and Tsao, 1996
4-Methyl-2-pentanone	108-10-1				123000		USEPA Region 3, 2006	123000	USEPA Region 3, 2006
Acetone	67-64-1				564000		USEPA Region 3, 2006	564000	USEPA Region 3, 2006
Benzene	71-43-2	190			109		USEPA Region 4, 2001	190	Tier 1 SL
Bromochloromethane	74-97-5								
Bromodichloromethane	75-27-4				6400		Buchman, 2008	6400	Buchman, 2008
Bromoform	75-25-2				640		USEPA Region 4, 2001	640	USEPA Region 4, 2001
Bromomethane	74-83-9				120		USEPA Region 4, 2001	120	USEPA Region 4, 2001
Carbon disulfide	75-15-0				0.92		Suter and Tsao, 1996	0.92	Suter and Tsao, 1996
Carbon tetrachloride	56-23-5				1500		USEPA Region 4, 2001	1500	USEPA Region 4, 2001
Chlorobenzene	108-90-7	5			105		USEPA Region 4, 2001	105	USEPA Region 4, 2001
Chloroethane	75-00-3				47		Suter and Tsao, 1996	47	Suter and Tsao, 1996
Chloroform	67-66-3				815		USEPA Region 4, 2001	815	USEPA Region 4, 2001
Chloromethane	74-87-3				2700		USEPA Region 4, 2001	2700	USEPA Region 4, 2001
cis-1,2-Dichloroethylene	156-59-2				590		Suter and Tsao, 1996	590	Suter and Tsao, 1996
cis-1,3-Dichloropropene	10061-01-5				0.055	FW	Buchman, 2008	0.055	Buchman, 2008
Cyclohexane	110-82-7								
Dibromochloromethane	124-48-1				6400		Buchman, 2008	6400	Buchman, 2008
Dichlorodifluoromethane	75-71-8								
Ethylbenzene	100-41-4	4.5			4.3		USEPA Region 4, 2001	4.5	Tier 1 SL

Appendix A Newtown Creek SLERA: Surface Water Screening Levels

Parameters	CAS	Tier 1 Screening Levels (µg/L)	Tier 2 Screening Values (µg/L)						
		USEPA Region 2 Marine Screening Benchmarks (USEPA 2010)[a]	USEPA (2009) Saltwater CCC		Alternative Tier 2 Screening Values			Selected Tier 2 SL[b]	
		Benchmark	Value	Note	Value	Note	Reference	Final Value	Tier 2 Reference
Isopropylbenzene	98-82-8								
Methyl acetate	79-20-9								
Methyl tert-Butyl Ether	1634-04-4								
Methylcyclohexane	108-87-2								
Methylene chloride	75-09-2				6400		Buchman, 2008	6400	Buchman, 2008
Styrene	100-42-5				910		USEPA Region 3, 2006	910	USEPA Region 3, 2006
Tetrachloroethene	127-18-4				45		USEPA Region 4, 2001	45	USEPA Region 4, 2001
Toluene	108-88-3	92			37		USEPA Region 4, 2001	92	Tier 1 SL
trans,1-2-Dichloroethylene	156-60-5				1160	FW	Buchman, 2008	1160	Buchman, 2008
trans-1,3-Dichloropropene	10061-02-6				0.055	FW	Buchman, 2008	0.055	Buchman, 2008
Trichloroethene	79-01-6				970		Texas Guidance, 2006	970	Texas Guidance, 2006
Trichlorofluoromethane	75-69-4				6400		Buchman, 2008	6400	Buchman, 2008
Vinyl acetate	108-05-4				16		Suter and Tsao, 1996	16	Suter and Tsao, 1996
Vinyl chloride	75-01-4				930	FW	USEPA Region 3, 2006	930	USEPA Region 3, 2006
Xylenes (total)	1330-20-7	19			19	R	USEPA Region 3, 2006	19	Tier 1 SL
TCL Semivolatiles									
1,1-Biphenyl	92-52-4								
1,2,4,5-Tetrachlorobenzene	95-94-3				129		USEPA Region 4, 2001	129	USEPA Region 4, 2001
1,4-Dioxane	123-91-1								
2,3,4,6-Tetrachlorophenol	58-90-2								
2,4,5-Trichlorophenol	95-95-4				12		USEPA Region 3, 2006	12	USEPA Region 3, 2006
2,4,6-Trichlorophenol	88-06-2				61		USEPA Region 3, 2006	61	USEPA Region 3, 2006
2,4-Dichlorophenol	120-83-2				36.5	FW	USEPA Region 4, 2001	36.5	USEPA Region 4, 2001
2,4-Dimethylphenol	105-67-9				42.4	FW	DEQ, 1998	42.4	DEQ, 1998
2,4-Dinitrophenol	51-28-5				48.5		USEPA Region 4, 2001	48.5	USEPA Region 4, 2001
2,4-Dinitrotoluene	121-14-2				310	FW	USEPA Region 4, 2001	310	USEPA Region 4, 2001
2,6-Dinitrotoluene	606-20-2				6.2	FW	USEPA Region 4, 2001	6.2	USEPA Region 4, 2001
2-Chloronaphthalene	91-58-7								
2-Chlorophenol	95-57-8				265		USEPA Region 3, 2006	265	USEPA Region 3, 2006
2-Methylnaphthalene	91-57-6	4.2			72.16		USEPA, 2003	72.16	USEPA, 2003
2-Methylphenol	95-48-7				1020		USEPA Region 3, 2006	1020	USEPA Region 3, 2006
2-Nitroaniline	88-74-4								
2-Nitrophenol	88-75-5				300	FW	Buchman, 2008	300	Buchman, 2008
3,3-Dichlorobenzidine	91-94-1				73		USEPA Region 3, 2006	73	USEPA Region 3, 2006
3-Nitroaniline	99-09-2								
4,6-Dinitro-2-methylphenol	534-52-1								

Appendix A Newtown Creek SLERA: Surface Water Screening Levels

Parameters	CAS	Tier 1 Screening Levels (µg/L)	Tier 2 Screening Values (µg/L)						
		USEPA Region 2 Marine Screening Benchmarks (USEPA 2010)[a]	USEPA (2009) Saltwater CCC		Alternative Tier 2 Screening Values			Selected Tier 2 SL[b]	
		Benchmark	Value	Note	Value	Note	Reference	Final Value	Tier 2 Reference
4-Bromophenyl-phenyl ether	101-55-3				1.5		Suter and Tsao, 1996	1.5	Suter and Tsao, 1996
4-Chloro-3-methylphenol	59-50-7				0.3	FW	USEPA Region 4, 2001	0.3	USEPA Region 4, 2001
4-Chloroaniline	106-47-8				232	FW	USEPA Region 3, 2006	232	USEPA Region 3, 2006
4-Chlorophenyl-phenyl ether	7005-72-3								
4-Methylphenol	106-44-5				510	S	Texas Guidance, 2006	510	Texas Guidance, 2006
4-Nitroaniline	100-01-6								
4-Nitrophenol	100-02-7				300	FW	Buchman, 2008	300	Buchman, 2008
Acenaphthene	83-32-9	6.6			55.85		USEPA, 2003	55.85	USEPA, 2003
Acenaphthylene	208-96-8				306.9		USEPA, 2003	306.9	USEPA, 2003
Acetophenone	98-86-2								
Anthracene	120-12-7				20.73		USEPA, 2003	20.73	USEPA, 2003
Atrazine	1912-24-9								
Benzaldehyde	100-52-7								
Benzo(g,h,i)perylene	191-24-2				0.4391		USEPA, 2003	0.4391	USEPA, 2003
Benzo(a)pyrene	50-32-8				0.9573		USEPA, 2003	0.9573	USEPA, 2003
Benzo(a)anthracene	56-55-3				2.227		USEPA, 2003	2.227	USEPA, 2003
Benzo(b)fluoroanthene	205-99-2				0.6774		USEPA, 2003	0.6774	USEPA, 2003
Benzo(k)fluoranthene	207-08-9				0.6415		USEPA, 2003	0.6415	USEPA, 2003
bis(2-Chloroethoxy)methane	111-91-1								
bis(2-Chloroethyl)ether	111-44-4								
bis(2-Chloroisopropyl)ether	39638-32-9								
bis(2-Ethylhexyl)phthalate	117-81-7				3		Suter and Tsao, 1996	3	Suter and Tsao, 1996
Butylbenzylphthalate	85-68-7				3.4		Buchman, 2008	3.4	Buchman, 2008
Caprolactam	105-60-2								
Chrysene	218-01-9				2.042		USEPA, 2003	2.042	USEPA, 2003
Dibenz(a,h)anthracene	53-70-3								
Dibenzofuran	132-64-9				65		USEPA Region 3, 2006	65	USEPA Region 3, 2006
Diethylphthalate	84-66-2				3.4		Buchman, 2008	3.4	Buchman, 2008
Dimethylphthalate	131-11-3				3.4		Buchman, 2008	3.4	Buchman, 2008
di-n-Butylphthalate	84-74-2				3.4		USEPA Region 3, 2006	3.4	USEPA Region 3, 2006
Di-n-octylphthalate	117-84-0				3.4		Buchman, 2008	3.4	Buchman, 2008
Fluoranthene	206-44-0				7.109		USEPA, 2003	7.109	USEPA, 2003
Fluorene	86-73-7	2.5			39.3		USEPA, 2003	39.3	USEPA, 2003
Hexachlorobenzene	118-74-1				129		Buchman, 2008	129	Buchman, 2008
Hexachlorobutadiene	87-68-3	0.3			0.32		USEPA Region 4, 2001	0.32	USEPA Region 4, 2001
Hexachlorocyclopentadiene	77-47-4	0.07			0.07		USEPA Region 4, 2001	0.07	Tier 1 SL

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Parameters	CAS	Tier 1 Screening Levels (µg/L)	Tier 2 Screening Values (µg/L)						
		USEPA Region 2 Marine Screening Benchmarks (USEPA 2010)[a]	USEPA (2009) Saltwater CCC		Alternative Tier 2 Screening Values			Selected Tier 2 SL[b]	
		Benchmark	Value	Note	Value	Note	Reference	Final Value	Tier 2 Reference
Hexachloroethane	67-72-1				94		Buchman, 2008	94	Buchman, 2008
Indeno(1,2,3-cd)pyrene	193-39-5				0.275		USEPA, 2003	0.275	USEPA, 2003
Isophorone	78-59-1				129		USEPA Region 4, 2001	129	USEPA Region 4, 2001
Naphthalene	91-20-3	16			193.5		USEPA, 2003	193.5	USEPA, 2003
Nitrobenzene	98-95-3				668		Buchman, 2008	668	Buchman, 2008
n-Nitroso-di-n-dipropylamine	621-64-7				120		USEPA Region 3, 2006	120	USEPA Region 3, 2006
n-Nitrosodiphenylamine	86-30-6				33000		USEPA Region 4, 2001	33000	USEPA Region 4, 2001
Pentachlorophenol	87-86-5	7.9	7.9		7.9	W	USEPA Region 4, 2001	7.9	Tier 1 SL
Phenanthrene	85-01-8	1.5			19.13		USEPA, 2003	19.13	USEPA, 2003
Phenol	108-95-2				58		USEPA Region 4, 2001	58	USEPA Region 4, 2001
Pyrene	129-00-0				10.11		USEPA, 2003	10.11	USEPA, 2003
Chlorinated Pesticides									
alpha-BHC	319-84-6				1400		USEPA Region 4, 2001	1400	USEPA Region 4, 2001
beta-BHC	319-85-7								
delta-BHC	319-86-8				500	FW	USEPA Region 4, 2001	500	USEPA Region 4, 2001
gamma-BHC (Lindane)	58-89-9	0.16			0.016		USEPA Region 4, 2001	0.16	Tier 1 SL
Heptachlor	76-44-8	0.0036	0.0036					0.0036	Tier 1 SL
Aldrin	309-00-2	1.3			0.13		USEPA Region 4, 2001	1.3	Tier 1 SL
Heptachlor epoxide	1024-57-3	0.0036	0.0036					0.0036	Tier 1 SL
Endosulfan I	959-98-8	0.0087	0.0087	D	0.0087		USEPA Region 4, 2001	0.0087	Tier 1 SL
Dieldrin	60-57-1	0.0019	0.0019					0.0019	Tier 1 SL
4,4-DDE	72-55-9		0.001	bb				0.001	USEPA, 2009
2,4-DDE	3424-82-6								
Endrin	72-20-8	0.0023	0.0023					0.0023	Tier 1 SL
Endosulfan II	33213-65-9	0.0087	0.0087	D	0.0087		USEPA Region 4, 2001	0.0087	Tier 1 SL
4,4-DDD	72-54-8		0.001	bb	0.025		USEPA Region 4, 2001	0.001	USEPA, 2009
2,4-DDD	53-19-0								
Endosulfan sulfate	1031-07-8				0.009		USEPA Region 3, 2006	0.009	USEPA Region 3, 2006
4,4-DDT	50-29-3	0.001	0.001		0.001		USEPA Region 4, 2001	0.001	Tier 1 SL
2,4-DDT	789-02-6								
Methoxychlor	72-43-5	0.03	0.03		0.03		USEPA Region 4, 2001	0.03	Tier 1 SL
Endrin ketone	53494-70-5				0.0023	O	USEPA Region 4, 2001	0.0023	USEPA Region 4, 2001
Endrin aldehyde	7421-93-4				0.0023	O	USEPA Region 4, 2001	0.0023	USEPA Region 4, 2001
alpha-Chlordane	5103-71-9	0.004	0.004	N	0.004	N	USEPA Region 4, 2001	0.004	Tier 1 SL
gamma-Chlordane	5566-34-7	0.004	0.004	N	0.004	N	USEPA Region 4, 2001	0.004	Tier 1 SL
Oxychlordane	27304-13-8				0.004	N	USEPA Region 4, 2001	0.004	USEPA Region 4, 2001

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Parameters	CAS	Tier 1 Screening Levels (µg/L)	Tier 2 Screening Values (µg/L)						
		USEPA Region 2 Marine Screening Benchmarks (USEPA 2010)[a]	USEPA (2009) Saltwater CCC		Alternative Tier 2 Screening Values			Selected Tier 2 SL[b]	
		Benchmark	Value	Note	Value	Note	Reference	Final Value	Tier 2 Reference
cis-Nonachlor	5103-73-1				0.004	N	USEPA Region 4, 2001	0.004	USEPA Region 4, 2001
trans-Nonachlor	39765-80-5				0.004	N	USEPA Region 4, 2001	0.004	USEPA Region 4, 2001
Toxaphene	8001-35-2	0.005	0.0002					0.005	Tier 1 SL
Hexachlorobenzene	118-74-1				129		Buchman, 2008	129	Buchman, 2008
Mirex	2385-85-5	0.001	0.001		0.001		USEPA Region 4, 2001	0.001	Tier 1 SL
Chlorinated Herbicides									
2,4,5-T (2,4,5-Trichlorophenoxyacetic acid)	93-76-5								
2,4,5-TP (Silvex)	93-72-1								
2,4-D (2,4-Dichlorophenoxyacetic acid)	94-75-7								
2,4-DB (2,4-DB-dimethylammonium)	94-82-6								
Dalapon	75-99-0								
Dicamba	1918-00-9								
Dichlorprop	120-36-5								
Dinoseb	88-85-7								
MCPA (2-Methyl-4-chlorophenoxyacetic acid)	94-74-6								
MCPP (Methylchlorophenoxypropionic acid)	93-65-2								
PCB Congeners									
PCB-1 to PCB-209	N/A		0.03		0.14		Suter and Tsao, 1996	0.03	USEPA, 2009
Aroclor-1221	11104-28-2				0.03		USEPA Region 4, 2001	0.03	USEPA Region 4, 2001
Aroclor-1242	53469-21-9				0.03		USEPA Region 4, 2001	0.03	USEPA Region 4, 2001
Aroclor-1248	12672-29-6				0.03		USEPA Region 4, 2001	0.03	USEPA Region 4, 2001
Aroclor-1254	11097-69-1				0.03		USEPA Region 4, 2001	0.03	USEPA Region 4, 2001
Aroclor-1260	11096-82-5				0.03		USEPA Region 4, 2001	0.03	USEPA Region 4, 2001
Total PCBs	N/A	0.03	0.03		0.14		Suter and Tsao, 1996	0.03	Tier 1 SL
TAL Metals									
Aluminum	7429-90-5		87	FW				87	USEPA, 2009
Antimony	7440-36-0				500		USEPA Region 3, 2006	500	USEPA Region 3, 2006
Arsenic	7440-38-2	36	36	H	36		USEPA Region 4, 2001	36	Tier 1 SL
Barium	7440-39-3				4		Suter and Tsao, 1996	4	Suter and Tsao, 1996
Beryllium	7440-41-7				0.66		Suter and Tsao, 1996	0.66	Suter and Tsao, 1996
Cadmium	7440-43-9	7.7	8.8	H	9.3		USEPA Region 4, 2001	8.8	USEPA, 2009
Calcium	7440-70-2								
Chromium	7440-47-3	50	50	H, L	50		USEPA Region 4, 2001	50	Tier 1 SL
Cobalt	7440-48-4				23		Suter and Tsao, 1996	23	Suter and Tsao, 1996
Copper	7440-50-8	3.4	3.1	H	2.9		USEPA Region 4, 2001	3.4	Tier 1 SL
Iron	7439-89-6		1000	FW				1000	USEPA, 2009

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Parameters	CAS	Tier 1 Screening Levels (µg/L)	Tier 2 Screening Values (µg/L)						
		USEPA Region 2 Marine Screening Benchmarks (USEPA 2010)[a]	USEPA (2009) Saltwater CCC		Alternative Tier 2 Screening Values			Selected Tier 2 SL[b]	
		Benchmark	Value	Note	Value	Note	Reference	Final Value	Tier 2 Reference
Lead	7439-92-1	8	8.1	H	8.5		USEPA Region 4, 2001	8.1	USEPA, 2009
Magnesium	7439-95-4								
Manganese	7439-96-5				120		Suter and Tsao, 1996	120	Suter and Tsao, 1996
Mercury	7439-97-6	0.94	0.94	H				0.94	Tier 1 SL
Methyl mercury	22967-92-6				0.0028		Suter and Tsao, 1996	0.0028	Suter and Tsao, 1996
Nickel	7440-02-0	8.2	8.2	H	8.3		USEPA Region 4, 2001	8.2	Tier 1 SL
Potassium	7440-09-7								
Silver	7440-22-4	1.9			0.23		USEPA Region 4, 2001	1.9	Tier 1 SL
Selenium	7782-49-2	71	71	H	71		USEPA Region 4, 2001	71	Tier 1 SL
Sodium	7440-23-5								
Thallium	7440-28-0				21.3		USEPA Region 4, 2001	21.3	USEPA Region 4, 2001
Tin	7440-31-5				73		Suter and Tsao, 1996	73	Suter and Tsao, 1996
Vanadium	7440-62-2				20		Suter and Tsao, 1996	20	Suter and Tsao, 1996
Zinc	7440-66-6	66	81	H	86		USEPA Region 4, 2001	81	USEPA, 2009
TCL Dioxins and Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001-02-0					aa	aa		
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9					aa	aa		
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4					aa	aa		
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9					aa	aa		
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7					aa	aa		
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9					aa	aa		
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6					aa	aa		
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9					aa	aa		
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7					aa	aa		
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9					aa	aa		
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3					aa	aa		
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6					aa	aa		
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4					aa	aa		
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5					aa	aa		
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4					aa	aa		
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9								
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6				0.00001		USEPA Region 4, 2001	0.00001	USEPA Region 4, 2001
Total Heptachlorodibenzofuran (HpCDF)	38998-75-3					aa	aa		
Total Heptachlorodibenzo-p-dioxin (HpCDD)	37871-00-4					aa	aa		
Total Hexachlorodibenzofuran (HxCDF)	55684-94-1					aa	aa		
Total Hexachlorodibenzo-p-dioxin (HxCDD)	34465-46-8					aa	aa		

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Parameters	CAS	Tier 1 Screening Levels (µg/L)	Tier 2 Screening Values (µg/L)						
		USEPA Region 2 Marine Screening Benchmarks (USEPA 2010)[a]	USEPA (2009) Saltwater CCC		Alternative Tier 2 Screening Values			Selected Tier 2 SL[b]	
		Benchmark	Value	Note	Value	Note	Reference	Final Value	Tier 2 Reference
Total Pentachlorodibenzofuran (PeCDF)	30402-15-4					aa	aa		
Total Pentachlorodibenzo-p-dioxin (PeCDD)	36088-22-9					aa	aa		
Total Tetrachlorodibenzofuran (TCDF)	30402-14-3					aa	aa		
Total Tetrachlorodibenzo-p-dioxin (TCDD)	41903-57-5					aa	aa		
General Chemistry									
Ammonia	7664-41-7		9.7	P	5	Y	USEPA Region 4, 2001	9.7	USEPA, 2009
Nitrate	14797-55-8								
Nitrite	14797-65-0								
Total Nitrogen (total and dissolved)	7727-37-9								
Total Phosphorus (total and dissolved)	7723-14-0	0.1						0.1	Tier 1 SL
Sulfate	14808-79-8								
Chloride	16887-00-6								
Bromide	24959-67-9								
Cyanide	57-12-5	1	1		1		USEPA Region 4, 2001	1	Tier 1 SL
Total coliform	N/A								
Fecal coliform	N/A								
Sulfides	18496-25-8	2	2		2		USEPA Region 3, 2006	2	Tier 1 SL
PAHs and alkyl PAHs by EPA Method 8270- SIM/NOAA 130									
1-Methylnapthalene	90-12-0				75.37		USEPA, 2003	75.37	USEPA, 2003
1-Methylphenanthrene	832-69-9				7.485		USEPA, 2003	7.485	USEPA, 2003
2,3,5-Trimethylnaphthalene	2245-38-7				9.785		USEPA, 2003	9.785	USEPA, 2003
2,6-Dimethylnaphthalene	581-42-0				25.79		USEPA, 2003	25.79	USEPA, 2003
2-Methylnaphthalene	91-57-6				72.16		USEPA, 2003	72.16	USEPA, 2003
Acenaphthene	83-32-9				55.85		USEPA, 2003	55.85	USEPA, 2003
Acenaphthylene	208-96-8				306.9		USEPA, 2003	306.9	USEPA, 2003
Anthracene	120-12-7				20.73		USEPA, 2003	20.73	USEPA, 2003
Fluorene	86-73-7				39.3		USEPA, 2003	39.3	USEPA, 2003
Naphthalene	91-20-3				193.5		USEPA, 2003	193.5	USEPA, 2003
Phenanthrene	85-01-8				19.13		USEPA, 2003	19.13	USEPA, 2003
Benzo(a)anthracene	56-55-3				2.227		USEPA, 2003	2.227	USEPA, 2003
Benzo(a)pyrene	50-32-8				0.9573		USEPA, 2003	0.9573	USEPA, 2003
Benzo(b)fluoroanthene	205-99-2				0.6774		USEPA, 2003	0.6774	USEPA, 2003
Benzo(e)pyrene	192-97-2				0.9008		USEPA, 2003	0.9008	USEPA, 2003
Benzo(g,h,i)perylene	191-24-2				0.4391		USEPA, 2003	0.4391	USEPA, 2003
Benzo(k)fluoranthene	207-08-9				0.6415		USEPA, 2003	0.6415	USEPA, 2003

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Parameters	CAS	Tier 1 Screening Levels (µg/L)	Tier 2 Screening Values (µg/L)						
		USEPA Region 2 Marine Screening Benchmarks (USEPA 2010)[a]	USEPA (2009) Saltwater CCC		Alternative Tier 2 Screening Values			Selected Tier 2 SL[b]	
		Benchmark	Value	Note	Value	Note	Reference	Final Value	Tier 2 Reference
Chrysene	218-01-9				2.042		USEPA, 2003	2.042	USEPA, 2003
Dibenzo(a,h)anthracene	53-70-3				0.2825		USEPA, 2003	0.2825	USEPA, 2003
Dibenzothiophene	132-65-0								
Fluoranthene	206-44-0				7.109		USEPA, 2003	7.109	USEPA, 2003
Indeno(1,2,3-cd) pyrene	193-39-5				0.275		USEPA, 2003	0.275	USEPA, 2003
Perylene	198-55-0				0.9008		USEPA, 2003	0.9008	USEPA, 2003
Pyrene	129-00-0				10.11		USEPA, 2003	10.11	USEPA, 2003
C1-Benzanthracene/chrysenes	N/A				0.8557		USEPA, 2003	0.8557	USEPA, 2003
C1-Dibenzothiophenes	N/A								
C1-Fluorenes	N/A				13.99		USEPA, 2003	13.99	USEPA, 2003
C1-Naphthalenes	N/A				81.69		USEPA, 2003	81.69	USEPA, 2003
C1-Phenanthrene/anthracenes	N/A				7.436		USEPA, 2003	7.436	USEPA, 2003
C1-Pyrene/fluoranthenes	N/A				4.887		USEPA, 2003	4.887	USEPA, 2003
C2-Benzanthracene/chrysenes	N/A				0.4827		USEPA, 2003	0.4827	USEPA, 2003
C2-Dibenzothiophenes	N/A								
C2-Fluorenes	N/A				5.305		USEPA, 2003	5.305	USEPA, 2003
C2-Naphthalenes	N/A				30.24		USEPA, 2003	30.24	USEPA, 2003
C2-Phenanthrene/anthracenes	N/A				3.199		USEPA, 2003	3.199	USEPA, 2003
C3-Benzanthracene/chrysenes	N/A				0.1675		USEPA, 2003	0.1675	USEPA, 2003
C3-Dibenzothiophenes	N/A								
C3-Fluorenes	N/A				1.916		USEPA, 2003	1.916	USEPA, 2003
C3-Naphthalenes	N/A				11.1		USEPA, 2003	11.1	USEPA, 2003
C3-Phenanthrene/anthracenes	N/A				1.256		USEPA, 2003	1.256	USEPA, 2003
C4-Benzanthracene/chrysenes	N/A				0.0706		USEPA, 2003	0.0706	USEPA, 2003
C4-Dibenzothiophenes	N/A								
C4-Naphthalenes	N/A				4.048		USEPA, 2003	4.048	USEPA, 2003
C4-Phenanthrenes/anthracenes	N/A				0.5594		USEPA, 2003	0.5594	USEPA, 2003
Benzonaphtothiophene	61523-34-0								
Benzothiophene	11095-43-5								
C1-Benzo(b)thiophene	N/A								
C2-Benzo(b)thiophene	N/A								
C3-Benzo(b)thiophene	N/A								
C4-Benzo(b)thiophene	N/A								
Retene	483-65-8								
cis/trans-Decalin	91-17-8								
C1-Decalin	N/A								

Appendix A Newtown Creek SLERA: Surface Water Screening Levels

Parameters	CAS	Tier 1 Screening Levels (µg/L)	Tier 2 Screening Values (µg/L)						
		USEPA Region 2 Marine Screening Benchmarks (USEPA 2010)[a]	USEPA (2009) Saltwater CCC		Alternative Tier 2 Screening Values			Selected Tier 2 SL[b]	
		Benchmark	Value	Note	Value	Note	Reference	Final Value	Tier 2 Reference
C2-Decalin	N/A								
C3-Decalin	N/A								
C4-Decalin	N/A								

Notes:

µg/L - microgram per liter
CAS - Chemical Abstracts Services
CCC - Calibration Check Compounds
SL - screening level
All values in µg/L
N/A - Not available for this analyte
[a] Tier 1 screening levels were taken from USEPA (2010), as per EPA request.
[b] Tier 2 and Tier 3 screening levels were selected based on the hierarchy presented in Section 3.1 of the SLERA.
A - Guidance Value
B - Standard
D - Total endosulfans
F - Specific standards for New York/New Jersey Harbor
G - Acid soluble form
H - Dissolved Form
I - As free cyanide
L - Chromium VI (hexavalent) value used
N - Value for chlordane used based on structural similarities
O - Value for endrin used based on structural similarities
P - At pH = 7, T = 20oC, salinity = 20ppt
R - Value for o-xylene used
S - Value for 2-methylphenol used as surrogate
W - At pH = 7
Y - See Ambient Water Quality Criteria - Ammonia (SaltH20) 440/5-88-004
FW - Freshwater
aa - Total dioxins calculated based on conversion to 2,3,7,8-TCDD equivalents using appropriate TEF for each congener
bb- Value for 4,4'-DDT used as surrogate
cc - Endpoint based on aesthetics

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APPENDIX B
NEWTOWN CREEK SLERA: SEDIMENT SCREENING LEVELS

Appendix B Newtown Creek SLERA: Sediment Screening Levels

Parameters	CAS	Tier 1 Screening Levels (mg/kg dry weight)	Tier 2 Screening Values (mg/kg dry weight)											
		USEPA Region 2 Marine Screening Benchmarks (USEPA, 2010)[a]	Toxicity Based Values					Equilibrium Partitioning Based values, Adjusted to 8.7% TOC				Other	Selected Tier 2 SL[b]	
			Long et al. 1995	McDonald et al. 1996	Field et al. 2002	Other Toxicity Based Values		USEPA Region 3 2006	USEPA Region 6 1999	USEPA Region 5 2003	NYSDEC 1999	WA DOE, Cited in Buchman 2008	Final Value	Tier 2 Reference
		Benchmark	Effects Range-Low (ER-L)	Threshold Effect Level (TEL)	Amphipod Logistic Regression T-20	Value	Reference					Apparent Effect Threshold (AET)		
TCL Volatiles by EPA Method 8260														
1,1,1-Trichloroethane	71-55-6							7.45		1.85			7.45	USEPA Region 3 2006
1,1,2,2-Tetrachloroethane	79-34-5							1.76		7.40			1.76	USEPA Region 3 2006
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1													
1,1,2-Trichloroethane	79-00-5							4.96					4.96	USEPA Region 3 2006
1,1,-Dichloroethylene	75-35-4							24.2		0.169			24.2	USEPA Region 3 2006
1,1-Dichloroethane	75-34-3									0.00500			0.00500	USEPA Region 5 2003
1,2,3-Trichlorobenzene	87-61-6										7.92		7.92	NYSDEC 1999
1,2,4-Trichlorobenzene	120-82-1							4.12		44.0	7.92		4.12	USEPA Region 3 2006
1,2-Dichloroethane	107-06-2									2.26			2.26	USEPA Region 5 2003
1,2-Dichloropropane	78-87-5									2.90			2.90	USEPA Region 5 2003
1,3-Dichlorobenzene	541-73-1							7.33		11.4	1.04		7.33	USEPA Region 3 2006
1,4-Dioxane	123-91-1								5.11	1.04			5.11	USEPA Region 6 1999
2-Butanone	78-93-3									0.369			0.369	USEPA Region 5 2003
2-Hexanone	591-78-6									0.506			0.506	USEPA Region 5 2003
4-Methyl-2-pentanone	108-10-1									0.218			0.218	USEPA Region 5 2003
Acetone	67-64-1								1.74	0.0861			1.74	USEPA Region 6 1999
Acetophenone	98-86-2													
Benzene	71-43-2	0.26						1.19		1.24			1.19	USEPA Region 3 2006
bis(2-Chloroethoxy)methane	111-91-1													
bis(2-Chloroethyl)ether	111-44-4									30.6			30.6	USEPA Region 5 2003
Bromochloromethane	74-97-5													
Bromodichloromethane	75-27-4													
Bromoform	75-25-2							11.4		4.28			11.4	USEPA Region 3 2006
Bromomethane	74-83-9									0.0119			0.0119	USEPA Region 5 2003
Carbon disulfide	75-15-0									0.208			0.208	USEPA Region 5 2003
Carbon tetrachloride	56-23-5							63.0		12.6			63.0	USEPA Region 3 2006
Chlorobenzene	108-90-7	0.035						1.41		2.53	0.305		1.41	USEPA Region 3 2006
Chloroethane	75-00-3													
Chloroform	67-66-3								0.830	1.05			0.830	USEPA Region 6 1999
Chloromethane	74-87-3													
cis-1,2-Dichloroethylene	156-59-2													
cis-1,3-Dichloropropene	10061-01-5													
Cyclohexane	110-82-7													
Dibromochloromethane	124-48-1													
Dichlorodifluoromethane	75-71-8													
Ethylbenzene	100-41-4	0.064						2.65		1.52	0.557	0.004	2.65	USEPA Region 3 2006
Hexachloroethane	67-72-1							6.99		5.08			6.99	USEPA Region 3 2006
Isopropylbenzene	98-82-8										1.04		1.04	NYSDEC 1999
Methyl acetate	79-20-9													
Methyl tert-Butyl Ether	1634-04-4													

Appendix B Newtown Creek SLERA: Sediment Screening Levels

Parameters	CAS	Tier 1 Screening Levels (mg/kg dry weight)	Tier 2 Screening Values (mg/kg dry weight)											
		USEPA Region 2 Marine Screening Benchmarks (USEPA, 2010)[a]	Toxicity Based Values					Equilibrium Partitioning Based values, Adjusted to 8.7% TOC				Other	Selected Tier 2 SL[b]	
			Long et al. 1995	McDonald et al. 1996	Field et al. 2002	Other Toxicity Based Values		USEPA Region 3 2006	USEPA Region 6 1999	USEPA Region 5 2003	NYSDEC 1999	WA DOE, Cited in Buchman 2008	Final Value	Tier 2 Reference
		Benchmark	Effects Range-Low (ER-L)	Threshold Effect Level (TEL)	Amphipod Logistic Regression T-20	Value	Reference					Apparent Effect Threshold (AET)		
Methylcyclohexane	108-87-2													
Methylene chloride	75-09-2									1.38			1.38	USEPA Region 5 2003
Styrene	100-42-5							61.5		2.21			61.5	USEPA Region 3 2006
Tetrachloroethene	127-18-4							1.65		8.61		0.057	1.65	USEPA Region 3 2006
Toluene	108-88-3	0.45						9.48		10.6	3.92		9.48	USEPA Region 3 2006
trans,1-2-Dichloroethylene	156-60-5									5.69			5.69	USEPA Region 5 2003
trans-1,3-Dichloropropene	10061-02-6													
Trichloroethene	79-01-6							77.9				0.041	77.9	USEPA Region 3 2006
Trichlorofluoromethane	75-69-4													
Vinyl acetate	108-05-4									0.113			0.113	USEPA Region 5 2003
Vinyl chloride	75-01-4								3.75				3.75	USEPA Region 6 1999
Xylenes (total)	1330-20-7	0.27								3.77	2.35		3.77	USEPA Region 5 2003
TCL Semivolatiles by EPA Method 8270														
1,1-Biphenyl	92-52-4				0.017								0.017	Field et al. 2002
1,2,4,5-Tetrachlorobenzene	95-94-3							409		10.9			409	USEPA Region 3 2006
1,2-Dibromo-3-chloropropane	96-12-8													
1,2-Dibromoethane	106-93-4													
1,2-Dichlorobenzene	95-50-1	0.12						8.60		2.56	1.04	0.013	8.60	USEPA Region 3 2006
1,4-Dichlorobenzene	106-46-7	0.12						4.00		2.77	1.04	0.11	4.00	USEPA Region 3 2006
1-Methylnapthalene	90-12-0				0.021								0.021	Field et al. 2002
1-Methylphenanthrene	832-69-9				0.018								0.018	Field et al. 2002
2,3,4,6-Tetrachlorophenol	58-90-2									1.12			1.12	USEPA Region 5 2003
2,3,5-Trimethylnaphthalene	2245-38-7													
2,4,5-Trichlorophenol	95-95-4							7.13				0.003	7.13	USEPA Region 3 2006
2,4,6-Trichlorophenol	88-06-2							23.1				0.006	23.1	USEPA Region 3 2006
2,4-Dichlorophenol	120-83-2									0.711		0.000208	0.711	USEPA Region 5 2003
2,4-Dimethylphenol	105-67-9									2.64		0.018	2.64	USEPA Region 5 2003
2,4-Dinitrophenol	51-28-5									0.0540			0.0540	USEPA Region 5 2003
2,4-Dinitrotoluene	121-14-2								1.64	0.125			1.64	USEPA Region 6 1999
2,6-Dimethylnaphthalene	581-42-0				0.025								0.025	Field et al. 2002
2,6-Dinitrotoluene	606-20-2								1.35	0.346			1.35	USEPA Region 6 1999
2-Chloronaphthalene	91-58-7									3.63			3.63	USEPA Region 5 2003
2-Chlorophenol	95-57-8							2.99		0.278		0.000333	2.99	USEPA Region 3 2006
2-Methylnaphthalene	91-57-6	0.07	0.07	0.0202	0.021			0.176		0.176	2.61	0.064	0.07	USEPA Region 2 2010
2-Methylphenol	95-48-7									0.482		0.008	0.482	USEPA Region 5 2003
2-Nitroaniline	88-74-4													
2-Nitrophenol	88-75-5													
3,3-Dichlorobenzidine	91-94-1							17.9		1.10			17.9	USEPA Region 3 2006
3-Nitroaniline	99-09-2													
4,6-Dinitro-2-methylphenol	534-52-1									0.905			0.905	USEPA Region 5 2003
4-Bromophenyl-phenyl ether	101-55-3									13.5			13.5	USEPA Region 5 2003

Appendix B Newtown Creek SLERA: Sediment Screening Levels

Parameters	CAS	Tier 1 Screening Levels (mg/kg dry weight)	Tier 2 Screening Values (mg/kg dry weight)											
		USEPA Region 2 Marine Screening Benchmarks (USEPA, 2010)[a]	Toxicity Based Values					Equilibrium Partitioning Based values, Adjusted to 8.7% TOC				Other	Selected Tier 2 SL[b]	
			Long et al. 1995	McDonald et al. 1996	Field et al. 2002	Other Toxicity Based Values		USEPA Region 3 2006	USEPA Region 6 1999	USEPA Region 5 2003	NYSDEC 1999	WA DOE, Cited in Buchman 2008		
		Benchmark	Effects Range-Low (ER-L)	Threshold Effect Level (TEL)	Amphipod Logistic Regression T-20	Value	Reference					Apparent Effect Threshold (AET)	Final Value	Tier 2 Reference
4-Chloro-3-methylphenol	59-50-7									3.38			3.38	USEPA Region 5 2003
4-Chloroaniline	106-47-8									1.27			1.27	USEPA Region 5 2003
4-Chlorophenyl-phenyl ether	7005-72-3													
4-Methylphenol	106-44-5									0.176		0.1	0.176	USEPA Region 5 2003
4-Nitroaniline	100-01-6													
4-Nitrophenol	100-02-7													
Acenaphthene	83-32-9	0.016	0.016	0.00671	0.019			0.0584		0.0584	20.9	0.13	0.016	USEPA Region 2 2010
Acenaphthylene	208-96-8	0.044	0.044	0.00587	0.014			0.0511		0.0511		0.071	0.044	USEPA Region 2 2010
Anthracene	120-12-7	0.0853	0.0853	0.0469	0.034			0.408		0.498	9.31	0.28	0.0853	USEPA Region 2 2010
Benzaldehyde	100-52-7													
Benzo(g,h,i)perylene	191-24-2				0.067					1.48		0.67	0.067	Field et al. 2002
Benzo(a)anthracene	56-55-3	0.261	0.261	0.0748	0.061			0.651	0.160	0.940	1.04	0.96	0.261	USEPA Region 2 2010
Benzo(a)pyrene	50-32-8	0.43	0.43	0.0888	0.069			0.773	0.230	1.31		1.1	0.43	USEPA Region 2 2010
Benzo(b)fluoranthene	205-99-2				0.13				909	90.5		1.8	0.13	Field et al. 2002
Benzo(e)pyrene	192-97-2													
Benzo(k)fluoranthene	207-08-9				0.07	0.24	USEPA Region 6 1999 (TRV)		0.240			1.8	0.07	Field et al. 2002
Benzonaphtothiophene	61523-34-0													
Benzothiophene	11095-43-5													
bis(2-Chloroisopropyl)ether	39638-32-9													
bis(2-Ethylhexyl)phthalate	117-81-7			0.182				1.58	1.02	1.58	17.4	1.3	0.182	McDonald et al. 1996
Butylbenzylphthalate	85-68-7							146		17.1		0.063	146	USEPA Region 3 2006
Caprolactam	105-60-2													
Chrysene	218-01-9	0.384	0.384	0.108	0.082			0.940	0.220			0.950	0.384	USEPA Region 2 2010
Dibenzo(a,h)anthracene	53-70-3	0.0634	0.0634	0.00622	0.019			0.0541	0.0310	0.287		0.230	0.0634	USEPA Region 2 2010
Dibenzofuran	132-64-9							63.5		3.91		0.110	63.5	USEPA Region 3 2006
Dibenzothiophene	132-65-0													
Diethylphthalate	84-66-2							1.90		2.57		0.006	1.90	USEPA Region 3 2006
Dimethylphthalate	131-11-3											0.006	0.006	WA DOE (Buchman, 2008)
di-n-Butylphthalate	84-74-2							10.1		9.69		0.058	10.1	USEPA Region 3 2006
Di-n-octylphthalate	117-84-0								1.26	353		0.061	1.26	USEPA Region 6 1999
Fluoranthene	206-44-0	0.6	0.6	0.113	0.119			0.983		3.68	117	1.3	0.6	USEPA Region 2 2010
Fluorene	86-73-7	0.019	0.019	0.0212	0.019			0.184		0.673	3.31	0.12	0.019	USEPA Region 2 2010
Hexachlorobenzene	118-74-1								0.0331	0.174	485	0.006	0.0331	USEPA Region 6 1999
Hexachlorobutadiene	87-68-3	0.016							0.339	0.231	0.139	0.0013	0.339	USEPA Region 6 1999
Hexachlorocyclopentadiene	77-47-4	0.007						1.21	0.0579	7.84	0.0609		1.21	USEPA Region 3 2006
Indeno(1,2,3-cd)pyrene	193-39-5				0.068				2.96	1.74		0.6	0.068	Field et al. 2002
Isophorone	78-59-1									3.76			3.76	USEPA Region 5 2003
Naphthalene	91-20-3	0.16	0.16	0.0346	0.03			0.301		1.53	3.31	0.23	0.16	USEPA Region 2 2010
Nitrobenzene	98-95-3								0.692	1.26		0.021	0.692	USEPA Region 6 1999
n-Nitroso-di-n-dipropylamine	621-64-7													
n-Nitrosodiphenylamine	86-30-6							3671				0.028	3671	USEPA Region 3 2006

Appendix B Newtown Creek SLERA: Sediment Screening Levels

Parameters	CAS	Tier 1 Screening Levels (mg/kg dry weight)	Tier 2 Screening Values (mg/kg dry weight)											
		USEPA Region 2 Marine Screening Benchmarks (USEPA, 2010)[a]	Toxicity Based Values					Equilibrium Partitioning Based values, Adjusted to 8.7% TOC				Other	Selected Tier 2 SL[b]	
			Long et al. 1995	McDonald et al. 1996	Field et al. 2002	Other Toxicity Based Values		USEPA Region 3 2006	USEPA Region 6 1999	USEPA Region 5 2003	NYSDEC 1999	WA DOE, Cited in Buchman 2008	Final Value	Tier 2 Reference
		Benchmark	Effects Range-Low (ER-L)	Threshold Effect Level (TEL)	Amphipod Logistic Regression T-20	Value	Reference					Apparent Effect Threshold (AET)		
Pentachlorophenol	87-86-5					0.36	USEPA Region 6 1999 (TRV)	69.3	0.360	200	3.48	0.017	0.360	USEPA Region 6 1999 (TRV)
Perylene	198-55-0				0.074								0.074	Field et al. 2002
Phenanthrene	85-01-8	0.24	0.24	0.0867	0.068			0.754			13.9	0.66	0.24	USEPA Region 2 2010
Phenol	108-95-2									0.427		0.13	0.427	USEPA Region 5 2003
Pyrene	129-00-0	0.665	0.665	0.153	0.125			1.33			83.6	2.4	0.665	USEPA Region 2 2010
Retene	483-65-8													
Organochlorine Pesticides by EPA Method 8081A / NOAA 130														
alpha-BHC	319-84-6							11.8		0.0522			11.8	USEPA Region 3 2006
beta-BHC	319-85-7									0.0435			0.0435	USEPA Region 5 2003
delta-BHC	319-86-8									622			622	USEPA Region 5 2003
gamma-BHC (Lindane)	58-89-9			0.00032				0.00278		0.0206		0.0048	0.00032	McDonald et al. 1996
Heptachlor	76-44-8	0.0009							0.00298	0.00522	0.00783	0.0003	0.00298	USEPA Region 6 1999
Aldrin	309-00-2									0.0174		0.0095	0.0174	USEPA Region 5 2003
Heptachlor epoxide	1024-57-3	0.0009				0.0006	CCME (2002) ISQG	0.00522		0.0215	0.00783		0.0009	USEPA Region 2 2010
Endosulfan I	959-98-8	0.00004								0.0284	0.000348		0.0284	USEPA Region 5 2003
Dieldrin	60-57-1	0.17		0.00072	0.00083			0.00626		0.0165		0.0019	0.17	USEPA Region 2 2010
Total DDT	N/A	0.00158	0.00158	0.00389								0.011	0.00158	USEPA Region 2 2010
4,4-DDE	72-55-9	0.0022	0.0022	0.00207	0.0031			0.0180	0.00170	0.0275		0.009	0.0022	USEPA Region 2 2010
2,4-DDE	3424-82-6													
Endrin	72-20-8	0.0073				0.00267	CCME (2002) ISQG	0.0232		0.0193	0.0635		0.00730	USEPA Region 2 2010
Endosulfan II	33213-65-9	0.00004								0.0169	0.000348		0.0169	USEPA Region 5 2003
4,4-DDD	72-54-8			0.00122	0.0022			0.0106		0.0425		0.016	0.00122	McDonald et al. 1996
2,4-DDD	53-19-0													
Endosulfan sulfate	1031-07-8							0.00311					0.00311	USEPA Region 3 2006
4,4-DDT	50-29-3			0.00199	0.0017			0.0104		0.0362		0.012	0.00199	McDonald et al. 1996
2,4-DDT	789-02-6													
Methoxychlor	72-43-5	0.006						0.258		0.118	0.0522		0.258	USEPA Region 3 2006
Endrin ketone	53494-70-5													
Endrin aldehyde	7421-93-4									4.18			4.18	USEPA Region 5 2003
alpha-Chlordane	5103-71-9	0.00002		0.00226							0.000174	0.0028	0.00226	McDonald et al. 1996
gamma-Chlordane	12789-03-6	0.00002		0.00226								0.0028	0.00226	McDonald et al. 1996
Oxychlordane	27304-13-8													
cis-Nonachlor	5103-73-1													
trans-Nonachlor	3976-80-5													
Toxaphene	8001-35-2	0.0001				0.0001	CCME (2002) ISQG	4.66		0.000670	0.000870		0.0001	USEPA Region 2 2010
Mirex	2385-85-5	0.007									0.0609		0.0609	NYSDEC 1999
Chlorinated Herbicides by EPA Method 8151A														
2,4,5-T (2,4,5-Trichlorophenoxyacetic acid)	93-76-5									511			511	USEPA Region 5 2003
2,4,5-TP (Silvex)	93-72-1									5.87			5.87	USEPA Region 5 2003
2,4-D (2,4-Dichlorophenoxyacetic acid)	94-75-7									11.1			11.1	USEPA Region 5 2003
2,4-DB (2,4-DB-dimethylammonium)	94-82-6													

Appendix B Newtown Creek SLERA: Sediment Screening Levels

Parameters	CAS	Tier 1 Screening Levels (mg/kg dry weight)	Tier 2 Screening Values (mg/kg dry weight)											
		USEPA Region 2 Marine Screening Benchmarks (USEPA, 2010)[a]	Toxicity Based Values					Equilibrium Partitioning Based values, Adjusted to 8.7% TOC				Other	Selected Tier 2 SL[b]	
			Long et al. 1995	McDonald et al. 1996	Field et al. 2002	Other Toxicity Based Values		USEPA Region 3 2006	USEPA Region 6 1999	USEPA Region 5 2003	NYSDEC 1999	WA DOE, Cited in Buchman 2008	Final Value	Tier 2 Reference
		Benchmark	Effects Range-Low (ER-L)	Threshold Effect Level (TEL)	Amphipod Logistic Regression T-20	Value	Reference					Apparent Effect Threshold (AET)		
Atrazine	1912-24-9													
Dalapon	75-99-0													
Dicamba	1918-00-9													
Dichlorprop	120-36-5													
Dinoseb	88-85-7									0.126			0.126	USEPA Region 5 2003
MCPA (2-Methyl-4-chlorophenoxyacetic acid)	94-74-6													
MCPP (Methylchlorophenoxypropionic acid)	93-65-2													
TCL PCBs by EPA Method 8082 / NOAA 130														
Aroclor-1016	12674-11-2								0.0227				0.0227	USEPA Region 6 1999
Aroclor-1221	11104-28-2													
Aroclor-1232	11141-16-5													
Aroclor-1242	53469-21-9													
Aroclor-1248	12672-29-6													
Aroclor-1254	11097-69-1							0.551	0.0227				0.551	USEPA Region 3 2006
Aroclor-1260	11096-82-5													
Aroclor-1262	37324-23-5													
Aroclor-1268	11100-14-4													
Total PCBs	N/A	0.0227	0.0227	0.0216	0.035	0.034	CCME (2002) ISQG					0.13	0.0227	USEPA Region 2 2010
PCB-1 to PCB-209 + homolog sums	N/A													
TAL Metals by EPA Method 6020/6010														
Aluminum	7429-90-5											18000	18000	WA DOE (Buchman, 2008)
Antimony	7440-36-0				0.63	2	USEPA Region 6 1999 (TRV)					9.3	0.63	Field et al. 2002
Arsenic	7440-38-2		8.2	7.24	7.4	6	USEPA Region 6 1999 (TRV)	63.0				35	8.2	Long et al. 1995
Barium	7440-39-3					130.1	WA DOE (Buchman, 2008)					48	130.1	WA DOE (Buchman, 2008)
Beryllium	7440-41-7													
Cadmium	7440-43-9	1.2	1.2	0.68	0.38			5.92				3	1.2	USEPA Region 2 2010
Calcium	7440-70-2													
Chromium	7440-47-3	81	81	52.3	49			455				62	81	USEPA Region 2 2010
Cobalt	7440-48-4					50	USEPA Region 5 2003 (FW)					10	50	USEPA Region 5 2003 (FW)
Copper	7440-50-8	34	34	18.7	32			163				390	34	USEPA Region 2 2010
Iron	7439-89-6											220000	220000	WA DOE (Buchman, 2008)
Lead	7439-92-1	46.7	46.7	30.24	30			263				400	46.7	USEPA Region 2 2010
Magnesium	7439-95-4													
Manganese	7439-96-5											260	260	WA DOE (Buchman, 2008)
Mercury	7439-97-6	0.15	0.15	0.13	0.14			1.13				0.41	0.15	USEPA Region 2 2010
Methyl mercury	22967-92-6					0.1	USEPA Region 6 1999 (TRV)						0.1	USEPA Region 6 1999 (TRV)
Nickel	7440-02-0	20.9	20.9	15.9	15			138				110	20.9	USEPA Region 2 2010
Potassium	7440-09-7													
Selenium	7782-49-2											1	1	WA DOE (Buchman, 2008)
Silver	7440-22-4	1	1	0.73	0.23			6.35				3.1	1	USEPA Region 2 2010
Sodium	7440-23-5													

Appendix B Newtown Creek SLERA: Sediment Screening Levels

Parameters	CAS	Tier 1 Screening Levels (mg/kg dry weight)	Tier 2 Screening Values (mg/kg dry weight)											
		USEPA Region 2 Marine Screening Benchmarks (USEPA, 2010)[a]	Toxicity Based Values					Equilibrium Partitioning Based values, Adjusted to 8.7% TOC				Other	Selected Tier 2 SL[b]	
			Long et al. 1995	McDonald et al. 1996	Field et al. 2002	Other Toxicity Based Values		USEPA Region 3 2006	USEPA Region 6 1999	USEPA Region 5 2003	NYSDEC 1999	WA DOE, Cited in Buchman 2008	Final Value	Tier 2 Reference
		Benchmark	Effects Range-Low (ER-L)	Threshold Effect Level (TEL)	Amphipod Logistic Regression T-20	Value	Reference					Apparent Effect Threshold (AET)		
Thallium	7440-28-0													
Tin	7440-31-5											3.4	3.4	WA DOE (Buchman, 2008)
Vanadium	7440-62-2											57	57	WA DOE (Buchman, 2008)
Zinc	7440-66-6	150	150	124	94			1079				410	150	USEPA Region 2 2010
TCL Dioxins and Furans by EPA 1613B														
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001-02-0						[To be included in TEQ]							
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	3268-87-9						[To be included in TEQ]							
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCD)	67562-39-4						[To be included in TEQ]							
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822-46-9						[To be included in TEQ]							
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCD)	55673-89-7						[To be included in TEQ]							
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCD)	70648-26-9						[To be included in TEQ]							
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCD)	39227-28-6						[To be included in TEQ]							
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCD)	57117-44-9						[To be included in TEQ]							
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCD)	57653-85-7						[To be included in TEQ]							
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCD)	72918-21-9						[To be included in TEQ]							
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCD)	19408-74-3						[To be included in TEQ]							
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6						[To be included in TEQ]							
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCD)	40321-76-4						[To be included in TEQ]							
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCD)	60851-34-5						[To be included in TEQ]							
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4						[To be included in TEQ]							
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9						[To be included in TEQ]							
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6					0.00000085	CCME (2002) ISQG		0.000892			0.0000036	0.0	CCME (2002) ISQG
Total Heptachlorodibenzofuran (HpCDF)	38998-75-3													
Total Heptachlorodibenzo-p-dioxin (HpCDD)	37871-00-4													
Total Hexachlorodibenzofuran (HxCDF)	55684-94-1													
Total Hexachlorodibenzo-p-dioxin (HxCDD)	34465-46-8													
Total Pentachlorodibenzofuran (PeCDF)	30402-15-4													
Total Pentachlorodibenzo-p-dioxin (PeCDD)	36088-22-9													
Total Tetrachlorodibenzofuran (TCDF)	30402-14-3													
Total Tetrachlorodibenzo-p-dioxin (TCDD)	41903-57-5													
General Chemistry														
pH	N/A													
Sulfide	18496-25-8											4.5	4.5	WA DOE (Buchman, 2008)
Total Phosphorous	14265-44-2													
Total Nitrogen	7727-37-9													
Ammonia	7664-41-7													
Cyanide	57-12-5					0.1	USEPA Region 6 1999 (TRV)			0.000870			0.1	USEPA Region 6 1999 (TRV)
PAHs and alkyl PAHs by EPA Method 8270- SIM / NOAA 130														
Alkyl PAHs														
Total PAHs (sum of 16 Priority Pollutants)	N/A	4.022	4.022	1.684									4.022	USEPA Region 2 2010
LMW PAHs	N/A	0.552	0.552	0.312								1.2	0.552	USEPA Region 2 2010

Appendix B Newtown Creek SLERA: Sediment Screening Levels

Parameters	CAS	Tier 1 Screening Levels (mg/kg dry weight)	Tier 2 Screening Values (mg/kg dry weight)											
		USEPA Region 2 Marine Screening Benchmarks (USEPA, 2010)[a]	Toxicity Based Values					Equilibrium Partitioning Based values, Adjusted to 8.7% TOC				Other	Selected Tier 2 SL[b]	
			Long et al. 1995	McDonald et al. 1996	Field et al. 2002	Other Toxicity Based Values		USEPA Region 3 2006	USEPA Region 6 1999	USEPA Region 5 2003	NYSDEC 1999	WA DOE, Cited in Buchman 2008	Final Value	Tier 2 Reference
		Benchmark	Effects Range-Low (ER-L)	Threshold Effect Level (TEL)	Amphipod Logistic Regression T-20	Value	Reference					Apparent Effect Threshold (AET)		
HMW PAHs	N/A	1.7	1.7	0.655								7.9	1.7	USEPA Region 2 2010

Notes:

FW - Freshwater
ISQG - Interim Sediment Quality Guidelines
SL - screening level
N/A - Not available for this analyte
TRV - Toxicity Reference Value
TOC - total organic compound

All values in mg/kg dry weight

[a] Tier 1 screening levels were taken from USEPA (2010), as per EPA request. Note that some of these values were NYSDEC EqP values calculated using 1% organic carbon.

[b] Tier 2 and Tier 3 screening levels were selected based on the hierarchy presented in Section 3.2 of the SLERA.

Equilibrium Partitioning Based values are rounded to three significant figures or four significant figures for values greater than 1000. All other values are shown as reported in the reference document.

References:

CCME (Canadian Council of Ministers of the Environment), 2002 (update). *Canadian Sediment Quality Guidelines for the Protection of Aquatic Life: Summary Tables* . In: Canadian Environmental Quality Guidelines, 1999, CCME, Winnipeg

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WA DOE (Washington State Department of Ecology) cited in: Buchman, M.F., 2008 (update). *National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRT)* . NOAA HAZMAT Report, Seattle, WA, NOAA.

APPENDIX C
NEWTOWN CREEK SLERA: BIOACCUMULATIVE COMPOUNDS

Appendix C Newtown Creek SLERA: Bioaccumulative Compounds

Class	Compound	CASRN
Metals and Metallic Compounds	arsenic*[1]	7440-38-2
	cadmium*	7440-43-9
	chromium VI*	7440-47-3
	copper*	7440-50-8
	lead*	7439-92-1
	methylmercury*	22967-92-6
	nickel*	7440-02-0
	selenium*	7782-49-2
	silver*	7440-22-4
	zinc*	7440-66-6
Substituted Phenols	pentachlorophenol*	87-86-5
Low-Molecular-Weight Aromatics	acenapthylene	208-96-8
	acenaphthene*	83-32-9
	anthracene	120-12-7
	fluorene	86-73-7
	phenanthrene*	85-01-8
High-Molecular-Weight PAHs	benzo(a)anthracene*	56-55-3
	benzo(a)pyrene*	50-32-8
	benzo(b)fluoranthene*	205-99-2
	benzo(k)fluoranthene*	207-08-9
	benzo(g,h,i)perylene*	191-24-2
	chrysene*	218-01-9
	dibenzo(a,h)anthracene	53-70-3
	fluoranthene*	206-44-0
	indeno(1,2,3-c,d)pyrene	193-39-5
	pyrene*	129-00-0
Chlorinated Aromatic Hydrocarbons	1,2-dichlorobenzene	95-50-1
	1,3-dichlorobenzene	541-73-1
	1,4-dichlorobenzene	106-46-7
	hexachlorobenzene (HCB)	118-74-1
	hexachloroethane	67-72-1
	hexachlorobutadiene	87-68-3
	hexachlorocyclopentadiene	77-47-4
	1,2,4,5-tetrachlorobenzene	95-94-3
	1,2,4-trichlorobenzene (TCB)	120-82-1
Halogenated Ethers	4-chlorophenyl phenyl ether	7005-72-3
	4-bromophenyl phenyl ether	101-55-3

Appendix C Newtown Creek SLERA: Bioaccumulative Compounds

Class	Compound	CASRN
Pesticides	aldrin*[2]	309-00-2
	chlordane*[2]	57-74-9
	p,p N-DDD*	72-54-8
	p,p N-DDE*	72-55-9
	p,p N-DDT*[2]	50-29-3
	dieldrin*[2]	60-57-1
	alpha-endosulfan[2]	959-98-8
	beta-endosulfan	33213-65-9
	endrin[2]	72-20-8
	heptachlor*[2]	76-44-8
	heptachlor epoxide	1024-57-3
	alpha-hexachlorocyclohexane (•-BHC)	319-84-6
	beta-hexachlorocyclohexane (•-BHC)	319-85-7
	delta-hexachlorocyclohexane (•-BHC)	319-86-8
	gamma-hexachlorocyclohexane (•-BHC, lindane)	58-89-9
	methoxychlor[2]	72-43-5
	mirex[2]	2385-85-5
	toxaphene*	8001-35-2
Dioxins/Furans	2,3,7,8-tetrachlorodibenzo-*p* -dioxin*	1746-01-6
	2,3,7,8-tetrachlorodibenzofuran*	51207-31-9
	1,2,3,7,8-pentachlorodibenzo-*p* -dioxin*	40321-76-4
	2,3,4,7,8-pentachlordibenzofuran*	57117-31-4
	1,2,3,7,8-pentachlorodibenzofuran*	57117-41-6
	1,2,3,4,7,8-hexachlorodibenzo-*p* -dioxin*	39227-28-6
	1,2,3,6,7,8-hexachlorodibenzo-*p* -dioxin*	57653-85-7
	1,2,3,4,7,8-hexachlorodibenzofuran*	70648-26-9
	1,2,3,4,6,7,8-heptachlorodibenzo-*p* -dioxin*	35822-46-9
PCBs (Aroclors)	Aroclor 1016*	12674-11-2
	Aroclor 1221	11104-28-2
	Aroclor 1232	11141-16-5
	Aroclor 1242*	53469-21-9
	Aroclor 1248*	12672-29-6
	Aroclor 1254*	11097-69-1
	Aroclor 1260*	11096-82-5
	Aroclor 1268	11100-14-4

Appendix C Newtown Creek SLERA: Bioaccumulative Compounds

Class	Compound	CASRN
PCBs (Congeners)[3]	PCB 8 2,4·-dichlorobiphenyl	34883-43-7
	PCB 18 2,2·,5-trichlorobiphenyl	37680-65-2
	PCB 28 2,4,4·-trichlorobiphenyl*	7012-37-5
	PCB 44 2,2·,3,5·-tetrachlorobiphenyl	41464-39-5
	PCB 52 2,2·,5,5·-tetrachlorobiphenyl	35693-99-3
	PCB 66 2,3·,4,4·-tetrachlorobiphenyl	32598-10-0
	PCB 77 3,3·4,4·-tetrachlorobiphenyl*	32598-13-3
	PCB 81 3,4,4·,5-tetrachlorobiphenyl*	70362-50-4
	PCB 101 2,2·,4,5,5·-pentachlorobiphenyl	37680-73-2
	PCB 105 2,3,3·,4,4·-pentachlorobiphenyl*	32598-14-4
	PCB 118 2,3·,4,4·,5,-pentachlorobiphenyl*	31508-00-6
	PCB 126 3,3·,4,4·,5-pentachlorobiphenyl*	57465-28-8
	PCB 128 2,2·,3,3·,4,4·-hexachlorobiphenyl	38380-07-7
	PCB 138 2,2·,3,4,4·,5·-hexachlorobiphenyl	35065-28-2
	PCB 153 2,2·,4,4·,5,5·-hexachlorobiphenyl	35065-27-1
	PCB 156 2,3,3·,4,4·,5-hexachlorobiphenyl*	38380-08-4
	PCB 169 3,3·4,4·,5,5·-hexachlorobiphenyl*	32774-16-6
	PCB 170 2,2·,3,3·,4,4·,5-heptachlorobiphenyl	35065-30-6
	PCB 180 2,2·,3,4,4·5,5·-heptachlorobiphenyl	35065-29-3
	PCB 187 2,2·,3,4·,5,5·,6-heptachlorobiphenyl	52663-68-0
	PCB 195 2,2·,3,3·,4,4·,5,6-octachlorobiphenyl	52663-78-2
	PCB 206 2,2·,3,3·,4,4·,5,5·,6-nonachlorobiphenyl	40186-72-9
	PCB 209 2,2·,3,3·,4,4·,5,5·,6,6·-decachlorobiphenyl	2051-24-3

Notes:

[1]Chemicals with asterisk have been researched for bioaccumulation information, which is contained in chemical specific information tables in USEPA (2000).

[2]These pesticides were noted by USEPA's Office of Pesticide Programs to have bioconcentration factor (BCF) > 1000, $t_{1/2}$ (hydrolysis) > 30 days, LC50 (acute fish) < 1 parts per million (ppm) and Log Octanol-Water Partition Coefficient (log K_{ow}) > 4.2.

[3]PCB congeners marked with an asterisk were recommended by Philip Cook, USEPA, Office of Research and Development, Duluth, Minnesota, and Richard Pruell, USEPA, Office of Research and Development, Narragansett, Rhode Island. Unmarked congeners are additional congeners measured by NOAA's National Status and Trends Program.

Reference:

USEPA (U.S. Environmental Protection Agency), 2000. *Bioaccumulative Testing and Interpretation for the Purpose of Sediment Quality Assessment* . Status and Needs. USEPA Bioaccumulation Analysis Workgroup. Office of Water. Office of Solid Waste. EPA-823-R-00-01.

APPENDIX D
NEWTOWN CREEK SLERA: AVIAN AND MAMMALIAN TOXICITY REFERENCE VALUES

Appendix D-1 Newtown Creek SLERA: Avian Toxicity Reference Values

CAS Number	Chemical	Source[1]	Test Species	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)
TCL Volatiles by EPA Method 8260a					
120-82-1	1,2,4-trichlorobenzene (TCB)	-	-	-	-
95-50-1	1,2-dichlorobenzene	Alumot et al. 1976b; 1,2-dichloroethane (DCA)	chicken	17.2	34.4
541-73-1	1,3-Dichlorobenzene	Alumot et al. 1976b; 1,2-dichloroethane (DCA)	chicken	17.2	34.4
106-46-7	1,4-Dichlorobenzene	ECOTOX ref 344; USEPA 2007a	Northern bobwhite	16.08	160.8
67-72-1	Hexachloroethane	Sample et al (1996). 1,2-dichloroethane (DCA).	chicken	17.2	34.4
TCL Semivolatiles by EPA Method 8270					
95-94-3	1,2,4,5-tetrachlorobenzene	-	-	-	-
95-50-1	1,2-dichlorobenzene	Alumot et al. 1976; 1,2-dichloroethane (DCA)	chicken	17.2	34.4
106-46-7	1,4-Dichlorobenzene	ECOTOX ref 344, USEPA 2007b	Northern bobwhite	16.08	160.8
7005-72-3	4-chlorophenyl phenyl ether	-	-	-	-
101-55-3	4-bromophenyl phenyl ether	-	-	-	-
83-32-9	Acenaphthene	Patton and Dieter 1980	mallard	32.5	325
208-96-8	Acenaphthylene	Patton and Dieter 1980	mallard	32.5	325
120-12-7	Anthracene	Patton and Dieter 1980	mallard	32.5	325
56-55-3	Benzo(a)anthracene	Beall 2007, benzo(a)anthracene	bobwhite quail	0.65	6.5
50-32-8	Benzo(a)pyrene	Rigdon, R,H. and J. Neal. 1963	Chicken	280	2800
205-99-2	Benzo(b)fluoranthene	Benzo(a)pyrene	Chicken	280	2800
191-24-2	Benzo(ghi)perylene	Benzo(a)pyrene	Chicken	280	2800
207-08-9	Benzo(k)fluoranthene	Benzo(a)pyrene	Chicken	280	2800
218-01-9	Chrysene	Benzo(a)pyrene	Chicken	280	2800
53-70-3	Dibenzo(a,h)anthracene	Benzo(a)pyrene	Chicken	280	2800
206-44-0	Fluoranthene	Benzo(a)pyrene	Chicken	280	2800
86-73-7	Fluorene	Patton and Dieter 1980	mallard	32.5	325
118-74-1	Hexachlorobenzene	Vos et al. 1971	Japanese quail	0.67	3.35
87-68-3	Hexachlorobutadiene	ECOTOX ref 35430, USEPA 2007b	Japanese quail	4	40
77-47-4	Hexachlorocyclopentadiene	-	-	-	-
67-72-1	Hexachloroethane	Sample et al (1996). 1,2-dichloroethane (DCA).	chicken	17.2	34.4
193-39-5	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	Chicken	280	2800

Appendix D-1 Newtown Creek SLERA: Avian Toxicity Reference Values

CAS Number	Chemical	Source[1]	Test Species	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)
87-86-5	Pentachlorophenol	Hudson et al. 1984		7.6	76
85-01-8	Phenanthrene	Patton and Dieter 1980	mallard	32.5	325
129-00-0	Pyrene	Benzo(a)pyrene	Chicken	280	2800
	Total HPAH	Benzo(a)pyrene	Chicken	280	2800
	Total LPAHs	Patton and Dieter 1980	mallard	32.5	325
CASID30311	Total PAH	Patton and Dieter 1980	mallard	32.5	325
Organochlorine Pesticides by EPA Method 8081A / NOAA 130					
72-54-8	4,4'-DDD	Eco-SSL (USEPA 2007e)	chicken	0.227	2.27
72-55-9	4,4'-DDE	Eco-SSL (USEPA 2007e)	chicken	0.227	2.27
50-29-3	4,4'-DDT	Eco-SSL (USEPA 2007e)	chicken	0.227	2.27
309-00-2	Aldrin	Hall et al. 1971	ring-necked pheasant	0.007	0.014
5103-71-9	alpha-Chlordane	Sample et al. 1996, Stickel et al. 1983	red-winged blackbird	2.14	10.7
57-74-9	Chlordane	Sample et al. 1996, Stickel et al. 1983	red-winged blackbird	2.14	10.7
12789-03-6	gamma-Chlordane	Sample et al. 1996, Stickel et al. 1983	red-winged blackbird	2.14	10.7
319-84-6	BHC-alpha	Chakravarty and Lahiri 1986, Chakravarty et al. 1986	mallard	0.571	0.857
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	Chakravarty and Lahiri 1986, Chakravarty et al. 1986	mallard	0.571	0.857
319-86-8	BHC, delta	Chakravarty and Lahiri 1986, Chakravarty et al. 1986	mallard	0.571	0.857
58-89-9	gamma-Hexachlorocyclohexane (BHC) (Lindane)	Chakravarty and Lahiri 1986; Chakravarty et al. 1986	mallard	0.571	0.857
60-57-1	Dieldrin	Eco-SSL (USEPA 2007c), Nebeker et al. 1992	mallard	0.0709	0.709
959-98-8	Endosulfan I	Sample et al. 1996, Abiola 1992	gray partridge	10	100
33213-65-9	Endosulfan II	Sample et al. 1996, Abiola 1992	gray partridge	10	100
72-20-8	Endrin	Sample et al. 1996	screech owl	0.01	0.1
76-44-8	Heptachlor	Hill et al. 1975	ring-necked pheasant	0.28	2.8
1024-57-3	Heptachlor Epoxide	Hill et al. 1975	ring-necked pheasant	0.28	2.8
118-74-1	Hexachlorobenzene	Vos et al. 1971	Japanese quail	0.67	3.35
72-43-5	Methoxychlor	Hudson et al. 1970		80	800
2385-85-5	Mirex	Hill et al. (1975)		3.3	33
8001-35-2	Toxaphene	Hudson et al., 1970		0.398	3.98
TCL PCBs by EPA Method 8082 / NOAA 130					

Appendix D-1 Newtown Creek SLERA: Avian Toxicity Reference Values

CAS Number	Chemical	Source[1]	Test Species	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)
12674-11-2	Aroclor 1016	Sample et al. 1996, Dahlgren et al. 1972	ring-necked pheasant	0.18	1.8
11104-28-2	Aroclor 1221	Sample et al. 1996, Dahlgren et al. 1972	ring-necked pheasant	0.18	1.8
11141-16-5	Aroclor 1232	Sample et al. 1996, Dahlgren et al. 1972	ring-necked pheasant	0.18	1.8
53469-21-9	Aroclor 1242	Sample et al. 1996, Dahlgren et al. 1972	ring-necked pheasant	0.18	1.8
12672-29-6	Aroclor 1248	Sample et al. 1996, Dahlgren et al. 1972	ring-necked pheasant	0.18	1.8
11097-69-1	Aroclor 1254	Sample et al. 1996, Dahlgren et al. 1972	ring-necked pheasant	0.18	1.8
11096-82-5	Aroclor 1260	Sample et al. 1996, Dahlgren et al. 1972	ring-necked pheasant	0.18	1.8
11100-14-4	Aroclor 1268	Sample et al. 1996, Dahlgren et al. 1972	ring-necked pheasant	0.18	1.8
PCB Congeners[(c, d, l)] by EPA Method 1668A b,c					
	Total PCB congeners	Sample et al. 1996; as Aroclor 1242	Screech owl	0.41	4.1
	PCB congeners TEQ	Sample et al. 1996; 2,3,7,8-TCDD	ring-necked pheasant	0.000014	0.00014
	Total PCBs as Aroclors	Dahlgren et al. 1972	ring-necked pheasant	0.18	1.8
34883-43-7	PCB 8 2,4·-dichlorobiphenyl	Evaluate as PCBs (Congeners)			
37680-65-2	PCB 18 2,2·,5-trichlorobiphenyl	Evaluate as PCBs (Congeners)			
7012-37-5	PCB 28 2,4,4·-trichlorobiphenyl	Evaluate as PCBs (Congeners)			
41464-39-5	PCB 44 2,2·,3,5·-tetrachlorobiphenyl	Evaluate as PCBs (Congeners)			
35693-99-3	PCB 52 2,2·,5,5·-tetrachlorobiphenyl	Evaluate as PCBs (Congeners)			
32598-10-0	PCB 66 2,3·,4,4·-tetrachlorobiphenyl	Evaluate as PCBs (Congeners)			
32598-13-3	PCB 77 3,3·4,4·-tetrachlorobiphenyl	Evaluate as PCBs (Congeners)			
70362-50-4	PCB 81 3,4,4·,5-tetrachlorobiphenyl	Evaluate as PCBs (Congeners)			
37680-73-2	PCB 101 2,2·,4,5,5·-pentachlorobiphenyl	Evaluate as PCBs (Congeners)			
32598-14-4	PCB 105 2,3,3·,4,4·-pentachlorobiphenyl	Evaluate as PCBs (Congeners)			
31508-00-6	PCB 118 2,3·,4,4·,5,-pentachlorobiphenyl	Evaluate as PCBs (Congeners)			
57465-28-8	PCB 126 3,3·,4,4·,5-pentachlorobiphenyl	Evaluate as PCBs (Congeners)			
38380-07-7	PCB 128 2,2·,3,3·,4,4·-hexachlorobiphenyl	Evaluate as PCBs (Congeners)			
35065-28-2	PCB 138 2,2·,3,4,4·,5·-hexachlorobiphenyl	Evaluate as PCBs (Congeners)			
35065-27-1	PCB 153 2,2·,4,4·,5,5·-hexachlorobiphenyl	Evaluate as PCBs (Congeners)			
38380-08-4	PCB 156 2,3,3·,4,4·,5-hexachlorobiphenyl	Evaluate as PCBs (Congeners)			
32774-16-6	PCB 169 3,3·4,4·,5,5·-hexachlorobiphenyl	Evaluate as PCBs (Congeners)			

Appendix D-1 Newtown Creek SLERA: Avian Toxicity Reference Values

CAS Number	Chemical	Source[1]	Test Species	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)
35065-30-6	PCB 170 2,2·,3,3·,4,4·,5-heptachlorobiphenyl	Evaluate as PCBs (Congeners)			
35065-29-3	PCB 180 2,2·,3,4,4·5,5·-heptachlorobiphenyl	Evaluate as PCBs (Congeners)			
52663-68-0	PCB 187 2,2·,3,4·,5,5·,6-heptachlorobiphenyl	Evaluate as PCBs (Congeners)			
52663-78-2	PCB 195 2,2·,3,3·,4,4·,5,6-octachlorobiphenyl	Evaluate as PCBs (Congeners)			
40186-72-9	PCB 206 2,2·,3,3·,4,4·,5,5·,6-nonachlorobiphenyl	Evaluate as PCBs (Congeners)			
2051-24-3	PCB 209 2,2·,3,3·,4,4·,5,5·,6,6·-decachlorobiphenyl	Evaluate as PCBs (Congeners)			
TAL Metals by EPA Method 6020/6010					
7440-38-2	Arsenic	Eco-SSL (EPA 2005a)	Chicken	2.24	4.5
7440-43-9	Cadmium	Eco-SSL (EPA 2005b)	Multiple	1.47	6.34
16065-83-1	Chromium	Eco-SSL (EPA 2008)	Multiple	2.66	15.6
18540-29-9	Chromium (VI)	No avian data in Eco-SSL	--	NA	
7440-50-8	Copper	Eco-SSL (EPA 2007d)	Chicken	4.05	12.1
7439-92-1	Lead	Eco-SSL (EPA 2005c)	Chicken	1.63	3.26
22967-92-6	Methylmercury	Sample et al (1996); methyl Hg	mallard duck	0.0064	0.064
7440-02-0	Nickel	Eco-SSL (EPA 2007e)	Multiple	6.71	67.1
7782-49-2	Selenium	Eco-SSL (EPA 2007f)	chicken	0.29	0.579
7440-22-4	Silver	Eco-SSL (EPA 2006)	Multiple	2.02	20.2
56573-85-4	Tributyltin	-	-	-	-
7440-66-6	Zinc	Eco-SSL (EPA 2007g)	Multiple	66.1	171
TCL Dioxins and Furans by EPA 1613B b					
	Dioxin/furan congeners	Sample et al. 1996; 2,3,7,8-TCDD	ring-necked pheasant	0.000014	0.00014
1746-01-6	2,3,7,8-tetrachlorodibenzo-p-dioxin	Evaluate as dioxins/furans total congeners			
51207-31-9	2,3,7,8-tetrachlorodibenzofuran	Evaluate as dioxins/furans total congeners			
40321-76-4	1,2,3,7,8-pentachlorodibenzo-p-dioxin	Evaluate as dioxins/furans total congeners			
57117-31-4	2,3,4,7,8-pentachlordibenzofuran	Evaluate as dioxins/furans total congeners			
57117-41-6	1,2,3,7,8-pentachlorodibenzofuran	Evaluate as dioxins/furans total congeners			
39227-28-6	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	Evaluate as dioxins/furans total congeners			
57653-85-7	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	Evaluate as dioxins/furans total congeners			
70648-26-9	1,2,3,4,7,8-hexachlorodibenzofuran	Evaluate as dioxins/furans total congeners			

Appendix D-1 Newtown Creek SLERA: Avian Toxicity Reference Values

CAS Number	Chemical	Source[1]	Test Species	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)
35822-46-9	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	Evaluate as dioxins/furans total congeners			

Notes:

CAS - Chemical Abstracts Services

NOAEL - no-observed adverse effect level

mg/kg-day - milligram per kilogram-day

[1] References are provided in Appendix D-2.

Appendix D-2 Newtown Creek SLERA: Mammalian Toxicity Reference Values

CAS Number	Chemical	Source	Form/Surrogate Analyte	Test Species	Test Species Body wt.	Test Species NOAEL (mg/kg-day)	Raccoon, NOAEL (mg/kg-day)	Test Species LOAEL (mg/kg-day)	Raccoon LOAEL (mg/kg-day)
TCL Volatiles by EPA Method 8260									
120-82-1	1,2,4-Trichlorobenzene	ATSDR 2010, Kitchin and Ebron 1983				120	120	360	360
95-50-1	1,2-Dichlorobenzene	NTP 1985		rat[a]	0.35	120	65.3	1200	653
541-73-1	1,3-Dichlorobenzene	Coulston and Kolbye 1994		rat	0.35	85.7	46.6	857	466
106-46-7	1,4-Dichlorobenzene	ATSDR 2006		rat	0.35	600	327	6000	3265
67-72-1	Hexachloroethane	ATSDR 1997		rat	0.35	21.2	12	212	115
TCL Semivolatiles by EPA Method 8270									
95-94-3	1,2,4,5-Tetrachlorobenzene	IRIS 2011		rat[a]	0.35	0.34	0.2	3.4	1.85
95-50-1	1,2-Dichlorobenzene	NTP 1985		rat	0.35	120	65.3	1200	653
106-46-7	1,4-Dichlorobenzene	ATSDR 2006		rat	0.35	600	327	6000	3265
101-55-3	4-Bromophenyl Phenyl Ether	INCHEM 1994, Francis 1989				100	100	1000	1000
7005-72-3	4-Chlorophenyl Phenyl Ether	INCHEM 1994, Francis 1989				100	100	1000	1000
83-32-9	Acenaphthene	Eco-SSL (EPA 2007h)		rat	0.247	65.6	32.7	170	84.8
208-96-8	Acenaphthylene	Eco-SSL (EPA 2007h)		rat	0.247	65.6	32.7	170	84.8
120-12-7	Anthracene	Eco-SSL (EPA 2007h)		rat	0.247	65.6	32.7	170	84.8
56-55-3	Benzo(a)anthracene	Eco-SSL (EPA 2007h)		mouse	0.038	0.615	0.192	18	5.62
50-32-8	Benzo(a)pyrene	Eco-SSL (EPA 2007h)		mouse	0.038	0.615	0.192	18	5.62
205-99-2	Benzo(b)fluoranthene	Eco-SSL (EPA 2007h)		mouse	0.038	0.615	0.192	18	5.62
191-24-2	Benzo(g,h,i)perylene	Eco-SSL (EPA 2007h)		mouse	0.038	0.615	0.192	18	5.62
207-08-9	Benzo(k)fluoranthene	Eco-SSL (EPA 2007h)		mouse	0.038	0.615	0.192	18	5.62
218-01-9	Chrysene	Eco-SSL (EPA 2007h)		mouse	0.038	0.615	0.192	18	5.62
53-70-3	Dibenzo(a,h)anthracene	Eco-SSL (EPA 2007h)		mouse	0.038	0.615	0.192	18	5.62
206-44-0	Fluoranthene	Eco-SSL (EPA 2007h)		mouse	0.038	0.615	0.192	18	5.62
86-73-7	Fluorene	Eco-SSL (EPA 2007h)		rat	0.247	65.6	32.7	170	84.8
118-74-1	Hexachlorobenzene	Gralla et al 1977		beagle dog	10	1.25	1.57	12.5	15.7
87-68-3	Hexachlorobutadiene	Schwetz et al. 1977		rat	0.35	2	1.09	20	10.9
77-47-4	Hexachlorocyclopentadiene	-				-		-	
67-72-1	Hexachloroethane	ATSDR 1997		rat	0.35	21.2	12	212	115
193-39-5	Indeno(1,2,3-cd)pyrene	Eco-SSL (EPA 2007h)		mouse	0.038	0.615	0.192	18	5.6
87-86-5	Pentachlorophenol	Sample et al 1996		rat	0.35	0.24	0.131	2.4	1.3
85-01-8	Phenanthrene	Eco-SSL (EPA 2007h)		rat	0.247	65.6	32.7	170	84.8
129-00-0	Pyrene	Eco-SSL (EPA 2007h)		mouse	0.038	0.615	0.192	18	5.62
	Total HPAH	Eco-SSL (EPA 2007h)	benzo(a)pyrene	mouse	0.038	0.615	0.192	18	5.62
	Total LPAH	Eco-SSL (EPA 2007h)	1-naphthaleneacetic acid	rat	0.247	65.6	32.72	170	84.8

Appendix D-2 Newtown Creek SLERA: Mammalian Toxicity Reference Values

CAS Number	Chemical	Source	Form/Surrogate Analyte	Test Species	Test Species Body wt.	Test Species NOAEL (mg/kg-day)	Raccoon, NOAEL (mg/kg-day)	Test Species LOAEL (mg/kg-day)	Raccoon LOAEL (mg/kg-day)
CASID30311	Total PAH	Eco-SSL (EPA 2007h)	benzo(a)pyrene	mouse	0.038	0.615	0.192	18	5.62
Organochlorine Pesticides by EPA Method 8081A / NOAA 130									
72-54-8	4,4'-DDD	Wrenn et al. 1970	DDT	rat	0.072	0.147	0.05	0.735	0.269
72-55-9	4,4'-DDE	Wrenn et al. 1970	DDT	rat	0.072	0.147	0.05	0.735	0.269
50-29-3	4,4'-DDT	Wrenn et al. 1970	NA	rat	0.072	0.147	0.05	0.735	0.269
309-00-2	Aldrin	Treon and Cleveland 1955	NA	rat	0.35	0.2	0.11	1	0.544
5103-71-9	alpha-Chlordane	Narotsky and Kavlock 1995	chlordane	rat[a]	0.35	2.1	1.14	21	11.4
57-74-9	Chlordane	Narotsky and Kavlock 1995	NA	rat[a]	0.35	2.1	1.14	21	11.4
12789-03-6	gamma-Chlordane	Narotsky and Kavlock 1995	chlordane	rat[a]	0.35	2.1	1.14	21	11.4
319-84-6	BHC-alpha	Sample et al. 1996	BHC-gamma (Lindane)	rat	0.35	8	4.35	80	43.5
319-85-7	BHC-beta	Van Velsen et al. 1986	NA	rat	0.35	0.4	0.22	2	1.09
319-86-8	BHC, delta	Sample et al. 1996	BHC-gamma (Lindane)	rat	0.35	8	4.35	80	43.5
58-89-9	BHC-gamma (Lindane)	Sample et al. 1996	NA	rat	0.35	8	4.35	80	43.5
60-57-1	Dieldrin	Eco-SSL (USEPA 2007c), Harr et al. 1970	NA	rat	0.217	0.015	0.01	0.03	0.014
959-98-8	Endosulfan I	Dikshith et al. 1984	endosulfan	rat	0.35	0.15	0.08	1.5	0.816
33213-65-9	Endosulfan II	Dikshith et al. 1984	endosulfan	rat	0.35	0.15	0.08	1.5	0.816
72-20-8	Endrin	Good and Ware 1969	NA	mouse	0.03	0.092	0.03	0.92	0.271
76-44-8	Heptachlor	ATSDR 2007	heptachor	mouse[a]	0.03	0.9	0.27	9.00	2.65
1024-57-3	Heptachlor epoxide	-	-	-	-	-	-	-	
118-74-1	Hexachlorobenzene	Gralla et al. 1977		beagle dog	10	1.25	1.57	12.50	15.73
72-43-5	Methoxychlor	Gray et al. 1988	NA	rat	0.35	4	2.18	8	4.35
2385-85-5	Mirex	USEPA 2011		rat	0.35	0.7	0.38	1.8	0.980
8001-35-2	Toxaphene	Sample et al. 1996	NA	rat	0.35	8	4.35	80	43.5
TCL PCBs by EPA Method 8082 / NOAA 130									
12674-11-2	Aroclor 1016	Sample et al 1996, Bleavins et al. 1980	aroclor 1016	mink	1	1.37	0.97	3.43	2.43
11104-28-2	Aroclor 1221	Sample et al. 1996, McCoy et al. 1995	aroclor 1254	Oldfield mouse	0.014	0.068	0.02	0.68	0.165
11141-16-5	Aroclor 1232	Sample et al. 1996, McCoy et al. 1995	aroclor 1254	Oldfield mouse	0.014	0.068	0.02	0.68	0.165
53469-21-9	Aroclor 1242	Sample et al. 1996, Bleavins et al. 1980	aroclor 1242	mink	1	0.069	0.05	0.69	0.488
12672-29-6	Aroclor 1248	Sample et al. 1996, Barsotti et al. 1976	aroclor 1248	Rhesus monkey	5	0.0087	0.01	0.087	0.092
11097-69-1	Aroclor 1254	Sample et al. 1996, McCoy et al. 1995	aroclor 1254	Oldfield mouse	0.014	0.068	0.02	0.68	0.165
11096-82-5	Aroclor 1260	Sample et al. 1996, McCoy et al. 1995	aroclor 1254	Oldfield mouse	0.014	0.068	0.02	0.68	0.165
11100-14-4	Aroclor 1268	Sample et al. 1996, McCoy et al. 1995	aroclor 1254	Oldfield mouse	0.014	0.068	0.02	0.68	0.165
PCB Congeners by EPA Method 1668A									
	Total PCB congeners	Aroclor 1248		Rhesus monkey	5	0.01	0.0106	0.10	0.1058
	PCB congeners TEQ	Sample et al 1996; 2,3,7,8-TCDD		rat	0.35	0.000001	5.442E-07	0.000010	0.00000544

Appendix D-2 Newtown Creek SLERA: Mammalian Toxicity Reference Values

CAS Number	Chemical	Source	Form/Surrogate Analyte	Test Species	Test Species Body wt.	Test Species NOAEL (mg/kg-day)	Raccoon, NOAEL (mg/kg-day)	Test Species LOAEL (mg/kg-day)	Raccoon LOAEL (mg/kg-day)
	Total PCBs as Aroclors	Sample et al 1996, McCoy et al. 1995	aroclor 1254	Oldfield mouse	0.014	0.068	0.02	0.68	0.165
34883-43-7	PCB 8 2,4·-dichlorobiphenyl	Evaluate as PCBs (Congeners)							
37680-65-2	PCB 18 2,2·,5-trichlorobiphenyl	Evaluate as PCBs (Congeners)							
7012-37-5	PCB 28 2,4,4·-trichlorobiphenyl	Evaluate as PCBs (Congeners)							
41464-39-5	PCB 44 2,2·,3,5·-tetrachlorobiphenyl	Evaluate as PCBs (Congeners)							
35693-99-3	PCB 52 2,2·,5,5·-tetrachlorobiphenyl	Evaluate as PCBs (Congeners)							
32598-10-0	PCB 66 2,3·,4,4·-tetrachlorobiphenyl	Evaluate as PCBs (Congeners)							
32598-13-3	PCB 77 3,3·4,4·-tetrachlorobiphenyl	Evaluate as PCBs (Congeners)							
70362-50-4	PCB 81 3,4,4·,5-tetrachlorobiphenyl	Evaluate as PCBs (Congeners)							
37680-73-2	PCB 101 2,2·,4,5,5·-pentachlorobiphenyl	Evaluate as PCBs (Congeners)							
32598-14-4	PCB 105 2,3,3·,4,4·-pentachlorobiphenyl	Evaluate as PCBs (Congeners)							
31508-00-6	PCB 118 2,3·,4,4·,5,-pentachlorobiphenyl	Evaluate as PCBs (Congeners)							
57465-28-8	PCB 126 3,3·,4,4·,5-pentachlorobiphenyl	Evaluate as PCBs (Congeners)							
38380-07-7	PCB 128 2,2·,3,3·,4,4·-hexachlorobiphenyl	Evaluate as PCBs (Congeners)							
35065-28-2	PCB 138 2,2·,3,4,4·,5·-hexachlorobiphenyl	Evaluate as PCBs (Congeners)							
35065-27-1	PCB 153 2,2·,4,4·,5,5·-hexachlorobiphenyl	Evaluate as PCBs (Congeners)							
38380-08-4	PCB 156 2,3,3·,4,4·,5-hexachlorobiphenyl	Evaluate as PCBs (Congeners)							
32774-16-6	PCB 169 3,3·4,4·,5,5·-hexachlorobiphenyl	Evaluate as PCBs (Congeners)							
35065-30-6	PCB 170 2,2·,3,3·,4,4·,5-heptachlorobiphenyl	Evaluate as PCBs (Congeners)							
35065-29-3	PCB 180 2,2·,3,4,4·5,5·-heptachlorobiphenyl	Evaluate as PCBs (Congeners)							
52663-68-0	PCB 187 2,2·,3,4·,5,5·,6-heptachlorobiphenyl	Evaluate as PCBs (Congeners)							
52663-78-2	PCB 195 2,2·,3,3·,4,4·,5,6-octachlorobiphenyl	Evaluate as PCBs (Congeners)							
40186-72-9	PCB 206 2,2·,3,3·,4,4·,5,5·,6-nonachlorobiphenyl	Evaluate as PCBs (Congeners)							
2051-24-3	PCB 209 2,2·,3,3·,4,4·,5,5·,6,6·-decachlorobiphenyl	Evaluate as PCBs (Congeners)							
TAL Metals by EPA Method 6020/6010									
7440-38-2	Arsenic	Eco-SSL (EPA 2005a)	sodium arsenite	dog	10.1	1.04	1.31	1.66	2.09
7440-43-9	Cadmium	Eco-SSL (EPA 2005b)	cadmium acetate	rat	0.43	0.77	0.44	7.7	4.41
7440-47-3	Chromium	Eco-SSL (EPA 2008)	multiple forms	Multiple		2.4	2.4	24	24
18540-29-9	Chromium (VI)	Eco-SSL (EPA 2008)		Multiple		9.24	9.24	92.4	92.4
7440-50-8	Copper	Eco-SSL (EPA 2007d)	copper sulfate pentahydrate	pig	100	5.6	12.53	9.34	20.9
7439-92-1	Lead	Eco-SSL (EPA 2005c)	lead acetate	rat	0.3	4.7	2.46	8.9	4.66
22967-92-6	Methylmercury	Sample et al 1996; methyl Hg		mink	1	0.0150	0.0106	0.0250	0.0177
7440-02-0	Nickel	Eco-SSL (EPA 2007e)	nickelous chloride	mouse	0.03	1.70	0.5006	0.34	0.1001
7782-49-2	Selenium	Eco-SSL (EPA 2007f)	sodium selenite	pig	17.8	0.143	0.21	0.215	0.312

Appendix D-2 Newtown Creek SLERA: Mammalian Toxicity Reference Values

CAS Number	Chemical	Source	Form/Surrogate Analyte	Test Species	Test Species Body wt.	Test Species NOAEL (mg/kg-day)	Raccoon, NOAEL (mg/kg-day)	Test Species LOAEL (mg/kg-day)	Raccoon LOAEL (mg/kg-day)
7440-22-4	Silver	Eco-SSL (EPA 2006)	silver acetate	pig	8.86	6.02	7.35	60.2	73.5
7440-66-6	Zinc	Eco-SSL (EPA 2007g)		Multiple		75.4	75.4	754	754
TCL Dioxins and Furans by EPA 1613B									
	Dioxin/furan total congeners	Sample et al. 1996; 2,3,7,8-TCDD	2,3,7,8-TCDD	rat	0.35	0.000001	0.00000054	0.00001000	0.00000544
1746-01-6	2,3,7,8-tetrachlorodibenzo-p-dioxin	Evaluate as dioxins/furans total congeners							
51207-31-9	2,3,7,8-tetrachlorodibenzofuran	Evaluate as dioxins/furans total congeners							
40321-76-4	1,2,3,7,8-pentachlorodibenzo-p-dioxin	Evaluate as dioxins/furans total congeners							
57117-31-4	2,3,4,7,8-pentachlordibenzofuran	Evaluate as dioxins/furans total congeners							
57117-41-6	1,2,3,7,8-pentachlorodibenzofuran	Evaluate as dioxins/furans total congeners							
39227-28-6	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	Evaluate as dioxins/furans total congeners							
57653-85-7	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	Evaluate as dioxins/furans total congeners							
70648-26-9	1,2,3,4,7,8-hexachlorodibenzofuran	Evaluate as dioxins/furans total congeners							
35822-46-9	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	Evaluate as dioxins/furans total congeners							

Appendix D-2 Newtown Creek SLERA: Mammalian Toxicity Reference Values

Notes:

[a] Assumed body weight from Sample et al 1996.

CAS - Chemical Abstracts Services

NOAEL - no-observed adverse effect level

mg/kg-day - milligram per kilogram-day

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Appendix D-2 Newtown Creek SLERA: Mammalian Toxicity Reference Values

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APPENDIX E
NEWTOWN CREEK SLERA: BIOTA-SEDIMENT ACCUMULATION FACTORS FOR RECEPTORS

Appendix E-1 Newtown Creek SLERA: Biota-Sediment Accumulation Factors (BSAFs) for Prey Items (USEPA and USACE data)[a]

Chemical	Migratory Fish		Non-migratory Fish		Epi-Benthic Invertebrates		Benthic Invertebrate		All Prey Items	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
TCL Volatiles by EPA Method 8260a										
1,2,4-trichlorobenzene (TCB)										
1,2-dichlorobenzene										
1,3-Dichlorobenzene										
1,4-Dichlorobenzene										
Hexachloroethane										
Tetrachloroethane										
TCL Semivolatiles by EPA Method 8270										
1,2,4,5-tetrachlorobenzene										
1,2-dichlorobenzene										
1,4-Dichlorobenzene										
4-chlorophenyl phenyl ether										
4-bromophenyl phenyl ether										
Acenaphthene							0.3125	2.0400	0.3125	2.0400
Acenaphthylene							0.5712	5.0744	0.5712	5.0744
Anthracene	0.0061	0.0061	0.0084	0.0084	1.5155	1.5155	0.6363	23.7004	0.5416	6.3076
Benzo(a)anthracene					2.9005	5.0716	0.4300	11.7785	1.6653	8.4250
Benzo(a)pyrene					2.9040	4.7011	0.2467	9.5120	1.5753	7.1065
Benzo(b)fluoranthene					0.8471	1.8679	0.5951	8.0329	0.7211	4.9504
Benzo(e)pyrene							0.1124	1.2457	0.1124	1.2457
Benzo(ghi)perylene					4.5629	6.2611	0.3468	16.7574	2.4549	11.5093
Benzo(k)fluoranthene					0.3851	0.3851	1.8514	15.0000	1.1182	7.6925
Chrysene					1.5704	3.4030	0.4223	7.3039	0.9963	5.3534
Dibenzo(a,h)anthracene					14.2575	14.2575	1.1462	37.0690	7.7018	25.6632
Fluoranthene	0.0049	0.0117			1.8047	2.7526	1.1488	42.2000	0.9861	14.9881
Fluorene	0.2073	0.2073	0.5256	0.5256			0.7042	10.7313	0.4790	3.8214
Hexachlorobenzene					4.5000	5.0000	2.1952	12.2301	3.3476	8.6151
Hexachlorobutadiene										
Hexachlorocyclopentadiene										
Hexachloroethane										
Indeno(1,2,3-cd)pyrene					7.2738	11.4025	0.4311	19.5522	3.8524	15.4774
Naphthalene							0.6774	3.1543	0.6774	3.1543
Pentachlorophenol										
Perylene	0.0516	0.0516					0.3048	1.9138	0.1782	1.9138
Phenanthrene	0.0212	0.0289	0.0184	0.0184	2.6488	3.9180	0.3995	8.8610	0.7720	3.2066

Appendix E-1 Newtown Creek SLERA: Biota-Sediment Accumulation Factors (BSAFs) for Prey Items (USEPA and USACE data)[a]

Chemical	Migratory Fish		Non-migratory Fish		Epi-Benthic Invertebrates		Benthic Invertebrate		All Prey Items	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Pyrene	0.0122	0.0122	0.0387	0.0387	0.7952	2.4118	0.3471	3.7310	0.2983	1.5484
Total HPAH										
Total LPAHs										
Total PAH										
Organochlorine Pesticides by EPA Method 8081A / NOAA 130										
4,4'-DDD	2.9158	4.4000	2.0000	2.0000	2.5000	3.0000	2.0273	11.2167	2.3608	5.1542
4,4'-DDE	15.5857	34.7724	18.0463	41.4710	16.7500	32.0000	6.0940	48.4682	14.1190	39.1779
4,4'-DDT	1.4723	5.2000	1.7575	2.1500	1.4500	2.2000	0.3703	1.5006	1.2625	2.7626
Aldrin							0.2365	0.4200	0.2365	0.4200
alpha-Chlordane							2.6839	7.1640	2.6839	7.1640
Chlordane										
gamma-Chlordane							3.4645	5.4220	3.4645	5.4220
BHC-alpha					0.5000	1.0000	0.7400	0.7400	0.6200	0.8700
beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)										
BHC, delta					0.7750	2.0000	0.0650	0.0650	0.4200	1.0325
gamma-Hexachlorocyclohexane (BHC) (Lindane)					0.4167	1.0000	0.5000	0.7740	0.4583	0.8870
Dieldrin	4.7350	11.0000	4.6600	5.7200	16.6000	44.0000	3.0850	9.5700	7.2700	17.5725
Endosulfan I										
Endosulfan II										
Endrin										
Heptachlor							1.8650	10.0700	1.8650	10.0700
Heptachlor Epoxide	0.8300	0.8300			0.6500	1.0000	0.3020	0.3020	0.5940	0.7107
Hexachlorobenzene					4.5000	5.0000	2.1952	12.2301	3.3476	8.6151
Methoxychlor					1.2000	2.0000			1.2000	2.0000
Mirex							3.1881	16.0033	3.1881	16.0033
Toxaphene										
TCL PCBs by EPA Method 8082 / NOAA 130										
Aroclor 1016										
Aroclor 1221										
Aroclor 1232										
Aroclor 1242										
Aroclor 1248							0.5440	1.2030	0.5440	1.2030
Aroclor 1254							1.6721	4.7900	1.6721	4.7900
Aroclor 1260							0.2272	0.5720	0.2272	0.5720
Aroclor 1262										

Appendix E-1 Newtown Creek SLERA: Biota-Sediment Accumulation Factors (BSAFs) for Prey Items (USEPA and USACE data)[a]

Chemical	Migratory Fish		Non-migratory Fish		Epi-Benthic Invertebrates		Benthic Invertebrate		All Prey Items	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Aroclor 1268										
PCB Congeners by EPA Method 1668A										
PCB congeners [b]	8.4346	51.0200	2.1659	8.9227	2.6720	8.1508	5.2171	27.8451	4.6224	23.9846
PCB congeners TEQ [b]	8.4346	51.0200	2.1659	8.9227	2.6720	8.1508	5.2171	27.8451	4.6224	23.9846
Total PCBs	8.4346	51.0200	2.1659	8.9227	2.6720	8.1508	5.2171	27.8451	4.6224	23.9846
PCB 8 2,4·-dichlorobiphenyl							1.2277	4.6420	1.2277	4.6420
PCB 18 2,2·,5-trichlorobiphenyl	0.2653	0.3779	1.5979	1.5979			3.0421	17.4860	1.6351	6.4872
PCB 28 2,4,4·-trichlorobiphenyl	1.0562	1.2486	2.8609	2.8609			4.3121	23.6467	2.7431	9.2520
PCB 44 2,2·,3,5·-tetrachlorobiphenyl	2.0715	3.8327	0.5410	0.5410			2.4875	11.5874	1.7000	5.3204
PCB 52 2,2·,5,5·-tetrachlorobiphenyl	21.1800	40.3148	1.6865	1.6865			3.5352	37.3979	8.8005	26.4664
PCB 66 2,3·,4,4·-tetrachlorobiphenyl	13.0444	93.3132	3.0078	11.4266	5.5450	10.2737	7.4745	32.4460	7.2679	36.8649
PCB 77 3,3·4,4·-tetrachlorobiphenyl	1.8434	14.1108	0.1559	0.6456	2.7499	10.5688	6.4241	22.6314	2.7933	11.9892
PCB 81 3,4,4·,5-tetrachlorobiphenyl	10.0734	147.0712	0.5699	1.9758	2.4928	12.0405			4.3787	53.6958
PCB 101 2,2·,4,5,5·-pentachlorobiphenyl	31.7519	59.6791	8.5675	8.5675			6.2804	44.4272	15.5333	37.5579
PCB 105 2,3,3·,4,4·-pentachlorobiphenyl	11.3211	49.5361	3.3311	10.5262	4.9649	10.3447	7.2630	75.8017	6.7200	36.5522
PCB 114	15.7068	155.1119	1.0464	4.4173	6.2803	29.2230			7.6778	62.9174
PCB 118 2,3·,4,4·,5,-pentachlorobiphenyl	36.7556	268.8134	5.9813	13.9602	9.1271	11.0911	3.3822	24.8412	13.8115	79.6765
PCB 123										
PCB 126 3,3·,4,4·,5-pentachlorobiphenyl	6.0991	61.4374	0.8777	3.1730	3.6997	10.5531	11.7821	58.4286	5.6146	33.3980
PCB 128 2,2·,3,3·,4,4·-hexachlorobiphenyl	27.8768	52.7135	6.8543	6.8543			3.6968	12.1188	12.8093	23.8955
PCB 138 2,2·,3,4,4·,5·-hexachlorobiphenyl	37.0001	67.9994	14.4848	14.4848			6.5690	34.8990	19.3513	39.1277
PCB 153 2,2·,4,4·,5,5·-hexachlorobiphenyl	31.8443	78.4381	23.6337	23.6337			9.4404	63.2888	21.6395	55.1202
PCB 156 2,3,3·,4,4·,5-hexachlorobiphenyl	10.3842	71.0669	1.9478	6.4938	6.2820	9.7567			6.2047	29.1058
PCB 157	10.1729	75.2696	1.5709	6.6178	3.5338	8.8312			5.0925	30.2395
PCB 167	12.1866	91.0561	1.9555	7.1681	6.0967	14.8604			6.7463	37.6949
PCB 169 3,3·4,4·,5,5·-hexachlorobiphenyl	0.5714	0.8422							0.5714	0.8422
PCB 170 2,2·,3,3·,4,4·,5-heptachlorobiphenyl	19.6069	31.5326	9.8098	9.8098			3.5847	24.6132	11.0005	21.9852
PCB 180 2,2·,3,4,4·5,5·-heptachlorobiphenyl	18.4152	42.1230	15.7862	15.7862			5.0551	29.2099	13.0855	29.0397
PCB 187 2,2·,3,4·,5,5·,6-heptachlorobiphenyl	32.8328	53.6089	15.3534	15.3534			11.1871	62.9406	19.7911	43.9677
PCB 189	8.8783	92.7384	0.9993	4.0763	3.6946	12.6461			4.5241	36.4869
PCB 195 2,2·,3,3·,4,4·,5,6-octachlorobiphenyl	5.7843	8.7808	1.7752	1.7752			5.3051	34.3011	4.2882	14.9524
PCB 206 2,2·,3,3·,4,4·,5,5·,6-nonachlorobiphenyl	2.5867	4.0295	0.6936	0.6936			2.3206	12.6804	1.8670	5.8011
PCB 209 2,2·,3,3·,4,4·,5,5·,6,6·-decachlorobiphenyl	2.4070	4.4524	0.3492	0.3492			2.5747	37.9032	1.7770	14.2349
TAL Metals by EPA Method 6020/6010										
Arsenic										

Appendix E-1 Newtown Creek SLERA: Biota-Sediment Accumulation Factors (BSAFs) for Prey Items (USEPA and USACE data)[a]

Chemical	Migratory Fish		Non-migratory Fish		Epi-Benthic Invertebrates		Benthic Invertebrate		All Prey Items	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Cadmium										
Chromium										
Chromium (VI)										
Copper										
Lead										
Methylmercury										
Nickel										
Selenium										
Silver										
Tributyltin (oxide)			2.7374				31.2291		16.9833	
Zinc										
TCL Dioxins and Furans by EPA 1613B										
1,2,3,4,6,7,8-HpCDD	0.0167	0.0664	0.0095	0.0140	0.0735	0.2251	0.2112	0.8240	0.0777	0.2824
1,2,3,4,6,7,8-HpCDF	1.3113	13.2959	0.0051	0.0110	0.0517	0.1860			0.4560	4.4976
1,2,3,4,7,8,9-HpCDF	0.0389	0.0559			0.2208	0.4385			0.1298	0.2472
1,2,3,4,7,8-HxCDD	0.0553	0.3000	0.0240	0.0240	0.0348	0.0348	0.5076	0.7840	0.1554	0.2857
1,2,3,4,7,8-HxCDF	0.0969	0.3000	0.0137	0.0310	1.1578	4.6779	0.2376	0.3180	0.3765	1.3317
1,2,3,6,7,8-HxCDD	0.5938	6.0000	0.0206	0.0350	0.1045	0.1387	0.2576	0.4040	0.2441	1.6444
1,2,3,6,7,8-HxCDF			0.1057	0.2730	0.2068	0.7056			0.1563	0.4893
1,2,3,7,8,9-HxCDD	0.0226	0.0226			0.1124	0.1124			0.0675	0.0675
1,2,3,7,8,9-HxCDF			0.0039	0.0039	0.0799	0.1500			0.0419	0.0770
1,2,3,7,8-PeCDD	0.7564	4.0000	0.0458	0.0800	0.1700	0.2455	0.4772	0.8880	0.3623	1.3034
1,2,3,7,8-PeCDF	0.9396	2.0000	0.0649	0.2800	2.7957	13.3346	0.5784	1.0240	1.0946	4.1596
2,3,4,6,7,8-HxCDF			0.0047	0.0090	0.0520	0.1146			0.0284	0.0618
2,3,4,7,8-PeCDF	0.7596	3.0000	0.1057	0.2457	2.8340	13.6036	0.5410	0.9450	1.0601	4.4486
2,3,7,8-TCDD	1.6978	12.0000	0.1663	0.2700	0.2817	0.7500	0.3529	1.2120	0.6246	3.5580
2,3,7,8-TCDF	0.9080	5.0000	0.0594	0.1405	2.0197	14.8206	0.3705	1.0610	0.8394	5.2555
OCDD	0.0545	0.5269	0.0041	0.0072	0.0320	0.1346			0.0302	0.2229
OCDF	0.0337	0.0753	0.0043	0.0043	0.2397	0.6792			0.0926	0.2530

Notes:

[a] BSAFs (on an organic carbon/lipid basis) from USEPA (2011) and USACE (2011)

[b] BSAF is assumed equal to that for total PCBs

References:

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Appendix E-2 Newtown Creek SLERA: Biota Accumulation Factors (BAFs) for Prey Items (Calcasieu Estuary Data)[a]

Chemical	Benthic Invertebrates		Epibenthic Invertebrates		Non-migratory fish		Pelagic-Migratory Fish		All Prey Item Groups		All Invertebrate		All Fish	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
TCL Volatiles by EPA Method 8260a														
1,2,4-trichlorobenzene (TCB)														
1,2-dichlorobenzene	60.7107	181.8182	39.5737	71.4286	--	--	46.7855	133.8925	49.0233	129.0464	50.1422	126.6234	46.7855	133.8925
1,3-Dichlorobenzene	71.0566	181.8182	36.2670	60.6684	--	--	48.7997	139.9691	52.0411	127.4852	53.6618	121.2433	48.7997	139.9691
1,4-Dichlorobenzene	89.3575	181.8182	41.9141	76.8116	--	--	48.5580	140.4762	59.9432	133.0353	65.6358	129.3149	48.5580	140.4762
Hexachloroethane	1.8591	11.1111	0.3904	2.0942	0.1729	0.5638	0.2274	4.4532	0.6624	4.5556	1.1247	6.6027	0.2002	2.5085
TCL Semivolatiles by EPA Method 8270														
1,2,4,5-tetrachlorobenzene														
1,2-dichlorobenzene	60.7107	181.8182	39.5737	71.4286	--	--	46.7855	133.8925	49.0233	129.0464	50.1422	126.6234	46.7855	133.8925
1,4-Dichlorobenzene	89.3575	181.8182	41.9141	76.8116	--	--	48.5580	140.4762	59.9432	133.0353	65.6358	129.3149	48.5580	140.4762
4-chlorophenyl phenyl ether														
4-bromophenyl phenyl ether														
Acenaphthene	1.5655	11.1111	0.3021	2.0942	0.1506	0.5547	0.2034	3.8733	0.5554	4.4083	0.9338	6.6027	0.1770	2.2140
Acenaphthylene	1.2972	11.1111	0.2497	2.0942	0.1631	0.5540	0.2168	4.2015	0.4817	4.4902	0.7734	6.6027	0.1899	2.3778
Anthracene	1.2614	11.1111	0.2453	2.0942	0.1605	0.5768	0.2131	4.1013	0.4701	4.4709	0.7533	6.6027	0.1868	2.3390
Benzo(a)anthracene	1.2450	11.1111	0.2206	2.0942	0.1741	0.5918	0.2239	4.2235	0.4659	4.5052	0.7328	6.6027	0.1990	2.4076
Benzo(a)pyrene	1.8562	11.1111	0.4844	3.4612	0.1657	0.6834	0.2276	4.2598	0.6835	4.8789	1.1703	7.2861	0.1966	2.4716
Benzo(b)fluoranthene	1.8567	11.1111	0.4735	3.3591	0.1545	0.5716	0.2212	4.1450	0.6765	4.7967	1.1651	7.2351	0.1878	2.3583
Benzo(ghi)perylene	1.8575	11.1111	0.4759	3.4203	0.1564	0.6092	0.2202	3.9927	0.6775	4.7833	1.1667	7.2657	0.1883	2.3010
Benzo(k)fluoranthene	1.8547	11.1111	0.4886	3.5610	0.1595	0.5984	0.2306	4.2078	0.6834	4.8696	1.1716	7.3361	0.1951	2.4031
Chrysene	1.2467	11.1111	0.2181	2.0942	0.1591	0.5646	0.2153	4.0475	0.4598	4.4543	0.7324	6.6027	0.1872	2.3060
Dibenzo(a,h)anthracene	1.8535	11.1111	0.5249	3.5968	0.1500	0.5300	0.2213	4.0718	0.6874	4.8274	1.1892	7.3539	0.1856	2.3009
Fluoranthene	1.2473	11.1111	0.2165	2.0942	0.1494	0.5106	0.2098	4.2910	0.4558	4.5017	0.7319	6.6027	0.1796	2.4008
Fluorene	1.4436	11.1111	0.2425	2.0942	0.1520	0.5533	0.2019	3.9741	0.5100	4.4332	0.8430	6.6027	0.1770	2.2637
Hexachlorobenzene	0.5311	1.1754	0.2292	1.5333	0.1409	0.5638	0.1934	3.5267	0.2736	1.6998	0.3802	1.3544	0.1671	2.0452
Hexachlorobutadiene	1.6486	9.2166	0.3449	2.0942	0.1712	0.5638	0.3021	4.3574	0.6167	4.0580	0.9967	5.6554	0.2367	2.4606
Hexachlorocyclopentadiene														
Hexachloroethane	1.8591	11.1111	0.3904	2.0942	0.1729	0.5638	0.2274	4.4532	0.6624	4.5556	1.1247	6.6027	0.2002	2.5085
Indeno(1,2,3-cd)pyrene	1.8539	11.1111	0.4881	3.5810	0.1547	0.5725	0.2229	4.0839	0.6799	4.8372	1.1710	7.3461	0.1888	2.3282
Pentachlorophenol	4.4158	21.7391	0.6732	4.1667	0.2006	0.4456	0.6186	7.7032	1.4771	8.5136	2.5445	12.9529	0.4096	4.0744

Appendix E-2 Newtown Creek SLERA: Biota Accumulation Factors (BAFs) for Prey Items (Calcasieu Estuary Data)[a]

Chemical	Benthic Invertebrates		Epibenthic Invertebrates		Non-migratory fish		Pelagic-Migratory Fish		All Prey Item Groups		All Invertebrate		All Fish	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Phenanthrene	1.2797	11.1111	0.2195	2.0942	0.1662	0.5745	0.2219	4.2089	0.4718	4.4972	0.7496	6.6027	0.1941	2.3917
Pyrene	1.2542	11.1111	0.2212	2.0942	0.1535	0.5949	0.2144	4.1230	0.4608	4.4808	0.7377	6.6027	0.1840	2.3590
Total HPAH														
Total LPAHs														
Total PAH														
Organochlorine Pesticides by EPA Method 8081A / NOAA 130														
4,4'-DDD	0.7251	1.9231	1.5001	7.9393	0.6700	1.3584	0.6390	1.1606	0.8836	3.0954	1.1126	4.9312	0.6545	1.2595
4,4'-DDE	0.8090	2.7273	1.4716	8.5116	0.8125	1.6998	1.0079	8.8760	1.0252	5.4537	1.1403	5.6194	0.9102	5.2879
4,4'-DDT	0.7356	1.6216	1.7196	7.5873	1.0245	21.5117	1.0902	20.5645	1.1425	12.8213	1.2276	4.6044	1.0573	21.0381
Aldrin	0.8198	3.1579	2.0311	12.3511	1.0365	2.2887	1.0372	5.4779	1.2312	5.8189	1.4255	7.7545	1.0368	3.8833
alpha-Chlordane	2.4832	17.6471	2.1071	12.2016	1.1747	2.6915	1.1931	5.6141	1.7395	9.5386	2.2952	14.9243	1.1839	4.1528
Chlordane														
gamma-Chlordane	0.7909	3.1579	1.9535	11.3682	1.1167	2.5763	1.2250	6.3275	1.2715	5.8575	1.3722	7.2631	1.1708	4.4519
BHC-alpha														
beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	0.4243	0.8667	1.3168	7.3553	0.9344	2.2887	2.1895	15.6679	1.2163	6.5447	0.8706	4.1110	1.5620	8.9783
BHC, delta	1.3098	3.2051	2.0819	12.2249	1.1406	2.2887	1.1480	2.0511	1.4201	4.9425	1.6958	7.7150	1.1443	2.1699
gamma-Hexachlorocyclohexane (BHC) (Lindane)	0.8040	3.1579	2.0970	12.0064	1.1950	2.2887	1.1765	2.0256	1.3181	4.8697	1.4505	7.5821	1.1857	2.1572
Dieldrin														
Endosulfan I	1.9928	13.0435	2.0633	12.0064	1.0671	2.2887	0.9736	2.2428	1.5242	7.3954	2.0281	12.5249	1.0203	2.2658
Endosulfan II	0.6304	1.6216	1.3860	7.9618	0.7343	1.3584	0.8305	3.0687	0.8953	3.5026	1.0082	4.7917	0.7824	2.2136
Endrin	0.6334	1.6216	1.5412	7.9519	0.6900	1.3584	0.6963	2.2423	0.8902	3.2936	1.0873	4.7868	0.6931	1.8003
Heptachlor	0.5356	1.1364	1.9888	12.0064	1.0986	2.2887	0.9677	2.7757	1.1477	4.5518	1.2622	6.5714	1.0332	2.5322
Heptachlor Epoxide	1.3802	8.4615	2.1255	11.9522	1.0810	2.2887	1.1080	4.4186	1.4237	6.7803	1.7528	10.2069	1.0945	3.3537
Hexachlorobenzene														
Methoxychlor	2.0907	13.9241	0.9495	6.3543	0.1964	0.3109	0.3428	2.3652	0.8948	5.7386	1.5201	10.1392	0.2696	1.3380
Mirex														
Toxaphene														
TCL PCBs by EPA Method 8082 / NOAA 130														
Aroclor 1016	0.8558	2.7027	0.3233	1.0227	0.1611	0.7368	0.2720	1.8548	0.4030	1.5793	0.5895	1.8627	0.2166	1.2958
Aroclor 1221	0.4783	1.3514	0.1640	0.5338	0.0808	0.3644	0.1377	0.9364	0.2152	0.7965	0.3211	0.9426	0.1092	0.6504

Appendix E-2 Newtown Creek SLERA: Biota Accumulation Factors (BAFs) for Prey Items (Calcasieu Estuary Data)[a]

Chemical	Benthic Invertebrates		Epibenthic Invertebrates		Non-migratory fish		Pelagic-Migratory Fish		All Prey Item Groups		All Invertebrate		All Fish	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Aroclor 1232	0.8558	2.7027	0.3233	1.0227	0.1611	0.7368	0.2720	1.8548	0.4030	1.5793	0.5895	1.8627	0.2166	1.2958
Aroclor 1242	0.8265	2.7027	0.3233	1.0227	0.1611	0.7368	0.2720	1.8548	0.3957	1.5793	0.5749	1.8627	0.2166	1.2958
Aroclor 1248	0.8558	2.7027	0.3233	1.0227	0.1611	0.7368	0.2720	1.8548	0.4030	1.5793	0.5895	1.8627	0.2166	1.2958
Aroclor 1254	1.9234	5.6923	0.6421	3.8482	0.4428	2.0367	1.3916	28.1971	1.1000	9.9436	1.2827	4.7703	0.9172	15.1169
Aroclor 1260	0.6425	1.4419	0.3094	0.9812	0.2887	1.3974	2.1369	31.4499	0.8444	8.8176	0.4760	1.2116	1.2128	16.4236
Aroclor 1268														
PCB Congeners by EPA Method 1668A														
PCB congeners	0.4177	0.6087	0.7527	2.8153	1.2357	5.8039	0.8580	3.9860	0.8160	3.3035	0.5852	1.7120	1.0469	4.8949
PCB congeners TEQ														
Total PCBs	0.8551	2.8000	0.3416	1.0814	0.2260	0.8070	0.8109	9.8919	0.5584	3.6451	0.5984	1.9407	0.5185	5.3494
PCB 8 2,4·-dichlorobiphenyl														
PCB 18 2,2·,5-trichlorobiphenyl														
PCB 28 2,4,4·-trichlorobiphenyl														
PCB 44 2,2·,3,5·-tetrachlorobiphenyl														
PCB 52 2,2·,5,5·-tetrachlorobiphenyl														
PCB 66 2,3·,4,4·-tetrachlorobiphenyl														
PCB 77 3,3·4,4·-tetrachlorobiphenyl	--	--	0.5716	1.1892	0.0305	0.0942	0.1633	1.3755	0.2551	0.8863	0.5716	1.1892	0.0969	0.7349
PCB 81 3,4,4·,5-tetrachlorobiphenyl	--	--	0.2362	0.4374	0.1833	0.5078	0.7395	4.9482	0.3863	1.9645	0.2362	0.4374	0.4614	2.7280
PCB 101 2,2·,4,5,5·-pentachlorobiphenyl														
PCB 105 2,3,3·,4,4·-pentachlorobiphenyl	0.3015	0.3040	1.0224	2.8661	0.3379	0.9334	1.7013	8.0363	0.8408	3.0350	0.6620	1.5850	1.0196	4.4849
PCB 114 2,3,4,4',5-PeCB	0.1303	0.1667	0.3695	0.9917	0.2451	1.0014	0.3694	1.7202	0.2786	0.9700	0.2499	0.5792	0.3072	1.3608
PCB 118 2,3·,4,4·,5,-pentachlorobiphenyl	0.3001	0.3830	1.1922	2.7613	1.6954	7.6129	1.7755	6.7553	1.2408	4.3781	0.7461	1.5721	1.7354	7.1841
PCB 123 2',3,4,4',5-PeCB	0.0302	0.0302	29.4633	74.0335	--	--	--	--	14.7467	37.0319	14.7467	37.0319	--	--
PCB 126 3,3·,4,4·,5-pentachlorobiphenyl	0.1519	0.2124	0.6094	1.4913	0.2636	1.2929	0.2213	0.8169	0.3115	0.9534	0.3807	0.8518	0.2424	1.0549
PCB 128 2,2·,3,3·,4,4·-hexachlorobiphenyl														
PCB 138 2,2·,3,4,4·,5·-hexachlorobiphenyl														
PCB 153 2,2·,4,4·,5,5·-hexachlorobiphenyl														
PCB 156 2,3,3·,4,4·,5-hexachlorobiphenyl	0.1315	0.1315	0.9442	1.7133	0.3429	1.0822	1.3992	6.3691	0.7045	2.3240	0.5379	0.9224	0.8711	3.7257
PCB 157 2,3,3',4,4',5-HxCB	0.2613	0.2613	1.0957	2.0078	0.4279	1.2573	0.5653	3.1828	0.5875	1.6773	0.6785	1.1345	0.4966	2.2200
PCB 167 2,3',4,4',5,5'-HxCB	0.2257	0.2882	0.5580	1.4540	0.4190	1.4181	1.2060	5.0857	0.6022	2.0615	0.3919	0.8711	0.8125	3.2519

Appendix E-2 Newtown Creek SLERA: Biota Accumulation Factors (BAFs) for Prey Items (Calcasieu Estuary Data)[a]

Chemical	Benthic Invertebrates		Epibenthic Invertebrates		Non-migratory fish		Pelagic-Migratory Fish		All Prey Item Groups		All Invertebrate		All Fish	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
PCB 169 3,3·4,4·,5,5·-hexachlorobiphenyl	0.0276	0.0477	0.2684	0.6592	0.0830	0.1706	0.1330	0.7788	0.1280	0.4141	0.1480	0.3534	0.1080	0.4747
PCB 170 2,2·,3,3·,4,4·,5-heptachlorobiphenyl														
PCB 180 2,2·,3,4,4·5,5·-heptachlorobiphenyl														
PCB 187 2,2·,3,4·,5,5·,6-heptachlorobiphenyl														
PCB 189 2,3,3',4,4',5,5'-HpCB	0.0413	0.0470	0.1429	0.3391	0.1788	0.6577	0.6105	3.4659	0.2434	1.1274	0.0921	0.1930	0.3947	2.0618
PCB 195 2,2·,3,3·,4,4·,5,6-octachlorobiphenyl														
PCB 206 2,2·,3,3·,4,4·,5,5·,6-nonachlorobiphenyl	0.0093	0.0093	1.4249	3.1946	--	--	--	--	0.7171	1.6019	0.7171	1.6019	--	--
PCB 209 2,2·,3,3·,4,4·,5,5·,6,6·-decachlorobiphenyl	0.0082	0.0082	1.3282	3.0880	--	--	--	--	0.6682	1.5481	0.6682	1.5481	--	--
TAL Metals by EPA Method 6020/6010														
Arsenic	0.1427	0.2159	0.1191	0.2495	0.0608	0.2681	0.1329	1.1084	0.1139	0.4605	0.1309	0.2327	0.0969	0.6882
Cadmium	1.0418	4.5455	0.1191	0.7752	0.0207	0.1135	0.1349	1.7170	0.3291	1.7878	0.5805	2.6603	0.0778	0.9153
Chromium	0.0089	0.0259	0.0080	0.0380	0.0064	0.0140	0.0126	0.0409	0.0090	0.0297	0.0085	0.0320	0.0095	0.0274
Chromium (VI)														
Copper	0.1112	0.6224	0.2688	0.8985	0.0661	0.2397	0.0280	0.2553	0.1185	0.5040	0.1900	0.7605	0.0470	0.2475
Lead	0.0087	0.0186	0.0059	0.0258	0.0056	0.0666	0.0063	0.0421	0.0066	0.0383	0.0073	0.0222	0.0059	0.0543
Methylmercury	256.1435	1258.5714	3.4585	34.3593	0.1795	0.6365	0.1559	0.7501	64.9843	323.5793	129.8010	646.4653	0.1677	0.6933
Nickel	0.1077	0.2941	0.0179	0.0832	0.0054	0.0390	0.0252	0.2261	0.0390	0.1606	0.0628	0.1887	0.0153	0.1325
Selenium	0.7121	1.1875	0.6059	1.6774	0.6614	3.2117	0.8594	3.4816	0.7097	2.3896	0.6590	1.4325	0.7604	3.3467
Silver														
Tributyltin (oxide)														
Zinc	0.0822	0.2389	0.1292	0.3969	0.2408	0.6802	0.1081	0.3057	0.1401	0.4054	0.1057	0.3179	0.1745	0.4930
TCL Dioxins and Furans by EPA 1613B														
Dioxin/furan congeners														
Total Dioxin/Furan TEQ mammal	0.0846	0.2293	0.2356	1.2357	0.0145	0.0425	0.1838	2.2237	0.1296	0.9328	0.1601	0.7325	0.0992	1.1331
1,2,3,4,6,7,8-HpCDD	0.0129	0.0191	0.0070	0.0228	0.0010	0.0019	0.0047	0.0377	0.0064	0.0204	0.0100	0.0209	0.0028	0.0198
1,2,3,4,6,7,8-HpCDF	0.0034	0.0050	0.0135	0.0735	0.0027	0.0227	0.0227	0.3403	0.0106	0.1104	0.0085	0.0393	0.0127	0.1815
1,2,3,4,7,8,9-HpCDF	0.0025	0.0037	0.0239	0.1683	0.0010	0.0068	0.0056	0.1034	0.0082	0.0705	0.0132	0.0860	0.0033	0.0551
1,2,3,4,7,8-HxCDD	0.0326	0.0761	0.0240	0.0634	0.0148	0.1200	0.0200	0.0566	0.0228	0.0790	0.0283	0.0698	0.0174	0.0883
1,2,3,4,7,8-HxCDF	0.0077	0.0120	0.0825	0.5281	0.0015	0.0042	0.0155	0.1467	0.0268	0.1727	0.0451	0.2701	0.0085	0.0754
1,2,3,6,7,8-HxCDD	0.1827	0.4038	0.0241	0.0522	0.0065	0.0262	0.0335	0.2758	0.0617	0.1895	0.1034	0.2280	0.0200	0.1510

Appendix E-2 Newtown Creek SLERA: Biota Accumulation Factors (BAFs) for Prey Items (Calcasieu Estuary Data)[a]

Chemical	Benthic Invertebrates		Epibenthic Invertebrates		Non-migratory fish		Pelagic-Migratory Fish		All Prey Item Groups		All Invertebrate		All Fish	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
1,2,3,6,7,8-HxCDF	0.0135	0.0288	0.0667	0.3664	0.0159	0.0655	0.0659	0.8204	0.0405	0.3203	0.0401	0.1976	0.0409	0.4430
1,2,3,7,8,9-HxCDD	0.1542	0.4040	0.0279	0.0709	0.0059	0.0173	0.0203	0.0870	0.0521	0.1448	0.0911	0.2375	0.0131	0.0521
1,2,3,7,8,9-HxCDF	0.0205	0.0558	0.0223	0.0676	0.0141	0.0932	0.0145	0.1808	0.0178	0.0994	0.0214	0.0617	0.0143	0.1370
1,2,3,7,8-PeCDD	0.1051	0.2064	0.0668	0.1475	0.0362	0.2092	0.0653	0.3317	0.0683	0.2237	0.0860	0.1770	0.0507	0.2704
1,2,3,7,8-PeCDF	0.0956	0.2414	0.0896	0.1276	0.0072	0.0179	0.1462	1.4704	0.0847	0.4643	0.0926	0.1845	0.0767	0.7442
2,3,4,6,7,8-HxCDF	0.0324	0.0827	0.0211	0.0356	0.0044	0.0241	0.0115	0.1159	0.0173	0.0646	0.0267	0.0591	0.0080	0.0700
2,3,4,7,8-PeCDF	0.2143	0.6056	0.0965	0.1710	0.0264	0.1110	0.1257	1.6724	0.1157	0.6400	0.1554	0.3883	0.0761	0.8917
2,3,7,8-TCDD	0.1458	0.3612	0.0839	0.1778	0.0440	0.2309	0.1832	2.5767	0.1142	0.8366	0.1148	0.2695	0.1136	1.4038
2,3,7,8-TCDF	0.3690	0.8717	0.2872	0.7431	0.0458	0.1259	0.1615	1.1039	0.2159	0.7111	0.3281	0.8074	0.1037	0.6149
OCDD	0.0117	0.0151	0.0057	0.0227	0.0008	0.0028	0.0050	0.0600	0.0058	0.0251	0.0087	0.0189	0.0029	0.0314
OCDF	--	--	0.0042	0.0117	0.0004	0.0010	0.0048	0.0938	0.0031	0.0355	0.0042	0.0117	0.0026	0.0474

Notes:

[a] BAFs (on a wet weight basis) from CDM 2002

Reference:

CDM, 2002. *Calcasieu Estuary Remedial Investigation/Feasibility Study (RI/FS): Baseline Ecological Risk Assessment (BERA).* Appendix G: Deterministic Ecological Risk Assessment for Aquatic and Wildlife Receptors. Contract No. 68-W5-0022.

APPENDIX F
NEWTOWN CREEK SLERA: WILDLIFE BASED SEDIMENT SCREENING LEVELS (MAXIMUM BSAFS)

Appendix F-1 Newtown Creek SLERA: Wildlife Based Sediment Screening Levels (Summary - Maximum BSAFs)

Chemical	SL_{sed} Sandpiper (mg/kg)	SL_{sed} Heron (mg/kg)	SL_{sed} Cormorant (mg/kg)	SL_{sed} Raccoon (mg/kg)
TCL Volatiles by EPA Method 8260				
1,2,4-trichlorobenzene (TCB)				3.23E+03
1,2-dichlorobenzene				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene				
Hexachloroethane	3.08E+00	5.75E+00	3.89E+01	7.37E+00
TCL Semivolatiles by EPA Method 8270				
1,2,4,5-tetrachlorobenzene				4.98E+00
1,2-dichlorobenzene				
1,4-Dichlorobenzene				
4-chlorophenyl phenyl ether				2.69E+03
4-bromophenyl phenyl ether				2.69E+03
Acenaphthene	1.04E+02	2.51E+02	5.40E+02	4.62E+02
Acenaphthylene	4.64E+01	1.02E+02	2.18E+02	1.93E+02
Anthracene	1.06E+01	8.24E+01	1.76E+02	1.56E+02
Benzo(a)anthracene	4.18E-01	1.24E+00	2.63E+00	6.92E-01
Benzo(a)pyrene	2.21E+02	6.30E+02	1.34E+03	8.17E-01
Benzo(b)fluoranthene	2.60E+02	9.02E+02	1.93E+03	1.16E+00
Benzo(ghi)perylene	1.28E+02	3.90E+02	8.30E+02	5.09E-01
Benzo(k)fluoranthene	1.42E+02	5.83E+02	1.24E+03	7.56E-01
Chrysene	2.84E+02	8.35E+02	1.78E+03	1.08E+00
Dibenzo(a,h)anthracene	5.86E+01	1.75E+02	3.73E+02	2.30E-01

Appendix F-1 Newtown Creek SLERA: Wildlife Based Sediment Screening Levels (Summary - Maximum BSAFs)

Chemical	SL_{sed} Sandpiper (mg/kg)	SL_{sed} Heron (mg/kg)	SL_{sed} Cormorant (mg/kg)	SL_{sed} Raccoon (mg/kg)
Fluoranthene	5.16E+01	3.00E+02	6.38E+02	3.92E-01
Fluorene	2.29E+01	1.35E+02	2.89E+02	2.54E+02
Hexachlorobenzene	4.16E-01	1.25E+00	2.65E+00	5.54E+00
Hexachlorobutadiene	8.36E-01	1.56E+00	9.23E+00	8.13E-01
Hexachlorocyclopentadiene				
Hexachloroethane	3.08E+00	5.75E+00	3.89E+01	7.37E+00
Indeno(1,2,3-cd)pyrene	1.10E+02	2.90E+02	6.18E+02	3.79E-01
Pentachlorophenol	6.98E-01	1.30E+00	1.06E+01	4.26E-02
Phenanthrene	2.75E+01	1.61E+02	3.45E+02	3.01E+02
Pyrene	5.29E+02	2.83E+03	6.11E+03	3.50E+00
Total HPAH	2.21E+02	6.30E+02	1.34E+03	8.17E-01
Total LPAH	2.29E+01	1.35E+02	2.89E+02	2.54E+02
Total PAH	2.57E+01	7.32E+01	1.56E+02	8.17E-01
Organochlorine Pesticides by EPA Method 8081A / NOAA 130				
4,4'-DDD	1.53E-01	7.03E-01	1.50E+00	3.14E-01
4,4'-DDE	3.64E-02	9.32E-02	1.98E-01	4.23E-02
4,4'-DDT	9.26E-01	1.30E+00	2.79E+00	5.71E-01
Aldrin	6.51E-02	2.41E-01	5.47E-01	5.92E+00
alpha-Chlordane	2.21E+00	4.78E+00	1.02E+01	4.82E+00
Chlordane	2.21E+00	4.78E+00	1.02E+01	4.82E+00
gamma-Chlordane	2.21E+00	6.30E+00	1.34E+01	6.33E+00
BHC-alpha	3.85E+00	1.00E+01	2.20E+01	1.32E+02

Appendix F-1 Newtown Creek SLERA: Wildlife Based Sediment Screening Levels (Summary - Maximum BSAFs)

Chemical	SL_{sed} Sandpiper (mg/kg)	SL_{sed} Heron (mg/kg)	SL_{sed} Cormorant (mg/kg)	SL_{sed} Raccoon (mg/kg)
BHC-beta	3.74E+00	9.84E+00	2.16E+01	6.49E+00
BHC, delta	9.17E+00	8.52E+00	1.82E+01	1.14E+02
gamma-Hexachlorocyclohexane (BHC) (Lindane)	3.74E+00	9.84E+00	2.16E+01	1.30E+02
Dieldrin	5.57E-02	6.48E-02	1.38E-01	1.26E-02
Endosulfan I	9.49E-01	1.76E+00	2.51E+01	2.75E-02
Endosulfan II	2.46E+00	4.60E+00	2.57E+01	7.18E-02
Endrin	2.46E-03	4.61E-03	3.15E-02	2.39E-02
Heptachlor	2.09E-01	4.46E-01	9.49E-01	8.00E-01
Heptachlor Epoxide	3.03E+00	5.95E+00	1.31E+01	
Hexachlorobenzene	4.16E-01	1.25E+00	2.65E+00	5.54E+00
Methoxychlor	9.37E+00	6.29E+02	1.36E+03	3.13E+01
Mirex	1.58E+00	3.31E+00	7.04E+00	7.28E-01
Toxaphene	2.19E+00	6.12E+00	1.34E+01	1.17E+02
TCL PCBs by EPA Method 8082 / NOAA 130				
Aroclor 1016	2.71E-01	5.99E-01	1.28E+00	6.06E+00
Aroclor 1221	2.71E-01	5.99E-01	1.28E+00	1.03E-01
Aroclor 1232	2.71E-01	5.99E-01	1.28E+00	1.03E-01
Aroclor 1242	2.71E-01	5.99E-01	1.28E+00	3.05E-01
Aroclor 1248	8.69E-01	2.32E+00	5.04E+00	2.10E-01
Aroclor 1254	2.71E-01	5.99E-01	1.28E+00	2.99E-01
Aroclor 1260	1.42E+00	4.68E+00	1.04E+01	7.10E-01
Aroclor 1268	2.71E-01	5.99E-01	1.28E+00	1.03E-01

Appendix F-1 Newtown Creek SLERA: Wildlife Based Sediment Screening Levels (Summary - Maximum BSAFs)

Chemical	SL_{sed} Sandpiper (mg/kg)	SL_{sed} Heron (mg/kg)	SL_{sed} Cormorant (mg/kg)	SL_{sed} Raccoon (mg/kg)
PCB Congeners by EPA Method 1668A				
Total PCB congeners	1.14E-01	2.75E-01	5.84E-01	1.35E-02
Total PCBs as Aroclors	5.00E-02	1.21E-01	2.56E-01	2.12E-02
TAL Metals by EPA Method 6020/6010				
Arsenic	9.01E+00	2.07E+01	1.84E+01	2.20E+01
Cadmium	6.45E-01	1.22E+00	9.11E+00	6.97E-01
Chromium	3.29E+01	1.53E+02	5.00E+02	1.95E+02
Chromium (VI)				7.50E+02
Copper	5.87E+00	1.17E+01	9.20E+01	6.79E+01
Lead	2.25E+01	1.26E+02	1.62E+02	2.45E+02
Methylmercury	1.18E-05	2.19E-05	5.23E-02	6.95E-05
Nickel	3.17E+01	7.60E+01	2.82E+02	1.01E+01
Selenium	2.31E-01	4.45E-01	4.92E-01	6.06E-01
Silver	1.11E+01	3.11E+01	6.79E+01	1.98E+02
Zinc	2.07E+02	4.50E+02	7.58E+02	9.44E+02
TCL Dioxins and Furans by EPA 1613B				
Dioxin/furan congeners or as TCDD	6.72E-05	6.25E-05	1.34E-04	4.53E-06

Notes:

BSAF - biota-sediment accumulation factor

mg/kg - milligram per kilogram

SL_{sed} - wildlife-based sediment screening level (mg/kg)

Appendix F-2 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Sandpiper[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
TCL Volatiles by EPA Method 8260							
1,2,4-trichlorobenzene (TCB)							
1,2-dichlorobenzene							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene							
Hexachloroethane		6.603	30.710	17.2	3.19E+02	3.11E+00	3.08E+00
TCL Semivolatiles by EPA Method 8270							
1,2,4,5-tetrachlorobenzene							
1,2-dichlorobenzene							
1,4-Dichlorobenzene							
4-chlorophenyl phenyl ether							
4-bromophenyl phenyl ether							
Acenaphthene	2.040		1.444	32.5	6.02E+02	1.25E+02	1.04E+02
Acenaphthylene	5.074		3.593	32.5	6.02E+02	5.03E+01	4.64E+01
Anthracene	23.70		16.78	32.5	6.02E+02	1.08E+01	1.06E+01
Benzo(a)anthracene	11.8		8.340	0.65	1.20E+01	4.33E-01	4.18E-01
Benzo(a)pyrene	9.512		6.735	280	5.19E+03	2.31E+02	2.21E+02
Benzo(b)fluoranthene	8.033		5.688	280	5.19E+03	2.74E+02	2.60E+02
Benzo(ghi)perylene	16.76		11.87	280	5.19E+03	1.31E+02	1.28E+02
Benzo(k)fluoranthene	15.00		10.62	280	5.19E+03	1.47E+02	1.42E+02
Chrysene	7.304		5.172	280	5.19E+03	3.01E+02	2.84E+02
Dibenzo(a,h)anthracene	37.1		26.247	280	5.19E+03	5.93E+01	5.86E+01
Fluoranthene	42.2		29.880	280	5.19E+03	5.21E+01	5.16E+01
Fluorene	10.73		7.598	32.5	6.02E+02	2.38E+01	2.29E+01
Hexachlorobenzene	12.23		8.659	0.67	1.24E+01	4.30E-01	4.16E-01
Hexachlorobutadiene		5.655	26.304	4	7.41E+01	8.45E-01	8.36E-01

Appendix F-2 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Sandpiper[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Hexachlorocyclopentadiene							
Hexachloroethane		6.603	30.710	17.2	3.19E+02	3.11E+00	3.08E+00
Indeno(1,2,3-cd)pyrene	19.55		13.84	280	5.19E+03	1.12E+02	1.10E+02
Pentachlorophenol		12.953	60.25	7.6	1.41E+02	7.01E-01	6.98E-01
Phenanthrene	8.861		6.274	32.5	6.02E+02	2.88E+01	2.75E+01
Pyrene	3.731		2.642	280	5.19E+03	5.89E+02	5.29E+02
Total HPAH [c]	9.512		6.735	280	5.19E+03	2.31E+02	2.21E+02
Total LPAH [d]	10.73		7.598	32.5	6.02E+02	2.38E+01	2.29E+01
Total PAH [c]	9.512		6.735	32.5	6.02E+02	2.68E+01	2.57E+01
Organochlorine Pesticides by EPA Method 8081A / NOAA 130							
4,4'-DDD	11.22		7.942	0.227	4.21E+00	1.59E-01	1.53E-01
4,4'-DDE	48.47		34.318	0.227	4.21E+00	3.68E-02	3.64E-02
4,4'-DDT	1.501		1.062	0.227	4.21E+00	1.19E+00	9.26E-01
Aldrin	0.420		0.297	0.007	1.30E-01	1.31E-01	6.51E-02
alpha-Chlordane	7.164		5.072	2.14	3.96E+01	2.34E+00	2.21E+00
Chlordane [e]	7.164		5.072	2.14	3.96E+01	2.34E+00	2.21E+00
gamma-Chlordane [e]	7.164		5.072	2.14	3.96E+01	2.34E+00	2.21E+00
BHC-alpha	0.740		0.524	0.571	1.06E+01	6.06E+00	3.85E+00
BHC-beta [f]	0.774		0.548	0.571	1.06E+01	5.79E+00	3.74E+00
BHC, delta	0.065		0.046	0.571	1.06E+01	6.90E+01	9.17E+00
gamma-Hexachlorocyclohexane (BHC) (Lindane)	0.774		0.548	0.571	1.06E+01	5.79E+00	3.74E+00
Dieldrin	9.570		6.776	0.0709	1.31E+00	5.82E-02	5.57E-02
Endosulfan I		12.525	58.256	10	1.85E+02	9.54E-01	9.49E-01
Endosulfan II		4.792	22.287	10	1.85E+02	2.49E+00	2.46E+00
Endrin		4.787	22.264	0.01	1.85E-01	2.50E-03	2.46E-03
Heptachlor	10.07		7.130	0.28	5.19E+00	2.18E-01	2.09E-01

Appendix F-2 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Sandpiper[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Heptachlor Epoxide	0.302		0.214	0.28	5.19E+00	7.28E+00	3.03E+00
Hexachlorobenzene	12.23		8.659	0.67	1.24E+01	4.30E-01	4.16E-01
Methoxychlor		10.139	47.159	80	1.48E+03	9.43E+00	9.37E+00
Mirex	16.00		11.331	3.3	6.11E+01	1.62E+00	1.58E+00
Toxaphene	1		0.708	0.398	7.37E+00	3.12E+00	2.19E+00
TCL PCBs by EPA Method 8082 / NOAA 130							
Aroclor 1016 [g]	4.790		3.392	0.18	3.33E+00	2.95E-01	2.71E-01
Aroclor 1221 [g]	4.790		3.392	0.18	3.33E+00	2.95E-01	2.71E-01
Aroclor 1232 [g]	4.790		3.392	0.18	3.33E+00	2.95E-01	2.71E-01
Aroclor 1242 [g]	4.790		3.392	0.18	3.33E+00	2.95E-01	2.71E-01
Aroclor 1248	1.203		0.852	0.18	3.33E+00	1.17E+00	8.69E-01
Aroclor 1254	4.790		3.392	0.18	3.33E+00	2.95E-01	2.71E-01
Aroclor 1260	0.572		0.405	0.18	3.33E+00	2.47E+00	1.42E+00
Aroclor 1268 [g]	4.790		3.392	0.18	3.33E+00	2.95E-01	2.71E-01
PCB Congeners by EPA Method 1668A							
Total PCB congeners [h]	27.85		19.716	0.41	7.60E+00	1.16E-01	1.14E-01
Total PCBs as Aroclors	27.85		19.716	0.18	3.33E+00	5.07E-02	5.00E-02
TAL Metals by EPA Method 6020/6010							
Arsenic		0.233	1.082	2.24	4.15E+01	1.15E+01	9.01E+00
Cadmium		2.660	12.374	1.47	2.72E+01	6.60E-01	6.45E-01
Chromium		0.032	0.149	2.66	4.93E+01	9.94E+01	3.29E+01
Chromium (VI)							
Copper		0.760	3.537	4.05	7.50E+01	6.36E+00	5.87E+00
Lead		0.022	0.103	1.63	3.02E+01	8.76E+01	2.25E+01
Methylmercury		646	3007	0.0064	1.19E-01	1.18E-05	1.18E-05
Nickel		0.189	0.877	6.71	1.24E+02	4.25E+01	3.17E+01

Appendix F-2 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Sandpiper[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Selenium		1.432	6.663	0.29	5.37E+00	2.42E-01	2.31E-01
Silver	1		0.708	2.02	3.74E+01	1.59E+01	1.11E+01
Zinc		0.318	1.479	66.1	1.22E+03	2.48E+02	2.07E+02
TCL Dioxins and Furans by EPA 1613B							
Dioxin/furan congeners or as TCDD	1.212		0.858	0.000014	2.59E-04	9.07E-05	6.72E-05

Notes:

Blank cells - No toxicity data available to develop TRV.

BAF - biota-sediment accumulation factor (kg dry weight/kg dry weight)

BSAF (OC/lipid basis) - biota-sediment accumulation factor (kg lipid/kg organic carbon)

dry wt basis - dry weight basis

kg - kilogram

mg - milligram

mg/kg - milligram per kilogram

mg/kg_{bw}/day - milligram per kilogram body weight per day

NOAEL - no-observed adverse effect level

$SL_{food\text{-}ingestion}$ - sediment screening level based on food ingestion

SL_{sed} - wildlife-based sediment screening level (mg/kg)

$SL_{sed\text{-}ingestion}$ - sediment screening level based on the incidental sediment ingestion

TRV - toxicity reference value

wet wt basis - wet weight basis

[1] See memorandum text for equations and parameter definitions.

[a] BSAF based on benthic invertebrates. When no BSAF available, a value of 1.0 was assumed.

[b] BAF based on all invertebrates for hexachloroethane, hexachlorobutadiene, pentachlorophenol, endosulfan I , endosulfan II, endrin, methoxychlor, arsenic, cadmium, chromium, copper, lead, methylmercury, nickel, selenium, and zinc.

[c] BSAF is assumed equal to that for benzo(a)pyrene.

[d] BSAF is assumed equal to that for fluorene.

[e] BSAF is assumed equal to that for chlorodane-alpha.

[f] BSAF is assumed equal to that for lindane.

[g] BSAF is assumed equal to that for Aroclor 1254.

[h] BSAF is assumed equal to that for total PCBs.

Appendix F-3 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Heron[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
TCL Volatiles by EPA Method 8260a							
1,2,4-trichlorobenzene (TCB)							
1,2-dichlorobenzene							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene							
Hexachloroethane		6.603	30.710	17.2	5.89E+03	5.75E+00	5.75E+00
TCL Semivolatiles by EPA Method 8270							
1,2,4,5-tetrachlorobenzene							
1,2-dichlorobenzene							
1,4-Dichlorobenzene							
4-chlorophenyl phenyl ether							
4-bromophenyl phenyl ether							
Acenaphthene	2.040		1.301	32.5	1.11E+04	2.57E+02	2.51E+02
Acenaphthylene	5.074		3.237	32.5	1.11E+04	1.03E+02	1.02E+02
Anthracene	6.308		4.024	32.5	1.11E+04	8.30E+01	8.24E+01
Benzo(a)anthracene	8.43		5.375	0.65	2.23E+02	1.24E+00	1.24E+00
Benzo(a)pyrene	7.11		4.533	280	9.59E+04	6.34E+02	6.30E+02
Benzo(b)fluoranthene	4.950		3.158	280	9.59E+04	9.11E+02	9.02E+02
Benzo(ghi)perylene	11.51		7.342	280	9.59E+04	3.92E+02	3.90E+02
Benzo(k)fluoranthene	7.69		4.907	280	9.59E+04	5.86E+02	5.83E+02
Chrysene	5.353		3.415	280	9.59E+04	8.42E+02	8.35E+02
Dibenzo(a,h)anthracene	25.66		16.371	280	9.59E+04	1.76E+02	1.75E+02
Fluoranthene	14.99		9.561	280	9.59E+04	3.01E+02	3.00E+02
Fluorene	3.821		2.438	32.5	1.11E+04	1.37E+02	1.35E+02
Hexachlorobenzene	8.62		5.496	0.67	2.29E+02	1.25E+00	1.25E+00
Hexachlorobutadiene		5.655	26.304	4	1.37E+03	1.56E+00	1.56E+00

Appendix F-3 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Heron[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Hexachlorocyclopentadiene							
Hexachloroethane		6.603	30.710	17.2	5.89E+03	5.75E+00	5.75E+00
Indeno(1,2,3-cd)pyrene	15.48		9.873	280	9.59E+04	2.91E+02	2.90E+02
Pentachlorophenol		12.953	60.246	7.6	2.60E+03	1.30E+00	1.30E+00
Phenanthrene	3.207		2.046	32.5	1.11E+04	1.63E+02	1.61E+02
Pyrene	1.548		0.988	280	9.59E+04	2.91E+03	2.83E+03
Total HPAH [c]	7.11		4.533	280	9.59E+04	6.34E+02	6.30E+02
Total LPAH [d]	3.821		2.438	32.5	1.11E+04	1.37E+02	1.35E+02
Total PAH [c]	7.11		4.533	32.5	1.11E+04	7.36E+01	7.32E+01
Organochlorine Pesticides by EPA Method 8081A / NOAA 130							
4,4'-DDD	5.15		3.288	0.227	7.77E+01	7.09E-01	7.03E-01
4,4'-DDE	39.18		24.993	0.227	7.77E+01	9.33E-02	9.32E-02
4,4'-DDT	2.76		1.762	0.227	7.77E+01	1.32E+00	1.30E+00
Aldrin	0.420		0.268	0.007	2.40E+00	2.68E-01	2.41E-01
alpha-Chlordane	7.16		4.570	2.14	7.33E+02	4.81E+00	4.78E+00
Chlordane [e]	7.16		4.570	2.14	7.33E+02	4.81E+00	4.78E+00
gamma-Chlordane	5.42		3.459	2.14	7.33E+02	6.36E+00	6.30E+00
BHC-alpha	0.87		0.555	0.571	1.96E+02	1.06E+01	1.00E+01
BHC-beta [f]	0.887		0.566	0.571	1.96E+02	1.04E+01	9.84E+00
BHC, delta	1.033		0.659	0.571	1.96E+02	8.90E+00	8.52E+00
gamma-Hexachlorocyclohexane (BHC) (Lindane)	0.887		0.566	0.571	1.96E+02	1.04E+01	9.84E+00
Dieldrin	17.57		11.21	0.0709	2.43E+01	6.50E-02	6.48E-02
Endosulfan I		12.525	58.26	10	3.42E+03	1.76E+00	1.76E+00
Endosulfan II		4.792	22.29	10	3.42E+03	4.61E+00	4.60E+00
Endrin		4.787	22.26	0.01	3.42E+00	4.61E-03	4.61E-03
Heptachlor	10.07		6.424	0.28	9.59E+01	4.48E-01	4.46E-01

Appendix F-3 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Heron[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Heptachlor Epoxide	0.711		0.453	0.28	9.59E+01	6.34E+00	5.95E+00
Hexachlorobenzene	8.62		5.496	0.67	2.29E+02	1.25E+00	1.25E+00
Methoxychlor	2		1.276	80	2.74E+04	6.44E+02	6.29E+02
Mirex	16.00		10.209	3.3	1.13E+03	3.32E+00	3.31E+00
Toxaphene	1		0.638	0.398	1.36E+02	6.41E+00	6.12E+00
TCL PCBs by EPA Method 8082 / NOAA 130							
Aroclor 1016 [g]	4.79		3.056	0.18	6.16E+01	6.05E-01	5.99E-01
Aroclor 1221 [g]	4.79		3.056	0.18	6.16E+01	6.05E-01	5.99E-01
Aroclor 1232 [g]	4.79		3.056	0.18	6.16E+01	6.05E-01	5.99E-01
Aroclor 1242 [g]	4.79		3.056	0.18	6.16E+01	6.05E-01	5.99E-01
Aroclor 1248	1.203		0.767	0.18	6.16E+01	2.41E+00	2.32E+00
Aroclor 1254	4.79		3.056	0.18	6.16E+01	6.05E-01	5.99E-01
Aroclor 1260	0.572		0.365	0.18	6.16E+01	5.07E+00	4.68E+00
Aroclor 1268 [g]	4.79		3.056	0.18	6.16E+01	6.05E-01	5.99E-01
PCB Congeners by EPA Method 1668A							
Total PCB congeners [h]	23.98		15.301	0.41	1.40E+02	2.75E-01	2.75E-01
Total PCBs as Aroclors	23.98		15.301	0.18	6.16E+01	1.21E-01	1.21E-01
TAL Metals by EPA Method 6020/6010							
Arsenic		0.233	1.082	2.24	7.67E+02	2.13E+01	2.07E+01
Cadmium		2.660	12.374	1.47	5.03E+02	1.22E+00	1.22E+00
Chromium		0.032	0.149	2.66	9.11E+02	1.84E+02	1.53E+02
Chromium (VI)							
Copper		0.760	3.537	4.05	1.39E+03	1.18E+01	1.17E+01
Lead		0.022	0.103	1.63	5.58E+02	1.62E+02	1.26E+02
Methylmercury		646	3007	0.0064	2.19E+00	2.19E-05	2.19E-05
Nickel		0.189	0.877	6.71	2.30E+03	7.86E+01	7.60E+01

Appendix F-3 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Heron[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Selenium		1.432	6.663	0.29	9.93E+01	4.47E-01	4.45E-01
Silver	1		0.638	2.02	6.92E+02	3.25E+01	3.11E+01
Zinc		0.318	1.479	66.1	2.26E+04	4.59E+02	4.50E+02
TCL Dioxins and Furans by EPA 1613B							
Dioxin/furan congeners or as TCDD	3.558		2.270	0.000014	4.79E-03	6.34E-05	6.25E-05

Notes:

Blank cells - No toxicity data available to develop TRV.

BAF - biota-sediment accumulation factor (kg dry weight/kg dry weight)

BSAF (OC/lipid basis) - biota-sediment accumulation factor (kg lipid/kg organic carbon)

dry wt basis - dry weight basis

kg - kilogram

mg - milligram

mg/kg - milligram per kilogram

mg/kg_{bw}/day - milligram per kilogram body weight per day

NOAEL - no-observed adverse effect level

$SL_{food\text{-}ingestion}$ - sediment screening level based on food ingestion

SL_{sed} - wildlife-based sediment screening level (mg/kg)

$SL_{sed\text{-}ingestion}$ - sediment screening level based on the incidental sediment ingestion

TRV - toxicity reference value

wet wt basis - wet weight basis

[1] See memorandum text for equations and parameter definitions.

[a] BSAF based on all receptors (used all receptors to have a more complete list). When no BSAF available, a value of 1.0 was assumed.

[b] BAF based on all invertebrates for hexachloroethane, hexachlorobutadiene, pentachlorophenol, endrin, arsenic, cadmium, chromium, copper, lead, methylmercury, nickel, selenium, and zinc.

[c] BSAF is assumed equal to that for benzo(a)pyrene.

[d] BSAF is assumed equal to that for fluorene

[e] BSAF is assumed equal to that for chlorodane-alpha.

[f] BSAF is assumed equal to that for lindane.

[g] BSAF is assumed equal to that for Aroclor 1254.

[h] BSAF is assumed equal to that for total PCBs.

Appendix F-4 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Cormorant[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
TCL Volatiles by EPA Method 8260a							
1,2,4-trichlorobenzene (TCB)							
1,2-dichlorobenzene							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene							
Hexachloroethane		2.508	8.802	17.2	3.43E+04	3.90E+01	3.89E+01
TCL Semivolatiles by EPA Method 8270							
1,2,4,5-tetrachlorobenzene							
1,2-dichlorobenzene							
1,4-Dichlorobenzene							
4-chlorophenyl phenyl ether							
4-bromophenyl phenyl ether							
Acenaphthene	2.040		1.191	32.5	6.49E+04	5.44E+02	5.40E+02
Acenaphthylene	5.074		2.963	32.5	6.49E+04	2.19E+02	2.18E+02
Anthracene	6.308		3.683	32.5	6.49E+04	1.76E+02	1.76E+02
Benzo(a)anthracene	8.43		4.919	0.65	1.30E+03	2.64E+00	2.63E+00
Benzo(a)pyrene	7.11		4.150	280	5.59E+05	1.35E+03	1.34E+03
Benzo(b)fluoranthene	4.950		2.891	280	5.59E+05	1.93E+03	1.93E+03
Benzo(ghi)perylene	11.51		6.720	280	5.59E+05	8.31E+02	8.30E+02
Benzo(k)fluoranthene	7.69		4.492	280	5.59E+05	1.24E+03	1.24E+03
Chrysene	5.353		3.126	280	5.59E+05	1.79E+03	1.78E+03
Dibenzo(a,h)anthracene	25.66		14.985	280	5.59E+05	3.73E+02	3.73E+02
Fluoranthene	14.99		8.752	280	5.59E+05	6.38E+02	6.38E+02
Fluorene	3.821		2.231	32.5	6.49E+04	2.91E+02	2.89E+02
Hexachlorobenzene	8.62		5.030	0.67	1.34E+03	2.66E+00	2.65E+00
Hexachlorobutadiene		2.461	8.634	4	7.98E+03	9.24E+00	9.23E+00

Appendix F-4 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Cormorant[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Hexachlorocyclopentadiene							
Hexachloroethane		2.508	8.802	17.2	3.43E+04	3.90E+01	3.89E+01
Indeno(1,2,3-cd)pyrene	15.48		9.037	280	5.59E+05	6.18E+02	6.18E+02
Pentachlorophenol		4.074	14.296	7.6	1.52E+04	1.06E+01	1.06E+01
Phenanthrene	3.207		1.872	32.5	6.49E+04	3.46E+02	3.45E+02
Pyrene	1.548		0.904	280	5.59E+05	6.18E+03	6.11E+03
Total HPAH [c]	7.11		4.150	280	5.59E+05	1.35E+03	1.34E+03
Total LPAH [d]	3.821		2.231	32.5	6.49E+04	2.91E+02	2.89E+02
Total PAH [c]	7.11		4.150	32.5	6.49E+04	1.56E+02	1.56E+02
Organochlorine Pesticides by EPA Method 8081A / NOAA 130							
4,4'-DDD	5.15		3.010	0.227	4.53E+02	1.51E+00	1.50E+00
4,4'-DDE	39.18		22.876	0.227	4.53E+02	1.98E-01	1.98E-01
4,4'-DDT	2.76		1.613	0.227	4.53E+02	2.81E+00	2.79E+00
Aldrin	0.420		0.245	0.007	1.40E+01	5.70E-01	5.47E-01
alpha-Chlordane	7.16		4.183	2.14	4.27E+03	1.02E+01	1.02E+01
Chlordane [e]	7.16		4.183	2.14	4.27E+03	1.02E+01	1.02E+01
gamma-Chlordane	5.42		3.166	2.14	4.27E+03	1.35E+01	1.34E+01
BHC-alpha	0.87		0.508	0.571	1.14E+03	2.24E+01	2.20E+01
BHC-beta [f]	0.887		0.518	0.571	1.14E+03	2.20E+01	2.16E+01
BHC, delta	1.033		0.603	0.56	1.12E+03	1.85E+01	1.82E+01
gamma-Hexachlorocyclohexane (BHC) (Lindane)	0.887		0.518	0.571	1.14E+03	2.20E+01	2.16E+01
Dieldrin	17.57		10.261	0.0709	1.41E+02	1.38E-01	1.38E-01
Endosulfan I		2.266	7.950	10	2.00E+04	2.51E+01	2.51E+01
Endosulfan II		2.214	7.767	10	2.00E+04	2.57E+01	2.57E+01
Endrin		1.800	6.317	0.01	2.00E+01	3.16E-02	3.15E-02
Heptachlor	10.07		5.880	0.28	5.59E+02	9.50E-01	9.49E-01

Appendix F-4 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Cormorant[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Heptachlor Epoxide	0.711		0.415	0.28	5.59E+02	1.35E+01	1.31E+01
Hexachlorobenzene	8.62		5.030	0.67	1.34E+03	2.66E+00	2.65E+00
Methoxychlor	2		1.168	80	1.60E+05	1.37E+03	1.36E+03
Mirex	16.00		9.344	3.3	6.58E+03	7.05E+00	7.04E+00
Toxaphene	1		0.584	0.398	7.94E+02	1.36E+01	1.34E+01
TCL PCBs by EPA Method 8082 / NOAA 130							
Aroclor 1016 [g]	4.79		2.797	0.18	3.59E+02	1.28E+00	1.28E+00
Aroclor 1221 [g]	4.79		2.797	0.18	3.59E+02	1.28E+00	1.28E+00
Aroclor 1232 [g]	4.79		2.797	0.18	3.59E+02	1.28E+00	1.28E+00
Aroclor 1242 [g]	4.79		2.797	0.18	3.59E+02	1.28E+00	1.28E+00
Aroclor 1248	1.203		0.702	0.18	3.59E+02	5.11E+00	5.04E+00
Aroclor 1254	4.79		2.797	0.18	3.59E+02	1.28E+00	1.28E+00
Aroclor 1260	0.572		0.334	0.18	3.59E+02	1.08E+01	1.04E+01
Aroclor 1268 [g]	4.79		2.797	0.18	3.59E+02	1.28E+00	1.28E+00
PCB Congeners by EPA Method 1668A							
Total PCB congeners [h]	23.98		14.005	0.41	8.18E+02	5.84E-01	5.84E-01
Total PCBs as Aroclors	23.98		14.005	0.18	3.59E+02	2.56E-01	2.56E-01
TAL Metals by EPA Method 6020/6010							
Arsenic		0.688	2.415	2.24	4.47E+03	1.85E+01	1.84E+01
Cadmium		0.915	3.211	1.47	2.93E+03	9.13E+00	9.11E+00
Chromium		0.027	0.096	2.66	5.31E+03	5.52E+02	5.00E+02
Chromium (VI)							
Copper		0.247	0.868	4.05	8.08E+03	9.31E+01	9.20E+01
Lead		0.054	0.191	1.63	3.25E+03	1.71E+02	1.62E+02
Methylmercury		0.693	2.433	0.0064	1.28E+01	5.25E-02	5.23E-02
Nickel		0.133	0.465	6.71	1.34E+04	2.88E+02	2.82E+02

Appendix F-4 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Cormorant[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Selenium		3.347	11.743	0.29	5.79E+02	4.93E-01	4.92E-01
Silver	1		0.584	2.02	4.03E+03	6.90E+01	6.79E+01
Zinc		0.493	1.730	66.1	1.32E+05	7.63E+02	7.58E+02
TCL Dioxins and Furans by EPA 1613B							
Dioxin/furan congeners or as TCDD	3.558		2.078	0.000014	2.79E-02	1.34E-04	1.34E-04

Notes:

Blank cells - No toxicity data available to develop TRV

BAF - biota-sediment accumulation factor (kg dry weight/kg dry weight)

BSAF (OC/lipid basis) - biota-sediment accumulation factor (kg lipid/kg organic carbon)

dry wt basis - dry weight basis

kg - kilogram

mg - milligram

mg/kg - milligram per kilogram

mg/kg_{bw}/day - milligram per kilogram body weight per day

NOAEL - no-observed adverse effect level

$SL_{food\text{-}ingestion}$ - sediment screening level based on food ingestion

SL_{sed} - wildlife-based sediment screening level (mg/kg)

$SL_{sed\text{-}ingestion}$ - sediment screening level based on the incidental sediment ingestion

TRV - toxicity reference value

wet wt basis - wet weight basis

[1] See memorandum text for equations and parameter definitions.

[a] BSAF based on all receptors (used all receptors to have a more complete list). When no BSAF available, a value of 1.0 was assumed.

[b] BAF based on all invertebrates for hexachlorobutadiene, pentachlorophenol, endrin, arsenic, cadmium, chromium, copper, lead, methylmercury, nickel, selenium, and zinc.

[c] BSAF is assumed equal to that for benzo(a)pyrene.

[d] BSAF is assumed equal to that for fluorene.

[e] BSAF is assumed equal to that for chlorodane-alpha.

[f] BSAF is assumed equal to that for lindane.

[g] BSAF is assumed equal to that for Aroclor 1254.

[h] BSAF is assumed equal to that for total PCBs.

Appendix F-5 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Raccoon[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) ($mg/kg_{bw}/day$)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
TCL Volatiles by EPA Method 8260							
1,2,4-trichlorobenzene (TCB)	1		0.638	120	2.51E+04	3.70E+03	3.23E+03
1,2-Dichlorobenzene							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene							
Hexachloroethane		6.603	30.7	12	2.42E+03	7.40E+00	7.37E+00
TCL Semivolatiles by EPA Method 8270							
1,2,4,5-Tetrachlorobenzene	1		0.638	0.185	3.87E+01	5.71E+00	4.98E+00
1,2-Dichlorobenzene							
1,4-Dichlorobenzene							
4-Bromophenyl Phenyl Ether	1		0.638	100	2.09E+04	3.09E+03	2.69E+03
4-Chlorophenyl Phenyl Ether	1		0.638	100	2.09E+04	3.09E+03	2.69E+03
Acenaphthene	2.040		1.301	32.7	6.85E+03	4.95E+02	4.62E+02
Acenaphthylene	5.074		3.237	32.7	6.85E+03	1.99E+02	1.93E+02
Anthracene	6.308		4.024	32.7	6.85E+03	1.60E+02	1.56E+02
Benzo(a)anthracene	8.43		5.375	0.192	4.02E+01	7.04E-01	6.92E-01
Benzo(a)pyrene	7.11		4.533	0.192	4.02E+01	8.34E-01	8.17E-01
Benzo(b)fluoranthene	4.950		3.158	0.192	4.02E+01	1.20E+00	1.16E+00
Benzo(g,h,i)perylene	11.51		7.342	0.192	4.02E+01	5.15E-01	5.09E-01
Benzo(k)fluoranthene	7.69		4.907	0.192	4.02E+01	7.71E-01	7.56E-01
Chrysene	5.353		3.415	0.192	4.02E+01	1.11E+00	1.08E+00
Dibenzo(a,h)anthracene	25.66		16.37	0.192	4.02E+01	2.31E-01	2.30E-01
Fluoranthene	14.99		9.561	0.192	4.02E+01	3.96E-01	3.92E-01
Fluorene	3.821		2.438	32.7	6.85E+03	2.64E+02	2.54E+02
Hexachlorobenzene	8.62		5.496	1.57	3.29E+02	5.63E+00	5.54E+00
Hexachlorobutadiene		5.655	26.304	1.09	2.28E+02	8.16E-01	8.13E-01

Appendix F-5 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Raccoon[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) ($mg/kg_{bw}/day$)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Hexachlorocyclopentadiene							
Hexachloroethane		6.603	30.710	12	2.42E+03	7.40E+00	7.37E+00
Indeno(1,2,3-cd)pyrene	15.48		9.873	0.192	4.02E+01	3.83E-01	3.79E-01
Pentachlorophenol		12.953	60.25	0.131	2.74E+01	4.27E-02	4.26E-02
Phenanthrene	3.207		2.046	32.7	6.85E+03	3.15E+02	3.01E+02
Pyrene	1.548		0.988	0.192	4.02E+01	3.83E+00	3.50E+00
Total HPAH [c]	7.11		4.533	0.192	4.02E+01	8.34E-01	8.17E-01
Total LPAH [d]	3.821		2.438	32.7	6.85E+03	2.64E+02	2.54E+02
Total PAH [c]	7.11		4.533	0.192	4.02E+01	8.34E-01	8.17E-01
Organochlorine Pesticides by EPA Method 8081A / NOAA 130							
4,4'-DDD	5.15		3.288	0.054	1.13E+01	3.23E-01	3.14E-01
4,4'-DDE	39.18		24.99	0.054	1.13E+01	4.24E-02	4.23E-02
4,4'-DDT	2.76		1.762	0.054	1.13E+01	6.02E-01	5.71E-01
Aldrin	0.420		0.268	0.109	2.28E+01	8.00E+00	5.92E+00
alpha-Chlordane	7.16		4.570	1.14	2.39E+02	4.92E+00	4.82E+00
Chlordane [e]	7.16		4.570	1.14	2.39E+02	4.92E+00	4.82E+00
gamma-Chlordane	5.42		3.459	1.14	2.39E+02	6.50E+00	6.33E+00
BHC-alpha	0.87		0.555	4.35	9.12E+02	1.54E+02	1.32E+02
BHC-beta [f]	0.887		0.566	0.218	4.56E+01	7.57E+00	6.49E+00
BHC, delta	1.033		0.659	4.35	9.12E+02	1.30E+02	1.14E+02
BHC-gamma (Lindane)	0.887		0.566	4.35	9.12E+02	1.51E+02	1.30E+02
Dieldrin	17.57		11.21	0.007	1.52E+00	1.27E-02	1.26E-02
Endosulfan I		12.525	58.26	0.082	1.71E+01	2.76E-02	2.75E-02
Endosulfan II		4.792	22.29	0.082	1.71E+01	7.21E-02	7.18E-02
Endrin		4.787	22.26	0.027	5.67E+00	2.40E-02	2.39E-02
Heptachlor	10.07		6.424	0.265	5.55E+01	8.12E-01	8.00E-01

Appendix F-5 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Raccoon[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) ($mg/kg_{bw}/day$)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Heptachlor Epoxide							
Hexachlorobenzene	8.62		5.496	1.57	3.29E+02	5.63E+00	5.54E+00
Methoxychlor	2		1.276	2.18	4.56E+02	3.36E+01	3.13E+01
Mirex	16.00		10.21	0.381	7.98E+01	7.35E-01	7.28E-01
Toxaphene	1		0.638	4.35	9.12E+02	1.34E+02	1.17E+02
TCL PCBs by EPA Method 8082 / NOAA 130							
Aroclor 1016 [g]	4.79		3.056	0.969	2.03E+02	6.25E+00	6.06E+00
Aroclor 1221 [g]	4.79		3.056	0.017	3.47E+00	1.07E-01	1.03E-01
Aroclor 1232 [g]	4.79		3.056	0.017	3.47E+00	1.07E-01	1.03E-01
Aroclor 1242 [g]	4.79		3.056	0.049	1.02E+01	3.15E-01	3.05E-01
Aroclor 1248	1.203		0.767	0.009	1.93E+00	2.36E-01	2.10E-01
Aroclor 1254	4.79		0.997	0.017	3.47E+00	3.27E-01	2.99E-01
Aroclor 1260	0.572		0.365	0.017	3.47E+00	8.93E-01	7.10E-01
Aroclor 1268 [g]	4.79		3.056	0.017	3.47E+00	1.07E-01	1.03E-01
PCB Congeners by EPA Method 1668A							
Total PCB congeners [h]	23.98		15.30	0.011	2.22E+00	1.36E-02	1.35E-02
Total PCBs as Aroclors	23.98		15.30	0.017	3.47E+00	2.13E-02	2.12E-02
TAL Metals by EPA Method 6020/6010							
Arsenic		0.233	1.082	1.31	2.75E+02	2.39E+01	2.20E+01
Cadmium		2.660	12.37	0.441	9.24E+01	7.02E-01	6.97E-01
Chromium		0.032	0.149	2.40	5.03E+02	3.18E+02	1.95E+02
Chromium (VI) [i]			0.149	9.24	1.94E+03	1.22E+03	7.50E+02
Copper		0.760	3.537	12.5	2.62E+03	6.97E+01	6.79E+01
Lead		0.022	0.103	2.46	5.15E+02	4.69E+02	2.45E+02
Methylmercury		646	3007	0.0106	2.22E+00	6.95E-05	6.95E-05
Nickel		0.189	0.877	0.5006	1.05E+02	1.12E+01	1.01E+01

Appendix F-5 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Raccoon[1]

Chemical	Maximum BSAF[a] (OC/lipid basis)	Maximum BAF[b] (wet wt basis)	Maximum BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Selenium		1.432	6.663	0.2078	4.35E+01	6.14E-01	6.06E-01
Silver	1		0.638	7.35	1.54E+03	2.27E+02	1.98E+02
Zinc		0.318	1.479	75.4	1.58E+04	1.00E+03	9.44E+02
TCL Dioxins and Furans by EPA 1613B							
Dioxin/furan total congeners or as TCDD	3.558		2.270	5.44219E-07	1.14E-04	4.72E-06	4.53E-06

Notes:

Blank cells - No toxicity data available to develop TRV

BAF - biota-sediment accumulation factor (kg dry weight/kg dry weight)

BSAF (OC/lipid basis) - biota-sediment accumulation factor (kg lipid/kg organic carbon)

dry wt basis - dry weight basis

kg - kilogram

mg - milligram

mg/kg - milligram per kilogram

mg/kg_{bw}/day - milligram per kilogram body weight per day

NOAEL - no-observed adverse effect level

$SL_{food\text{-}ingestion}$ - sediment screening level based on food ingestion

SL_{sed} - wildlife-based sediment screening level (mg/kg)

$SL_{sed\text{-}ingestion}$ - sediment screening level based on the incidental sediment ingestion

TRV - toxicity reference value

wet wt basis - wet weight basis

[1] See memorandum text for equations and parameter definitions.

[a] BSAF based on all receptors (used all receptors to have a more complete list). When no BSAF available, a value of 1.0 was assumed.

[b] BAF based on all invertebrates for hexachlorobutadiene, pentachlorophenol, endrin, arsenic, cadmium, chromium, copper, lead, methylmercury, nickel, selenium, and zinc.

[c] BSAF is assumed equal to that for benzo(a)pyrene.

[d] BSAF is assumed equal to that for fluorene.

[e] BSAF is assumed equal to that for chlorodane-alpha.

[f] BSAF is assumed equal to that for lindane.

[g] BSAF is assumed equal to that for Aroclor 1254.

[h] BSAF is assumed equal to that for total PCBs.

[i] BSAF is assumed equal to that for chromium.

APPENDIX G
NEWTOWN CREEK SLERA: WILDLIFE BASED SEDIMENT SCREENING LEVELS (AVERAGE BSAFS)

Appendix G-1 Newtown Creek SLERA: Wildlife Based Sediment Screening Levels (Summary - Average BSAFs)

Chemical	SL_{sed} Sandpiper (mg/kg)	SL_{sed} Heron (mg/kg)	SL_{sed} Cormorant (mg/kg)	SL_{sed} Raccoon (mg/kg)
TCL Volatiles by EPA Method 8260				
1,2,4-trichlorobenzene (TCB)				3.23E+03
1,2-dichlorobenzene				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene				
Hexachloroethane	1.73E+01	3.36E+01	4.82E+02	4.27E+01
TCL Semivolatiles by EPA Method 8270				
1,2,4,5-tetrachlorobenzene				4.98E+00
1,2-dichlorobenzene				
1,4-Dichlorobenzene				
4-chlorophenyl phenyl ether				2.69E+03
4-bromophenyl phenyl ether				2.69E+03
Acenaphthene	3.47E+02	1.46E+03	3.37E+03	2.20E+03
Acenaphthylene	2.56E+02	8.46E+02	1.89E+03	1.41E+03
Anthracene	2.41E+02	8.89E+02	1.99E+03	1.47E+03
Benzo(a)anthracene	5.98E+00	6.11E+00	1.32E+01	3.27E+00
Benzo(a)pyrene	3.28E+03	2.78E+03	6.01E+03	3.44E+00
Benzo(b)fluoranthene	2.16E+03	5.87E+03	1.30E+04	6.83E+00
Benzo(ghi)perylene	2.85E+03	1.80E+03	3.87E+03	2.28E+00
Benzo(k)fluoranthene	9.66E+02	3.87E+03	8.43E+03	4.68E+00
Chrysene	2.60E+03	4.32E+03	9.44E+03	5.18E+00
Dibenzo(a,h)anthracene	1.40E+03	5.82E+02	1.24E+03	7.55E-01

Appendix G-1 Newtown Creek SLERA: Wildlife Based Sediment Screening Levels (Summary - Average BSAFs)

Chemical	SL_{sed} Sandpiper (mg/kg)	SL_{sed} Heron (mg/kg)	SL_{sed} Cormorant (mg/kg)	SL_{sed} Raccoon (mg/kg)
Fluoranthene	1.40E+03	4.36E+03	9.54E+03	5.23E+00
Fluorene	2.26E+02	9.95E+02	2.24E+03	1.61E+03
Hexachlorobenzene	2.01E+00	3.18E+00	6.80E+00	1.39E+01
Hexachlorobutadiene	4.50E+00	8.81E+00	9.50E+01	4.54E+00
Hexachlorocyclopentadiene				
Hexachloroethane	1.73E+01	3.36E+01	4.82E+02	4.27E+01
Indeno(1,2,3-cd)pyrene	2.57E+03	1.16E+03	2.47E+03	1.48E+00
Pentachlorophenol	3.48E+00	6.58E+00	1.05E+02	2.16E-01
Phenanthrene	3.10E+02	6.39E+02	1.41E+03	1.10E+03
Pyrene	2.85E+03	1.31E+04	3.03E+04	1.33E+01
Total HPAH	3.28E+03	2.78E+03	6.01E+03	3.44E+00
Total LPAH	2.26E+02	9.95E+02	2.24E+03	1.61E+03
Total PAH	3.81E+02	3.23E+02	6.97E+02	3.44E+00
Organochlorine Pesticides by EPA Method 8081A / NOAA 130				
4,4'-DDD	7.27E-01	1.52E+00	3.26E+00	6.63E-01
4,4'-DDE	2.73E-01	2.58E-01	5.49E-01	1.17E-01
4,4'-DDT	2.24E+00	2.79E+00	6.06E+00	1.18E+00
Aldrin	8.32E-02	3.98E-01	9.43E-01	8.75E+00
alpha-Chlordane	5.41E+00	1.26E+01	2.71E+01	1.25E+01
Chlordane	5.41E+00	1.26E+01	2.71E+01	1.25E+01
gamma-Chlordane	5.41E+00	9.81E+00	2.10E+01	9.76E+00
BHC-alpha	3.85E+00	1.38E+01	3.06E+01	1.75E+02

Appendix G-1 Newtown Creek SLERA: Wildlife Based Sediment Screening Levels (Summary - Average BSAFs)

Chemical	SL_{sed} Sandpiper (mg/kg)	SL_{sed} Heron (mg/kg)	SL_{sed} Cormorant (mg/kg)	SL_{sed} Raccoon (mg/kg)
BHC-beta	4.85E+00	1.82E+01	4.10E+01	1.11E+01
BHC, delta	9.17E+00	1.97E+01	4.38E+01	2.37E+02
gamma-Hexachlorocyclohexane (BHC) (Lindane)	4.85E+00	1.82E+01	4.10E+01	2.22E+02
Dieldrin	1.59E-01	1.56E-01	3.32E-01	3.01E-02
Endosulfan I	5.71E+00	1.09E+01	5.56E+01	1.69E-01
Endosulfan II	1.11E+01	2.18E+01	7.24E+01	3.36E-01
Endrin	1.04E-02	2.02E-02	8.17E-02	1.04E-01
Heptachlor	9.60E-01	2.36E+00	5.08E+00	4.06E+00
Heptachlor Epoxide	3.03E+00	7.03E+00	1.57E+01	
Hexachlorobenzene	2.01E+00	3.18E+00	6.80E+00	1.39E+01
Methoxychlor	6.03E+01	1.03E+03	2.25E+03	4.99E+01
Mirex	7.17E+00	1.64E+01	3.52E+01	3.53E+00
Toxaphene	2.19E+00	6.12E+00	1.34E+01	1.17E+02
TCL PCBs by EPA Method 8082 / NOAA 130				
Aroclor 1016	6.74E-01	1.69E+00	3.64E+00	1.64E+01
Aroclor 1221	6.74E-01	1.69E+00	3.64E+00	2.81E-01
Aroclor 1232	6.74E-01	1.69E+00	3.64E+00	2.81E-01
Aroclor 1242	6.74E-01	1.69E+00	3.64E+00	8.28E-01
Aroclor 1248	1.46E+00	4.90E+00	1.10E+01	4.11E-01
Aroclor 1254	6.74E-01	1.69E+00	3.64E+00	2.99E-01
Aroclor 1260	2.17E+00	1.06E+01	2.52E+01	1.36E+00
Aroclor 1268	6.74E-01	1.69E+00	3.64E+00	2.81E-01

Appendix G-1 Newtown Creek SLERA: Wildlife Based Sediment Screening Levels (Summary - Average BSAFs)

Chemical	SL_{sed} Sandpiper (mg/kg)	SL_{sed} Heron (mg/kg)	SL_{sed} Cormorant (mg/kg)	SL_{sed} Raccoon (mg/kg)
PCB Congeners by EPA Method 1668A				
Total PCB congeners	5.71E-01	1.41E+00	3.02E+00	6.85E-02
Total PCBs as Aroclors	2.50E-01	6.21E-01	1.33E+00	1.07E-01
TAL Metals by EPA Method 6020/6010				
Arsenic	1.37E+01	3.60E+01	1.28E+02	3.67E+01
Cadmium	2.72E+00	5.53E+00	1.04E+02	3.11E+00
Chromium	4.36E+01	3.94E+02	1.23E+03	3.54E+02
Chromium (VI)				1.36E+03
Copper	1.90E+01	4.55E+01	4.62E+02	2.52E+02
Lead	2.71E+01	2.61E+02	1.05E+03	3.78E+02
Methylmercury	5.89E-05	1.09E-04	2.13E-01	3.46E-04
Nickel	6.30E+01	2.14E+02	2.10E+03	2.55E+01
Selenium	4.79E-01	9.62E-01	2.16E+00	1.30E+00
Silver	1.11E+01	3.11E+01	6.79E+01	1.98E+02
Zinc	4.64E+02	1.30E+03	2.12E+03	2.53E+03
TCL Dioxins and Furans by EPA 1613B				
Dioxin/furan congeners or as TCDD	1.42E-04	3.36E-04	7.45E-04	2.18E-05

Notes:

BSAF - biota-sediment accumulation factor

mg/kg - milligram per kilogram

SL_{sed} - wildlife-based sediment screening level (mg/kg)

Appendix G-2 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Sandpiper[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
TCL Volatiles by EPA Method 8260							
1,2,4-trichlorobenzene (TCB)							
1,2-dichlorobenzene							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene							
Hexachloroethane		1.125	5.231	17.2	3.19E+02	1.83E+01	1.73E+01
TCL Semivolatiles by EPA Method 8270							
1,2,4,5-tetrachlorobenzene							
1,2-dichlorobenzene							
1,4-Dichlorobenzene							
4-chlorophenyl phenyl ether							
4-bromophenyl phenyl ether							
Acenaphthene	0.313		0.221	32.5	6.02E+02	8.16E+02	3.47E+02
Acenaphthylene	0.571		0.404	32.5	6.02E+02	4.47E+02	2.56E+02
Anthracene	0.636		0.451	32.5	6.02E+02	4.01E+02	2.41E+02
Benzo(a)anthracene	0.430		0.304	0.65	1.20E+01	1.19E+01	5.98E+00
Benzo(a)pyrene	0.247		0.175	280	5.19E+03	8.91E+03	3.28E+03
Benzo(b)fluoranthene	0.595		0.421	280	5.19E+03	3.69E+03	2.16E+03
Benzo(ghi)perylene	0.347		0.246	280	5.19E+03	6.34E+03	2.85E+03
Benzo(k)fluoranthene	1.851		1.311	280	5.19E+03	1.19E+03	9.66E+02
Chrysene	0.422		0.299	280	5.19E+03	5.20E+03	2.60E+03
Dibenzo(a,h)anthracene	1.146		0.812	280	5.19E+03	1.92E+03	1.40E+03
Fluoranthene	1.149		0.813	280	5.19E+03	1.91E+03	1.40E+03
Fluorene	0.704		0.499	32.5	6.02E+02	3.62E+02	2.26E+02
Hexachlorobenzene	2.195		1.554	0.67	1.24E+01	2.40E+00	2.01E+00
Hexachlorobutadiene		0.997	4.636	4	7.41E+01	4.80E+00	4.50E+00

Appendix G-2 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Sandpiper[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Hexachlorocyclopentadiene							
Hexachloroethane		1.125	5.231	17.2	3.19E+02	1.83E+01	1.73E+01
Indeno(1,2,3-cd)pyrene	0.431		0.305	280	5.19E+03	5.10E+03	2.57E+03
Pentachlorophenol		2.545	11.835	7.6	1.41E+02	3.57E+00	3.48E+00
Phenanthrene	0.399		0.283	32.5	6.02E+02	6.39E+02	3.10E+02
Pyrene	0.347		0.246	280	5.19E+03	6.33E+03	2.85E+03
Total HPAH [c]	0.247		0.175	280	5.19E+03	8.91E+03	3.28E+03
Total LPAH [d]	0.704		0.499	32.5	6.02E+02	3.62E+02	2.26E+02
Total PAH [c]	0.247		0.175	32.5	6.02E+02	1.03E+03	3.81E+02
Organochlorine Pesticides by EPA Method 8081A / NOAA 130							
4,4'-DDD	2.027		1.435	0.227	4.21E+00	8.79E-01	7.27E-01
4,4'-DDE	6.094		4.315	0.227	4.21E+00	2.92E-01	2.73E-01
4,4'-DDT	0.370		0.262	0.227	4.21E+00	4.81E+00	2.24E+00
Aldrin	0.237		0.167	0.007	1.30E-01	2.32E-01	8.32E-02
alpha-Chlordane	2.684		1.900	2.14	3.96E+01	6.26E+00	5.41E+00
Chlordane [e]	2.684		1.900	2.14	3.96E+01	6.26E+00	5.41E+00
gamma-Chlordane [e]	2.684		1.900	2.14	3.96E+01	6.26E+00	5.41E+00
BHC-alpha	0.740		0.524	0.571	1.06E+01	6.06E+00	3.85E+00
BHC-beta [f]	0.500		0.354	0.571	1.06E+01	8.96E+00	4.85E+00
BHC, delta	0.065		0.046	0.571	1.06E+01	6.90E+01	9.17E+00
gamma-Hexachlorocyclohexane (BHC) (Lindane)	0.500		0.354	0.571	1.06E+01	8.96E+00	4.85E+00
Dieldrin	3.085		2.184	0.0709	1.31E+00	1.80E-01	1.59E-01
Endosulfan I		2.028	9.433	10	1.85E+02	5.89E+00	5.71E+00
Endosulfan II		1.008	4.689	10	1.85E+02	1.19E+01	1.11E+01
Endrin		1.087	5.057	0.01	1.85E-01	1.10E-02	1.04E-02
Heptachlor	1.865		1.321	0.28	5.19E+00	1.18E+00	9.60E-01

Appendix G-2 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Sandpiper[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Heptachlor Epoxide	0.302		0.214	0.28	5.19E+00	7.28E+00	3.03E+00
Hexachlorobenzene	2.195		1.554	0.67	1.24E+01	2.40E+00	2.01E+00
Methoxychlor		1.520	7.070	80	1.48E+03	6.29E+01	6.03E+01
Mirex	3.188		2.257	3.3	6.11E+01	8.13E+00	7.17E+00
Toxaphene	1		0.708	0.398	7.37E+00	3.12E+00	2.19E+00
TCL PCBs by EPA Method 8082 / NOAA 130							
Aroclor 1016[g]	1.672		1.184	0.18	3.33E+00	8.45E-01	6.74E-01
Aroclor 1221[g]	1.672		1.184	0.18	3.33E+00	8.45E-01	6.74E-01
Aroclor 1232[g]	1.672		1.184	0.18	3.33E+00	8.45E-01	6.74E-01
Aroclor 1242[g]	1.672		1.184	0.18	3.33E+00	8.45E-01	6.74E-01
Aroclor 1248	0.544		0.385	0.18	3.33E+00	2.60E+00	1.46E+00
Aroclor 1254	1.672		1.184	0.18	3.33E+00	8.45E-01	6.74E-01
Aroclor 1260	0.227		0.161	0.18	3.33E+00	6.22E+00	2.17E+00
Aroclor 1268[g]	1.672		1.184	0.18	3.33E+00	8.45E-01	6.74E-01
PCB Congeners by EPA Method 1668A							
Total PCB congeners[h]	5.217		3.694	0.41	7.60E+00	6.17E-01	5.71E-01
Total PCBs as Aroclors	5.217		3.694	0.18	3.33E+00	2.71E-01	2.50E-01
TAL Metals by EPA Method 6020/6010							
Arsenic		0.131	0.609	2.24	4.15E+01	2.04E+01	1.37E+01
Cadmium		0.580	2.700	1.47	2.72E+01	3.03E+00	2.72E+00
Chromium		0.008	0.039	2.66	4.93E+01	3.76E+02	4.36E+01
Chromium (VI)							
Copper		0.190	0.884	4.05	7.50E+01	2.55E+01	1.90E+01
Lead		0.007	0.034	1.63	3.02E+01	2.66E+02	2.71E+01
Methylmercury		130	604	0.0064	1.19E-01	5.89E-05	5.89E-05
Nickel		0.063	0.292	6.71	1.24E+02	1.28E+02	6.30E+01

Appendix G-2 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Sandpiper[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Selenium		0.659	3.065	0.29	5.37E+00	5.26E-01	4.79E-01
Silver	1		0.708	2.02	3.74E+01	1.59E+01	1.11E+01
Zinc		0.106	0.492	66.1	1.22E+03	7.47E+02	4.64E+02
TCL Dioxins and Furans by EPA 1613B							
Dioxin/furan congeners or as TCDD	0.353		0.250	0.000014	2.59E-04	3.11E-04	1.42E-04

Notes:

Blank cells - No toxicity data available to develop TRV

BAF - biota-sediment accumulation factor (kg dry weight/kg dry weight)

BSAF (OC/lipid basis) - biota-sediment accumulation factor (kg lipid/kg organic carbon)

dry wt basis - dry weight basis

kg - kilogram

mg - milligram

mg/kg - milligram per kilogram

mg/kg_{bw}/day - milligram per kilogram body weight per day

NOAEL - no-observed adverse effect level

$SL_{food\text{-}ingestion}$ - sediment screening level based on food ingestion

SL_{sed} - wildlife-based sediment screening level (mg/kg)

$SL_{sed\text{-}ingestion}$ - sediment screening level based on the incidental sediment ingestion

TRV - toxicity reference value

wet wt basis - wet weight basis

[1] See memorandum text for equations and parameter definitions.

[a] BSAF based on benthic invertebrates. When no BSAF available, a value of 1.0 was assumed.

[b] BAF based on all invertebrates for hexachloroethane, hexachlorobutadiene, pentachlorophenol, endosulfan I , endosulfan II, endrin, methoxychlor, arsenic, cadmium, chromium, copper, lead, methylmercury, nickel, selenium, and zinc.

[c] BSAF is assumed equal to that for benzo(a)pyrene.

[d] BSAF is assumed equal to that for fluorene.

[e] BSAF is assumed equal to that for chlorodane-alpha.

[f] BSAF is assumed equal to that for lindane.

[g] BSAF is assumed equal to that for Aroclor 1254.

[h] BSAF is assumed equal to that for total PCBs.

Appendix G-3 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Heron[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
TCL Volatiles by EPA Method 8260a							
1,2,4-trichlorobenzene (TCB)							
1,2-dichlorobenzene							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene							
Hexachloroethane		1.125	5.231	17.2	5.89E+03	3.38E+01	3.36E+01
TCL Semivolatiles by EPA Method 8270							
1,2,4,5-tetrachlorobenzene							
1,2-dichlorobenzene							
1,4-Dichlorobenzene							
4-chlorophenyl phenyl ether							
4-bromophenyl phenyl ether							
Acenaphthene	0.313		0.199	32.5	1.11E+04	1.67E+03	1.46E+03
Acenaphthylene	0.571		0.364	32.5	1.11E+04	9.16E+02	8.46E+02
Anthracene	0.542		0.345	32.5	1.11E+04	9.66E+02	8.89E+02
Benzo(a)anthracene	1.67		1.062	0.65	2.23E+02	6.29E+00	6.11E+00
Benzo(a)pyrene	1.58		1.005	280	9.59E+04	2.86E+03	2.78E+03
Benzo(b)fluoranthene	0.721		0.460	280	9.59E+04	6.25E+03	5.87E+03
Benzo(ghi)perylene	2.45		1.566	280	9.59E+04	1.84E+03	1.80E+03
Benzo(k)fluoranthene	1.12		0.713	280	9.59E+04	4.03E+03	3.87E+03
Chrysene	0.996		0.636	280	9.59E+04	4.53E+03	4.32E+03
Dibenzo(a,h)anthracene	7.70		4.913	280	9.59E+04	5.85E+02	5.82E+02
Fluoranthene	0.986		0.629	280	9.59E+04	4.57E+03	4.36E+03
Fluorene	0.479		0.306	32.5	1.11E+04	1.09E+03	9.95E+02
Hexachlorobenzene	3.35		2.136	0.67	2.29E+02	3.22E+00	3.18E+00
Hexachlorobutadiene		0.997	4.636	4	1.37E+03	8.86E+00	8.81E+00

Appendix G-3 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Heron[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Hexachlorocyclopentadiene							
Hexachloroethane		1.125	5.231	17.2	5.89E+03	3.38E+01	3.36E+01
Indeno(1,2,3-cd)pyrene	3.85		2.458	280	9.59E+04	1.17E+03	1.16E+03
Pentachlorophenol		2.545	11.835	7.6	2.60E+03	6.60E+00	6.58E+00
Phenanthrene	0.772		0.492	32.5	1.11E+04	6.78E+02	6.39E+02
Pyrene	0.298		0.190	280	9.59E+04	1.51E+04	1.31E+04
Total HPAH [c]	1.58		1.005	280	9.59E+04	2.86E+03	2.78E+03
Total LPAH [d]	0.479		0.306	32.5	1.11E+04	1.09E+03	9.95E+02
Total PAH [c]	1.58		1.005	32.5	1.11E+04	3.32E+02	3.23E+02
Organochlorine Pesticides by EPA Method 8081A / NOAA 130							
4,4'-DDD	2.36		1.506	0.227	7.77E+01	1.55E+00	1.52E+00
4,4'-DDE	14.1		9.007	0.227	7.77E+01	2.59E-01	2.58E-01
4,4'-DDT	1.26		0.805	0.227	7.77E+01	2.90E+00	2.79E+00
Aldrin	0.237		0.151	0.007	2.40E+00	4.77E-01	3.98E-01
alpha-Chlordane	2.68		1.712	2.14	7.33E+02	1.28E+01	1.26E+01
Chlordane [e]	2.68		1.712	2.14	7.33E+02	1.28E+01	1.26E+01
gamma-Chlordane	3.46		2.210	2.14	7.33E+02	9.95E+00	9.81E+00
BHC-alpha	0.62		0.396	0.571	1.96E+02	1.48E+01	1.38E+01
BHC-beta [f]	0.458		0.292	0.571	1.96E+02	2.01E+01	1.82E+01
BHC, delta	0.420		0.268	0.571	1.96E+02	2.19E+01	1.97E+01
gamma-Hexachlorocyclohexane (BHC) (Lindane)	0.458		0.292	0.571	1.96E+02	2.01E+01	1.82E+01
Dieldrin	7.27		4.638	0.0709	2.43E+01	1.57E-01	1.56E-01
Endosulfan I		2.028	9.433	10	3.42E+03	1.09E+01	1.09E+01
Endosulfan II		1.008	4.689	10	3.42E+03	2.19E+01	2.18E+01
Endrin		1.087	5.057	0.01	3.42E+00	2.03E-02	2.02E-02
Heptachlor	1.865		1.190	0.28	9.59E+01	2.42E+00	2.36E+00

Appendix G-3 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Heron[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Heptachlor Epoxide	0.594		0.379	0.28	9.59E+01	7.59E+00	7.03E+00
Hexachlorobenzene	3.35		2.136	0.67	2.29E+02	3.22E+00	3.18E+00
Methoxychlor	1.2		0.766	80	2.74E+04	1.07E+03	1.03E+03
Mirex	3.19		2.034	3.3	1.13E+03	1.67E+01	1.64E+01
Toxaphene	1		0.638	0.398	1.36E+02	6.41E+00	6.12E+00
TCL PCBs by EPA Method 8082 / NOAA 130							
Aroclor 1016 [g]	1.67		1.067	0.18	6.16E+01	1.73E+00	1.69E+00
Aroclor 1221 [g]	1.67		1.067	0.18	6.16E+01	1.73E+00	1.69E+00
Aroclor 1232 [g]	1.67		1.067	0.18	6.16E+01	1.73E+00	1.69E+00
Aroclor 1242 [g]	1.67		1.067	0.18	6.16E+01	1.73E+00	1.69E+00
Aroclor 1248	0.544		0.347	0.18	6.16E+01	5.33E+00	4.90E+00
Aroclor 1254	1.67		1.067	0.18	6.16E+01	1.73E+00	1.69E+00
Aroclor 1260	0.2272		0.145	0.18	6.16E+01	1.28E+01	1.06E+01
Aroclor 1268 [g]	1.67		1.067	0.18	6.16E+01	1.73E+00	1.69E+00
PCB Congeners by EPA Method 1668A							
Total PCB congeners [h]	4.62		2.949	0.41	1.40E+02	1.43E+00	1.41E+00
Total PCBs as Aroclors	4.62		2.949	0.18	6.16E+01	6.27E-01	6.21E-01
TAL Metals by EPA Method 6020/6010							
Arsenic		0.131	0.609	2.24	7.67E+02	3.78E+01	3.60E+01
Cadmium		0.580	2.700	1.47	5.03E+02	5.59E+00	5.53E+00
Chromium		0.008	0.039	2.66	9.11E+02	6.95E+02	3.94E+02
Chromium (VI)							
Copper		0.190	0.884	4.05	1.39E+03	4.71E+01	4.55E+01
Lead		0.007	0.034	1.63	5.58E+02	4.92E+02	2.61E+02
Methylmercury		130	604	0.0064	2.19E+00	1.09E-04	1.09E-04
Nickel		0.063	0.292	6.71	2.30E+03	2.36E+02	2.14E+02

Appendix G-3 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Heron[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Selenium		0.659	3.065	0.29	9.93E+01	9.72E-01	9.62E-01
Silver	1		0.638	2.02	6.92E+02	3.25E+01	3.11E+01
Zinc		0.106	0.492	66.1	2.26E+04	1.38E+03	1.30E+03
TCL Dioxins and Furans by EPA 1613B							
Dioxin/furan congeners or as TCDD	0.625		0.398	0.000014	4.79E-03	3.61E-04	3.36E-04

Notes:

Blank cells - No toxicity data available to develop TRV

BAF - biota-sediment accumulation factor (kg dry weight/kg dry weight)

BSAF (OC/lipid basis) - biota-sediment accumulation factor (kg lipid/kg organic carbon)

dry wt basis - dry weight basis

kg - kilogram

mg - milligram

mg/kg - milligram per kilogram

mg/kg_{bw}/day - milligram per kilogram body weight per day

NOAEL - no-observed adverse effect level

$SL_{food\text{-}ingestion}$ - sediment screening level based on food ingestion

SL_{sed} - wildlife-based sediment screening level (mg/kg)

$SL_{sed\text{-}ingestion}$ - sediment screening level based on the incidental sediment ingestion

TRV - toxicity reference value

wet wt basis - wet weight basis

[1] See memorandum text for equations and parameter definitions.

[a] BSAF based on all receptors (used all receptors to have a more complete list). When no BSAF available, a value of 1.0 was assumed.

[b] BAF based on all invertebrates for hexachloroethane, hexachlorobutadiene, pentachlorophenol, endrin, arsenic, cadmium, chromium, copper, lead, methylmercury, nickel, selenium, and zinc.

[c] BSAF is assumed equal to that for benzo(a)pyrene.

[d] BSAF is assumed equal to that for fluorene.

[e] BSAF is assumed equal to that for chlorodane-alpha.

[f] BSAF is assumed equal to that for lindane.

[g] BSAF is assumed equal to that for Aroclor 1254.

[h] BSAF is assumed equal to that for total PCBs.

Appendix G-4 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Cormorant[1]

Chemical	Average BSAF [a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
TCL Volatiles by EPA Method 8260a							
1,2,4-trichlorobenzene (TCB)							
1,2-dichlorobenzene							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene							
Hexachloroethane		0.200	0.702	17.2	3.43E+04	4.89E+02	4.82E+02
TCL Semivolatiles by EPA Method 8270							
1,2,4,5-tetrachlorobenzene							
1,2-dichlorobenzene							
1,4-Dichlorobenzene							
4-chlorophenyl phenyl ether							
4-bromophenyl phenyl ether							
Acenaphthene	0.313		0.182	32.5	6.49E+04	3.55E+03	3.37E+03
Acenaphthylene	0.571		0.334	32.5	6.49E+04	1.94E+03	1.89E+03
Anthracene	0.542		0.316	32.5	6.49E+04	2.05E+03	1.99E+03
Benzo(a)anthracene	1.67		0.972	0.65	1.30E+03	1.33E+01	1.32E+01
Benzo(a)pyrene	1.58		0.920	280	5.59E+05	6.07E+03	6.01E+03
Benzo(b)fluoranthene	0.721		0.421	280	5.59E+05	1.33E+04	1.30E+04
Benzo(ghi)perylene	2.45		1.433	280	5.59E+05	3.90E+03	3.87E+03
Benzo(k)fluoranthene	1.12		0.653	280	5.59E+05	8.56E+03	8.43E+03
Chrysene	0.996		0.582	280	5.59E+05	9.60E+03	9.44E+03
Dibenzo(a,h)anthracene	7.70		4.497	280	5.59E+05	1.24E+03	1.24E+03
Fluoranthene	0.986		0.576	280	5.59E+05	9.70E+03	9.54E+03
Fluorene	0.479		0.280	32.5	6.49E+04	2.32E+03	2.24E+03
Hexachlorobenzene	3.35		1.955	0.67	1.34E+03	6.84E+00	6.80E+00
Hexachlorobutadiene		0.237	0.830	4	7.98E+03	9.61E+01	9.50E+01

Appendix G-4 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Cormorant[1]

Chemical	Average BSAF [a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Hexachlorocyclopentadiene							
Hexachloroethane		0.200	0.702	17.2	3.43E+04	4.89E+02	4.82E+02
Indeno(1,2,3-cd)pyrene	3.85		2.249	280	5.59E+05	2.48E+03	2.47E+03
Pentachlorophenol		0.410	1.437	7.6	1.52E+04	1.06E+02	1.05E+02
Phenanthrene	0.772		0.451	32.5	6.49E+04	1.44E+03	1.41E+03
Pyrene	0.298		0.174	280	5.59E+05	3.21E+04	3.03E+04
Total HPAH [c]	1.58		0.920	280	5.59E+05	6.07E+03	6.01E+03
Total LPAH [d]	0.479		0.280	32.5	6.49E+04	2.32E+03	2.24E+03
Total PAH [c]	1.58		0.920	32.5	6.49E+04	7.05E+02	6.97E+02
Organochlorine Pesticides by EPA Method 8081A / NOAA 130							
4,4'-DDD	2.36		1.378	0.227	4.53E+02	3.29E+00	3.26E+00
4,4'-DDE	14.1		8.244	0.227	4.53E+02	5.49E-01	5.49E-01
4,4'-DDT	1.26		0.737	0.227	4.53E+02	6.14E+00	6.06E+00
Aldrin	0.237		0.138	0.007	1.40E+01	1.01E+00	9.43E-01
alpha-Chlordane	2.68		1.567	2.14	4.27E+03	2.72E+01	2.71E+01
Chlordane [e]	2.68		1.567	2.14	4.27E+03	2.72E+01	2.71E+01
gamma-Chlordane	3.46		2.023	2.14	4.27E+03	2.11E+01	2.10E+01
BHC-alpha	0.62		0.362	0.571	1.14E+03	3.15E+01	3.06E+01
BHC-beta [f]	0.458		0.268	0.571	1.14E+03	4.26E+01	4.10E+01
BHC, delta	0.420		0.245	0.56	1.12E+03	4.56E+01	4.38E+01
gamma-Hexachlorocyclohexane (BHC) (Lindane)	0.458		0.268	0.571	1.14E+03	4.26E+01	4.10E+01
Dieldrin	7.27		4.245	0.0709	1.41E+02	3.33E-01	3.32E-01
Endosulfan I		1.020	3.580	10	2.00E+04	5.57E+01	5.56E+01
Endosulfan II		0.782	2.745	10	2.00E+04	7.27E+01	7.24E+01
Endrin		0.693	2.432	0.01	2.00E+01	8.20E-02	8.17E-02
Heptachlor	1.865		1.089	0.28	5.59E+02	5.13E+00	5.08E+00

Appendix G-4 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Cormorant[1]

Chemical	Average BSAF [a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Heptachlor Epoxide	0.594		0.347	0.28	5.59E+02	1.61E+01	1.57E+01
Hexachlorobenzene	3.35		1.955	0.67	1.34E+03	6.84E+00	6.80E+00
Methoxychlor	1.2		0.701	80	1.60E+05	2.28E+03	2.25E+03
Mirex	3.19		1.862	3.3	6.58E+03	3.54E+01	3.52E+01
Toxaphene	1		0.584	0.398	7.94E+02	1.36E+01	1.34E+01
TCL PCBs by EPA Method 8082 / NOAA 130							
Aroclor 1016 [g]	1.67		0.976	0.18	3.59E+02	3.68E+00	3.64E+00
Aroclor 1221 [g]	1.67		0.976	0.18	3.59E+02	3.68E+00	3.64E+00
Aroclor 1232 [g]	1.67		0.976	0.18	3.59E+02	3.68E+00	3.64E+00
Aroclor 1242 [g]	1.67		0.976	0.18	3.59E+02	3.68E+00	3.64E+00
Aroclor 1248	0.544		0.318	0.18	3.59E+02	1.13E+01	1.10E+01
Aroclor 1254	1.67		0.976	0.18	3.59E+02	3.68E+00	3.64E+00
Aroclor 1260	0.2272		0.133	0.18	3.59E+02	2.71E+01	2.52E+01
Aroclor 1268 [g]	1.67		0.976	0.18	3.59E+02	3.68E+00	3.64E+00
PCB Congeners by EPA Method 1668A							
Total PCB congeners [h]	4.62		2.699	0.41	8.18E+02	3.03E+00	3.02E+00
Total PCBs as Aroclors	4.62		2.699	0.18	3.59E+02	1.33E+00	1.33E+00
TAL Metals by EPA Method 6020/6010							
Arsenic		0.097	0.340	2.24	4.47E+03	1.31E+02	1.28E+02
Cadmium		0.078	0.273	1.47	2.93E+03	1.07E+02	1.04E+02
Chromium		0.009	0.033	2.66	5.31E+03	1.60E+03	1.23E+03
Chromium (VI)							
Copper		0.047	0.165	4.05	8.08E+03	4.90E+02	4.62E+02
Lead		0.006	0.021	1.63	3.25E+03	1.56E+03	1.05E+03
Methylmercury		0.168	0.588	0.0064	1.28E+01	2.17E-01	2.13E-01
Nickel		0.015	0.054	6.71	1.34E+04	2.49E+03	2.10E+03

Appendix G-4 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Cormorant[1]

Chemical	Average BSAF [a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Selenium		0.760	2.668	0.29	5.79E+02	2.17E+00	2.16E+00
Silver	1		0.584	2.02	4.03E+03	6.90E+01	6.79E+01
Zinc		0.174	0.612	66.1	1.32E+05	2.15E+03	2.12E+03
TCL Dioxins and Furans by EPA 1613B							
Dioxin/furan congeners or as TCDD	0.625		0.365	0.000014	2.79E-02	7.66E-04	7.45E-04

Notes:

Blank cells - No toxicity data available to develop TRV

BAF - biota-sediment accumulation factor (kg dry weight/kg dry weight)

BSAF (OC/lipid basis) - biota-sediment accumulation factor (kg lipid/kg organic carbon)

dry wt basis - dry weight basis

kg - kilogram

mg - milligram

mg/kg - milligram per kilogram

mg/kg_{bw}/day - milligram per kilogram body weight per day

NOAEL - no-observed adverse effect level

$SL_{food\text{-}ingestion}$ - sediment screening level based on food ingestion

SL_{sed} - wildlife-based sediment screening level (mg/kg)

$SL_{sed\text{-}ingestion}$ - sediment screening level based on the incidental sediment ingestion

TRV - toxicity reference value

wet wt basis - wet weight basis

[1] See memorandum text for equations and parameter definitions.

[a] BSAF based on all receptors (used all receptors to have a more complete list). When no BSAF available, a value of 1.0 was assumed.

[b] BAF based on all invertebrates for hexachlorobutadiene, pentachlorophenol, endrin, arsenic, cadmium, chromium, copper, lead, methylmercury, nickel, selenium, and zinc.

[c] BSAF is assumed equal to that for benzo(a)pyrene.

[d] BSAF is assumed equal to that for fluorene.

[e] BSAF is assumed equal to that for chlorodane-alpha.

[f] BSAF is assumed equal to that for lindane.

[g] BSAF is assumed equal to that for Aroclor 1254.

[h] BSAF is assumed equal to that for total PCBs.

Appendix G-5 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Raccoon[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
TCL Volatiles by EPA Method 8260							
1,2,4-trichlorobenzene (TCB)	1		0.638	120	2.51E+04	3.70E+03	3.23E+03
1,2-Dichlorobenzene							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene							
Hexachloroethane		1.125	5.2	12	2.42E+03	4.34E+01	4.27E+01
TCL Semivolatiles by EPA Method 8270							
1,2,4,5-Tetrachlorobenzene	1		0.638	0.185	3.87E+01	5.71E+00	4.98E+00
1,2-Dichlorobenzene							
1,4-Dichlorobenzene							
4-Bromophenyl Phenyl Ether	1		0.638	100	2.09E+04	3.09E+03	2.69E+03
4-Chlorophenyl Phenyl Ether	1		0.638	100	2.09E+04	3.09E+03	2.69E+03
Acenaphthene	0.313		0.199	32.7	6.85E+03	3.23E+03	2.20E+03
Acenaphthylene	0.571		0.364	32.7	6.85E+03	1.77E+03	1.41E+03
Anthracene	0.542		0.345	32.7	6.85E+03	1.86E+03	1.47E+03
Benzo(a)anthracene	1.67		1.062	0.192	4.02E+01	3.56E+00	3.27E+00
Benzo(a)pyrene	1.58		1.005	0.192	4.02E+01	3.76E+00	3.44E+00
Benzo(b)fluoranthene	0.721		0.460	0.192	4.02E+01	8.22E+00	6.83E+00
Benzo(g,h,i)perylene	2.45		1.566	0.192	4.02E+01	2.42E+00	2.28E+00
Benzo(k)fluoranthene	1.12		0.713	0.192	4.02E+01	5.30E+00	4.68E+00
Chrysene	0.996		0.636	0.192	4.02E+01	5.95E+00	5.18E+00
Dibenzo(a,h)anthracene	7.70		4.913	0.192	4.02E+01	7.70E-01	7.55E-01
Fluoranthene	0.986		0.629	0.192	4.02E+01	6.01E+00	5.23E+00
Fluorene	0.479		0.306	32.7	6.85E+03	2.11E+03	1.61E+03
Hexachlorobenzene	3.35		2.136	1.57	3.29E+02	1.45E+01	1.39E+01
Hexachlorobutadiene		0.997	4.636	1.09	2.28E+02	4.63E+00	4.54E+00

Appendix G-5 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Raccoon[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Hexachlorocyclopentadiene							
Hexachloroethane		1.125	5.231	12	2.42E+03	4.34E+01	4.27E+01
Indeno(1,2,3-cd)pyrene	3.85		2.458	0.192	4.02E+01	1.54E+00	1.48E+00
Pentachlorophenol		2.545	11.835	0.131	2.74E+01	2.17E-01	2.16E-01
Phenanthrene	0.772		0.492	32.7	6.85E+03	1.31E+03	1.10E+03
Pyrene	0.298		0.190	0.192	4.02E+01	1.99E+01	1.33E+01
Total HPAH [c]	1.58		1.005	0.192	4.02E+01	3.76E+00	3.44E+00
Total LPAH [d]	0.479		0.306	32.7	6.85E+03	2.11E+03	1.61E+03
Total PAH [c]	1.58		1.005	0.192	4.02E+01	3.76E+00	3.44E+00
Organochlorine Pesticides by EPA Method 8081A / NOAA 130							
4,4'-DDD	2.36		1.506	0.054	1.13E+01	7.04E-01	6.63E-01
4,4'-DDE	14.12		9.007	0.054	1.13E+01	1.18E-01	1.17E-01
4,4'-DDT	1.26		0.805	0.054	1.13E+01	1.32E+00	1.18E+00
Aldrin	0.237		0.151	0.109	2.28E+01	1.42E+01	8.75E+00
alpha-Chlordane	2.68		1.712	1.14	2.39E+02	1.31E+01	1.25E+01
Chlordane [e]	2.68		1.712	1.14	2.39E+02	1.31E+01	1.25E+01
gamma-Chlordane	3.46		2.210	1.14	2.39E+02	1.02E+01	9.76E+00
BHC-alpha	0.62		0.396	4.35	9.12E+02	2.17E+02	1.75E+02
BHC-beta [f]	0.458		0.292	0.218	4.56E+01	1.47E+01	1.11E+01
BHC, delta	0.420		0.268	4.35	9.12E+02	3.20E+02	2.37E+02
BHC-gamma (Lindane)	0.458		0.292	4.35	9.12E+02	2.93E+02	2.22E+02
Dieldrin	7.27		4.638	0.007	1.52E+00	3.07E-02	3.01E-02
Endosulfan I		2.028	9.433	0.082	1.71E+01	1.70E-01	1.69E-01
Endosulfan II		1.008	4.689	0.082	1.71E+01	3.43E-01	3.36E-01
Endrin		1.087	5.057	0.027	5.67E+00	1.05E-01	1.04E-01
Heptachlor	1.865		1.190	0.265	5.55E+01	4.39E+00	4.06E+00

Appendix G-5 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Raccoon[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Heptachlor Epoxide							
Hexachlorobenzene	3.35		2.136	1.57	3.29E+02	1.45E+01	1.39E+01
Methoxychlor	1.2		0.766	2.18	4.56E+02	5.60E+01	4.99E+01
Mirex	3.19		2.034	0.381	7.98E+01	3.69E+00	3.53E+00
Toxaphene	1		0.638	4.35	9.12E+02	1.34E+02	1.17E+02
TCL PCBs by EPA Method 8082 / NOAA 130							
Aroclor 1016 [g]	1.67		1.067	0.969	2.03E+02	1.79E+01	1.64E+01
Aroclor 1221 [g]	1.67		1.067	0.017	3.47E+00	3.05E-01	2.81E-01
Aroclor 1232 [g]	1.67		1.067	0.017	3.47E+00	3.05E-01	2.81E-01
Aroclor 1242 [g]	1.67		1.067	0.049	1.02E+01	9.01E-01	8.28E-01
Aroclor 1248	0.544		0.347	0.009	1.93E+00	5.22E-01	4.11E-01
Aroclor 1254	1.67		0.997	0.017	3.47E+00	3.27E-01	2.99E-01
Aroclor 1260	0.2272		0.145	0.017	3.47E+00	2.25E+00	1.36E+00
Aroclor 1268 [g]	1.67		1.067	0.017	3.47E+00	3.05E-01	2.81E-01
PCB Congeners by EPA Method 1668A							
Total PCB congeners [h]	4.62		2.949	0.011	2.22E+00	7.06E-02	6.85E-02
Total PCBs as Aroclors	4.62		2.949	0.017	3.47E+00	1.10E-01	1.07E-01
TAL Metals by EPA Method 6020/6010							
Arsenic		0.131	0.609	1.31	2.75E+02	4.24E+01	3.67E+01
Cadmium		0.580	2.700	0.441	9.24E+01	3.22E+00	3.11E+00
Chromium		0.008	0.039	2.40	5.03E+02	1.20E+03	3.54E+02
Chromium (VI) [i]			0.039	9.24	1.94E+03	4.63E+03	1.36E+03
Copper		0.190	0.884	12.5	2.62E+03	2.79E+02	2.52E+02
Lead		0.007	0.034	2.46	5.15E+02	1.42E+03	3.78E+02
Methylmercury		130	604	0.0106	2.22E+00	3.46E-04	3.46E-04
Nickel		0.063	0.292	0.5006	1.05E+02	3.37E+01	2.55E+01

Appendix G-5 Newtown Creek SLERA: Calculation of Sediment Based Screening Levels for the Raccoon[1]

Chemical	Average BSAF[a] (OC/lipid basis)	Average BAF[b] (wet wt basis)	Average BSAF or BAF[b] (dry wt basis)	TRV (NOAEL) (mg/kg_{bw}/day)	$SL_{sed\text{-}Ingestion}$ (mg/kg)	$SL_{food\text{-}ingestion}$ (mg/kg)	SL_{sed} (mg/kg)
Selenium		0.659	3.065	0.2078	4.35E+01	1.33E+00	1.30E+00
Silver	1		0.638	7.35	1.54E+03	2.27E+02	1.98E+02
Zinc		0.106	0.492	75.4	1.58E+04	3.02E+03	2.53E+03
TCL Dioxins and Furans by EPA 1613B							
Dioxin/furan total congeners or as TCDD	0.625		0.398	5.44219E-07	1.14E-04	2.69E-05	2.18E-05

Notes:

Blank cells - No toxicity data available to develop TRV

BAF - biota-sediment accumulation factor (kg dry weight/kg dry weight)

BSAF (OC/lipid basis) - biota-sediment accumulation factor (kg lipid/kg organic carbon)

dry wt basis - dry weight basis

kg - kilogram

mg - milligram

mg/kg - milligram per kilogram

mg/kg_{bw}/day - milligram per kilogram body weight per day

NOAEL - no-observed adverse effect level

$SL_{food\text{-}ingestion}$ - sediment screening level based on food ingestion

SL_{sed} - wildlife-based sediment screening level (mg/kg)

$SL_{sed\text{-}ingestion}$ - sediment screening level based on the incidental sediment ingestion

TRV - toxicity reference value

wet wt basis - wet weight basis

[1] See memorandum text for equations and parameter definitions.

[a] BSAF based on all receptors (used all receptors to have a more complete list). When no BSAF available, a value of 1.0 was assumed.

[b] BAF based on all invertebrates for hexachlorobutadiene, pentachlorophenol, endrin, arsenic, cadmium, chromium, copper, lead, methylmercury, nickel, selenium, and zinc.

[c] BSAF is assumed equal to that for benzo(a)pyrene.

[d] BSAF is assumed equal to that for fluorene.

[e] BSAF is assumed equal to that for chlorodane-alpha.

[f] BSAF is assumed equal to that for lindane.

[g] BSAF is assumed equal to that for Aroclor 1254.

[h] BSAF is assumed equal to that for total PCBs.

[i] BSAF is assumed equal to that for Chromium.

ATTACHMENT 2
EVALUATION OF HISTORICAL DATA FROM THE OU6 RI

As described in the draft *Data Applicability Report* (DAR; Anchor QEA 2012), three historical datasets are available. Based on the Minimum Data Acceptance Criteria (MDAC), the Laurel Hill *Remedial Investigation Report, Operable Unit 6* (OU6) dataset (Anchor 2007) was classified DU-1, acceptable for all Remedial Investigation (RI), risk assessment, and Feasibility Study uses. The New York City Department of Environmental Protection (NYCDEP) Maintenance Dredging Sampling dataset (NYCDEP 2009) and the U.S. Environmental Protection Agency (USEPA) Expanded Site Inspection dataset (Weston Solutions 2009) were classified DU-2, suitable for certain aspects of evaluation with the approval of the appropriate project manager.

Upon inspection, the USEPA data were not considered suitable for use in the risk assessment for several reasons. First, the thickness of the surface samples was 0 to 2 feet, which likely extends beneath the surface mixed and biological active layers. Furthermore, supporting documentation was unavailable for this dataset, including analytical methods and validation documentation. Reporting and method detection limits were also uncertain.

The NYCDEP data were also not considered suitable for use in the risk assessment for the following reasons:

- Supporting documentation was unavailable.
- Sample location, sample depths, and validation information were unavailable.
- Reporting limits were provided; however, method detection limits were not documented.
- The core slices, collected to characterize dredge material, were too thick to be of relevance to surface sediment contaminant concentrations.

Because the OU6 data were classified as DU-1, they were evaluated further for possible use in the Phase 1 RI Screening Level Ecological Risk Assessment (SLERA). For some chemicals (conventionals, metals, polychlorinated biphenyl [PCB] Aroclors, dioxins/furans, semivolatile organic compounds, and volatile organic compounds), the analytical methods were sufficiently similar to those used in the Phase 1 RI to permit use of the data in the SLERA. For other chemicals, the analytical methods were sufficiently different, such that the data are not considered useful for risk assessment purposes—namely there were no high-resolution data for PCB congeners or pesticides. Further evaluation included a

side-by-side comparison of the OU6 and Phase 1 RI sediment data as "spatial plots" (see Figures 2-1 through 2-3). Samples collected in the main stem and side channels are indicated by color. All OU6 data are represented by orange symbols. For some chemicals, the two datasets produced similar concentrations (e.g., copper and 2,4′ and 4,4′-DDD, -DDE, -DDT [DDx]), while for others, the concentrations were quite different (e.g., antimony and benzaldehyde).

Moreover, the SLERA was conducted for the Study Area as a whole. The Phase 1 RI data were evenly distributed throughout the Study Area, providing a strong basis for estimating both maximum concentrations and 95 percent upper confidence limit on the arithmetic mean concentrations. In contrast, the OU6 data were concentrated in the vicinity of Maspeth Creek and, therefore, provide a biased representation of the Study Area as a whole. Given the above, the OU6 data are considered inappropriate for use in the SLERA or Baseline Ecological Risk Assessment (BERA) problem formulation (PF) processes, although data for some chemicals may be useful for other RI purposes.

In summary, only the Phase 1 RI data were used in the SLERA or BERA PF evaluations.

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Weston Solutions, 2009. *Expanded Site Inspection Report Newtown Creek Brooklyn/Queens, New York*. CERCLIS ID No. NYN000206282, USEPA Contract No. EP-W-06-072, W.O. No. 20405.012.013.0524.00, Document Control No. 524-2A-AEFX. Prepared by Weston Solutions, Inc. Edison, New Jersey. Prepared for U.S. Environmental Protection Agency. July 2009.

FIGURES

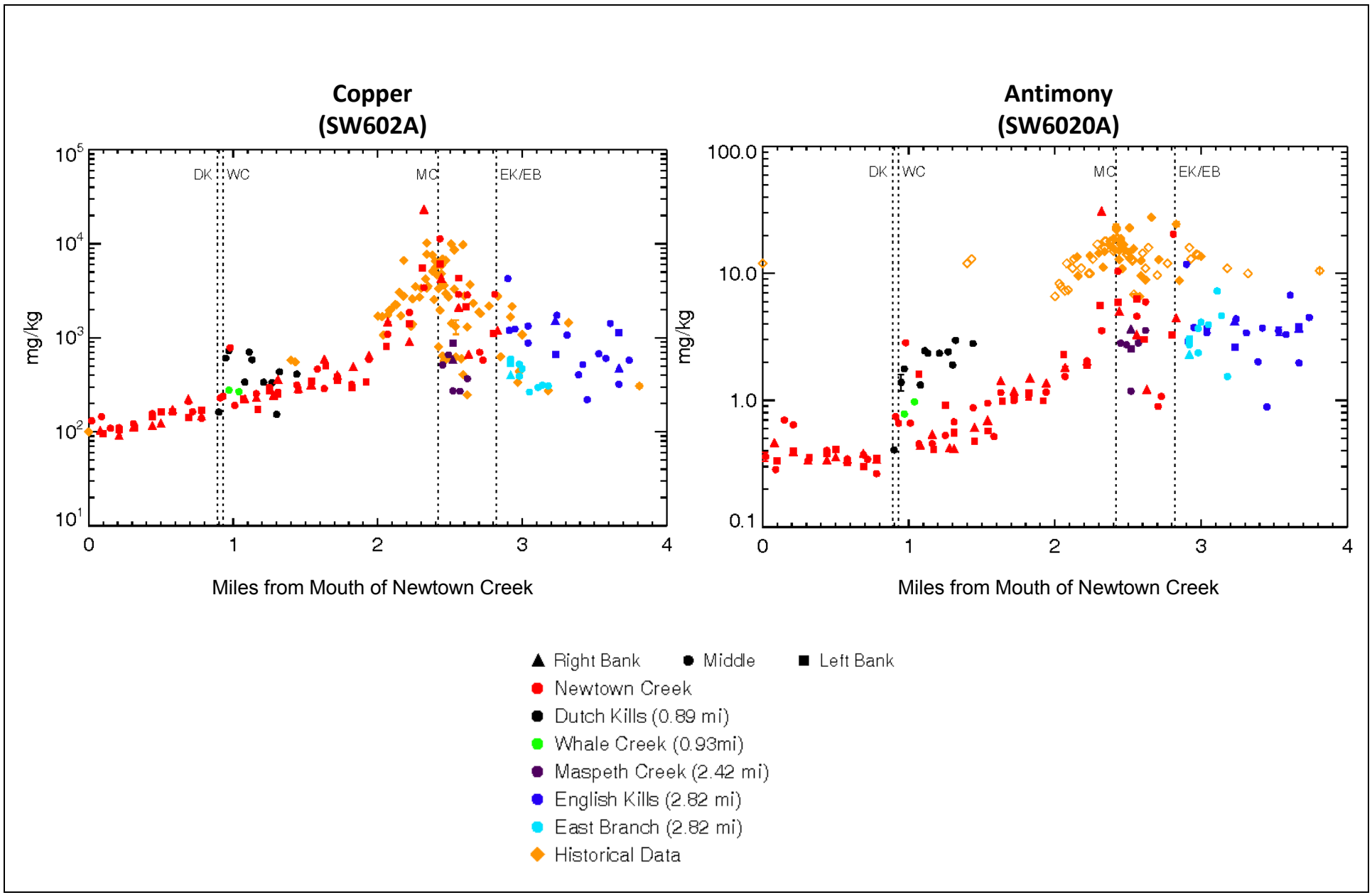

Figure 2-1
Comparison of Phase 1 Remedial Investigation and Laurel Hill OU6 Surface Sediment Data
SLERA Technical Memorandum No. 2
Newtown Creek RI/FS

ANCHOR QEA

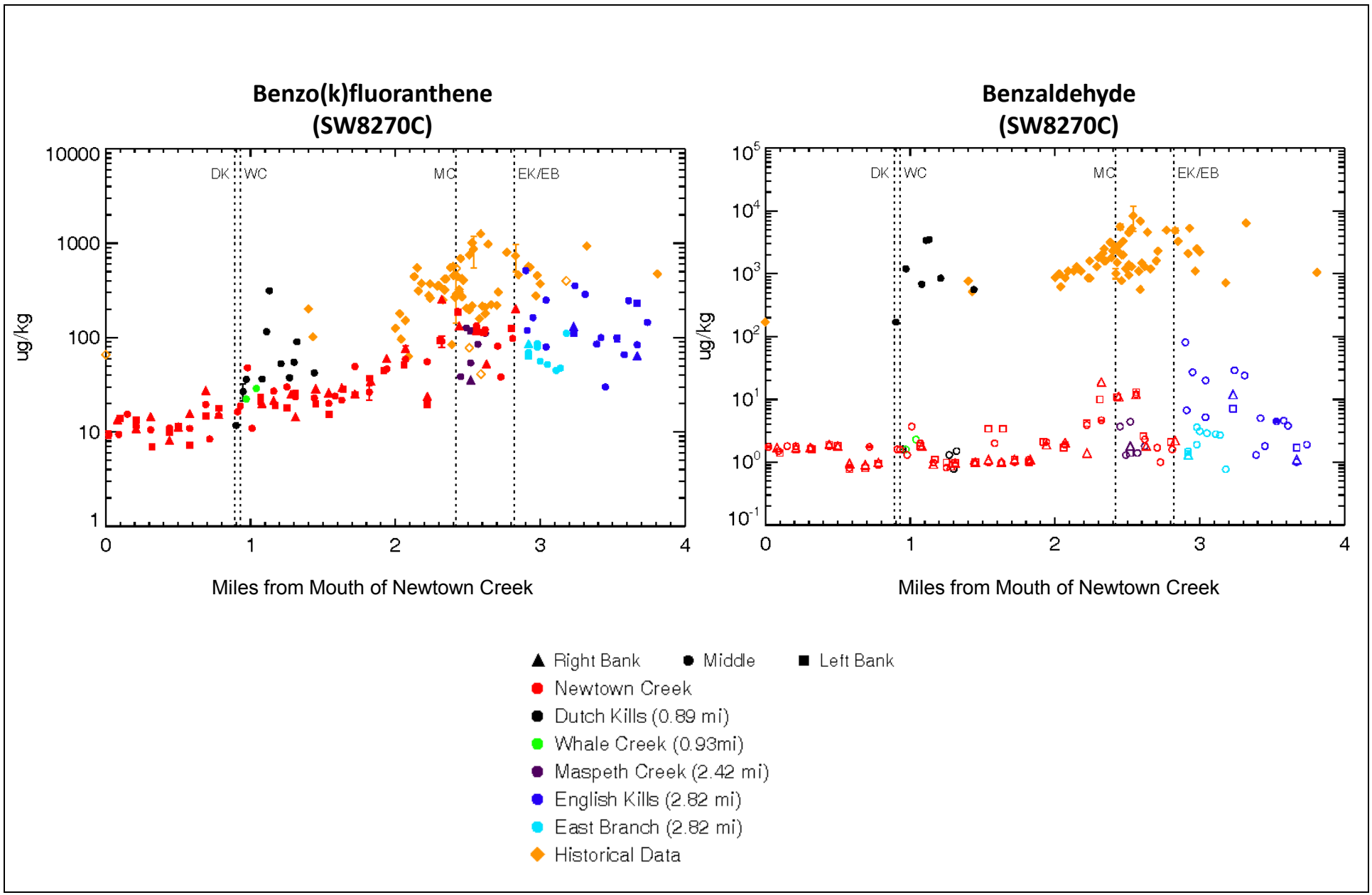

Figure 2-2
Comparison of Phase 1 Remedial Investigation and Laurel Hill OU6 Surface Sediment Data
SLERA Technical Memorandum No. 2
Newtown Creek RI/FS

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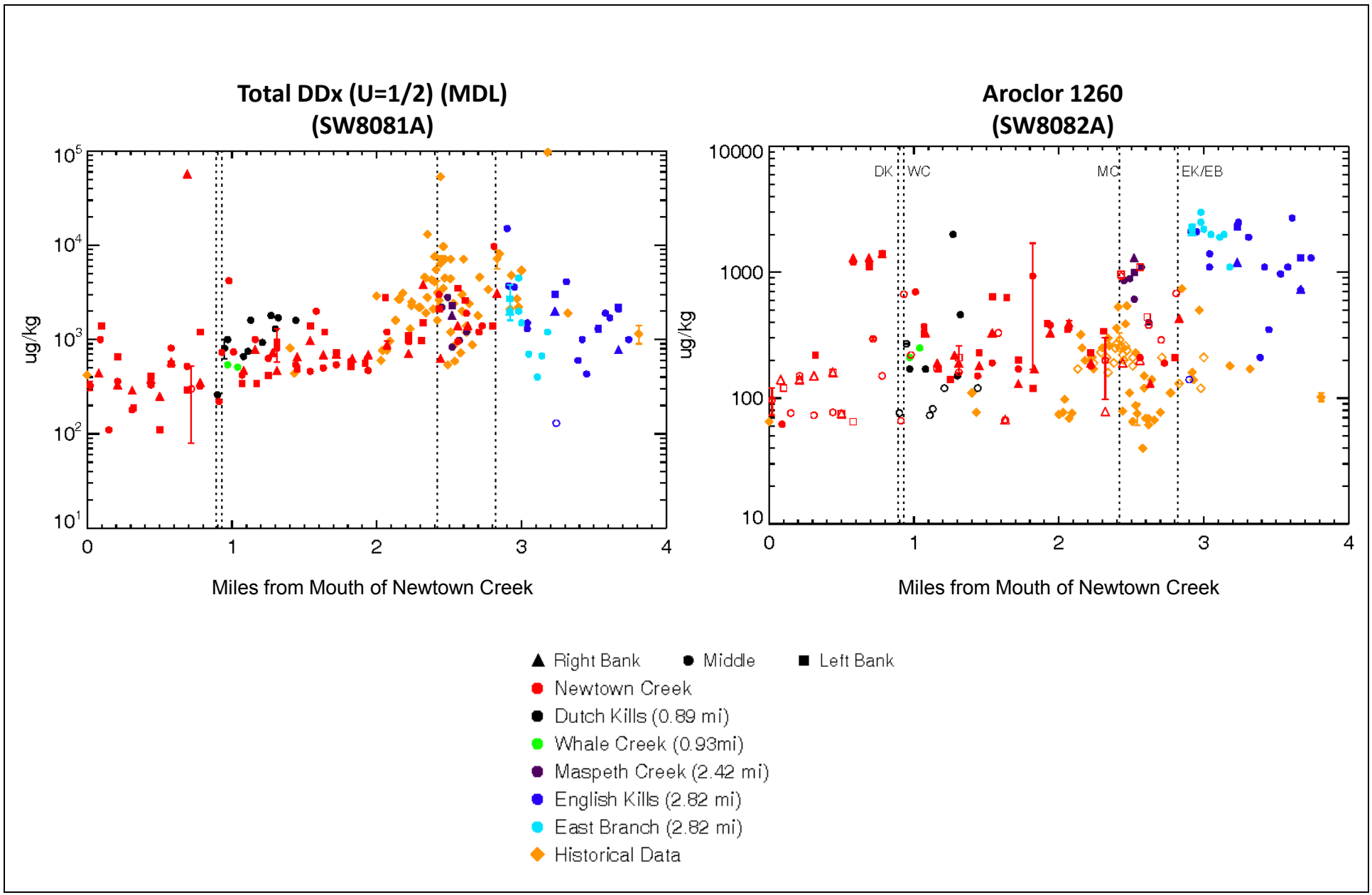

Figure 2-3
Comparison of Phase 1 Remedial Investigation and Laurel Hill OU6 Surface Sediment Data
SLERA Technical Memorandum No. 2
Newtown Creek RI/FS

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ATTACHMENT 2
USEPA COMMENTS ON SCREENING LEVEL TECHNICAL MEMORANDUM NO. 2, DATED SEPTEMBER 18, 2013

EPA Comments on Screening Level Ecological Risk Assessment
Technical Memorandum No. 2
Newtown Creek Remedial Investigation/Feasibility
Prepared by Anchor QEA, LLC

September 18, 2013

EPA and its partner agencies have completed the technical review of the Draft Screening Level Ecological Risk Assessment (SLERA) Technical Memorandum No. 2 (TM2), prepared by Anchor QEA, LLC, dated August 2013, for the Remedial Investigation/Feasibility Study for Newtown Creek, located in Brooklyn and Queens, New York. Comments are listed below.

General Comments

1. Please note that the conclusions reached in the SLERA TM1 and TM2 are based on the most recent data have been collected. Following Steps 3 through 6 of EPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments Interim Final* (1997), as the investigation continues, and new data become available, EPA will evaluate the new data to ensure that previous decisions are still applicable.

2. Comments presented in this comment letter need not be incorporated into the SLERA TM2. These comments should be considered for the baseline ecological risk assessment (BERA), since a scientific/management decision has been made to conduct a BERA at the Newtown Creek site.

3. The datasets for surface water and surface sediment used in this SLERA TM2 include field duplicates, which should be excluded from the dataset since they are for quality assurance/quality control (QA/QC) purposes.

4. The terms for dioxins/furans should be consistent. The terms used include "Dioxin/Furans", "Dioxin Furans", "2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)", "TCDD Congeners TEQ". If TEFs were applied to dioxin/furan congeners only, and did not include dioxin-like PCBs in the summed total, then the correct term to use should be "total dioxin/furan TEQ" or "dioxin/furan TEQ".

5. Selected screening values used in the SLERA TM2 appear mainly from EPA Region 5, especially for surface sediment. While Region 5 does provide screening levels for many chemicals not included in other screening level databases, use of these values may be inappropriate. Region 5 values are RCRA interim values, and as such are not generally considered to be among the most preferred values for screening marine or brackish sediments. The hierarchy for selecting screening levels should be discussed with EPA prior to initiation of the BERA.

6. ProUCL (Kaplan and Meier method) should be used to calculate dioxin and furan TEQ. The substitution method (half of reporting limit) used in the SLERA TM2 produced biased high values due to large number of nondetects.

Specific Comments

1. Executive Summary:
   a. Page ES-2, First Paragraph: Please make sure all identified COPECs in surface sediment and surface water listed in the text are consistent with those listed in Table ES-1. For example, cyanide was not listed in the text but is shown in Table ES-1.

   b. Page E-2: Please replace "dioxin/furans" with "total dioxin/furan TEQ" or "dioxin/furan TEQ", since there are 17 dioxin and furan congeners comprising the total and TEFs were used to calculate total TEQ. The results for total dioxin/furan congeners should be reported as "total dioxin/furan TEQ" or "dioxin/furan TEQ".

   c. Table ES-1, Page 2: It lists "Dioxin Furans". See the preceding Specific Comment and General Comment 2.

2. Page 5, Last Sentence: It reads "The Phase 1 data have been reported in three separate DSRs". Please note that there are discrepancies in the datasets between the three Data Summary Reports (DSRs) and the SLERA TM2. See Specific Comment No.5.

3. Page 7, Footnote, 4th Line: It states "....by the average carbon content of 8.7 percent, which was calculated using all Study Area data available at the time." Please explain the source of "all Study Area data". If the surface sediment data presented and evaluated in the SLERA TM2 are from the Phase 1 field investigation, then the average site specific TOC from Phase 1 data should be used.

4. Page 8, Section 3.2 Exposure Point Concentrations, Second Paragraph: Please note that if 95% UCLs were calculated from the surface water and sediment datasets which include field duplicates, then the 95% UCLs are incorrect.

5. Page 9, Third Paragraph, Last Second Sentence: It reads "Lastly, with more than 350 surface water samples collected…." Please verify that the total number of surface water samples includes both the three DSRs and the SLERA TM2.

   DSR No. 1 (Table 3-10) lists a total of 137 surface water samples collected from February to June 2012. DSR No. 2 (Table 3-8) lists 57 samples collected from July to August 2012. In DSR No. 3, Table 3-8 lists 151 samples collected from September 2012 to January 2013. Thus, the total number of surface water samples is calculated to be 345 (=137+57+151). However, in this report (Table A-1), a total of 353 surface water samples are reported. By checking the EDDs provided on the CDs, the 353 surface water samples include 18 field duplicates, resulting in a discrepancy in the number of field samples and the number of duplicates. Please make all necessary corrections.

6. Page 10, Third Paragraph, Last Second Sentence: It reads "With more than 140 surface sediment samples collected……." It is apparent that field duplicate samples were included as field samples in the total count of surface sediment samples, since there are 133 sample locations and only one sample per location. Please note that field duplicates are QA/QC samples and should not be treated as environmental samples.

7. Page 14, Second Paragraph, Line 5: It states "…. 95% UCL TDI (i.e., the 95% UCL of all of the TDI values, in which each TDI value was calculated using 95% UCL BAFs or BSAFs)….". Clarification for terms "95% UCL TDI" and "95% UCL BAFs or BSAFs" is necessary. This comment applies to these terms used in other parts of the report as well, such as on page 16.

   Does "95% UCL" refer to the chemical concentration in sediment? If so, is this concentration being used to derive the TDI and chemical concentration in each food item? For example, are these values based on chemical concentrations in sediment multiplied by BSAF? If this is the case, precise and clear terms are needed. Or simply delete "95% UCL" since it has been stated several times in previous sections of the report that 95% UCL rather than maximum concentrations are used in food chain modeling.

8. Page 18, Second Paragraph: The term "95% UCL exposure assumptions" is misused. If 95% UCL only refers to the chemical concentration in sediment, there are no other "95% UCL exposure assumptions". Please make all necessary changes.

9. "Method detection limit" and "reporting limit" have been used interchangeably in the tables and text. Please make sure that "reporting limit" and not "method detection limit" is used.

10. Figures 1 and 2 Screening Level Risk Assessment Process for Surface Water and Sediment, and for Wildlife: Both figures show that COPECs identified at Step 2 of the SLERA will be evaluated in the BERA Problem Formulation. However, additional surface water, sediment and tissue samples will be collected during the Phase 2 field program, and chemical results from the Phase 2 field program should also be evaluated via the screening process to identify COPECs. Thus, the COPECs identified from the SLERA should not be the only COPECs to be evaluated in the BERA.

11. Table C-1 Wildlife – Preliminary COPECs Maximum Exposure Assumptions:

    a. It has been noted that TDIs for three receptors are identical for the same group of chemicals such as total HPAH, total LPAH, TCDD congeners TEQ, total PCB Aroclors, etc. Please check and verify and, if applicable, explain in the text why these results are valid.

    b. Please also clarify the term "TCDD congeners TEQ". Does this refer to total TCDD TEQ which is the TEQ of 17 dioxin/furan congeners and 12 dioxin-like PCBs?

    c. Footnotes: All "method detection limit" uses should be changed to "reporting limit". This comment also applies to the remainder of the report.

12. Appendix D Wildlife Screening Level Analyses – 95% UCL Exposure Assumptions: Please see Specific Comment No. 7. The only 95% UCL was based on sediment concentrations. Please make the necessary changes. In addition, if the 95% UCL concentration is greater than the maximum detected concentration, then the maximum detected concentration should be used. Thus, the 95% UCL is not automatically the exposure point concentration.